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Poverty reduction and agricultural change in Peru

The role of trade

by

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In the last decades Peru, one of the top performing countries in Latin America, experienced a dramatic reduction in poverty. The set of structural reforms implemented by Peru during the mid-90s included trade liberalisation which implied a drastic reduction of tariffs on highly protected sectors, and particularly, in agriculture where most poor Peruvians work, and Free Trade Agreements. How relatively free trade has affected the poor in the country remains a gap in economic literature. Studies addressing the role of trade on individual welfare tend to focus exclusively on income labour distribution and inequality while few use data collected before the most comprehensive liberalisation process took place in Peru. Using microdata, this study inquires on whether trade helped reduced poverty, considering how the poor engage in different economic activities and industries. The main finding is that, regardless of the economic sector, exports markedly reduces the probability of being poor. In the formal agriculture sector, data suggests that higher wages and more employment benefitted the poor. Similarly, tariff cuts were a driver of poverty reduction. However, the impact of imports depends on how the poor engage the labour market. During the period under study, those in the informal sector were more likely to be hurt by the reduction of some forms of protection and increasing imports. Further research is required to determine if that condition is outweighed by gains from trade or in some cases static.

Keywords: poverty, trade, Peru, trade liberalisation, informality.

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1 Introduction

This chapter introduces the main outline of the present investigation and its main research purposes.

1.1 Research Problem

In the last decades, international trade increased substantially amid a process of liberalisation and global integration. Since the implementation of the Uruguay Round in 1995 an important number of developing countries which were former members of the General Agreement on Tariffs and Trade – GATT formally joined the World Trade Organisation (WTO).

Against this backdrop, in the late 1980s, most Latin American (LAC) countries started a liberalisation reform (Agosin & Ffrench-Davis, 1993; Vos, Taylor & Paes de Barros, 2002). However, while most of them witnessed a substantial decrease in poverty, studies on the link between poverty and free trade in the region have yielded different outcomes. Some pointed out that trade liberalisation fostered economic growth but negligibly contributed to reduce poverty or even fuelled inequality (for example Behrman, Birdsall & Székely, 2001). Others highlighted that trade opening has poverty-reduction effects even in an inequality-rising scenario (Ganuza et al. 2006; Perry & Olarreaga, 2006; Durán, LaFleur, Pallendra, 2011).

Peru, which by the end of the 1980's decade was considered a basket economy but after just two decades became one of the top LAC performers, is a case of study on this conundrum. Since 1990 it embarked on a series of structural reforms including a radical change in its trade regime which during the preceding decade followed an import substitution policy with high tariffs and restricted import lists (World Bank, 2017a; Nogués, 2012).

By 1990, tariffs were drastically lowered, import restrictions were removed and with the implementation of a “Tariff policy”, the country set out the basis of an open trade policy (Webb, Camminati & Thorne, 2005; Finger & Nogués, 2006). These reforms were significantly

deepened with the creation of the Ministry of Foreign Trade and Tourism (Mincetur) and negotiations of free trade agreements (FTA) with its major trading partners (Baracat et al., 2013; World Bank, 2017a). Appendix A contains information on the FTA negotiated by Peru during the last liberalisation processes.

An expansion of exports and imports followed the reforms. Thus, while in 1990 the trade-GDP ratio stood at 29%, in 2016 it stood above 50% (BCRP, 2019a). This was parallel to a remarkable reduction of poverty, which fell from 54.4% to 20.7% in the same period (United Nations Development Programme – UNDP, 2016a; INEI, 2018a). Nonetheless, a high concentration of semi-processed products in the Peruvian export basket and few non-mining firms involved in trade (World Bank, 2017a), cast doubts on the likelihood of trade as a critical determinant on poverty outcomes in the country.

Though the role of trade has been acknowledged as a key driver for poverty alleviation (United Nations, 2015a), the topic remains subject to an ongoing debate. Earlier studies for Peru showed limited effects of trade opening on poverty reduction (Vasi & Carpio, 2006), yet more recent studies challenge that findings (Šimůnková, 2012). These studies underscore important implications of changes in trade policy, but they also pose important shortcomings. First, they examine effects on individual well-being exclusively assessing income labour distribution and inequality, but not poverty. Secondly, the data they use corresponds to 1990–2000. However, the more comprehensive trade liberalisation process in Peru took place with the negotiation of modern FTAs, particularly the Peru-United States and the Peru-China FTAs, that entered into force in 2009 and 2011, respectively. Both feature schedules for progressive, linear tariff elimination during 10 years and therefore their effects shall be evaluated through observations on the following years.

It is after the 2000s that the country continued to open which entailed a progressive liberalisation of highly protected sectors such as agriculture (Baldarrago & Salinas, 2017). It is precisely in this sector where the poor in Peru are concentrated (INEI, 2018a) and which in the last years has experienced a significant transformation, usually associated with trade expansion (Morris et al. 2017). Hence, understanding the changes in this sector is vital in the analysis of poverty, an aspect that studies had overlooked.

Therefore, the purpose of this work is to estimate the impact of recent liberalisation episodes on poverty reduction in Peru using household data. The paper contributes to trade and poverty

economic literature by investigating the effects of changes in trade policy on the probability of being poor, by looking at how and which industry the poor engage, particularly those in the agriculture sector. To the author's best knowledge, this is the first attempt to measure *ex-post* trade impacts on poverty at industry level, exploiting microdata. As noted above, previous research on the subject tended to focus only on other measures of welfare or limited their analysis to particularly early stages of trade liberalisation.

It further seeks to contribute evidence to the policy debate in the country, heavily focused on trade-related measures, notably in the agriculture sector, as proven the recent expedition of the Executive Urgency Decree 043-2019 that modifies its regulatory framework with implications for all Peruvians in this sector.

1.2 Aim and Scope

The aim of this work is to assess whether trade liberalisation in the country helped reduce poverty during 2010 and 2016 in Peru. During this period, the country registered a sizable reduction in the incidence of poverty. Thus, using data from the National Household Survey (Encuesta Nacional de Hogares – ENAHO) the study looks at how trade impacted the probability to fall into poverty given certain individual, industry and country characteristics. It relates changes in poverty induced by shifts in trade policy measures by trade-related variables, namely exports, imports, and tariffs.

It is worth noting; however, that the study does not address the growth-poverty relationship which, according to the extensive literature is the major factor influencing poverty outcomes, the study's main subject. For Peru, evidence suggests that between 65% and 85% of poverty reduction since the 2000s is explained by economic growth (Granada, 2016; García & Céspedes 2011). While this link is clear, the growth-trade-poverty relationship is still subject to a heated scholar debate. Instead, the present investigation directly relates trade and poverty as in Goldberg and Pavcnik (2005a).

Likewise, it is important to stress that while the study investigates if trade might raise or reduce the likelihood of falling into poverty, it does not address the channels through which trade reaches the poor, as it uses a partial equilibrium approach. This shortcoming is addressed by looking at data provided by the National Household Survey and relates trends with previous

research on the channels on trade-poverty, focusing in the agriculture sector. On the other hand, using a partial equilibrium approach does not constrain this investigation to strong assumptions as found in other studies, namely general equilibrium models based on *ex-post* micro simulations (Goldberg & Pavcnik, 2005a; Porto, 2006; Winters & Martuscelli, 2014).

The study's main goal is to answer *if changes in trade policy in Peru helped reduce poverty* with focus on the agricultural sector, which has been subject to structural changes over the last decades (Morris et al., 2017). To address this general question, the study will investigate the following sub research questions (henceforth "RQ"):

1. Did tariffs cuts benefit the poor?
2. Did increasing exports and imports help reduce poverty?

The study also looks at the dimension of the informality in the country and how this may affect poverty-trade outcomes. In addition, it identifies trade linkages i.e. employment and wages as observed in previous work. The latter is based on the observation that trade liberalisation may benefit (hurt) the poor not only through effects on wages but also via potential opportunities if trade stimulates employment (Perry & Olarreaga, 2006).

The empirical strategy to formally answer questions 1 and 2 will use a Logistic probability model using microdata from the ENAHO and trade data provided by the WTO. This approach is applied at country level and in the agriculture sector. This work also uses data from ENAHO to look at trends of both employment and wages in the agriculture sector during the investigated period (2010-2016). As previously mentioned, this will allow the investigation to abstract from the linkages through which trade operates in this sector.

1.3 Outline of the Thesis

The remaining of the thesis is organised as follows. Section 2 gives contextual information on the trade liberalisation episodes occurred in Peru during 2010-2016. It also looks at trade trends in the country and how trade policy might have affected the development of agriculture. In this sector, the theory and empirical evidence on the trade-poverty link are also covered. Section 3 presents data used in the investigation and explains how the study followed steps to match and effectively use the primary information sources. Section 4 explains the methodological

approach followed by the study and the theoretical model used. This section deals with technical areas on the estimation methodology. Section 5 presents and discusses the main findings of the study while Section 6 concludes with a summary of the study and a brief policy implications discussion. It includes prospects of research on the topic identified throughout the investigation.

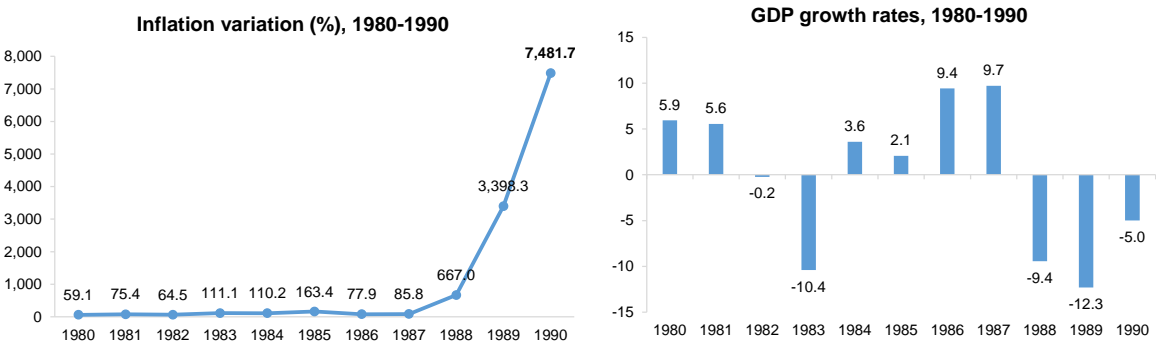
2 Theory

This section presents a brief overview of Peruvian economy and the trade liberalisation process since the 1990s. It also reviews and discusses the literature and empirical evidence on the link trade-poverty.

2.1 Trade liberalisation in Peru

During the last decade, the Peru went from economic crisis to macroeconomic stability with high rates of GDP growth, especially during the “commodity boom” period (2004-2013). Social and political turmoil were fuelled by poor economic policies. During the 1980s GDP decreased 1.05% annually and by the end of the decade, Peruvian GDP had contracted around 25% while inflation reached a peak of 7,500% as seem on Figure 1 (Banco Central de Reserva del Perú – BCRP, 2019a).

Figure 1. Peru’s economic development prior trade liberalisation



Source: Central Reserve Bank of Peru – BCRP.

However, since the 1990s the country embarked on a series of structural reforms which included a profound change in its trade policy, a process that had already started in most of the LAC countries (see Table 1). Before this, Peruvian trade was based on an Import Substitution policy and extensive use of imports lists. Tariffs ranged from 10% to 84%, were highly disperse as

classified in more than 56 tariff lines, but the reform brought down these levels and reduced the dispersion of the tariff structure (Webb, Camminati & Thorne, 2005).

Table 1. Trade liberalisation in LAC. Adapted from Duran, Mulder and Onodera (2008)

Countries	Unilateral Liberalisation		Multilateral Liberalisation	
	First liberalisation programme	Unilateral Average Tariff cuts ^{1/}	GATT entry	WTO entry
Argentina	1989	39 to 14.8	1967	1995
Brazil	1990	51 to 10	1948	1995
Chile	1975	94 to 5.8	1949	1995
Colombia	1990	44 to 6.7	1981	1995
Costa Rica	1986	27 to 5.2	1990	1995
Ecuador	1988	40 to 10.1	-	1995
Mexico	1985	24 to 4.4	1986	1995
Peru	1990	66 to 1.8	1951	1995

^{1/} Trade weighted average. Considers changes from date of first liberalisation until 2018. Updated using the WTO's World Tariff Profiles 2019 Report.

Hence, since mid-1990s onwards, Peruvian trade policy was characterised by a unilateral reduction of tariffs. Indeed, in 1991 the average tariff went from 66% to 26% and import restrictions were lifted (Webb, Camminati & Thorne, 2005). This first wave of liberalisation was strengthened with the creation of the Ministry of Foreign Commerce and Tourism – Mincetur in 2002 and the negotiation of free trade agreements (FTA) (Baracat et al., 2013; World Bank, 2017a). Moreover, with the expedition of the Ministerial Resolution 005-2006-EF/15 “Tariff Policy Guidelines” in 2006, Peru set the basis for a long-term trade policy which included a continuous tariff reform (Finger & Nogués, 2006). In 2018 the average tariff was 0.9% while the most-favoured-nation (MFN)¹ tariff stood at 2.2% in 2019 from 12.8% in 2000

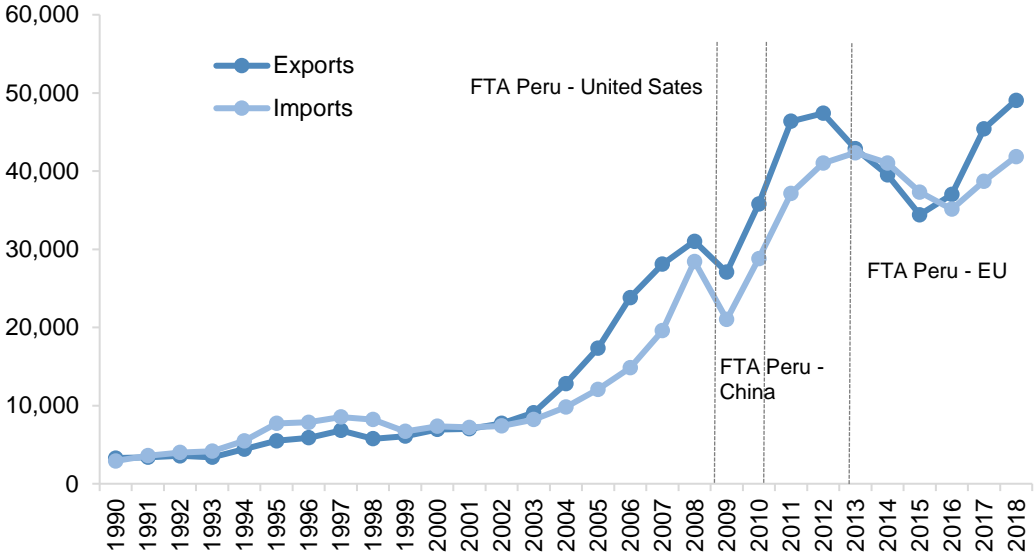
¹ The most-favoured-nation (MFN) is the tariff Peru applies to all countries with which the country does not have FTA. The MFN rate is the same for all countries as specified in the General Agreement on Tariffs and Trade (GATT), that is, if Peru unilaterally lowers its tariffs for one country, this should be extended to all the imports from third countries (WTO, 2020).

(MEF, 2019a; WTO, 2019). Similarly, while in 2001, Peru had only one trade agreement, by 2019, it had 53 (WTO, 2019).

2.2 Trends of trade and agricultural transformation

Following the reforms, inflation fell, and GDP in Peru recovered, making it emerge as the fastest growing economy in LAC (World Bank, 2017a). In 2016 inflation was 3.5% and since 2000, GDP growth averaged 5% per year (BCRP, 2019a). Similarly, trade expanded with a significant increase of trade over GDP. This ratio went from 29% to 50% between 1990 and 2016 as exports and imports rose (see Figure 2).

Figure 2. Peru foreign trade (million US\$ FOB)



Source: Central Reserve Bank of Peru – BCRP.

On the import side, capital and intermediate goods, destined to local production of goods and services, became the major trade inflows. On average they concentrated 79% of the total imports and grew 2% annually between 2010 and 2016 (Superintendencia Nacional de Aduanas y de Administración Tributaria – Sunat, 2019a). Equally, on the export side, an important increase of non-traditional (with more value added) products took place. While traditional

exports overall contracted 1% between the period of analysis driven by a steep decrease in mining exports, non-traditional exports grew on average 6% (Sunat, 2019a).

Particularly, Peruvian agricultural exports’ value rose 10% and this figure was 14% for non-traditional agricultural exports. Consequently, during the 2010-2016 Peru emerged as an important world food supplier (USDA, 2017), for example, it became the second and third largest global supplier of asparagus and grapes (United Nations International Trade Statistics – Comtrade, 2019). The diversification of the Peruvian export basket countered the impact of declining semi-processed mining exports and, on average, total exports grew 2.3% during the 2010-2016 period. However, these products remained as the largest exports.

The expansion of trade in the country reinforced an ongoing structural change as observed by Vásquez (2014) and Xinshen, McMillan, and Rodrik (2017). Accordingly, the authors noted a shift in the composition of the labour force with movements towards more productive sectors – known as structural change– raising the productivity within sectors and the entire economy as shown in Figure 3. Certainly, the participation of economic sectors such as manufacturing, and services became more prominent in the overall economy while agriculture declined. However, agricultural production and overall productivity continued to expand (Morris et al. 2017).

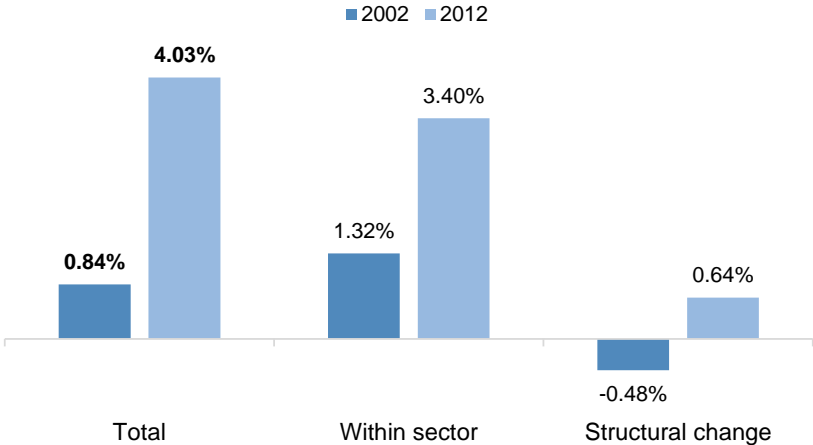
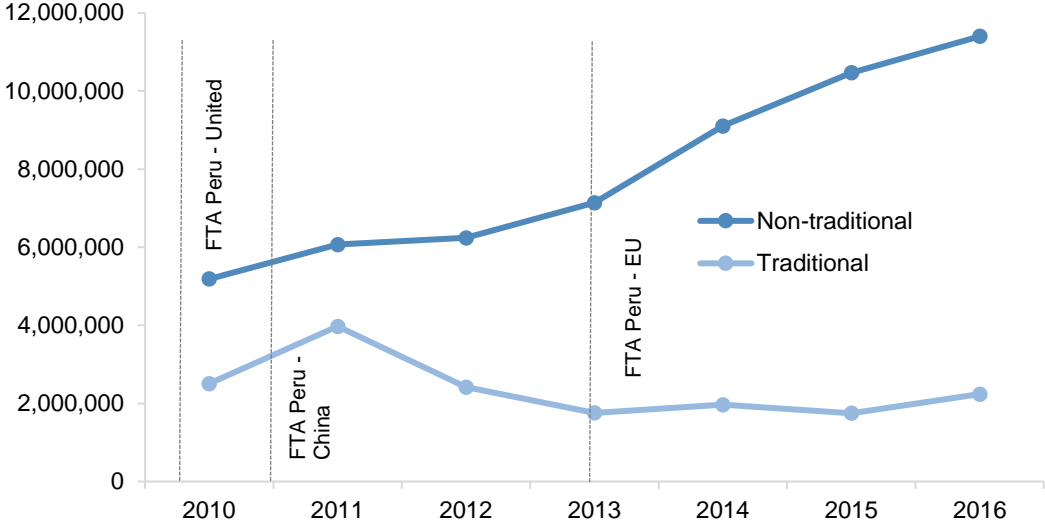


Figure 3. Peru: labour productivity growth (Xinshen, McMillan, & Rodrik, 2017)

Indeed, the agro-export boom as depicted in Figure 4, brought about profound changes in the agriculture sector. As noted by Morris et al. (2017), while the relative share of this sector dropped, the share of agricultural exports expressed as percentage of total exports and GDP saw the opposite trend. The former went from 9% to 14% between 2010 and 2016 boosted by the

country’s integration in the world economy through open trade (World Bank, 2017a; Morris et al., 2017; Sunat, 2019a).

Figure 4. Agricultural exports (US\$ FOB)



Source: National Customs and Tax Superintendence – Sunat

Therefore, whereas the structure of the Peruvian economy changed, the contribution of agriculture to total employment remained high. Moreover, despite remarkable progress, the majority of poor Peruvians were still found in this sector (Instituto Nacional de Estadística e Informática INEI, 2018a), disproportionately affected by high levels of informality, above 90% (Ministerio de Trabajo y Promoción del Empleo – MTPE, 2019).

2.3 Trade and poverty: literature review

The relationship between trade and poverty is not one that can be measured straightforward as the channels through which the former affects the latter are various and to a great extent depend on country-specific factors (Le Goff & Sing, 2014; Winters et al., 2004; Perry & Olarreaga, 2006; Goldberg & Pavcnik, 2004b; McCulloch et al., 2002). Furthermore, the net effects of trade on poverty are much contingent on the outcomes prevailing in the process (Santos-Paulino & Thornquist, 2015).

McCulloch et al. (2002) provide an analytical framework to assess the impact of trade liberalisation on poverty that is relevant for this study as much of the bulk of the literature had

been built around and extended upon it, i.e. Porto (2006), Goldberg and Pavcnik (2005a), Nicita (2004), Doanh and Heo (2009). According to this model, the main pathways by which poverty can be affected by trade: (i) price transmission mechanisms to households, (ii) wage and employment (iii) public profits for pro-poor expenditure, (iv) income volatility.

However, earlier studies on this subject found mixed evidence on poverty reduction through these channels. Using micro household data for Mexico, Nicita (2004) finds that while lower relative prices reduced the cost of consumption in the country, some households' income were negatively affected. Similarly, the wage of skilled workers gained relative to unskilled workers, fuelling inequality. However, the author found that trade liberalisation had a positive effect on reducing poverty, with more than 3 million people moving out poverty.

Contrary, by investigating the changes in the distribution of income during the trade liberalisation episodes, Hanson (2007) observed adverse effects on poverty in Mexico. Likewise, Goldberg and Pavcnik (2005a) did not find evidence supporting a relationship between urban poverty reduction and changes in trade policy in Colombia. Yet, these studies shed more light on the income effect, and the shape of wage distribution as in the case of Hanson (2007)'s study, but do not provide information on changes in consumption to more accurately assess the relationship between poverty and trade.

This gap is addressed by Porto (2006) in his study on the welfare effects of Mercosur (Southern Common Market) in Argentina. Using a general equilibrium model, the author estimates the impact of tariff reductions experienced in the country on the distribution of income and poverty observing pro-poor effects. Subsequent studies, including those focused outside the LAC, found supportive evidence on trade liberalisation as a determinant of poverty (Wong & Kulmer, 2011; Martuscelli & Winters, 2014). Others had highlighted positive effects conditional to complementary policies (Maridueña, 2017; Mitra, 2016; Goldberg & Pavcnik, 2007c; Baldárrago & Salinas, 2017)

Another strand of literature evaluating the trade-poverty link has focused on the dimension of informality in labour markets and how trade policy changes affect it. Perry and Olarreaga (2006) noted that informality could redirect the impacts of trade on wages and poverty but did not find evidence of this in LAC. This aspect is particularly pertinent for Peru, as informality is an important distorting factor in the labour market (MTPE, 2018). On this matter, Goldberg and Pavcnik (2003d) examined this link in Brazil and Colombia and did not find significant

evidence of trade affecting the informal labour market. Yet Cisneros-Acevedo (2019) reported that a freer trade policy in Peru had different effects depending on the *margins* of informality (informality in the informal sector and informality in the formal sector) in which the individual engages.

Finally, on the link between agriculture, poverty and trade, Awokuse, (2009) observed that agriculture is a crucial determinant for growth, a linkage that trade openness strengthens. This has been observed by Castellares et al. (2018). The authors examined the impact of the Agrarian Law 27360 (a special labour regime for the agricultural sector in Peru) and found positive effects on growth and employment and noted that poverty fell in agro-export provinces under the regime.

In a similar vein, Zana (2012) studied the impact of the agro-export boom during 2007-2010 and found evidence relating this and household's income increase and less vulnerability to poverty, yet her study only considered households in some export districts and accounted only for the effects of the exports in her model framework, leaving aside potential import competing effects. Lastly, relying on aggregated data, Morón (2019) examines the impact of trade liberalisation and other variables on poverty reduction in Peru and found a positive relation. However, the study does not look at the changes in trade policy. Instead, it uses the share of trade in GDP but does not control for shocks affecting this ratio.

Overall, the previous literature shows a complex link between trade and poverty. The empirical evidence stresses the importance of country-specific features. Literature for Peru is scarce and more focused on some of the trade channels by which changes in the trade regime can impact poverty, a gap that this study aims to fill in.

3 Data

3.1 Data source

The estimates of the model were drawn from three primary sources. The first comes from the National Survey of Households (Encuesta Nacional de Hogares - ENAHO) conducted on an annual and quarterly basis by the National Statistics and Information Institute – INEI (Instituto Nacional de Estadística e Informática - INEI). The ENAHO's data is available since 1995, but it only became a continuous survey since 2003. It is a nationally representative social survey as it covers rural and urban areas within the 24 *departamentos* and the Constitutional Province of Callao in the country, which are the basic units of political division in Peru (INEI, 2016b).

A pooled dataset comprising six cross-section editions from ENAHO spanning from 2010 to 2016 is used to investigate the effect of trade on poverty. The survey includes detailed information on household living conditions and individual characteristics administered in different modules. For this study, the data used was retrieved from the labour and income module (ENAHO01A-500) which provides information on employment, income, and expenditure of all households' members aged fourteen years or over as well as data on workers' characteristics (age, gender, marital status, education, area of residence). One feature of this module is that it also contains information regarding the worker's formality status and industry association, the latter according to the International Standard Industrial Classification of All

Economic Activities (ISIC)² at the 4-digit level. The study used the last revision (ISIC4) which is also provided by the ENAHO.

Additionally, data was obtained from the Sumarias module, which offers information on poverty conditions. While this information is reported at household level, it allows us to link this data to individual level through a series of household identification codes used in the survey's sample design³.

Along with the microlevel data provided by the ENAHO, the study obtained data from the World Trade Organisation (WTO) Tariff Analysis Online which contains wide-ranging information on applied and bound tariffs by WTO's countries at the standard codes of the Harmonized System (HS) at a 6-digit level for all reported traded commodities. The available information, however, is published in different HS editions. For 2010 and 2011, data on tariffs was expressed in the 2007 version (HS2007), whereas from 2012 onwards it was published in the 2012 version (HS2012). The study used the HS2007 edition as the base of its analysis firstly, as information on correspondence with later HS editions is provided by the World Bank's World Integrated Trade System (WITS) and secondly because available information on this edition allowed to establish a link with the industrial ISIC classification provided by the ENAHO.

Information on trade flows comes from the National Customs and Tax Superintendence (Sunat). The data is presented at 10-digit level using as the base the HS codes. As in the case of tariff data, information on exports and imports was expressed in the HS2007 and HS2012 editions

² The Industrial Classification of All Economic Activities (ISIC) is the international categorization of all economic activities administrated by the United Nations Statistics Division (UNSD).

³ The codes used were the identification number assigned by INEI to each surveyed household and the conglomerate code which identifies the area of residence of selected households in each wave of the survey.

for the 2010-2011 and 2012-2016 periods, respectively. Using correlation tables published by Sunat, trade data was translated to the HS2007 version.

As previously noted, poverty and individual characteristics were linked to trade-related data using the ISIC4 edition of economic activities classification provided by the household data. The matching was mainly done following the criteria of correspondence tables accessible at the United Nations Statistics Division (UNSD) online platform. For missing information, matching was conducted based on the INEI's online facility tool on ISIC search, revision, and correspondence.

3.2 Variables and definitions

3.2.1 Who are the poor?

A critical aspect in the analysis of poverty and how it is affected by external factors, i.e. trade is the definition and measurement of this variable. Yet, as noted by scholars, an operational and unique definition is a difficult task as stressed by Ravallion (2015) it can be sensitive to arbitrary welfare scaling. Another discussion is whether an “absolute” or “relative” measurement approach should be taken to correctly assess changes in poverty and the forces driving those trends, both with different implications (Ferreira et al., 2016; Jolliffe & Prydz, 2016; Ravallion & Lokshin, 2005). Thus, while poverty is widely recognised as a multidimensional phenomenon⁴, most empirical studies on the effect of trade policy on poverty had taken an absolute consumption or income approach (Winters & Martuscelli, 2014). This study joined the previous economic literature and took the latter using a monetary poverty metric.

⁴ See for example World Bank (2018c), Alkire & Foster (2011), Ferreira (2011), Sen (1993).

One reason for this is that the present investigation aims to evaluate the impact on poverty rather than on inequality. In their study for Colombia, Goldberg and Pavcnik (2005a) suggested that a relative poverty approach is more suitable to deal with investigations focused on the effects of trade on inequality. The authors acknowledge that relative poverty might be relevant for the assessment of welfare; however, they underscored that absolute living standards are particularly important when middle-income developing countries are researched as in the case of Peru. On the other hand, Winters et al. (2004) highlighted that methodologies using simple absolute measures of poverty could be extended to other aspects of poverty.

Therefore, this research identifies as poor those whose consumption falls below the poverty line calculated by INEI. The methodology used by said public agency for this purpose considers a food and non-food component. Accordingly, the former comprises a socially accepted basket of goods based on real patterns of consumption of Peruvian households traced from ENAHO and on minimum energy nutrient requirements for an average individual considering aspects such as sex, age, and area of residence (INEI, 2018a).

Similarly, the non-food component includes a basket of food and services that satisfies other basic needs, i.e. education, health, housing, others. Hence, individuals living in a household with a per capita expenditure lower than the food poverty line are categorised as *extremely poor*, whereas members of households whose per capita expenditure do not reach the non-food poverty line are considered *poor*. The assessment of the present study classifies as “poor” to all individuals below the non-food poverty line, which includes the extreme poor without making a distinction between them.

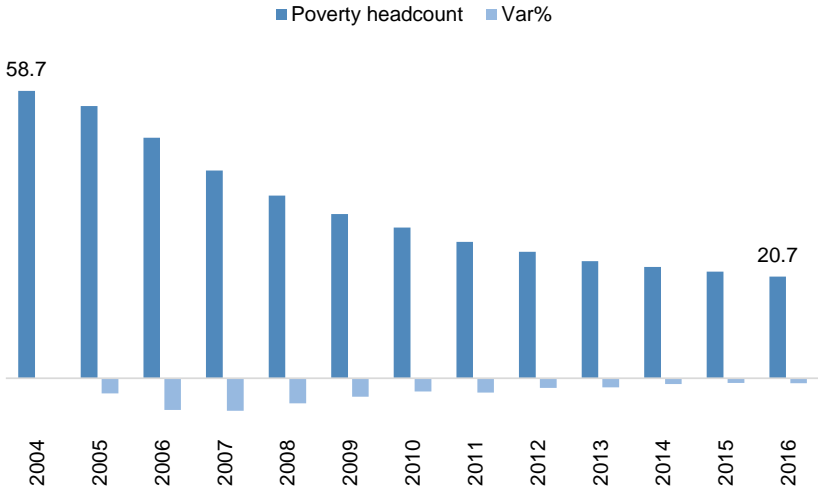
In this background and recalling the research question stated in section 1, the goal of the study is to examine how the poverty condition of individuals engaged in a specific economic activity changes due to shifts in the trade regime adopted by Peru. To investigate this, the evolution and dynamics of poverty in the country and how relevant variables interplay in this context will be analysed.

3.2.2 Trends in poverty in Peru

Poverty in Peru has followed a downtrend since the mid-90s. Section 1 presented the country’s economic environment by the end of the 1980 decade characterised by a deep recession and hyperinflation process which, in turn, unduly hindered the welfare of Peruvians. Hence, per

capita income fell below those in 1960, while the poverty rate stood at 54.4% in 1991 (Llosa & Paniza, 2015; UNDP, 2016b). This scenario, however, was progressively reversed following the structural reforms implemented in Peru in the 90's decade after which the economy experienced a considerable expansion.

Figure 5. Peru: poverty incidence 2004-2016 1/



1/ Data unavailable for var% in 2004.
Source: INEI.

The reforms brought about profound changes in the composition of the population affecting the share of the population in poverty conditions (World Bank, 2017b). Accordingly, the percentage of those considered as poor and the group outside this category upturned. The former went from 55% in 1997 to 21% in 2016. Remarkably, the poverty headcount was reduced by 38 percentage points (pp.) in the last decade, with around 10 million people lifted out of poverty, as seen in Figure 1. Also, the severity of poverty and the poverty gap fell as, on one hand, per capita expenditure increased 25.8% and, on the other, per capita income went up by 28.6% nationwide, these figures being 71.8% and 86.1% for the population at the lowest decile in the

income distribution, respectively (INEI, 2018a). Data available on other measures of poverty shows the same pattern⁵.

3.2.3 Poverty drivers

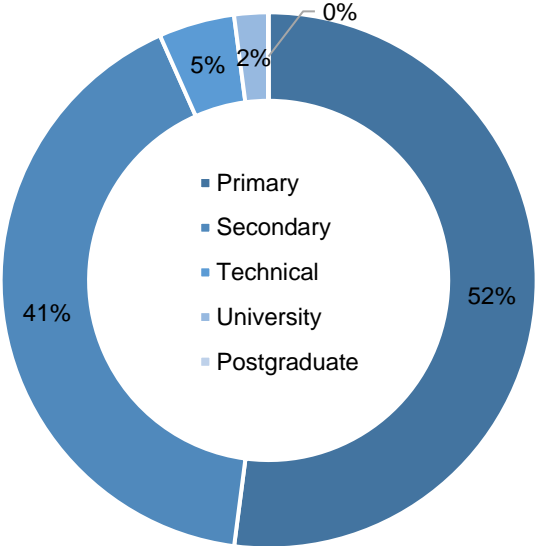
During the period investigated, Peru saw a remarkable reduction in poverty which also marked the emergence of better-off groups within the population. As previously reviewed, growth was to a great extent the primary driver of such pattern (García & Céspedes, 2011; Granada, 2016); however, country and individual's features played a key role at determining poverty outcomes. Hence, while the middle-income class increased from 16.4% to 36.9% between 2005 and 2014 as more people escaped poverty (BCRP, 2015b), some scholars had pointed out factors heightening the odds of falling into poverty chiefly among the geographical, industry-related and socio-demographic variables.

Asencios (2014), for instance, underlines that middle-income households whose head attains lower levels of education or engages in informal economic activities face higher probabilities of being poor. Indeed, according to ENAHO data, over the period investigated 52.1% of the

⁵ For example, multidimensional poverty fell from 20.2% to 12.7% over the period 2006-2012 with a decline in the intensity in deprivation in areas related to education, health and standards of living while the Human Development Index (HDI) increased in the last years, although at a slower pace (UNDP & Oxford Poverty & Human Development Initiative OPHI, 2019; UNPD, 2019).

poor who are aged over fourteen years did only attain at least one year of primary education or had no education whereas this figure was 23.6% among the non-poor (see Figure 6). Furthermore, on average, poverty incidence among Peruvians who completed primary education was 37.1%⁶ compared to 5.2% for those who reached superior education⁷.

Figure 6. Poverty by level of education attained



Source: ENAHO.

⁶ No education and basic regular education are included.

⁷ It includes technical non-university studies, university studies and postgraduate studies.

Similarly, Arteaga and Glewwe (2019) found that ethnic factors in Peru have an indirect impact on poverty through disparities in education and human capital formation, both widely recognised as determinants of poverty (Londoño de la Cuesta, 1996). This is particularly important for the assessment of the impact of changes in trade policy on poverty as the presence of structural and cultural barriers in a multi-ethnic country as Peru might potentially limit its effects. From inspection data in the sample it was found that indigenous ethnic groups⁸ constitute around a quarter of the total population, yet poverty incidence for them was the highest compared with other ethnical categories (see Table 2).

Notwithstanding ethnic-related variables are positively associated with the likelihood of being poor, geographical distribution appears to be a more potent driver for poverty incidence in Peru. Previous studies on this regard have shown, for instance, that while indigenous households face sizable challenges and a higher probability of being poor, the latter considerably reduces by 37% if households are located in urban areas. Moreover, controlling for other socio-demographic characteristics, ethnicity marginally contributes to such probability suggesting that prevalence of poverty within different ethnic groups, particularly indigenous, is to a greater extent determined by geographic factors (World Bank, 2015b).

Certainly, according to estimates of INEI (2018a), poverty in Peru is most likely a rural phenomenon with an overwhelming majority of the poor living in this area. 6 out of 10 poor were living in rural areas where poverty rates were three times as high as in urban settings, as

⁸ According to Ministerio de Cultura (Peruvian Culture Ministry) (2019) there are 55 indigenous ethnic groups in Peru living in the Amazonia (Jungle) and Andes (Highlands) region. ENAHO rounds census include a question for ethnical auto perception and classifies these groups into three categories: Quechuas, Aymaras and de la Amazonia. It further identifies other ethnic groups: Afroperuvian, white, mestizo (mixed Amerindian/native and white) and other (which could include Chinese and Japanese descent). Mestizos make up the largest part of the population (55%) followed by the indigenous (27%) while the rest are minorities. Following previous studies dealing with ethnic-related variables in Peru (see for example Cisneros-Azevedo, 2019), the present study establishes five major ethnical categories: native (comprising all indigenous people), white, mestizo, Afroperuvian and other. This categorisation is also in line with that of Kenneth (2019) in the World Atlas.

seen in Table 2. It is worth noting, however, that poverty fell in rural and urban areas going from 53% to 36% in the former and from 17% to 10% in the latter between 2010-2016. This trend goes in line with that observed for LAC in the last decades (de Janvry & Sadoulet, 2000).

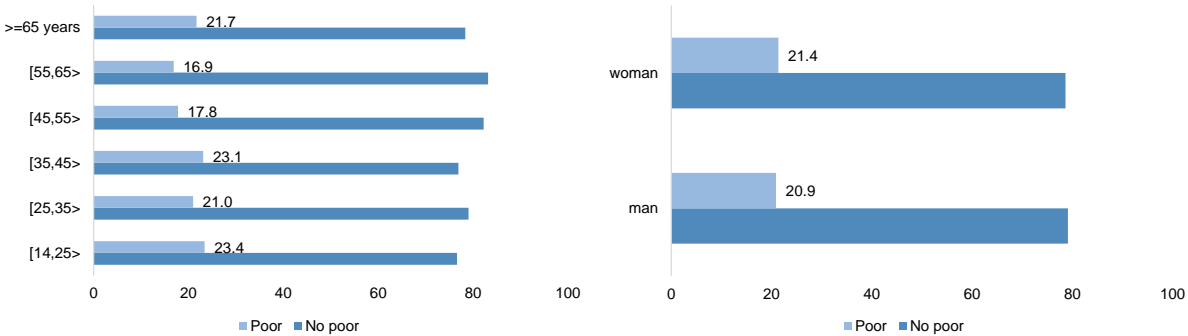
Table 2. Poverty by geographical division and individual characteristics (%), 2010-2016

Area		Region	
Rural	45.8	Coast	13.3
Urban	13.8	Andean highlands	32.6
		Jungle	27.2
Ethnicity		Civil status	
Native	28.8	Married	19.8
Afroperuvian	23.9	Single	19.7
White	19.4	Cohabitant	27.7
Mestizo	15.9	Other	17.9

Source: ENAHO.

Further geographical division in the Peruvian territory helps to explain variations on poverty incidence within the country. From Table 2, it is observed that poverty affected more to Peruvians living outside the coastal regions and that the probability of being poor in the Andean highlands was the highest. Besides, according to data from ENAHO, differences are also found at the administrative division level (departamentos) in the country. For example, while departamentos such as Cajamarca and Huancavelica reported poverty rates above 40% during the examined period, in Arequipa, Lambayeque, and Tacna they were in a range of 12%-20% and Ica, below 5%.

Figure 7. Poverty by age group and sex (2010-2016)



Source: ENAHO.

Socio-demographic dynamics played a role in poverty incidence. Consequently, data revealed that young Peruvians aged 14-25 and 35-40 are hit harder by poverty as depicted in Figure 7. Studies on well-being have also identified the former group as one the most affected by poverty and other forms of deprivation (OECD, 2016). Likewise, on gender-based characteristics, data shows that females face higher probabilities of being poor than males. Nonetheless, this gap was on average 2 pp. during the spanning period of study. Conversely, based on civil status, cohabitants and married are more likely to be poor, as seen in Table 2.

Data also revealed that industry-related features affected poverty. Hence, Peruvians working in small-size firms are more likely to be poor. 9 out of 10 poor Peruvians work in small enterprises⁹. Equally, as seen in Table 3, self-employment was the largest occupation category among the poor accounting for 40% of the total. In contrast, most of the non-poor perform as employees. Also, those engaged in the agriculture sector experienced higher poverty rates. Over the study period, 59% of the poor in the country were found in this economic sector in which on average poverty reached 47% of workers.

⁹ ENAHO provides data on firm size based on 5 categories: 1-20 employees; 21-50 employees; 51-100 employees; 101-500 employees and over 500 workers. Accordingly, the study considers as small enterprises to those with less than 20 workers. This approach differs from other studies and the official analysis conducted by INEI. However, it is based on the information provided by ENAHO and reflects to a great extent the dynamics of the Peruvian labour market. For example, in their analysis on productivity and informality for Peru, Chong et. al (2008) used firm size with less than 100 workers as a predictor to measure the impact of training programmes on the quality of employment.

Table 3. Poverty by industry, occupation and firm size (2010-2016)

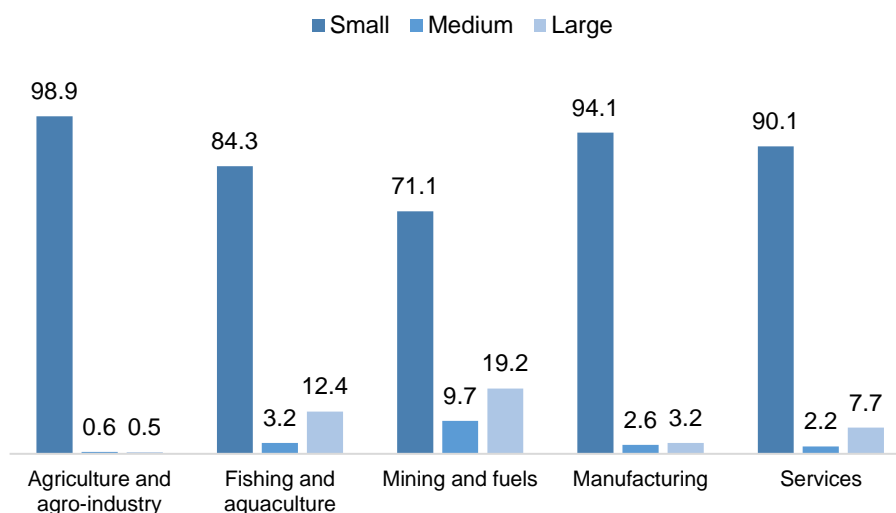
Industry		Occupation	
Agriculture and agro-	46.7	Employer	10.1
Fishing and aquacultu	20.1	Self employed	26.5
Mining and fuels	11.1	Employee	13.6
Manufacturing	18.4	Unpaid family worker	41.8
Services	12.1		17.3
Other	16.7		
Size			
Small	27		
Medium	11.1		
Large	6.8		

Source: ENAHO.

Finally, informality, one of the most distorting factors in the Peruvian economy, was also a factor exacerbating the effects of poverty in the country. As previous studies suggested, informality in Peru has been both stubbornly high despite remarkable economic growth (OECD, 2016; World Bank, 2017a; Yamada & Chacaltana, 2009; Loayza, 2008) and inconsistent with the high-middle-income status gained by the country, even if compared with its peers in the region such as Chile and Colombia. For example, in Peru, informality reaches 70% of economically and occupied active population - EOAP (INEI, 2020b) whereas in Chile, this figure is 28.4% (INE, 2020). Its effects translate in lower productivity (reference) and poor-quality standards for employment (reference) including lack of social protection, which in turn, increases the probability of Peruvians being poor.

Not surprisingly, over the period assessed 95% of the total poor held an informal job. By industry, informality was more prevalent in small firms and the agriculture sector, as observed from Table 3 and Figure 8. Thus, not only the poor are found performing farm-related activities, but also under informal conditions which proved to be intricately linked with poverty conditions.

Figure 8. Poverty by industry and firm size



Source: ENAHO.

Therefore, to investigate the impact of trade on poverty in Peru, the study will include all the variables that from data inspection appear to be relevant at determining the probability of being poor in the country. These variables will be treated as controls to isolate the effects of trade.

3.2.4 Statistics and variable summary

This study will specify a model that relates poverty and variables that reflect changes in trade policy in the country. Following previous research, it will first analyse the effect of changes in tariffs that occurred in Peru between 2010 and 2016. The chosen measure in this regard is the Most-Favoured-Nation (MFN) treatment Peru grants to all its trading partners.

One drawback of using the MFN is that, due to its nature, it does not reflect unique treatments granted by Peru through FTAs. Besides, it only accounts for the effects of trade liberalisation on the import side; thus, the MFN is a conservative measure of the tariff barriers imposed by the country as noted by Cisneros-Azevedo (2019).

While the bulk of economic literature focuses only on this variable to assess the impact of trade, more recent studies have raised awareness on the importance of accounting for measures that capture the impact of trade through different channels. For example, Fukase (2013) includes the exports on his analysis on the impact of trade on the Vietnamese unskilled workers after trade opening accounting for linkages on income and employment. In a similar vein, this research will include exports and imports in its model.

The main reason for doing that is to capture the exposure of different sectors of the economy to changes in trade policy and how such shocks hurt or benefit the poor. Indeed, as reviewed in Section 2, as a result of the negotiation of several FTAs both Peruvian exports and imports exponentially increased as, on the one hand, they gained either better conditions or access to global markets and, on the other, purchasing of capital and intermediate goods that constitute the bulk of total imports rose driven by lower prices. Therefore, the share of exports and imports at industry level will be taken to measure the effects of trade liberalisation.

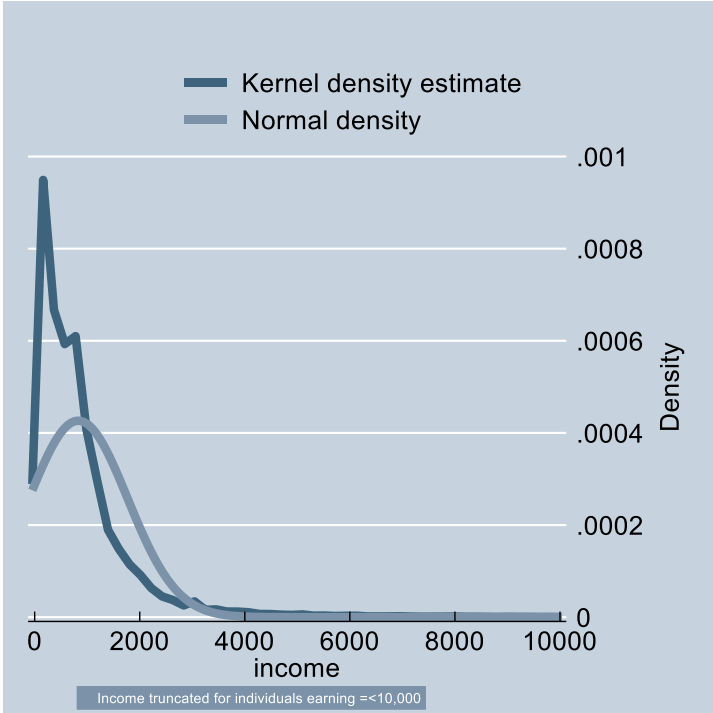
From data inspection in the previous subsection suggested that country-specific features and individual characteristics should be taken into consideration when measuring the likelihood of falling into poverty induced by external shocks, i.e. trade liberalisation episodes as they might redirect the latter's effects. Consequently, to account firstly for geographical differences, the study uses categorical variables to control for area or residence, divided into rural and urban areas¹⁰, region, and departamento where the individual lives.

Secondly, to account for socio-demographic and industry-related factors, categorical variables will be included to control for sex, ethnicity, age group, marital status, level of education, occupation, formal job status, firm size of the enterprise where the individual is currently

¹⁰ A further distinction between urban areas in Lima, the capital of Peru, and the rest urban areas in the country is made. This is because Lima, not only by itself concentrate around 10% of the total population of the country, but where the economic activity tends to concentrate.

working. Additionally, the study considers the monthly income from economic activity. As noted by Ackah (2007), it will allow the study to account for effects from engaging in different economic sectors. This is particularly important as in Peru, income from economic activity makes up more than 70% of the total income (INEI, 2018b). Figure 9 plots the income distribution.

Figure 9. Monthly income distribution in Peruvian Sol (2010-2016)



Source: ENAHO.

Table 5 contains descriptive statistics for the variables in the study including the base level of each of the categorical variables thereof. It includes trade-related variables as specified in the following section.

Table 4. Descriptive statistics for the pooled ENAHO dataset, 2010-2016

Variable	Mean	Std. Dev.	Min	Max
Age category				
[14,20>	0.166	0.372	0	1
[20,25>	0.104	0.306	0	1
[25,30>	0.085	0.278	0	1
[30,35>	0.082	0.275	0	1
[35,40>	0.086	0.280	0	1
[40,45>	0.084	0.278	0	1
[45,50>	0.081	0.272	0	1
[50,55>	0.072	0.258	0	1
[55,60>	0.062	0.240	0	1
[60,65>	0.050	0.218	0	1
>=65 years	0.128	0.334	0	1
Education level				
Primary	0.346	0.476	0	1
Secondary	0.412	0.492	0	1
Technical	0.110	0.313	0	1
University	0.121	0.326	0	1
Postgraduate	0.011	0.107	0	1
Sex				
woman	0.488	0.500	0	1
man	0.512	0.500	0	1
Civil status				
Married	0.297	0.457	0	1
Single	0.334	0.471	0	1
Cohabitant	0.235	0.424	0	1
Other	0.135	0.342	0	1
Ethnicity				
Native	0.319	0.466	0	1
Afroperuvian	0.017	0.129	0	1
White	0.042	0.200	0	1
Mestizo	0.521	0.500	0	1
Other	0.102	0.302	0	1
Area				
Rural	0.364	0.481	0	1
Urban	0.636	0.481	0	1
Region				
Coast	0.415	0.493	0	1
Andean highlands	0.377	0.485	0	1
Jungle	0.207	0.405	0	1
Size				
Small	0.817	0.387	0	1
Medium	0.025	0.156	0	1
Large	0.158	0.365	0	1
Informal status				
informal	0.802	0.399	0	1
formal	0.198	0.399	0	1
log_income	6.093	1.374	0	11.42656
Tariff (MFN)	3.977	1.293	0	6.7663
Share Exports by industry	6.026	9.598	0	74.331
Share of imports by industry	8.465	16.003	0	70.511

4 Methodology

The study aims to investigate the impact of trade on poverty reduction, as observed in Peru during the 2010-2016. In a survey of the literature on the different methodologies to address the relationship trade-poverty Reimer (2002) verified four approaches namely cross-country analysis, computable equilibrium models (CGE) based on simulations, partial equilibrium models, and micro-macro synthesis models. According to the author, the two former use information on aggregate level while the third approach relies on microdata, and the latter is a combination of post-simulations a lá CGE but using household data.

This paper follows the third approach. Data and methodology constraints are a reason for that; nonetheless, the primary motivation for having selected this approach is that as underscored by Winters and Martuscelli (2014) the study of the trade-poverty relation must be empirical, that is, assess real outcomes of changes in trade policy. Thus, exploring microdata this research addresses the dynamics of these trends applied to the Peruvian economy. It is worth emphasising that the main goal is to assess changes in the probability of being poor at industry level. Hence, while individual features are considered, the paper looks at the effects of trade on poverty through industry engagement. The theoretical model implemented to examine these effects is:

$$y_{ijt} = \beta_0 + \beta_1 I_{ijt} + \beta_2 T_{jt} + F_j + F_y + F_d + \omega_{ijt} \quad (1)$$

Where y_{ijt} is the binary outcome for the study dependent variable to indicate whether individuals are poor ($y_{ijt} = 1$) or not ($y_{ijt} = 0$). I_{ijt} is a vector of individual characteristics including age, gender, education, ethnicity, civil status, area of residence, monthly income, other specified in Table 5. T_{jt} is a vector of trade exposure measures that includes tariffs, the share of exports (Exp_j) and imports (Imp_j) imports of each industry over the total. β_1 and β_2 are the set of coefficients explaining the variation in poverty explained by individual features and trade, respectively. Fixed effect for industry F_j (based on ISIC4 classification), departamento F_d and year F_y are included to account for omitted variable biases. ω_{ijt} is the

error term. i refers to individual-related characteristics, while j and t refer to industry and time observation, respectively.

To estimate equation (1) the study uses a logistic model. To control for latent forms of heteroskedasticity and serial correlation in ω_{ijt} , the model is estimated using robust standard errors. Also, to reduce sampling bias, sampling weights provided by ENAHO will be used for estimations. Following Horrace and Oaxaca (2006) on the treatment of predicted values, a sensitivity analysis using a linear probability model will also be performed. The robustness check also includes substituting MFN for the nominal duty applied (“arancel nominal promedio”) that Peru effectively charges on its imports.

Regardless of the tariff chosen, as in Topalova (2005), tariffs for non-traded goods are set to zero. Following Baldarrago and Salinas (2017), the study will implement a version of the model (1) excluding non-traded sectors to assess the impact of possible biases derived from that assumption.

The industry classification of economic activities follows ISIC4 grouping criteria. Nonetheless, to assess the impact of trade on the agriculture sector, non-farm activities, i.e. hunting, fishing, and aquaculture, had been separated from this sector and assigned to different industry categories¹¹.

¹¹ The main categories are agriculture and agro-industry, fishing and aquaculture, mining and fuels, manufacturing, services and other.

Finally, the sample from the pooled dataset includes individuals aged at least fourteen years who were part of the EOAP, explicitly, those who reported being employed or unemployed during each wave of the survey¹². Those classified as “inactive” that is, unemployed but do not look for a job are disregarded from the sample.

¹² This is because two-fold. Firstly, the Income model used from ENAHO (ENAHO01A-500) for the study’s dataset does only have information on household members above 14 years. Secondly, because the study seeks to evaluate the impact of trade directly through industry engagement. At household level analysis, INEI’s reports on poverty incidence reveals that this phenomenon particularly affected Peruvian aged 0 and 10 (INEI, 2018). As noted by the World Bank (2015b) this is associated with head household characterises and poverty conditions, which is to a certain extend addressed by the study at investigating the effects on trade on those households individuals engaged in the economic activity. Yet, further research is needed to rigorously assess this aspect.

5 Empirical analysis

5.1 Main results

The main results of the effect of trade liberalisation in Peru between 2010 and 2016 as modelled in equation (1) is reported in this section. In this section, the study addresses the RQ 1 to RQ 2. In this stage the analysis is conducted without distinguishing between the informal and informal sector; thus, the analysis includes the entire universe of the sample. The baseline of this approach is presented in section 5.1.1.

A formal distinction between the formal and informal sectors in the economy is presented in section 5.1.2. From the descriptive analysis in section 3 it was observed that informality plays an essential role in determining not only employment conditions, but poverty outcomes as most of the poor are found in this sector.

Sections 5.1.3 and 5.1.4 presents the impacts of trade on the agriculture sector as introduced in section 2. This is because data from ENAHO revealed that poverty incidence in this sector is more acute compared with other sectors. Additionally, compared to them, farm and industry-related activities within the sector are enormously hit by informality. On these accounts, the research also analyses the outcomes of trade on poverty, making a distinction between those engaged in formal and informal activities for the agriculture sector.

5.1.1 Trade and poverty reduction in Peru

Table 5 presents the main findings of the investigation at country level. Model 1 includes only control variables, as described in section 3. The extended model to address the research questions is included in Model 2 and Model 3 in the same table. The former describes the impact using as trade exposure measure the MFN while the latter as specified in equation (1) adds the impacts of trade and imports.

In Model (1) covariates of poverty as identified in the previous data inspection study proved to be statically significant in the quantitative analysis thus, its expected association with the probability of falling into poverty is confirmed. Hence, it can be seen, groups age above 14 years are less likely to be poor in the country except for those between 30-40 years. Also, women experience a higher probability of being poor.

Education proved a significant driver for poverty, and this is confirmed not only in Model (1) but in all specifications of the study's theoretical model [Model (2) and model (3)]. Hence, higher levels of educational attainment reduce the likelihood of being poor. The most substantial effect is observed for those who reached university and postgraduate studies. By contrast, ethnic background played against poverty outcomes. As discussed in the descriptive analysis in section 3, non-native people in the country are less likely of being poor. Similarly, divided by civil status, except for cohabitants, those who were single and held other forms of civil status (such as widow and divorced) face lower probabilities of poverty compared to those who were married.

When looking at geographical features, it is confirmed that Peruvians living in rural areas and outside coastal regions, which are the reference categories in the analysis, are more prone to poverty. Accordingly, compared to those groups, people living in urban areas are less likely to be poor, whereas those in the Andean highlands and the Amazon Jungle have a higher probability of being poor.

Based on industry-related aspects, the assessment shows that by occupation, independent workers and employees experienced higher probabilities of being poor compared to those whose occupation is classified as an employer. Moreover, Peruvians working in the informal sector are more vulnerable to poverty. Thus, as shown in Model (1), compared to those in the informal sector, individuals holding a formal job position have lower probabilities of being

poor. Likewise, higher levels of income are negatively associated with the possibility of being poor as expected¹³.

Finally, Model (1) predicts that Peruvians working in small size firms are more likely to fall into poverty. In contrast with this group, medium and larger size firm's workers are less likely to be poor.

Model (2) accounts for effects in tariffs changes and shows a positive relationship with poverty. Hence, a decrease in the rate of the MFN is associated with a decrease in the (log of the odds) of being impoverished by 0.061. This variable is statistically significant at 10% although in Model (3) it is not statistically significant as it loses power at explaining trade effects on poverty. This suggests that when tariffs rates in Peru fell, the likelihood of being poor decreased.

Model (3) or extended model includes the effects of the participation of each industry -as defined in section 4- in the total basket of exports/ imports as a measure of trade on poverty. It indicates a strong negative relationship between poverty and exports which is additionally statistically significant at 10%, which is stronger than the positive effect on poverty of imports and the rate of MFN tariffs. The two latter are not statistically significant in Model (3).

It is important to draw attention to the fact that Table 5 reports the underlying coefficients of what is known as the log of the odds, that is the degree of change in the logit of the model's dependent variable (probability of being poor) for a one-unit change in the predictor covariate (Mitchell & Chen, 2005)¹⁴. However, the study also estimates the marginal effects for the trade-

¹³ The income variable used in the model was transformed into its logistic form when dealing with unusual and outliers' observations. Hence, interpretation here is as follows: one-unit increase in income the expected log of the odds of being poor decreases by $(e^{b_i} - 1)$, holding all other variables constant.

¹⁴ This is also true for the estimations reported in the following tables throughout the paper, unless specifically indicated.

related variables on the probability of being poor. Tables on these estimates are found in Appendix B. Figures 6, 7, and 8 plot the estimated effects for further inspection. As such when the share of industry j over the total exports of the country is at 10%, the probability of being poor is around 0.207 (20.7%) whereas if this ratio increases to 50%, the probability of being in poverty falls by 11 pp. to 0.098 (9.8%).

To the contrary, when the share of imports of industry j is at 10% the probability of being poor is 0.174 (17.4%) while when this share is 50%, the probability of being poor increases by 6 pp., that is, stands at 0.234 (23.4%). Comparably, when the rate of MFN decreases, so does the probability of being poor.

Table 5. Baseline estimations for trade liberalisation effects on poverty in Peru, 2010-2016

	(1) Country Model	(2) Country Model	(3) Country Model
Group age = 2, [20,25>	-0.0639** (0.0321)	-0.0645** (0.0321)	-0.0651** (0.0321)
Group age = 3, [25,30>	-0.107*** (0.0347)	-0.108*** (0.0347)	-0.108*** (0.0347)
Group age = 4, [30,35>	-0.00946 (0.0352)	-0.0103 (0.0352)	-0.0114 (0.0352)
Group age = 5, [35,40>	0.0292 (0.0353)	0.0282 (0.0353)	0.0274 (0.0353)
Group age = 6, [40,45>	-0.208*** (0.0363)	-0.209*** (0.0363)	-0.210*** (0.0363)
Group age = 7, [45,50>	-0.505*** (0.0375)	-0.506*** (0.0375)	-0.507*** (0.0376)
Group age = 8, [50,55>	-0.713*** (0.0394)	-0.714*** (0.0394)	-0.714*** (0.0394)
Group age = 9, [55,60>	-0.867*** (0.0412)	-0.868*** (0.0412)	-0.870*** (0.0412)
Group age = 10, [60,65>	-0.920*** (0.0426)	-0.921*** (0.0426)	-0.922*** (0.0426)
Group age = 11, >=65 years	-0.959*** (0.0381)	-0.960*** (0.0381)	-0.963*** (0.0381)
Sex = 2, man	-0.474*** (0.0160)	-0.474*** (0.0160)	-0.475*** (0.0160)
Level of education = 2, Secondary	-0.583*** (0.0163)	-0.583*** (0.0163)	-0.583*** (0.0163)
Level of education = 3, Technical	-1.307*** (0.0306)	-1.308*** (0.0306)	-1.306*** (0.0306)
Level of education = 4, University	-2.116*** (0.0447)	-2.117*** (0.0447)	-2.115*** (0.0447)
Level of education = 5,	-2.955***	-2.955***	-2.951***

Postgraduate	(0.238)	(0.238)	(0.238)
Ethnical background = 2, Afroperuvian	-0.261***	-0.261***	-0.263***
	(0.0485)	(0.0485)	(0.0485)
Ethnical background = 3, White	-0.287***	-0.287***	-0.289***
	(0.0371)	(0.0371)	(0.0371)
Ethnical background = 4, Mestizo	-0.214***	-0.213***	-0.217***
	(0.0195)	(0.0195)	(0.0195)
Ethnical background = 5, Other	-0.0323	-0.0322	-0.0345
	(0.0254)	(0.0254)	(0.0254)
Civil status = 2, Single	-0.253***	-0.253***	-0.254***
	(0.0248)	(0.0248)	(0.0248)
Civil status = 3, Cohabitant	0.265***	0.265***	0.265***
	(0.0180)	(0.0180)	(0.0180)
Civil status = 4, Other	-0.0928***	-0.0930***	-0.0938***
	(0.0216)	(0.0216)	(0.0216)
Natural Region = 2, Andean highlands	0.420***	0.420***	0.420***
	(0.0282)	(0.0282)	(0.0282)
Natural Region = 3, Jungle	0.0882**	0.0880**	0.0878**
	(0.0383)	(0.0383)	(0.0384)
Area of residence = 1, Urban	-0.221***	-0.221***	-0.219***
	(0.0162)	(0.0162)	(0.0162)
Occupation = 2, Self employed	0.692***	0.692***	0.698***
	(0.0347)	(0.0347)	(0.0348)
Occupation = 3, Employee	0.817***	0.818***	0.823***
	(0.0370)	(0.0370)	(0.0372)
Occupation = 5, Other	0.0178	0.0274	0.0273
	(0.105)	(0.105)	(0.105)
log_income	-0.354***	-0.354***	-0.355***
	(0.00640)	(0.00640)	(0.00641)
Firm size = 2, Medium	-0.0321	-0.0320	-0.0311
	(0.0472)	(0.0472)	(0.0472)
Firm size = 3, Large	-0.0356	-0.0352	-0.0335
	(0.0310)	(0.0310)	(0.0310)
Informality in principal activity = 2, formal	-0.676***	-0.676***	-0.677***
	(0.0321)	(0.0321)	(0.0320)
Tariff in industry j		0.0617**	0.0302
		(0.0301)	(0.0306)
Exp in industry j			-0.0284***
			(0.00505)
Imp in industry j			0.0123
			(0.0108)
Constant	2.239***	1.847***	2.216***
	(0.0751)	(0.206)	(0.244)
Observations	326,253	326,253	326,253
Year FE	YES	YES	YES

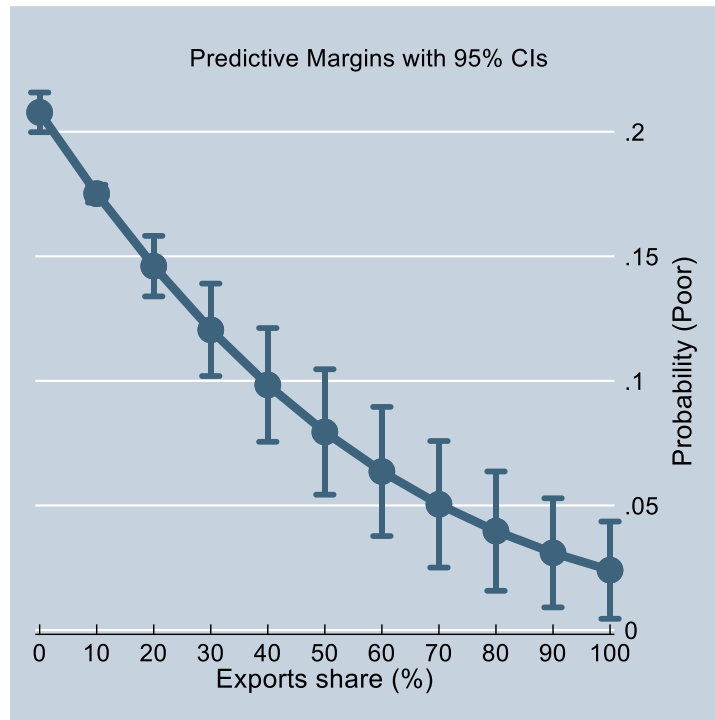
Industry FE	YES	YES	YES
Departamento FE	YES	YES	YES

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

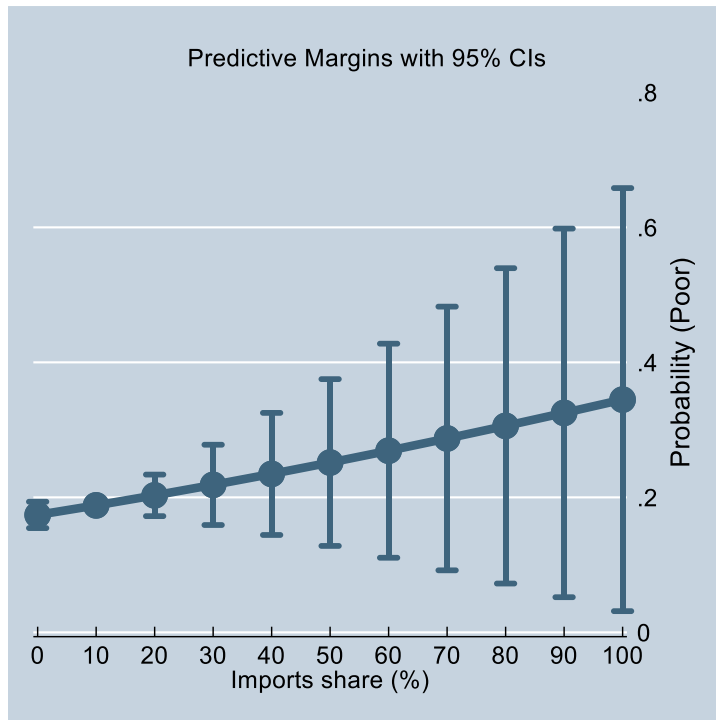
Source: ENAHO 2010-2016.

Figure 10. Marginals effects of trade on the exports side



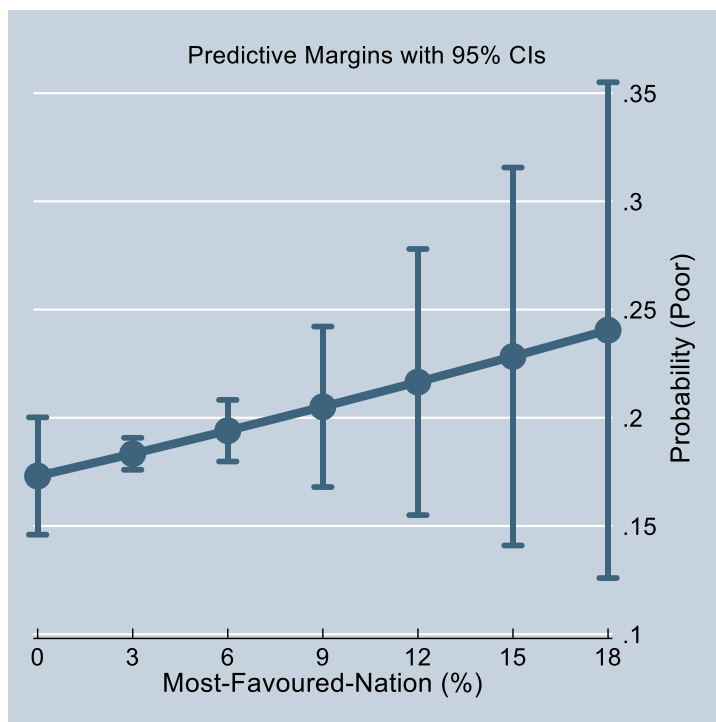
Source: Sunat trade flows for 2010-2016.

Figure 11. Marginals effects of trade on the imports side



Source: Sunat trade flows for 2010-2016.

Figure 12. Marginal effects of changes in MFN rates



Source: Sunat trade flows for 2010-2016.

5.1.2 The informal sector and trade structure

One noticeable feature of the previous assessment as depicted in Figures 6 and 8 is that contrary to the case for exports, robust standard errors for imports are higher and could yield in extreme cases lower probabilities for the outcome on variable y (poverty condition). On one hand, this study finds that on the import side, the negative impact on poverty is mainly driven by the informal sector which accounts for the overwhelming majority (76%) of the sample conversely, the formal sector is roughly a quarter of it. Table 6 shows that import's negative effect is steeper in the latter. However, both are not statistically significant. Effects driven by control variables are reported in Appendix C.

Table 6. Trade liberalisation effects on poverty in Peru by sector, 2010-2016

	(1) Country formal sector	(2) Country informal sector
Tariffs in industry j	-0.0955 (0.153)	0.0388 (0.0314)
Exports in industry j	-0.0220 (0.0274)	-0.0244*** (0.00524)
Imports in industry j	0.00993 (0.0337)	0.0117 (0.0114)
Constant	3.851*** (1.159)	2.057*** (0.252)
Observations	79,043	247,210
Year FE	YES	YES
Industry FE	YES	YES
Departamento FE	YES	YES

Robust standard errors in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Source: ENAHO 2010-2016.

On the other hand, when looking at the structure of imports according to the Broad Economic Category (BEC) (i.e. capital, intermediate and consume goods) the investigation finds that the negative impact of imports dissipates if only capital and intermediate goods, e.g. inputs and machinery used by the national industry for the production of goods and services are taken into account. The effects of tariffs, however, counteracts this outcome. Table 11 in Appendix C reports these results. This is particularly important as 33% and 48% of the total country's

imports correspondent to capital and intermediate goods, respectively (see Section 1), whose destination is likely to be captured by the formal sector¹⁵.

Notwithstanding, disaggregate data by industry indicates that industry-features may play a role when assessing the impact of trade. As previously noted, Agriculture is the sector where the poor are concentrated and where informality is a major concern given its linkages with poverty and low-quality employment standards (see Section 3). Thus, the study turns to analyse the role of trade on poverty in the sector.

5.1.3 Agriculture and agro-industry

Table 7 reports the effect of trade on poverty in farm and agro-related industries (for information on the effects of control variables, refer to Appendix C). As from descriptive analysis in Section 3, it is notable there are higher levels of informality within the sector activities. 96 out of 100 workers in agriculture have an informal job. This structural segmentation appears relevant when assessing the effects of trade on the sector.

Column 1 of Table 7 presents the overall results for the sector, and as for estimations for the country, imports exert a negative impact on the likelihood of being poor, although this is not statistically significant. By contrast, at 10% of significance, exports prove again a powerful tool to drive down poverty in the sector. This pattern is consistent regardless of the formal and informal dimension of the sector, suggesting strong linkages that might reshape vulnerability to poverty. On the other hand, unlike the country model presented in Table 6, tariffs appear to harm poverty outcomes indicating that to some extent removal of some forms of protections

¹⁵ This assumption is based on the fact that while in Peru the formal country makes up a small part of the economic activity, it generates around 80% of the country's GDP (INEI, 2018b). In 2018, the informal sector comprised 7,480,000 producing units while the formal sector was constituted by 2,393, 033 units (INEI, 2018c).

increases the probability of falling into poverty. Column 3 shows the same pattern for the informal sector.

Against this background, Column 2 reports outcomes for the formal sector, which considerably diverges from those at the general level. The first difference is that tariffs cuts are associated with poverty reduction diminishing the likelihood for individuals of being poor. Equally, higher shares of agro-exports in the country's exportable offer and increasing imports for the sector reduce the probability of those engaged in this economic activity.

Table 7. Trade liberalisation effects on poverty in Peru in the agriculture sector, 2010-2016

	(1) Agriculture sector	(2) Agriculture formal sector	(3) Agriculture informal sector
Tariffs	-1.395*** (0.304)	0.0366 (2.374)	-1.411*** (0.305)
Exports	-0.952*** (0.178)	-0.00979 (1.391)	-0.963*** (0.179)
Imports	0.0179 (0.0902)	-1.031 (0.761)	0.0469 (0.0906)
Constant	18.54*** (3.974)	16.96 (31.96)	18.44*** (3.992)
Observations	95,482	3,711	91,672
Year FE	YES	YES	YES
Departamento FE	YES	YES	YES

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Source: ENAHO 2010-2016.

5.1.4 Agro-exports linkages

As noted from the previous analysis, exports proved to be a strong driver for poverty reduction during the period of trade liberalisation investigated. While the channels through which this

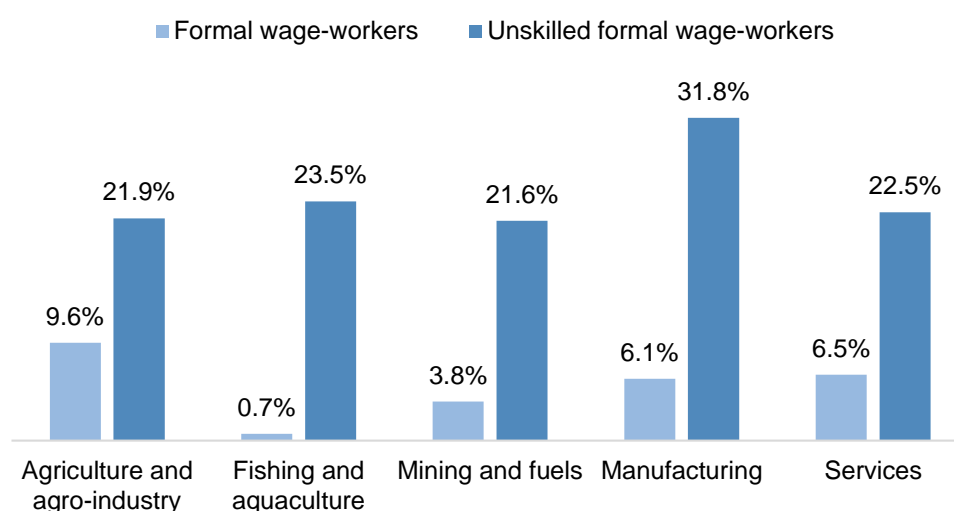
variable operates are not directly addressed¹⁶, it can be abstracted from the effects of changes in trade policy by looking at the dynamics of some of the market labour factors that the bulk of the economic literature focus on when investigating the link between trade and poverty namely employment and income.

Mainly, the study looks at the agriculture sector which as explained in Section 2 was one of the economic sectors in the country experiencing a marked transformation intricately linked with the opening of foreign markets coupled with lower rates of poverty, although where the majority of poor are found. It is then expected to see changes in these variables associated with a steadily upward trend in exports.

Certainly, as shown in Figure 9 and Table 10, employment for wage/salary workers increased on average 4.5% annually throughout 2010 and 2016. Moreover, this figure was of 9.6% for those in the formal sector, the largest between all economic sectors. Similarly, data shows that income in the formal sector rose on average 5.8% yearly widening the income gap concerning the workers in the informal sector. Moreover, data shows that the number of unskilled workers employed in the formal sector rose 21.9%, contributing to the formalisation of the economy. Therefore, this circumstantial evidence suggests that policy changes in the trade regime adopted by the country benefited the poor on the export side through the creation of formal jobs and higher wages. However, the informality might have limited the spill overs brought by increasing exports.

¹⁶ For a thorough review of the channels through which trade can impact the poor see McCulloch, Winters and Cirera (2001), Winters (2002) and Heo and Doanh (2009).

Figure 13. Employment in the agriculture sector 2010-2016



Source: ENAHO 2010-2016.

Table 8. Employment and income growth in the agriculture sector 2010-2016

	<u>2010</u>	<u>2016</u>
Employment (1000 people)		
EOAP employed	3,914	4,173
Wage-workers	694	906
Formal wage-workers	88	153
Unskilled wage-workers	497	855
Unskilled formal wage-workers	41	135
Monthly average income (real Peruvian Sol, 2007=100)		
EOAP employed	398.3	554.9
Wage-workers	417.4	671.7
Wage-formal workers	756.5	1062.2
Wage-informal workers	368.2	592.4

Source: ENAHO 2010-2016.

5.1.5 Robustness test

Various sensitivity analyses were conducted to rule out biases in the estimations of the present investigation. Accordingly, the first robustness check addresses the model specification. The study relies on a logistic model using maximum likelihood estimations to account for the main shortcomings of an LPM for dichotomous outcomes as underlined by Kennedy (2008). Nevertheless, scholars had also emphasised the utility of simple LPM (Hellevik, 2009) thus, as

suggested by Horrace and Oaxaca (2006)¹⁷, the study implements an estimation of equation (1) following a truncated distribution of the sample used as detailed in Section 4. Results are reported in Appendix D¹⁸.

Secondly, the preferred measure linking trade and cut reductions during the period investigated is substituted. Instead of MFN, the study includes in the analysis the nominal tariff or effectively applied duties which consider preferential access to Peruvian markets gained bilaterally through negotiations of FTAs as described in Section 2. Results are also reported in Appendix D. Changes in both the specification model and in some of the critical variables for the analysis show consistency with the results obtained in the study's baseline estimations.

5.2 Discussion

The study finds overall a positive impact of trade liberalisation episodes in the country during 2010-2016 on poverty outcomes. This result echoes previous studies for the Peruvian economy on trade liberalisation and individual well-being. Looking at the effects of the Peru – United States FTA, Šimůnková (2012) found that trade opening aid poverty through increases in

¹⁷ Linear Probability Models (LPM) follow the assumptions established in OLS models. While LPM models implementation and interpretability is more straightforward, under certain circumstances modelling binary dependent variables assuming a linear function distribution can lead to some transgressions to the OLS's underlying assumptions i.e. homoscedasticity which can be addressed using robust standard errors or feasible generalized least squares (FGLS) estimator, however, the major shortcoming of this model is that it could yield “nonsense” probabilities, that is outside the range 0-1 (Greene, 2012). Horrace and Oaxaca (2006) contend that when the number of the predicted values outside this range is low, this can be addressed by truncating the sample, that is, excluding observations with “nonsense” probabilities. For the present study, the number of observations was 7% of total. Following the authors, those observations were left aside to perform the robustness check.

¹⁸ Estimations before and after implementing Horrace and Oaxaca's methodology using LPM for further inspection are also reported.

income for both poor and non-poor Peruvians. Indeed, it was only after the negotiations of modern FTAs that exports, and imports showed a significant increase as tariffs were reduced significantly. The effects of this trend reached the poor engaged in different economic activities. However, whether the individuals were found either the formal or informal sector determined to a great extent how trade impacted the likelihood of falling into poverty.

The model specified in Section 4 found exports a strong driver of poverty reduction regardless of where the individual was working, consistent with the vast majority of the economic literature on the topic (Heo & Doanh, 2009; McCaig, 2011). The analysis and evidence on the agriculture sector suggest that the linkages through which exports operate are increases in wages and employment. Similar results had been obtained by Castellares, Regalado and Huarancca (2018) who investigated the effects of the Agrarian Law in Peru and observed higher wages and employment growth in workers associated with increasing agro-export activities. Also, in this line, the BCRP (2019c) found a positive impact of this law on the employment rate and mean income of the workers in the agriculture sector driven by better conditions and access to international markets and diversification of the exportable offer.

Thus, the expansion of Peruvian exports, mainly agro exports, due to extensive use of FTAs as noted by Vasquez (2017) proved to be effective at reducing poverty. These findings are in line with recent literature on the topic such as the work of Fukase (2013) whose study on the Vietnamese economy following the implementation of the FTA between the country and the United States suggested that trade liberalisation contributed to the growth of wages in provinces exposed to expanding exports. Furthermore, the investigation's results support studies stressing the contribution of agriculture through a wide range of linkages to both growth and poverty reduction (Tiffin, R. & Irz, X., 2006; Cervantes-Godoy, D. & J. Dewbre, 2010; Dethier & Effenberger, 2011; Christiaensen et al., 2011; Ivanic, M., & Martin, W., 2018;).

The reduction of poverty through exports is a critical finding for the economic literature focused on Peru as most of it had previously pointed out a limited effect of this variable due to a strong bias to traditional sectors with no muscle to drive forward changes for the poor. As such Vasi and Carpio (2006) estimated that the first wave of liberalisation in Peru (1990-2000) benefited traditional sectors because of lower barriers to enter new markets but not diversification of the export portfolio, particularly in traditional sectors, i.e. agriculture, fishing and mining., thus the authors observed positive but limited effects of trade liberalisation.

By contrast, the second wave of Peruvian liberalisation studied in this investigation generated an increase in exports of non-traditional sectors and products, e.g. new export crops with more value-added as reviewed in Section 2. The study shows then that the change in the structure of trade-flows, mainly in the agriculture sector, benefited the poor. Trade liberalisation and adoption of non-traditional of exports crops had been recognised to drive welfare gains but constrained to country and individual characteristics as in Brazil (Damiani, 2003), Guatemala (Carletto et al., 2007) and Vietnam (Gulati & Narayanan, 2003).

Indeed, previous research on the impact of trade liberalisation –particularly agricultural trade opening– underlines the role of country-features and supplement policies on poverty outcomes (Hertel, 2006; Litchfield, Mcculloch & Winters, 2003) which is also confirmed from the analysis of the Peruvian economy in this study. It revealed that the probability of being poor both at country level and in the agriculture sector due to changes in trade policy significantly depends on the dynamics and segmentation of economy characterised by high levels of informality. As such, tariffs cuts appear to hurt the poor, yet these effects are no longer observed in the formal sector. The former effect was also observed in some LAC countries as noted by Goldberg and Pavcnik (2005c) for Colombia and by Baldárrago and Salinas (2017) for Peru, the latter at district level. Nevertheless, some studies on developing countries outside the region depicted different outcomes as Coello, Fall and Suwa-Eisenmann (2011) showed for Vietnam.

Baldárrago and Salinas (2017) underlined that liberalised imports may create some “losers” and can adversely hinder some economic sectors through the import-competing channel. Certainly, while this study finds exports help reduce poverty, it observes a negative impact of imports, a dichotomy also found for Brazil (Castilho, Menéndez & Sztulman, 2012). however, the study extends its analysis to account for potential effects of informality –a common and important feature in most the LAC economies– and the structure of trade, i.e. the composition of the purchased traded goods.

By doing so, the study found that the effect of imports is more pronounced for those performing in the informal sector, yet when considering the impact of importing capital and intermediate goods, imports turn to influence the likelihood of being poor negatively. Hence, trade might have indeed boosted access to necessary inputs for the national industry as noted by Goldberg, Khandelwal, Pavcnik and Topalova (2009) for India. One plausible explanation for that is potential savings from lower tariffs applied to imports of such goods. For instance, according to official information from Mincetur (2014) only between 2009-2013 Peruvian firms saved

around US\$ 996 million due to reductions in tariffs when importing from the United States one of the major providers of intermediate and capital products for Peru.

On this regard Winters and Martuscelli (2014) contend that access to cheaper and more intermediate goods can indeed raise productivity and therefore induce positive changes in incomes and economic growth, yet they also stress that this might displace workers as production becomes less labour dependent. From a poverty perspective, this is important to understand as displaced workers in less productive or informal activities are more likely to fall into poverty. Nevertheless, while Xinshen, McMillan and Rodrik (2017) observed this (“negative structural change”) for most the LAC countries, the authors do not observe that pattern for Peru and Chile. However, the extent to which trade through the import competing channel might play a role in this scenario has not been examined thoroughly.

Lastly, the study found that individual and geographic aspects played an important role when assessing the impact of trade on poverty as most of the economic literature had underlined. Firstly, higher levels of education consistently show a negative relation with the probability to fall into poverty. Yet, from data analysis for the period under investigation, the study also found an increase in employment for unskilled workers in the formal sector. This has been observed by the BCRP (2018d) for the formal agriculture sector exposed to trade in line with the findings of Fukase (2013) for the unskilled labour force in export sectors in Vietnam.

Secondly, the area of residence proved a relevant driver on the likelihood of being poor even amid trade liberalisation. While the study does not directly address factors shaping the dynamics of trade-spatial dispersion, it abstracts from the adverse effects of the latter (area of residence) reported continuously in its results on the trade-poverty link. One factor behind this pattern might be associated to the enormous infrastructure gap (MEFb, 2019) and high trade-related logistics costs (Begazo, Goodwin & Gramegn, 2018; World Bank, 2018c), two distortion factors that can offset the effect of trade policy, i.e. changes of prices at border and pass-through to domestic prices (Winters et al., 2004). Goldberg and Pavcnik (2004e), Martínez-Zarzoso et al. (2018), Balat, Brambilla and Porto (2009) and Vasi and Carpio (2006) had demonstrated trade-related costs distorting effects on poverty for Colombia, Tunisia, Uganda and Peru, respectively.

Overall, the impact of trade liberalisation in Peru from 2010 to 2016 proved to be pro-poor. Agricultural transformation and an export orientation in the sector are a sharp tool the country

can continue to harness to fight poverty. Nevertheless, informality remains a factor limiting its effects. Policies aiming to address this phenomenon, and sizable infrastructure deficiencies can significantly improve the positive effects of trade.

6 Conclusion

6.1 Summary and conclusion

The present study aimed to research the relationship between trade liberalisation and poverty in Peru. Using microdata from the National Household Survey (ENAHO), it assessed changes in the probability of being poor during the liberalisation episodes occurred in Peru during 2010-2016 looking at how and which industry individuals engage.

The study focused on the mentioned period as it was the most comprehensive trade liberalisation the country underwent with the negotiation of FTAs with its major trading partners, i.e. the United States and China and regional peer countries. Previous waves of trade opening occurred during the implemented structural reforms Peru embarked on in the 90's and consisted mainly in a unilateral removal of high and disperse tariffs and import lists. The expansion of trade was more pronounced during the decade under study, particularly the transformation of the agriculture sector driven by exports as Peru integrated into the global economy using FTAs. Thus, the study included in its analysis the impact of trade in the sector.

The empirical strategy was the adoption of a partial equilibrium approach using a logistic probability model to measure the impact of trade on the poor in Peru. The main question of the study was to answer if changes in trade policy helped reduced poverty in Peru between 2010 and 2016. Thus, from the study of the sub research questions stated in Section 1, the conclusion is that trade did aid to poverty; however, this outcome was to a great extent determined by how the individuals engage in the economic activity, that is, if they work in the informal/formal sector. Certainly, informality is a distorting feature in most of the LAC economies, but more prevalent in Peru (Yamada & Chacaltana, 2009; Loayza, 2008).

Table 6 briefs the main findings of the present research as reported and discussed in Section 5 and shows that trade liberalisation was a sharp tool to reduce poverty through the export channel. The positive effect of this variable remained in all the sectors of the economy studied.

By contrast, the impact of increasing imports reported adverse effects on poverty, particularly in the informal sector. However, when looking at the structure of the trade inflows to the country, heavily concentrated in capital and intermediate goods, the impact of imports becomes positive. This might be associated with the fact that those products are destined to local industries to provide products and services, boosting economic activity, and therefore to reach the poor through economic expansion. Increases in labour productivity associated with imports of capital goods and inputs for the industry and a consequent reduction of the labour force have not been observed by scholars for the country.

The effect of tariff cuts was in general positive for alleviating poverty, however as in the case of imports, its effects are heavily determined by the segmentation of the labour in the formal and informal sector. This suggests that removing some forms of protection might hurt the poor, highlighting the necessity to supplement trade policy to harness its positive effects.

Table 9. Findings summary

Research question	Variable	Overall impact	Formal sector	Informal sector
Country				
RQ 1	Tariffs	Positive	Negative	Positive
RQ 2	Exports	Positive	Positive	Positive
	Imports	Negative	Negative*	Negative
Agriculture sector				
	Tariffs	Negative	Positive	Negative
	Exports	Positive	Positive	Positive
	Imports	Negative	Positive	Negative
	Employment	Positive	Positive	Positive
	Wage	Positive	Positive	Positive

Finally, on the analysis of the agriculture sector, the study found a positive effect of exports much in line with those at country level. By contrast, imports and tariffs negatively impact the poor in the sector when they were engaged in informal work. The impact of trade measures as exports, tariff cuts and imports proved to be positive for those in the formal sector.

Moreover, data from ENAHO provided evidence regarding the possible channels through which trade operates. Hence, during 2010 and 2016 a positive effect was observed in employment and wages in the sector, particularly in the formal sector (see Table 9) contributing to the much needed formal employment in the country as noted by the BCRP (2019c).

6.2 Policy implications and future research

The effects of trade liberalisation on poverty remain a heated topic in the economic literature driven by different results in countries studied. Idiosyncratic factors might lie behind this outcome as proved by the empirical evidence surveyed in this investigation. Winters and Martuscelli (2014) contend that, indeed depending on what policies are liberalized and the way the poor engage in the economy, trade may heterogeneously impact poor households.

The evidence for Peru empirically tested in this study suggests positive effects of trade on poverty. However, the perverse effects of high levels of informality limit the impact of trade, more oriented to the formal sector, which still makes a small part of the working population. Policies aiming at reducing the sheer size of the informal sector are much needed to correctly design and implement policies, including trade policies, to alleviate poverty. Peru has made important progress in reducing poverty lifting 10 million people out of poverty in the last decade. However, evidence-based policies can indeed harness the ongoing transformation the country experiences, particularly when economic growth positive effects are losing momentum (García & Céspedes, 2011).

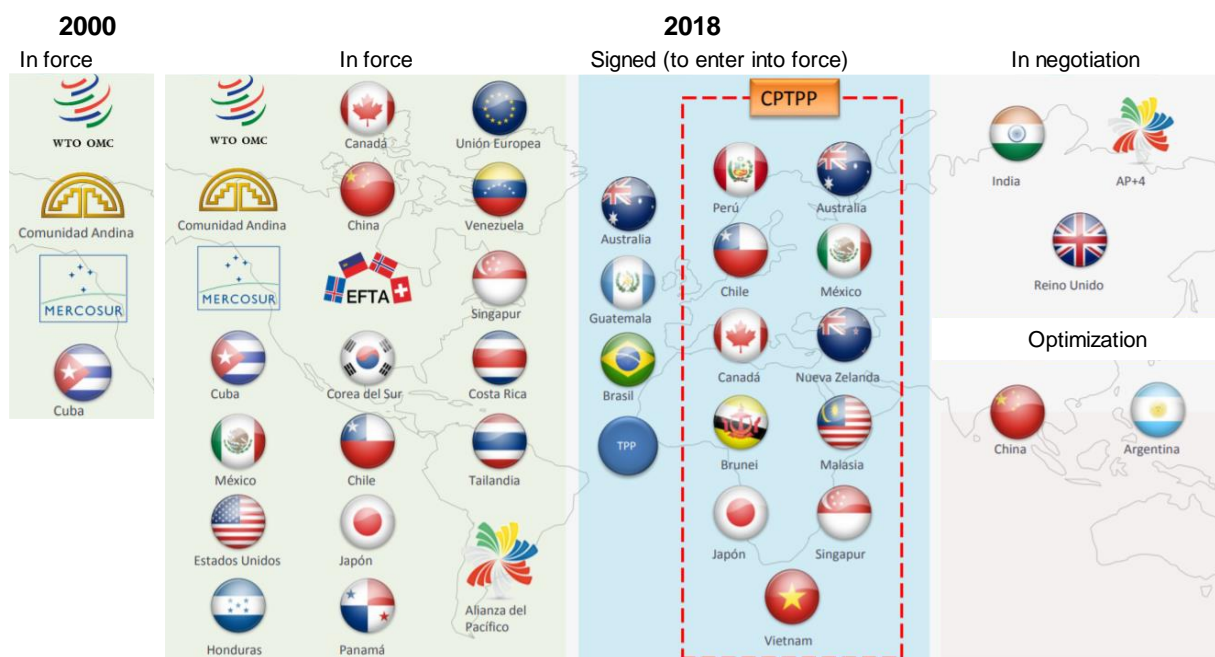
Exports, particularly, agro exports appeared as a strong driver for poverty reduction supporting previous investigation on the effects of the Agrarian Law, mostly orientated to boost non-traditional agricultural products. Recently, on September 2019, the Peruvian government correctly extended the period of application of this law until 2031 with some modifications on its legal framework. Indeed, this tool can help public efforts to tackle poverty in the country. This should go in hand with policies oriented to facilitate the logistics and administrative burdens exports face in the country. A third wave in this regard is underway in the country (World Bank, 2017a; WTO, 2019a) that should be a long-term policy.

Finally, more research on the channels through which trade operates is key against this backdrop. Tailored policies to address poverty need evidence-based foundations. Accounting for the mechanisms and not only the direction of trade effects is essential. As such Winters (2004) refers to the “backward” or “forward” linkages to refer to the effects of trade within and outside the liberalised sector. Investigation supplementing the direction of the effects of trade in this regard are needed. Also on the import side, it is critical to assess the extent to which trade operates, especially, through the import competing channel to have a more accurate

picture of the impact of trade on the economy and how this affects the poor disproportionately concentrated in the informal sector.

Appendix A: Peru, FTAs and trade liberalisation

Table 10. Peru. FTAs 2000-2018. Adapted from Bayona, S. (2019)



Appendix B: Marginal effects of trade-related variables

Delta-method						
	Margin	Std. Err.	z	P>z	[95% Conf. Interval]	
Exports at						
0%	0.20779	0.004066	51.11	0	0.1998211	0.2157581
10%	0.175151	0.00183	95.69	0	0.1715636	0.1787387
20%	0.146059	0.006194	23.58	0	0.1339193	0.1581978
30%	0.120503	0.009467	12.73	0	0.1019471	0.1390587
40%	0.09838	0.011645	8.45	0	0.0755552	0.1212045
50%	0.079505	0.012846	6.19	0	0.0543271	0.1046832
60%	0.063631	0.013226	4.81	0	0.0377092	0.0895537
70%	0.050467	0.012959	3.89	0	0.0250682	0.0758653
80%	0.039694	0.01222	3.25	0.001	0.0157424	0.0636449
90%	0.030987	0.011174	2.77	0.006	0.0090867	0.0528877
100%	0.024031	0.00996	2.41	0.016	0.0045094	0.0435531
Delta-method						
	Margin	Std. Err.	z	P>z	[95% Conf. Interval]	
Imports at						
0%	0.174012	0.009967	17.46	0	0.1544784	0.1935462
10%	0.188133	0.002381	79.03	0	0.1834671	0.1927984
20%	0.202967	0.015707	12.92	0	0.1721811	0.2337528
30%	0.218503	0.030345	7.2	0	0.1590284	0.2779777
40%	0.234724	0.046144	5.09	0	0.1442825	0.3251654
50%	0.251607	0.063029	3.99	0	0.1280721	0.3751421
60%	0.269125	0.080906	3.33	0.001	0.1105512	0.427698
70%	0.287243	0.099665	2.88	0.004	0.0919029	0.4825836
80%	0.305925	0.119179	2.57	0.01	0.0723388	0.5395103
90%	0.325125	0.139303	2.33	0.02	0.052096	0.598154
100%	0.344797	0.159881	2.16	0.031	0.0314347	0.6581584
Delta-method						
	Margin	Std. Err.	z	P>z	[95% Conf. Interval]	
MFN at						
18%	0.240473	0.058452	4.11	0	0.1259088	0.3550365
15%	0.228305	0.044557	5.12	0	0.140975	0.3156345
12%	0.216502	0.031371	6.9	0	0.1550166	0.2779865
9%	0.205071	0.018926	10.84	0	0.167978	0.2421644
6%	0.19402	0.007261	26.72	0	0.1797887	0.208252
3%	0.183354	0.003769	48.65	0	0.1759676	0.1907407
0%	0.173076	0.013831	12.51	0	0.1459683	0.2001841

Appendix C: Estimations tables

Table 6. Trade liberalisation effects on poverty in Peru by sector, 2010-2016 (including control variables)	(1) Country formal sector	(2) Country informal sector
Group age = 2, [20,25>	-0.0752 (0.206)	-0.0764** (0.0327)
Group age = 3, [25,30>	-0.104 (0.204)	-0.116*** (0.0357)
Group age = 4, [30,35>	-0.131 (0.205)	0.00457 (0.0361)
Group age = 5, [35,40>	-0.00241 (0.205)	0.0332 (0.0362)
Group age = 6, [40,45>	-0.152 (0.208)	-0.219*** (0.0371)
Group age = 7, [45,50>	-0.482** (0.212)	-0.507*** (0.0384)
Group age = 8, [50,55>	-0.667*** (0.222)	-0.718*** (0.0400)
Group age = 9, [55,60>	-0.772*** (0.228)	-0.875*** (0.0419)
Group age = 10, [60,65>	-0.962*** (0.245)	-0.916*** (0.0433)
Group age = 11, >=65 years	-1.067*** (0.266)	-0.954*** (0.0386)
Sex = 2, man	-0.450*** (0.0611)	-0.477*** (0.0164)
Level of education = 2, Secondary	-0.469*** (0.0778)	-0.585*** (0.0166)
Level of education = 3, Technical	-1.178*** (0.0906)	-1.308*** (0.0339)
Level of education = 4, University	-2.120*** (0.113)	-2.039*** (0.0504)
Level of education = 5, Postgraduate	-2.542*** (0.281)	-3.463*** (0.421)
Ethnical background = 2, Afroperuvian	-0.313* (0.190)	-0.258*** (0.0500)
Ethnical background = 3, White	-0.362*** (0.133)	-0.283*** (0.0386)
Ethnical background = 4, Mestizo	-0.221*** (0.0701)	-0.217*** (0.0202)
Ethnical background = 5, Other	-0.00110 (0.0994)	-0.0401 (0.0260)

Civil status = 2, Single	-0.267*** (0.0868)	-0.258*** (0.0257)
Civil status = 3, Cohabitant	0.402*** (0.0651)	0.246*** (0.0186)
Civil status = 4, Other	-0.00187 (0.0927)	-0.104*** (0.0220)
Natural Region = 2, Andean highlands	0.300** (0.148)	0.438*** (0.0289)
Natural Region = 3, Jungle	0.232 (0.214)	0.0887** (0.0392)
Area of residence = 1, Urban	-0.328*** (0.0678)	-0.203*** (0.0167)
Occupation = 2, Self employed	0.441*** (0.147)	0.707*** (0.0354)
Occupation = 3, Employee	0.833*** (0.147)	0.823*** (0.0380)
Occupation = 5, Other	1.718 (1.126)	0.0269 (0.106)
log_income	-0.653*** (0.0355)	-0.339*** (0.00648)
Firm size = 2, Medium	0.0515 (0.114)	-0.102* (0.0533)
Firm size = 3, Large	-0.101 (0.0831)	0.0126 (0.0348)
Tariffs in industry j	-0.0955 (0.153)	0.0388 (0.0314)
Share of Exports in industry j	-0.0220 (0.0274)	-0.0244*** (0.00524)
Share of Imports in industry j	0.00993 (0.0337)	0.0117 (0.0114)
Constant	3.851*** (1.159)	2.057*** (0.252)
Observations	79,043	247,210
Year FE	YES	YES
Industry FE	YES	YES
Departamento FE	YES	YES

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 7. Trade liberalisation effects on poverty in Peru in the agriculture sector, 2010-2016 (including control variables)	(1) Agriculture sector	(2) Agriculture formal sector	(3) Agriculture informal sector
Group age = 2, [20,25>	-0.0964* (0.0581)	-0.603 (0.453)	-0.0948 (0.0582)
Group age = 3, [25,30>	-0.0208 (0.0594)	-0.333 (0.483)	-0.0230 (0.0591)
Group age = 4, [30,35>	-0.00920 (0.0586)	-0.804* (0.462)	0.0134 (0.0588)
Group age = 5, [35,40>	0.0965* (0.0571)	-0.106 (0.457)	0.0943* (0.0572)
Group age = 6, [40,45>	-0.222*** (0.0579)	-0.265 (0.468)	-0.229*** (0.0578)
Group age = 7, [45,50>	-0.487*** (0.0583)	-0.823* (0.488)	-0.488*** (0.0582)
Group age = 8, [50,55>	-0.650*** (0.0605)	-0.567 (0.549)	-0.658*** (0.0602)
Group age = 9, [55,60>	-0.818*** (0.0617)	-1.444*** (0.545)	-0.814*** (0.0618)
Group age = 10, [60,65>	-0.879*** (0.0622)	-1.178** (0.586)	-0.878*** (0.0622)
Group age = 11, >=65 years	-0.822*** (0.0581)	0.0338 (0.793)	-0.825*** (0.0578)
Sex = 2, man	-0.375*** (0.0235)	-0.233 (0.213)	-0.380*** (0.0236)
Level of education = 2, Secondary	-0.569*** (0.0231)	-0.375** (0.176)	-0.577*** (0.0231)
Level of education = 3, Technical	-1.247*** (0.0723)	-1.176*** (0.326)	-1.231*** (0.0748)
Level of education = 4, University	-1.675*** (0.109)	-1.514*** (0.534)	-1.643*** (0.109)
Level of education = 5, Postgraduate	-2.748*** (0.864)		-2.305*** (0.891)
Ethnical background = 2, Afroperuvian	-0.346*** (0.0718)	-0.261 (0.404)	-0.331*** (0.0732)
Ethnical background = 3, White	-0.347*** (0.0530)	-0.545 (0.401)	-0.331*** (0.0535)
Ethnical background = 4, Mestizo	-0.333*** (0.0275)	-0.186 (0.257)	-0.331*** (0.0271)
Ethnical background = 5, Other	-0.0731** (0.0343)	0.432 (0.304)	-0.0835** (0.0340)
Civil status = 2, Single	-0.285*** (0.0365)	-0.0949 (0.238)	-0.292*** (0.0367)
Civil status = 3, Cohabitant	0.209*** (0.0243)	0.217 (0.198)	0.208*** (0.0243)
Civil status = 4, Other	-0.301*** (0.0285)	-0.251 (0.271)	-0.300*** (0.0287)
Natural Region = 2, Andean highlands	0.666***	-0.449	0.665***

	(0.0430)	(0.477)	(0.0436)
Natural Region = 3, Jungle	0.222***	-0.665	0.220***
	(0.0534)	(0.910)	(0.0539)
Area of residence = 1, Urban	-0.0793***	0.352**	-0.0839***
	(0.0260)	(0.169)	(0.0264)
Occupation = 2, Self employed	0.884***	-1.300	0.884***
	(0.0390)	(1.398)	(0.0391)
Occupation = 3, Employee	1.028***	0.704	1.034***
	(0.0456)	(0.571)	(0.0457)
log_income	-0.291***	-1.106***	-0.289***
	(0.00855)	(0.228)	(0.00855)
Informality in principal activity = 2, formal	-0.410***		
	(0.108)		
Firm size = 2, Medium	-0.0794	0.346	-0.163*
	(0.0853)	(0.376)	(0.0872)
Firm size = 3, Large	-0.438***	-0.512*	-0.401***
	(0.0914)	(0.303)	(0.0993)
Tariffs in industry j	-1.395***	0.0366	-1.411***
	(0.304)	(2.374)	(0.305)
Share of Exports in industry j	-0.952***	-0.00979	-0.963***
	(0.178)	(1.391)	(0.179)
Share of Imports in industry j	0.0179	-1.031	0.0469
	(0.0902)	(0.761)	(0.0906)
Constant	18.54***	16.96	18.44***
	(3.974)	(31.96)	(3.992)
Observations	95,482	3,711	91,672
Year FE	YES	YES	YES
Departamento FE	YES	YES	YES

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 11. Trade liberalisation effects on poverty in Peru by BEM (capital and intermediate goods) 2010-2016

	(1) Capitals and intermediate goods
Group age = 2, [20,25>	-0.0756 (0.206)
Group age = 3, [25,30>	-0.104 (0.204)
Group age = 4, [30,35>	-0.132 (0.205)
Group age = 5, [35,40>	-0.00213 (0.205)
Group age = 6, [40,45>	-0.152 (0.207)
Group age = 7, [45,50>	-0.482** (0.212)
Group age = 8, [50,55>	-0.666*** (0.222)
Group age = 9, [55,60>	-0.772*** (0.227)
Group age = 10, [60,65>	-0.962*** (0.245)
Group age = 11, >=65 years	-1.068*** (0.266)
Sex = 2, man	-0.450*** (0.0611)
Level of education = 2, Secondary	-0.469*** (0.0779)
Level of education = 3, Technical	-1.179*** (0.0906)
Level of education = 4, University	-2.120*** (0.113)
Level of education = 5, Postgraduate	-2.542*** (0.281)
Ethnical background = 2, Afroperuvian	-0.313* (0.190)
Ethnical background = 3, White	-0.361*** (0.133)
Ethnical background = 4, Mestizo	-0.220*** (0.0700)
Ethnical background = 5, Other	-0.00252 (0.0994)
Civil status = 2, Single	-0.265*** (0.0868)
Civil status = 3, Cohabitant	0.403*** (0.0651)
Civil status = 4, Other	-0.00123 (0.0927)
Natural Region = 2, Andean highlands	0.301**

	(0.148)
Natural Region = 3, Jungle	0.231
	(0.213)
Area of residence = 1, Urban	-0.329***
	(0.0677)
Occupation = 2, Self employed	0.441***
	(0.147)
Occupation = 3, Employee	0.833***
	(0.147)
Occupation = 5, Other	1.718
	(1.126)
log_income	-0.653***
	(0.0355)
Firm size = 2, Medium	0.0515
	(0.114)
Firm size = 3, Large	-0.102
	(0.0831)
Tariffs in industry j	-0.0915
	(0.154)
Share of imports in industry j	-0.0135
	(0.0259)
Share of imports in industry j (1)	-0.0541
	(0.0569)
Constant	4.201***
	(1.221)
Observations	79,043
Year FE	YES
Industry FE	YES
Departamento FE	YES

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Appendix D: Robustness check

Robustness check 1	(1) Country Model LPM	(2) Country Model truncated LPM
Group age = 2, [20,25>	-0.0249*** (0.00444)	-0.0151*** (0.00460)
Group age = 3, [25,30>	-0.0238*** (0.00452)	-0.0150*** (0.00477)
Group age = 4, [30,35>	-0.0103** (0.00474)	3.55e-05 (0.00499)
Group age = 5, [35,40>	-0.00366 (0.00485)	0.00695 (0.00509)
Group age = 6, [40,45>	-0.0330*** (0.00487)	-0.0293*** (0.00516)
Group age = 7, [45,50>	-0.0662*** (0.00487)	-0.0730*** (0.00524)
Group age = 8, [50,55>	-0.0885*** (0.00495)	-0.106*** (0.00537)
Group age = 9, [55,60>	-0.108*** (0.00510)	-0.132*** (0.00566)
Group age = 10, [60,65>	-0.118*** (0.00539)	-0.145*** (0.00601)
Group age = 11, >=65 years	-0.139*** (0.00530)	-0.160*** (0.00567)
Sex = 2, man	-0.0546*** (0.00172)	-0.0727*** (0.00202)
Level of education = 2, Secondary	-0.0969*** (0.00254)	-0.103*** (0.00261)
Level of education = 3, Technical	-0.158*** (0.00299)	-0.184*** (0.00329)
Level of education = 4, University	-0.166*** (0.00288)	-0.219*** (0.00323)
Level of education = 5, Postgraduate	-0.132*** (0.00353)	-0.186*** (0.00452)
Ethnical background = 2, Afroperuvian	-0.0198*** (0.00618)	-0.0298*** (0.00678)
Ethnical background = 3, White	-0.0186*** (0.00408)	-0.0313*** (0.00474)
Ethnical background = 4, Mestizo	-0.0154*** (0.00223)	-0.0240*** (0.00249)
Ethnical background = 5, Other	0.00798** (0.00332)	0.00337 (0.00356)
Civil status = 2, Single	-0.0321***	-0.0398***

	(0.00250)	(0.00297)
Civil status = 3, Cohabitant	0.0327***	0.0370***
	(0.00229)	(0.00249)
Civil status = 4, Other	-0.0151***	-0.0174***
	(0.00243)	(0.00286)
Natural Region = 2, Andean highlands	0.0634***	0.0737***
	(0.00384)	(0.00425)
Natural Region = 3, Jungle	0.00372	0.0104*
	(0.00563)	(0.00612)
Area of residence = 1, Urban	-0.0629***	-0.0547***
	(0.00263)	(0.00269)
Occupation = 2, Self employed	0.0608***	0.101***
	(0.00308)	(0.00391)
Occupation = 3, Employee	0.0726***	0.117***
	(0.00331)	(0.00418)
Occupation = 5, Other	-0.0662***	-0.0298*
	(0.0174)	(0.0176)
log_income	-0.0505***	-0.0598***
	(0.000904)	(0.000993)
Firm size = 2, Medium	-0.0117***	-0.00852*
	(0.00429)	(0.00503)
Firm size = 3, Large	-0.0136***	-0.0102***
	(0.00262)	(0.00311)
Informality in principal activity = 2, formal	-0.0275***	-0.0526***
	(0.00211)	(0.00258)
Tariffs in industry j	-0.00162	0.00186
	(0.00395)	(0.00416)
Share of imports in industry j	-0.0108***	-0.00965***
	(0.000738)	(0.000776)
Share of imports in industry j	0.00239*	0.00281**
	(0.00125)	(0.00138)
Constant	0.927***	0.926***
	(0.0306)	(0.0327)
Observations	326,253	283,869
R-squared	0.208	0.197
Year FE	YES	YES
Industry FE	YES	YES
Departamento FE	YES	YES

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Robustness 2	(1) Country Model truncated LPM	(2) Country Model truncated LPM & nominal tariff
Group age = 2, [20,25>	-0.0151*** (0.00460)	-0.0150*** (0.00460)
Group age = 3, [25,30>	-0.0150*** (0.00477)	-0.0149*** (0.00477)
Group age = 4, [30,35>	3.55e-05 (0.00499)	7.17e-05 (0.00499)
Group age = 5, [35,40>	0.00695 (0.00509)	0.00699 (0.00510)
Group age = 6, [40,45>	-0.0293*** (0.00516)	-0.0293*** (0.00516)
Group age = 7, [45,50>	-0.0730*** (0.00524)	-0.0730*** (0.00524)
Group age = 8, [50,55>	-0.106*** (0.00537)	-0.106*** (0.00538)
Group age = 9, [55,60>	-0.132*** (0.00566)	-0.132*** (0.00566)
Group age = 10, [60,65>	-0.145*** (0.00601)	-0.144*** (0.00601)
Group age = 11, >=65 years	-0.160*** (0.00567)	-0.160*** (0.00568)
Sex = 2, man	-0.0727*** (0.00202)	-0.0727*** (0.00202)
Level of education = 2, Secondary	-0.103*** (0.00261)	-0.103*** (0.00261)
Level of education = 3, Technical	-0.184*** (0.00329)	-0.184*** (0.00329)
Level of education = 4, University	-0.219*** (0.00323)	-0.219*** (0.00323)
Level of education = 5, Postgraduate	-0.186*** (0.00452)	-0.186*** (0.00452)
Ethnical background = 2, Afroperuvian	-0.0298*** (0.00678)	-0.0298*** (0.00678)
Ethnical background = 3, White	-0.0313*** (0.00474)	-0.0313*** (0.00474)
Ethnical background = 4, Mestizo	-0.0240*** (0.00249)	-0.0239*** (0.00249)
Ethnical background = 5, Other	0.00337 (0.00356)	0.00338 (0.00356)
Civil status = 2, Single	-0.0398*** (0.00297)	-0.0398*** (0.00297)
Civil status = 3, Cohabitant	0.0370*** (0.00249)	0.0370*** (0.00249)

Civil status = 4, Other	-0.0174*** (0.00286)	-0.0174*** (0.00286)
Natural Region = 2, Andean highlands	0.0737*** (0.00425)	0.0737*** (0.00425)
Natural Region = 3, Jungle	0.0104* (0.00612)	0.0104* (0.00612)
Area of residence = 1, Urban	-0.0547*** (0.00269)	-0.0547*** (0.00269)
Occupation = 2, Self employed	0.101*** (0.00391)	0.101*** (0.00391)
Occupation = 3, Employee	0.117*** (0.00418)	0.117*** (0.00418)
Occupation = 5, Other	-0.0298* (0.0176)	-0.0298* (0.0176)
log_income	-0.0598*** (0.000993)	-0.0598*** (0.000993)
Firm size = 2, Medium	-0.00852* (0.00503)	-0.00855* (0.00503)
Firm size = 3, Large	-0.0102*** (0.00311)	-0.0102*** (0.00311)
Informality in principal activity = 2, formal	-0.0526*** (0.00258)	-0.0526*** (0.00258)
Tariffs in industry (MFN) j	0.00186 (0.00416)	
Share of imports in industry j	-0.00965*** (0.000776)	-0.00974*** (0.000768)
Share of imports in industry j	0.00281** (0.00138) (0.0791)	0.00282** (0.00138) (0.0796)
Tariffs in industry j (Nominal duty)		0.000226 (0.00201)
Constant	0.926*** (0.0327)	0.938*** (0.0183)
Observations	283,869	283,871
R-squared	0.197	0.197
Year FE	YES	YES
Industry FE	YES	YES
Departamento FE	YES	YES

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Robustness 3	(1) Country Model traded goods only
Group age = 2, [20,25>	-0.116** (0.0512)
Group age = 3, [25,30>	-0.0761 (0.0533)
Group age = 4, [30,35>	-0.0449 (0.0526)
Group age = 5, [35,40>	0.0227 (0.0516)
Group age = 6, [40,45>	-0.221*** (0.0528)
Group age = 7, [45,50>	-0.554*** (0.0531)
Group age = 8, [50,55>	-0.720*** (0.0549)
Group age = 9, [55,60>	-0.900*** (0.0562)
Group age = 10, [60,65>	-0.959*** (0.0570)
Group age = 11, >=65 years	-0.912*** (0.0528)
Sex = 2, man	-0.381*** (0.0220)
Level of education = 2, Secondary	-0.576*** (0.0213)
Level of education = 3, Technical	-1.372*** (0.0570)
Level of education = 4, University	-1.926*** (0.0927)
Level of education = 5, Postgraduate	-3.760*** (0.852)
Ethnical background = 2, Afroperuvian	-0.371*** (0.0649)
Ethnical background = 3, White	-0.294*** (0.0511)
Ethnical background = 4, Mestizo	-0.294*** (0.0264)
Ethnical background = 5, Other	-0.0710** (0.0329)
Civil status = 2, Single	-0.286*** (0.0334)
Civil status = 3, Cohabitant	0.201*** (0.0232)
Civil status = 4, Other	-0.260*** (0.0273)
Natural Region = 2, Andean highlands	0.597*** (0.0374)

Natural Region = 3, Jungle	0.178*** (0.0484)
Area of residence = 1, Urban	-0.127*** (0.0231)
Occupation = 2, Self employed	0.797*** (0.0388)
Occupation = 3, Employee	0.915*** (0.0444)
log_income	-0.312*** (0.00807)
Firm size = 2, Medium	-0.0359 (0.0709)
Firm size = 3, Large	-0.300*** (0.0646)
Informality in principal activity = 2, formal	-0.573*** (0.0652)
Tariffs in industry j	0.0315 (0.0795)
Share of imports in industry j	-0.0112 (0.0105)
Share of imports in industry j	0.0203* (0.0115)
Constant	1.690*** (0.592)
Observations	127,457
Year FE	YES
Industry FE	YES
Departamento FE	YES

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