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The Effect of Trade on Poverty Reduction

A panel data study on trade's effect on poverty, investigating the different impacts between high- and low-income countries.

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Abstract

Poverty is a global issue that has been targeted to be eradicated completely. This study examines the causal effect of trade on poverty and its reduction by using panel data for 195 countries over the time of 32 years. The purpose is to investigate if there is a positive relationship between trade and poverty and whether the impact of trade is different between high-income countries and low-income countries. To fulfil the purpose of this study, a fixed-effects model is estimated with robust standard errors. The estimated results imply no direct effect of trade on poverty, providing a low, yet positive and insignificant relationship. The results are inconsistent with earlier studies that found evidence on the effect. However, these findings can be used for future research.

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1. Introduction

Global poverty places as one of the world's most serious issues today, and despite constant contributions and endeavours toward minimising poverty, it has been challenging to overcome the issue. Unfortunately, although the progress made during the last generation¹, setbacks have occurred and reversed accomplishments within poverty reduction. According to WHO (2022), the sudden occurrence of the coronavirus pandemic has hazarded individuals' standards of living, pushing the poverty rate back to its worst level, and precisely because of that, one of the most urgent global goals today is the development against poverty (Roser & Ortiz-Ospina, 2013).

The issue of poverty is crucial because of the wide range of unfortunes associated with it. As a result of poverty, adult men and women, youths, children and newborns are all troubled with poor living standards, which will feature in the rest of their lives. Living under poor conditions mainly implies a lack of food, nutrition, hygiene, and shelter. Living under poor conditions can bring about insecurity for every tomorrow, and not least, the lack of voice as a human being. It disturbs any opportunities for stable incomes for the families as poor living conditions affect the social mobility of achieving employment. Furthermore, with most likely no educational attainment to lean on, families cannot provide greater conditions for their children's future or allow them the chance of stability in food, shelter, or education (WBG, 2022). The risks of psychological damage and physical harm primarily impact the children living in poverty, as the conditions of providing them with the necessities that every human child deserves are unsuccessful (APA, 2009).

Poverty eradication has been a global development goal since decades ago. The aim has been worked towards, accomplishments have been achieved, and new goals have been revised and set. The United Nations and its members agreed upon eight Millennium Development Goals to work towards and attain over 15 years, committing to conquering poverty, hunger, diseases, illiteracy, environmental degradation, and discrimination against women (WHO, 2018). Fifteen years of commitment has led to significant growth

¹ The use of generation refers to the latest 25 years (the World Bank Group, 2022).

and development in some fields. In contrast, others were more demanding, which led to further negotiation within the general assembly that resulted in a development agenda for another fifteen years – “*Transforming our world: the 2030 Agenda for Sustainable Development*”, a UN Resolution (A/RES/70/1) adopted by the UN General Assembly in 2015, which is an expansion to 17 Sustainable Development Goals (SDGs), consisting of 169 targets. The first of the SDGs is the goal to “*end poverty in all its form everywhere*”, which goes hand in hand with the goals of no hunger, improved health and well-being, quality education, access to water and sanitation, and reduced inequality in all its forms – while simultaneously achieving economic growth and preserving nature.

Frankel and Romer (1999) found significance in the indirect impact of trade on poverty reduction through trade’s contribution to economic growth, with that impact being stronger than that from direct action on poverty reduction. At most, the indirect effects were found to outweigh the direct effects due to trade giving access to greater potential benefits and valuable gains, such as opportunities for higher employment levels, more excellent investment opportunities in, for example, human capital, and more so, the greater availability of complementary factors of production that yields higher productivity among the poorer population. Trade is significant due to the self-sustained growth that it is contributed with, a source of wealth that utilizes economies of scale, creates opportunities for economic growth and access to technologies to improve one’s productivity and competitiveness. However, it is crucial to acknowledge that with greater trade flow, liberalisation, and experienced beneficial expansion come risks and uncertainties such as disturbances in social stability and unsettling social conditions, which the poorest ones will face (Brooks, 2003).

This motivates the contribution of my study. This paper aims to investigate the impact trade has on eradicating poverty around the world over the period of 1988 to 2020 and whether the impact differs between developing and developed countries. My contribution is entirely empirical, using panel data on nearly all countries across the world to examine the effect. Onwards, the purpose is to investigate whether the positive effect, which is expected, is shared by the poorest of countries or if it is merely beneficial for the already developed countries with established international trade patterns.

According to evidence presented later in this study, greater trade positively affects poverty reduction. Previous economic studies have concluded that trade has a sustainable effect on economic growth while acknowledging that trade development has created both positive and negative impacts. Trade may leave harm during its process of eradicating all types of poverties. It is explained by Berg and Krueger (2002, as cited in Brooks, 2003) that the overall effect of trade liberalisation and trade openness is beneficial for the poor, on average proportionally to the rest of the population. However, it is commonly emphasised that economic growth is far from systematic and varies across countries and over time.

For the empirical investigation, I used a data set consisting of cross-country data from 195 countries from 1988 to 2020, obtaining a comprehensive panel data set, but unfortunately quite unbalanced. The Fixed-effects model regressions were conducted with this data set and the results shows that a higher tariff rate has a positive yet insignificant effect on the poverty rate. The lack of significance in this relationship is inconsistent with the economic trading theories and earlier studies on the relationship between trade and poverty. Therefore, further research is of interest and is needed as the outcome of this investigation is unexpected.

The disposition of the paper follows with sections and subsections. The following section is a background providing information and statistics on the main topics of this paper, which is sub-sectioned into poverty, trade and trade barriers and tariffs. The third section shortly presents some common theoretical models within the trade, which are associated with a great part of the literature in this field. The paper proceeds with a literature review in section 4, which provides theories and earlier findings on trade's impact on poverty. Onwards, section 5 presents the empirical model and method, defining the theoretical and econometric model and describing the data, sources, and variables. The empirical results and analysis are presented and discussed in section 6 – analysing the obtained regressions and reflecting on their outcomes. At last, a conclusion section is provided, summarising the study altogether, answering the expectations and highlighting for further research.

2. Background

In this section, information on poverty and trade is presented. First, defining poverty and its global encompass earlier and today, and the effort towards achieving the goal of no poverty of any form by 2030. Lastly, I will present the global extent of trade and the purpose of trade barriers.

2.1 Poverty

Poverty has been a global threat for a highly long time. According to the World Bank Group, the share of individuals living in extreme poverty has sustainably depreciated during this generation, referring to around the latest 25 years, moving towards the global goal of no poverty in all its form. Thereupon came the coronavirus pandemic about two years ago, moving poverty into the worst setback of its generation with inclining extreme poverty rates instead. COVID-19² affected all individuals globally, becoming a pandemic rather quickly and leaving most of the damage to the poorer countries and households, who have suffered greater job losses and lower income rates. Among many damages are illness, scarce necessities, shortage of nutrition, loss of income, lack of care, and lower living standards (the World Bank Group [WBG], 2022).

Today, statistics on poverty are measured by national poverty lines, set to 1.90 dollars a day, referring to the purchasing power parity of 2011. Living on less than two dollars a day (equivalent to 20 SEK) may seem impossible for us. However, looking around our world today, around 700 million of our fellow human beings barely survive on merely 1.90 dollars a day or even less. That means about 10% of the world's population lives in poverty (Concern US, 2022). The WBG (2022) emphasises that poverty is more than not being able to afford equipment and substances. Poverty is the lack of ability to meet basic needs such as food, shelter, and clothing. Suffering from poverty comes with various problems such as hunger, an illness that stays helpless, and the lack of access to education and social- and economic opportunities.

² An infectious disease caused by the SARS-CoV-2 virus, a fast-spreading virus that harmed great parts of the population and quickly became a pandemic (WHO, 2021).

Throughout the latest generation, concerns about the too high poverty rate have been raised. Therefore, goals have been set to eradicate poverty, and efforts have been made to raise awareness and help reduce poverty. The Sustainable Development Goals, formerly the Millennium Development Goals, established by the United Nations (UN), have incorporated poverty reduction as one of the aims. Out of all the 17 sustainable development goals (SDGs) on the agenda by 2030, the first is *Poverty Eradication – to end poverty in all its forms everywhere*. It is acknowledged that the challenge to eradicate extreme poverty is a vital one for sustainable development and also the greatest challenge of them all (UN, SDGs, n.d.). Within this goal (SDG1), seven targets are being aimed for:

- 1.1 to eradicate extreme poverty,
- 1.2 to reduce poverty by at least 50%,
- 1.3 to implement social protection systems,
- 1.4 equal rights to ownership, essential services, technology, and economic resources,
- 1.5 to build resilience to environmental, economic, and social disasters, to build the strength of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events and other environmental disasters,
- 1.6 mobilisation of resources to end poverty,
- 1.7 pro-poor public spending, create a sound policy framework at the national, regional, and international levels, based on pro-poor and gender-sensitive development strategies to support accelerate investment in poverty eradication actions (Ritchie et al., 2018).

These particular development goals have been stated earlier as one of the key Millennium Development Goals (MDGs) set till 2015. The MDGs consisted of 8 goals that the members of the UN all agreed upon to achieve by the year 2015. MDG1 was to eradicate extreme poverty and hunger, and according to the UN, “*the MDGs helped to lift more than one billion people out of extreme poverty, to make inroads against hunger, to enable more girls to attend school than ever and to protect our planet*” (World Health Organization [WHO], 2018). Moreover, it was reported that while some countries succeeded impressively in the health-related targets, other countries were suffering from

high levels of HIV and AIDS, economic difficulties, and other conflicts and thereby still staying behind in the progress (WHO, 2018).

During the time of 1947 to 1963, a rapid decline in US families' incomes was discovered. The percentage of families living under \$3000³ fell from 31.4% to 18.5% during those years. This accelerating decline towards poverty assembled discussions and the motive to analyse the incidence of poverty and investigate what factors contribute to and affect those living in poverty (Thurow, 1967). Further on, discussions have been raised on whether the effects on poverty have shed light on middle- and low-income countries and rely solely on the international poverty border at \$1.90 per day. Such that the absolute poorest people are overseen and unable to be identified (WBG, 2021). This has altered the focus to highlight those in most need of support, focusing on those in extreme poverty (Roser & Ortiz-Ospina, 2013).

The most crucial plague of our time is poverty. Measures recognised that international trade is engaging as a powerful tool that steadily stimulates the overall economic progress and mitigates poverty (UNCTAD, 2006, as cited in UN, n.d.). It is generally agreed that to stimulate countries' development and economic growth and hopefully eradicate portions of poverty, an opening of those countries' markets for trade is a fundamental instrument. The common philosophy regarding trade liberalisation is that it contributes to a more extended economic growth through improvements in efficiently allocating scarce resources, which then accelerates economic welfare (Rodríguez & Rodrik, 2000, as cited in UN, n.d.).

2.2 Trade, trade barriers and tariffs

A significant way to expand the range of products a domestic consumer has access to is through international trade – not only does trade allow domestic industries to export their products, but it also decreases the cost of production through rising competition (Radcliffe, 2022). The WBG (2021) acts in favour of the developing countries and pushes them to participate in the global trading system, aiming to fuel growth, improve employment- and economic opportunities, and reduce poverty.

³ This poverty line refers to the year 1963 dollars. The use of this poverty line is being questioned yet not defended by the author (Thurow, 1967).

Frankel and Romer (1999, as cited in Brooks, 2003) continue to argue that the indirect effect of trade is highly valuable due to the potential it creates in benefits, gains in employment, investment opportunities, human capital, productivity in production, greater trade flow and liberalisation that fuels economic growth. Followingly, the comparative advantage models elaborated by a few economists such as Ricardo, Heckscher, and Ohlin emphasise that under free trade, countries will always produce their exporting goods at a cheaper level than their competitors and their other goods. They will profit by producing it at a lower opportunity cost than its trading partners, exporting them and earning profit even if they are of lower quality, and then importing the goods that are produced relatively cheaper elsewhere – in that sense, resources are being allocated where they will be most efficient. It is argued that great competition in the international market enhances technological efficiency and exchange of knowledge, leading to consumer profits which are said to advantage all trading partner countries (Holthoff, 2009).

The free trade being advocated for above has been argued to be only partially beneficial. The disadvantages with free trade are the lowered tax revenues, allegedly worse working conditions for the employees and the risk of other producers copying one's idea or product and selling knockoffs. Therefore, barriers to trade have been introduced, and these so-called trade barriers appear in several forms. They are established through government policies to restrain the flow of international products, goods, and services. The barriers are seen as protection to shield certain industries and certain segments of the economy. The most common barrier to impose is trade tariffs: tariffs that arise as a tax on certain imported goods, raising the price of the imported goods and creating less competition for the imports. Different product groups have different tariff rates imposed on their imported merchandise. The rates differ between countries and being a major trading partner may affect the rate. All types of tariffs, imports, and duties are reported by the World Trade Organization (Pettinger, 2019). The levying of tariffs is primarily created to protect emerging industries⁴ in their developing economies or even already advanced industries as a retaliation technique and to protect the domestic employees and consumers on the market (Radcliffe, 2022). The undesirable effect of a high tariff rate is the increased price

⁴ Emerging industry (infant industry) is a business in its early stage of development with a new technology or product (Kenton, 2021).

level of imported goods. Thereby, the market will face higher consumer prices, less attractive consumption, and limited volumes of imports (Kenton, 2021).

Conclusively, as the protection of trade barriers is beneficial for some industries, they may harm other sectors simultaneously. Commonly, the tariffs are primarily high for the developing countries, allegedly twice as high barriers on import as they are for the developed countries – making it more expensive to import interesting goods and less attractive for them to export (World Trade Organization [WTO], n.d.). As the modern view on trade and barriers advocates for free trade, organisations such as the WTO aim to restrict countries' opportunities to impose tariffs, attempting to resume the level of production and consumption that was distorted by the tariffs (Radcliffe, 2022). In any case, the contraction of the trade barrier has been steady and growth-stimulating, as the global tariffs have decreased on average from an 11-percentage tariff in 2000 to a 7 percent tariff rate in 2006 (WTO, n.d.).

3. Theories on the benefits of trade to a country

One of the most substantial contributions to economic theory is the Ricardian theory of comparative advantage, an idea of international trade that determines the trade pattern of a country and claims gains from trade if there is comparative advantage. If there is an ability to produce goods at a lower opportunity cost, countries will specialise in these goods in which they are relatively more productive (Maneschi, 1992). An established theory and model that incorporates the common assumptions of perfect competition but does not ease countries' ability to distinguish what products that give the better returns. Therefore, the Heckscher-Ohlin Model (H-O) was developed. H-O is an economic theory that addresses and evaluates trade and proposes the most efficient way of trading between two countries (Kopp, 2022). The theory analyses and justify how different trading nations should operate and ideally export and import their resources and material. By asserting the benefits of international trade when countries all devote their most effort, naturally, all countries are allowed to adjust their production to capital-intensive, taking favour from the elastic demand, increasing the cost of labour, and decreasing the marginal productivity.

Within this theory, the amount of capital per worker is essential, rather than the absolute amount of capital. The advantage of the H-O model is its ability not only to limit itself and evaluate tradable commodities but also to incorporate the costs of production factors, such as labour. Some critiques against the theory of trade are its lack of political engagement from the government and the lack of investment from industry stakeholders (Britannica, 2021). There is a theorem within this model that clarifies the relationship between the movements of goods prices and factor prices, the Stolper-Samuelson theorem. By acknowledging that when prices of skilled workers in intense industries rise, the relative wages in the economy should increase as well, while the real wage for the unskilled workers will decrease (Lam, 2015).

Furthermore, the theoretical policies of free trade that benefit countries are the promotion of innovation and competition. The economic policies for free trade aim to remove any kind of import- and export discrimination, to reduce any obstacles preventing the import and allow more goods to reach the market. These advantages of greater goods with higher quality and lower prices benefit a country with greater work opportunities, quicker innovation, and enhanced competition. When economies open up for global trade and investment, there is clear evidence for sustained economic growth as economic success increases rates of good living standards (Spillan, 2017). Further discussion on how trade affects poverty is provided in the literature review.

4. Literature Review

To review the relationship between trade and its effect on poverty, I will present literature findings from various studies that regard trade and poverty in the following subsection, along with results from earlier studies that investigated trades' effect on poverty. The second subsection will present findings of control variables on the relationship between trade and poverty.

4.1 The relationship between Trade and Poverty

Over time, theories and approaches to development and poverty eradication have had contrasting discussions, questioning development aid and international trade. While one segment endorsed free trade as an economic order yielding in development, others advocated for assistance by the development of the richer countries and favoured wealth

development and poverty reduction in the poorer nations (Holthoff, 2009). *“The dependency theory was an approach of understanding the economic underdevelopment that emphasises the putative constraints imposed by the global political and economic order”* (Munro, 2018). Believers in this theory were convinced that the global market was built to systematically treat the poorer countries unfavourably, guiding these countries into a neo-colonial aid dependency on the more affluent countries. Further on, they all advocated for a total disengagement from the world market, and its aid structures, as the only action to deviate from the circle of underdevelopment. It was not until the 1980s, when South Korea, Hong Kong, Singapore, and Taiwan opened up for integration with the world market and received an economic boost, that the neoclassical foreign trade theories that advocate trade liberalisation were established all over again. Henceforth, liberalisation measures were imposed with the purpose of generating economic growth and industrialisation, which hopefully would encourage solutions to the debt crisis and ultimately reduce poverty (Holthoff, 2009).

Nevertheless, one should acknowledge that the development of trade creates both benefits and disadvantages, in that trade may leave harm during its process of eradicating all types of poverties. According to Berg and Krueger (2002), as cited in Brooks (2003), the overall effect of trade liberalisation and trade openness is beneficial for the poor by fuelling economic growth, on average proportionally with the rest of the population. However, it is emphasised that economic growth is far from systematic and varies considering countries and over time. Aligning with the beliefs of Holthoff (2009), it is common that the trade barriers imposed on developing countries are much greater than those by the developed countries (Dollar & Collier, 2002, as cited in Brooks, 2003). Therefore, rather than implementing policies to restrain trade and impede overall growth, policies aim to increase the beneficial rates for the poorer economies by providing greater opportunities for those individuals to participate in, so productivity in the tradable goods sector will increase and boost growth (Brooks, 2003).

In 2006 the UN published a chronicle explaining that the instrument of international trade reduced half the portion of men, women, and children living on less than one dollar per day, suffering from hunger. It is indicated that trade has helped achieve steady growth in the developing countries, reaching significant increases in global trade over a period of

10 years, including the consistent rate of exports and thereby enhancing the revenues from exports, increasing GDP per capita, and with that, higher employment rates and investment levels. The relationship from trade to poverty is then affected by several factors. Further, it is found that the strong growth in developing countries is by virtue of reducing the global tariff barriers (UNCTAD, 2006, as cited in UN, n.d.).

That is briefly interpreted as the causation between trade and growth is more complex than that and built upon national context. Different countries endure diverse effects on poverty depending on macroeconomic factors such as economic stability, infrastructure, and the fiscal sector. Therefore, it is emphasised that the countries should be aware and cautious before entering as competition in the global market. Trade alone cannot reach all goals to eradicate poverty, it does not unquestionably lead to constant growth and a world without poverty, but trade does favourably open for a wide range of opportunities – it is then essential for each developing country to prepare with supply capacity and technical- and financial cooperation for the global competition. The relationship that is presented in the chronicle underlines the unemployment that may occur as distress from the transitioning onto the open market – countries need to be assembled for the reallocation of workers, which includes time for education, training new policies, and unemployment benefit programs for the sectors that work under no competitive advantages (Rodríguez & Rodrik, 2000, as cited in UN, n.d.).

In line with the previous chronicle, Hayashikawa (2008) agrees upon the relationship between trade and poverty being strong yet far from automatic. The primary justification is that the degree of development matter and differ across countries. Not all developing countries or social groups are experiencing growing development. Brooks (2003) has expressed that with increased trade flows, liberalisation and beneficial expansions come risks and uncertainties that the poorest ones will face. These difficulties will show by the smaller scaled farmers and trading industries that involves a large number of poor. Such difficulties may be social stability disruption, environmental changes that yield unsettling conditions, and high adjustment costs unbearable for the poorest.

The International Consumer Unity and Trust Society (CUTS) established a series of case studies on the linkage between the growth of exports and poverty reduction. A case of 13 developing countries in Asia and sub-Saharan Africa revealed a positive relationship between the two variables, with Vietnam as the highest performing country for both variables. Despite the overall strong positive relationships, some countries were found to deviate slightly, either by experiencing low rates overall, by an impressive reduction in poverty or by having high export rates and yet only a modest poverty reduction, such as Cambodia did. This analysis reinforced the theory of other factors being significant for poverty reduction. It was found through this 13-countries-case-study that trade did not sustain significantly for all economies, not for the poorer economies (CUTS International, 2008).

Forwardly, Hayashikawa (2008) argued that trade does not deliver, nor is it a sufficient condition for the poorer countries as they encounter impediments of expansion and diversification in their exports, even if they are firmly integrated into the world of trade. Trade is not sufficient for the low-income groups as their share of export declined because of the low levels of capacity and capital, which would be necessary for trade to deliver. McCulloch, Winters, and Cirec (2001, as cited in Hayashikawa, 2008) then identified the primary justification as to why these poorer countries lack the beneficial share of the trade market: the necessity of a balanced growth strategy – to access full perquisites from the openness to trade standardisations of stability, policy, governance, and education needs to be present to lead to “*economic growth and, depending on pace and patten, growth is food for the poor*”. Moreover, the structural weaknesses within the lower-income countries are due to the poor ability to respond and the restraints on the supply-side, scarcity of human capital, and unskilled governance and institutions, which then yields inefficient infrastructure and geographical prospects. Lastly, the high costs of doing business that bear with the adjustments have been highly criticised – the poorer population is more vulnerable to the magnitude of income changes (CUTS, 2008, as cited in Hayashikawa, 2008).

Although evidence from Hayashikawa (2008) shows that the middle- and low-income countries obtain a smaller share of the long-term growth, it is strongly stated that no economy has been successfully developed by operating against international trade and

foreign investment. Fairly all economies that have seized the opportunities given by the open markets and trade liberalisation have all indeed achieved continuous economic growth. The author listed the reasons why trade matters and its importance:

- It plays a crucial channel in self-sustained growth and poverty reduction and is a source of wealth generator.
- It plays a crucial channel for domestic firms as they exploit the more prominent and affluent markets to utilise economies of scale, creating opportunities for sustained economic growth.
- It plays a crucial channel for developing countries as it allows them access to technologies that improve their productivity and competitiveness, generating further growth and employment opportunities.

It was found by Rodriguez and Rodrik (1999, as cited in Hayashikawa, 2008) that the results of trade liberalisation promoting economic growth were reflected by inaccurate variables, and thus difficult to determine a causal relationship between trade and poverty based on the literature. For such heterogeneity, further studies and research are complex – earlier studies do fail to establish the systematic relationship and an econometric regression in the field due to the variables being endogenous and complex in the causal relationship, risking reverse causality. In addition, according to Bhagwati and Srinivasan (2001, as cited in Hayashikawa, 2008), there are difficulties in identifying the causality, measuring and defining openness, and isolating the effects of trade liberalisation. A regression ran by Turner, Nguyen and Bird (2008), provided fuzzy outcomes which were inappropriate to explain the relationship between trade and growth. Therefore, they concluded the regression to be invalid. Hayashikawa (2008) agreed with previous authors on the complex relationship and declared an empirical analysis rather challenging. Further mentioning a possible test “*for the indirect linkage between open trade (changes in trade volume) and poverty (changes in income share of the poorest)*”, the outcome gave significant evidence of robust associations on the effect of openness on growth. Consequently, causality between trade and income has been stated as challenging to measure due to other variables playing as relevant factors and the unrecognised direction of the correlation (Holthoff, 2009).

Nevertheless, three main channels in which trade directly impacts poverty exist. Trade will adjust profits; this means changes in border prices, which will appear in the prices presented to the poor. These variations will affect the flexibility of wages and the labour force, which will appear in employment levels. Furthermore, larger parties, such as fiscal policies, are playing a more significant part in the trade market than expected – governments' revenues and expenditures are volatile and will appear in taxes and social expenditures (Winters, 2002, as cited in Hayashikawa, 2008). Indeed, trade liberalisation has forced governments to answer and become more translucent when facing benchmarks of international standards and reinforced the market discipline in societies. To allow the poor to capitalise on the gains from trade, societies must target the most critical sectors for the poor through policies to increase their productivity and efficiency of trade (McCulloch et al., 2001, as cited in Brooks, 2003).

To this day, the disparity between the richer nations and the poorest ones has not shrunk but instead grown wider. That is due to the poorest countries being stuck behind as the rest have continued to emerge. Since neither financial and technical aid nor free trade has helped with the lacking growth or poverty alleviation, it has been questioned whether the aid efforts have not been adequate or if the international trading system is what persistently preserves the underdevelopment. The predicted impact of trade on developed countries is indeed differing from the impact on the poorer countries (Holthoff, 2009).

Oh and Lee (2018) investigated this disparity in *Does Trade Contribute to Poverty Reduction? If It Does, Where the Benefit Go?* by exploiting the Multidimensional Poverty Index, developed by the Oxford Poverty and Human Development Institute and the UN Development Program, as their dependent variable to study the development of poverty via trade. By examining data sets on a macro level across 20 countries from 1990 to 2015, the framework included the economic environment, governance indicators, and human resource quality factors. A fixed-effects model was generated to determine the effect of trade on poverty. As their independent variables representing trade, they studied the export and import share, with control variables such as the GDP per capita, inflation, financial dept, the rule of law, and primary education contemplation ratio. The percentage of export tends to accompany the reduction of poverty. At the same time, an increasing share of import or import tariffs has the tendency to increase poverty, as explained by

Harrison (2007, as cited in Oh & Lee, 2018). It is presented that the relationship between the poor population and economic inflation is contentious as the inflation indicator reflects the change in consumer price index (CPI). Yet, many studies have reached the outcome of rich ones suffering less from inflation than the poor, and as a result, higher inflation led to higher poverty rates (Oh & Lee, 2018).

Above all outcomes from the regression, it is concluded that trade affects poverty differently across countries. Some theories agree that trade implies growth, and that trade implies eradication of poverty. But it is more controversial than that. Other approaches speak for trade indeed being beneficial for the eradication of poverty, though it is not a principal factor. This study found that expanding export shares affected the urban areas with lower poverty rates but did not have the same effect on the rural areas, which depended on the factual situation that different areas produce and trade different goods. This raises the discussion of whether it is because of the structural system that the poor, lower-income, and rural areas are not benefiting from the trade or due to the factual situation. If so, it is suggested that strategies and policies are necessary to help the poorer areas by transferring the benefits to these groups (Oh & Lee, 2018). Brooks (2003) agrees with this, explaining that as there is a substantial relationship between poverty and the small-scaled agricultures in greater parts of the developing countries. The agricultural sector is argued to be a key sector for the solution of poverty eradication with its potential to create a vast demand for domestic products. The connection between agriculture and other sectors, such as the rural areas, generates opportunities for more trade and development, which will affect stimulation in the rural regions.

Within the theoretical framework of the study, the traditional trade theory advocates for trade liberalisation affecting the wages of unskilled workers positively, which is then associated with inequality- and poverty reduction in the developing countries, related to the Heckscher-Ohlin model and the Stolper-Samuelson theorem presented in the theoretical framework section 3. Moreover, it is found that the effects and benefits rely on labour market flexibility (Cain, Hasan, & Mitra, 2010, as cited in Oh & Lee, 2018).

4.2 Earlier findings on poverty and its control variables

The issue of poverty and detecting its affecting causes have been studied before. Among the papers is *Poverty Across the Globe: A Cross-Sectional Analysis of the Underlying Causes*, conducted by Gabrielle A. Gentilcore (2017), who analyses the underlying causes of poverty across 50 countries in year 2012. Gentilcore (2017) used the poverty headcount ratio indicator with the 1.90 dollar verge based on the 2011 international prices. Six independent variables and their relationships to poverty were examined, and these independent variables were categorised into two investigating independent variables: economic and health. Using ordinary least squares (OLS), the outcomes showed significant results on the relationship between the natural logarithm of the unemployment rate, the natural logarithm of the percentage of the population with access to improved drinking-water and sanitation sources, and the poverty headcount ratio. Two models were generated as omitted variables appeared when included in the same model. The unemployment rate showed a significant positive relationship with the poverty headcount in both models – the higher the unemployment rate, the higher the poverty ratio. The variables of access to water and sanitation both showed negative relationships to poverty, indicating that the greater the share of the population with improved drinking-water and sanitation sources, the fewer people will live in poverty. The three remaining variables, infant mortality rate, the population density per square mile, and the average number of years a person is expected to live, all resulted in insignificant coefficient estimates in both generated models. However, it is comprehended that these specific variables are essential and should be included in the regression, as indicated by the F-tests (Gentilcore, 2017).

Further on, Chioma Austin-Mona Azih (2017) examined the 50 states of the US on what social- and economic factors were correlating with high or low poverty rates in *Analysis of Factors Contributing to Poverty in the United States: An Empirical Study*. Through quantitative and qualitative methods, seven independent variables were analysed on their correlation with the dependent variable, poverty. These explanatory variables were categorised by social- and economic variables, all with assigned hypotheses of their relationship to poverty. Below I collected the seven explanatory variables, categorised by either a social or an economic variable, and stated the hypotheses for each variable.

Table 1 Explanatory variables and hypotheses

	Government spending on education, a negative relationship is expected.
Social variables	Female-headed households, a positive relationship is expected.
	Violent crime rate, a positive relationship is expected.
	Divorce rate, a positive relationship is expected.
	Unemployment rate, a positive relationship is expected.
Economic variables	Minimum wage, a negative relationship is expected.
	Welfare spending, a positive relationship is expected.

Source: Adapted from Azih (2017), p. 154-155.

Using secondary quantitative data from public records and aggregate data on the US states from MicroCase software, an empirical analysis of scatter plots and ANOVA tables were conducted. The strongest correlation found with poverty was the ratio of female-headed households. A positive and significant finding was motivated by the argument that households with a woman in charge of managing the family are seen as more vulnerable and exploited to poverty. Primarily due to the discrimination against women in the workforce, the encountering of barriers to work, or not being able to work at all. Further on, compared to the male-headed households, expectations are that women are earning less, have no access to welfare, have lower education, have possible health issues, and have histories of domestic violence or substance abuse.

Moreover, as expected, education spending had a significant negative effect on the poverty rate, indicating that as the government invests more of their spending on education, individuals are provided with the necessary skills and knowledge which allow them to attain higher incomes, resulting in a lower poverty rate. Education spending is an investment by the government that can significantly lift individuals in the long run (Azih, 2017). *“Among individuals living in families in which the head has less than a high school education, 31.3% are below the poverty line, compared with just 9.6% of those whose head has at least a high school education”* (Hoynes, Page, & Stevens, 2006, as cited in Azih, 2017).

Henceforth, the findings supported the relationship between poverty and violent crime rate and divorce rate; violent crime is considered to foster instability and society, compromising living standards by affecting economic opportunities. Moving on to the economic category, the primary variable with the most robust supported findings and significant correlation to poverty was the unemployment rate. As unemployment has influential channels both on a macro and microeconomic level, a high rate would compromise individual and market opportunities, limiting economic growth. Lastly, the variable of minimum wage and welfare spending showed insignificant relationships to poverty, which was unexpected results as literature had supported the relationship as boosting income level, thereby reducing poverty rates, and respectively reinforcing and worsening poverty. Conclusively, it is established that the government must act more and address the issues of poverty and the market conditions as it deteriorates individuals' standards of living and interferes with development and growth, creating inefficiency and incapability (Azih, 2017).

Lastly, Thurow (1967) studied the causes of poverty, considering all types of families in the poverty model: families living on farms, families headed by a non-white, families with no one in the labour force, families with education in the family head, families that work full time, and the industrial structure of the US states. Thurow's model distinguishes Alaska and Hawaii from the model by using a dummy variable. Both states had high shares of non-whites, yet not black, and was therefore perceived as non-suffering from the same type of discrimination. The six mentioned variables are abundant, and the standard economic factors explain the incidence of poverty and why some workers have lower marginal productivity than others. It is found that education is uttermost the variable that will effectively eliminate poverty. Hence, poverty will decline if capital is adequate to provide and improve greater shares of the labour force with higher education. However, it is asserted that potential reductions do not translate to actual reductions without any policy interventions that affect the mentioned explanatory variables. There are necessary actions that need to be taken by the government to affect school enrolment, the system of the workforce, and discrimination in all degrees. Accelerating the growth rate of a family's income depends on the capacity of the economy to grow in productivity and efficiency of use of labour and capital (Thurow, 1967).

5. Empirical Model and Method

This section introduces relevant concerns for my empirical research. The subsections start with presenting my theoretical and econometric model. After that, the data sources are presented along with a description of the explanatory variables and the expected signs of the relationships between the dependent and independent variables. Finally, in the last subsection, the choice of method is explained and how this empirical analysis has progressed.

5.1 Theoretical and Econometric Model

To examine the impact of trade on poverty, a theoretical model is conducted to capture the determinants of the effect, including factors related to the poverty headcount ratio. The theoretical model used in this paper and the determinants of the poverty headcount ratio can be expressed as the following function:

$$Poverty = f(TR_{it}, UR_{it}, WA_{it}, lnPD_{it}, E_{it}) \quad (1)$$

The poverty headcount ratio is the only dependent variable of my study. It is the measurement of poverty reduction given in function (1) above and explained by the factor of TR , which is the tariff rate applied to countries' importations. This is my primarily independent variable investigated and is the weighted average tariff rate for the countries on all types of products imported. The tariff variable is expected to have a positive sign and relationship to poverty, meaning higher tariff rates result in higher poverty rates. The following control variable is UR , the unemployment rate of unemployed individuals who are open to work and is seeking for employment. The sign is expected to be positive; the higher the unemployment rate indicates a greater share of being out of work which means no income and a higher poverty rate. WA is the variable indicating the rate of population that has access to improved drinking-water sources, which I expect to have a negative relationship to poverty since a higher rate indicates more having access to this necessity and the poverty headcount ratio should decrease. $lnPD$ is the natural log of population density. The rate of how dense the population for each country is living and the expected sign is positive – the denser areas individuals live in, the worse living conditions and poverty headcount ratio will increase. The last control variable is the rate of education, E ,

which is the ratio of school enrolment, at the secondary education level, in relation to total school enrolment. I expect this relationship to be negative since education is the foundation of a future with opportunities, income, and less poverty. To investigate whether the impact differs between the high- and low-income countries, I will distinguish high-income country tariffs from low-income country tariffs by using two dummy variables presented in the econometric model below.

To estimate the effect of trade on poverty, the partial derivatives of function (1) are transformed into the econometric equation defined as:

$$\begin{aligned}
 Poverty_{it} = & \beta_0 + \beta_1 TR_{it} + \beta_2 UR_{it} + \beta_3 WA_{it} + \beta_4 \ln D_{it} + \beta_5 E_{it} + \beta_6 High_{it} \\
 & + \beta_7 Low_{it} + \beta_8 TR_{it} \times High_{it} + \tau_i + \varepsilon_{it}
 \end{aligned} \tag{2}$$

i denotes country and t represents time.

The econometric model (2) presented above includes the coefficient estimates of each determinant shown earlier in equation (1). Additionally, the two dummy variables indicate the countries' income groups: high-income countries and low-income countries.⁵ These dummy variables allow me to investigate whether the impact of trade differs between the two income countries. Therefore, the coefficient estimates of the interaction term of *tariff rate x high income* is included. Moreover, the model is built up with a tau variable, τ_i , which is the fixed effect term. Finally, the econometric model accounts for any residuals produced by the statistical model in its error term, ε_{it} . Based upon the previous discussions of expected relationships between the variables, the expected coefficient estimate signs for β_1, β_2 and β_4 are positive, and those for β_3 and β_5 are expected to be negative.

5.2 Data and Explanatory Variables Descriptions

The empirical part of this study is based on secondary data sets collected from two primary sources. The mainly used source is the World Bank Group, World Development Indicators, which provided specific cross-country data on poverty ratios, tariff rates,

⁵ The countries are divided into groups of either *High-* or *Low-*income country accordingly to the WBG (2022). Where countries noted as high- and upper-middle by the WBG belongs to High-income countries in this study and where low- and lower-middle belongs to Low-income countries in this study.

unemployment rate, population density and rate and level of education. The second data source is Our World in Data, providing cross-country data on the total share of the population having access to the improved level of drinking-water. All the indicators were last updated in 2022, giving the most recent numbers. Data has been collected over decades, and what is included in this empirical analysis is data collected from the earliest of 1988 to 2020 for 195 countries across the world. Regarding data on access to drinking-water sources, the earliest available data is from 2000 to 2020.

This is considered a large data set with observations of 195 countries with 32 years of data each, though unfortunately, there is a lot of missing data for many years and many of the countries in this study. When accounting for all variables in the data set, the definitive empirical study only observes 941 of these observations since the regressions only validate the year and country that have data available on all the variables in the data set. Due to the unbalanced dataset with many missing observations throughout the data set, only 941 observations are investigated.

Worth mentioning is that the data set includes as many of the world's countries as possible in hopes of investigating the effect at large, aiming to receive as realistic a representation as possible. The data set also includes a few regions that made the World Bank Dataset, although they are not countries but merely regions and islands belonging to countries. For simplicity, such regions and islands will be referred to as countries onwards. Moreover, some countries are excluded from my data set and not represented due to no data being found or far too little and unbalanced data being available for these countries. A list stating the delimited countries and what income group they classify as is presented in Appendix A at the end of this study.

Further limitations of this paper would be the large share of missing data caused by countries not having reporting data at all. Many countries have been without statistical data for many years, and unfortunately, these yield a poor representation of the reality in this study. Due to time limitations and limited opportunities, the unbalanced data set is not accounted for.

Table 2 below lists the variables used in the empirical analysis and a short description of the variables. Moreover, the expected signs for the explanatory variables are argued for.

Table 2 – List of Variables

Dependent variable		
	<i>Poverty</i>	Poverty headcount ratio at \$1.90 a day, 2011 PPP
Independent variables		
+	<i>Tariff</i>	Tariff rate, applied, simple mean, all products, %
+	<i>Unemployment</i>	Percentage of unemployment out of the total labour force
-	<i>Water</i>	Percentage of the population with access to improved drinking-water ⁶
+	<i>lnDensity</i>	The natural logarithm of population density ⁷
-	<i>Education</i>	Secondary school enrolment ratio to ratio of total school enrolment ⁸

Note: Only *lnDensity* is in its natural logarithm form. The signs +/- stated in front of the independent variables indicate the expected relationship with the dependent variables.

My primary independent variable explaining my dependent variable of poverty is the tariff rate. As presented in section 2.2, the background of trade, trade barriers, and tariffs, the tax imposed on imported goods has been advocated to protect certain markets and competition. However, the modest view has leaned more towards free trade, an open market for trading to stimulate export and import, more opportunities, more consumption choices, employment opportunities, and economic growth. That implies that the expected sign of tariffs' effect on poverty is positive – the higher the tariff rates imposed, the higher the costs of import, less trading, and thereby no decrease in the poverty headcount ratio.

The choice of tariff rate as the independent variable for this empirical study is based on the simplicity of investigating the opportunities and demand for international trade. The tariff rate measures the simple mean applied tariff, the unweighted average effective rate for all products (WBG, 2022) – a more suitable measurement for trade's effect on poverty than the use of net trade (exports minus imports). The tariff rate is the most appropriate measurement for this paper as I aim to identify different effects of trade on high- versus low-income countries, and it is stated that barriers of trade imposed on low-income

⁶ Improved drinking-water sources are shielded from outside contamination (WHO, 2021).

⁷ Population density is calculated by dividing the population by land area in square kilometres (WBG, 2022).

⁸ Secondary education refers to completing the provision of basic education that begins at the primary educational level, aiming to lay the foundation of lifelong learning and human development (WBG, 2022).

countries are commonly higher than those on the high-income countries (Dollar and Collier, 2002, as cited in Brooks, 2003).

The expected relationship for the unemployment rate is positive as a greater share of unemployed in the workforce results in a greater share of the workforce experiencing low or merely no income. *Water* and *Education* as control variables are expected to have a negative relationship to the dependent variable of poverty. Access to improved drinking-water sources has been standardised as a measure of individuals living conditions, along with sanitation and hygiene (Ritchie & Roser, 2021). Therefore, the greater the share of the population with access to improved drinking-water sources, the lower the percentage living in poverty. With that, I expect the poverty headcount ratio to decrease.

It was found by Thurow (1967) that the uttermost effective decline of poverty is the effect of education. Thereby, the more individuals that are given educational opportunities, the greater the share of school enrolment. I expect the poverty headcount ratio to diminish as the common overview is that education yields greater opportunities in the workforce, yielding in employment and income, fuelling growth, attaining possibilities of higher pay, and receiving necessities of health and higher standards of living.

Lastly, regarding population density, I would expect that as the population rises, so does population density, a smaller margin of area to live on per individual and thus disturbing the standards of living – indicating a positive relationship between population density and poverty. Overpopulated cities become a problem as overcrowding results in a lack of open space, the risk of shortage of clean water, and high exposure to pollution, affecting political, social, and economic conditions.

5.3 Choice of Method

My paper is a study of panel data, also known as longitudinal data, as my data set consists of observations over time and for several countries. By collecting both cross-sectional data and time-series data combined, more degrees of freedom are given, which provides a more accurate inference of model parameters and improves the efficiency of econometric estimates. Further, it allows control over the impact of other unobserved, omitted, biased variables and unobserved heterogeneity, which are assumed to be random

variables if regressing the random-effects model, or as fixed parameters as in the fixed-effects model (Hsiao, 2007).

To fulfil the purpose of this study and answer the research question, ordinary least squares (OLS) tests are conducted in a quantitative method as I am researching a large data set. To test whether *Pooled OLS*, *Random-Effects* or *Fixed-Effects model* is preferred for my investigation, I ran the tests for fixed-effects models and interpreted the provided F-test⁹ that I could reject the null hypothesis of all individual intercepts being equal to zero—concluding that I preferred the fixed-effects over pooled OLS. Furthermore, the Breusch and Pagan Lagrangian multiplier test (1979) for random effects was conducted. The outcome indicated that a random-effects model was preferred over pooled OLS¹⁰, as the hypothesis of all variances being equal to zero could be rejected. Lastly, as I wish to detect any endogenous regressors in the model to avoid any failures of the OLS estimator, I use model misspecification to detect any possible correlation between the explanatory variables and error terms. For that, I specify the Hausman specification test (1978), which determined that the fixed-effects model was preferred over the random-effects, as the null hypothesis of no correlation between the two terms can be rejected.¹¹

As mentioned earlier, a challenge of panel data is the unobserved heterogeneity and omitted variables, but the fixed-effects model is developed to address these issues and reduce this bias (Hill et al., 2019). By means of this agreement between the statistics and theory, the fixed-effects model appears to fulfil the purpose of my study. However, the limitations of the model should not be forgotten. The challenge that I find related to my study is explicitly the risk of Type II error – to fail to reject a false null hypothesis due to the larger standard errors that are common for fixed-effects coefficient estimates in comparison to computed standard errors in other models (Hill et al., 2019). Furthermore, robustness tests will be conducted later in the empirical results and analysis to detect any risks of multicollinearity, heteroscedasticity, and autocorrelation.

⁹ F-test of the fixed-effects model showed $\text{Prob} > F = 0.0000$.

¹⁰ Outcome of the Breusch-Pagan Lagrangian multiplier test showed $\text{Prob} > \chi^2 = 0.0000$.

¹¹ The Hausman specification test showed $P > \chi^2 = 0.0012$. Hausman test with Fixed-effects as consistent and Random-effect as efficient.

6. Empirical Results and Analysis

This section is devoted to presenting the results. First presented are the descriptive statistics. The following subsections present a correlation matrix that shows the minimum-, maximum-, mean- and median values, standard deviations, and the number of observations. The correlations between the dependent and the independent variables are then analysed. Lastly, the empirical results are presented and analysed.

6.1 Descriptive Statistics

Table 3 below shows the descriptive statistics for all variables included in this paper's data set and empirical model. The table provides the values of means, median, and standard deviations as well as the minimum- and maximum values and the number of observations.

Table 3 Descriptive statistics

	Mean	Median	Standard deviation	Minimum	Maximum	Observations
High Income	0.59793	1	0.49035	0	1	6402
Low Income	0.39690	0	0.48928	0	1	6402
Poverty Headcount Ratio	9.8332	1.6	17.348	0	94.3	1649
Tariff Rate	8.5127	6.51	6.9631	0	105.36	3657
Unemployment Rate	8.3999	7.06	5.9012	0.05	38.8	3523
Water	89.230	96.03	14.358	24.58	100	4025
Density	176.56	73.519	502.74	0.13643	8044.52	6379
Education	75.876	84.168	31.419	4.2858	163.93	4085

Note: The standard deviation presented above is *the overall std. dev.*

The number of observations presented above is the total number of observations in the data set.

None of the variables are of the logarithmic form.

The minimum and maximum columns show the variables' lowest versus highest values. The highest poverty rate in this data set meets 94.3%, which was the poverty rate in Congo in 2002. The lowest rate is here presented as 0%, which may at first be found unlikely. Still, it is interpreted as zero as the years close by, both before and after, the zero-

percentage poverty rate is very low, barely above zero per cent. Therefore, I conclude that the minimum value of the poverty data is, in fact, zero, and this minimum regard more than one country. In 1989 Bangladesh experienced the highest tariff rate of 105.36%. North Macedonia suffered high unemployment in 1996, with a rate of 38.8% unemployment. At most, a 100% of the population has access to improved drinking-water sources.

Moreover, the data set is relatively well behaved as the standard deviations are minor, except for the standard deviation for the population density variable, *lnDensity*, with a high statistic of 502.74. This high estimate indicates that the data on population density is more spread out and highly above the mean variable and is less reliable. This is observed and controlled for by taking the natural logarithm of the variable to get the ratio of the population density – as the rest of the explanatory variables are presented in percentage rates or ratios.

To summarise, there are significant differences between the minimum- and maximum values, indicating that countries differ significantly in these specific variables, living under contrasting conditions and experiencing different opportunities.

6.2 Correlation Analysis

Table 4 below is a Pearson Correlation Matrix, which displays all the pairwise correlation coefficient estimates between all variables included in the data set of this study. According to Pearson's R measure, the matrix is standardised, running from -1 (negative one), which indicates a perfect negative relationship, via zero, which means no relationship at all, to +1 (one positive), which indicates a perfect positive relationship. The Pearson's correlation coefficient estimates conducted in the matrix are test statistics used to measure the statistical relationship and magnitude between two variables and give the direction of the relationship.

Table 4 Pearson Correlation Matrix

	High	Low	Poverty	Tariff	Un-employment	Water	lnDensity	Education	Tariff x High
High	1.0000 <i>6402</i>								
Low	-1.0000 <i>6402</i>	1.0000 <i>6402</i>							
Poverty	-0.5998* <i>1649</i>	0.5998* <i>1649</i>	1.0000 <i>1649</i>						
Tariff	-0.3946* <i>3657</i>	0.3946* <i>3657</i>	0.5108* <i>1336</i>	1.0000 <i>3657</i>					
Unemployment	0.0599* <i>3523</i>	-0.0599* <i>3523</i>	-0.0900* <i>1437</i>	0.0117 <i>2567</i>	1.0000 <i>3523</i>				
Water	0.6769* <i>4025</i>	-0.6769* <i>4025</i>	-0.8356* <i>1324</i>	-0.4051* <i>2908</i>	0.1013* <i>2452</i>	1.0000 <i>4025</i>			
lnDensity	0.0899* <i>6379</i>	-0.0899* <i>6379</i>	-0.0743* <i>1646</i>	-0.0371* <i>3645</i>	-0.0735* <i>3508</i>	0.2112* <i>4025</i>	1.0000 <i>6379</i>		
Education	0.6754* <i>4085</i>	-0.6754* <i>4085</i>	-0.7146* <i>1318</i>	-0.5525* <i>2687</i>	0.0140 <i>2620</i>	0.7801* <i>2683</i>	0.1693* <i>4073</i>	1.0000 <i>4085</i>	
Tariff x High	0.5690* <i>3657</i>	-0.5690* <i>3657</i>	-0.1428* <i>1336</i>	0.3042* <i>3657</i>	0.0718* <i>2567</i>	0.3512* <i>2908</i>	-0.0218 <i>3645</i>	0.1716* <i>2687</i>	1.000 <i>3657</i>

Note: Only *lnDensity* is a variable of its natural logarithm form.

* (star) indicates that the coefficient estimate is significant at an alpha level of 0.05.

The numbers in *italics* underneath the coefficient estimates are the number of observations for each variable correlation.

I have chosen to conduct the Pearson correlation matrix (*pwcorr* command in STATA) Although the simple correlation matrix (*corr* command in STATA) is recommended for data sets with a large number of missing data, the estimated correlations in the simple correlation matrix¹² only focus on the observations with absolute non-missing values, dropping all correlations related to the variables with any missing values and ignoring them all, even if there are valid values for other variables. I preferred to conduct the

¹² The coefficient estimates for this correlation matrix are presented in Appendix B.

Pearson correlation because on the contrary, the Pearson correlation uses all available information possible, only using pairwise deletion of the missing data and only dropping the correlations for the specific variables' correlation if one or the other has missing values. Formerly, to indicate that I am aware of the lost data and for perspective on the correlations, I have notated in italic numbers underneath the coefficient estimates, displaying the number of observations calculated in the data set. Thereby, one can bear in mind the number of missing values when interpreting the coefficient estimates of the correlations.

Looking at the presented correlations, the study wishes to have a high correlation between the dependent and main independent variable of the model, *Poverty* and *Tariff*. A correlation coefficient estimate of 0.5108 units is found through the Pearson correlation matrix, which is positive as expected and of substantial magnitude. Moreover, the correlation between *High* and *Low* are perfectly negative and perfectly positive as they are dummy variables, the countries are stated as either high- or low-income countries in the data set. Furthermore, a highly correlated relationship that should be acknowledged is the correlation between *Water* and *Education*, with a positive correlation coefficient estimate of 0.7801 units, the relationship is high and leaning towards a perfect positive relationship. This correlation may cause multicollinearity as they are highly correlated to each other, causing difficulties in interpreting the regressions and causing overfitting problems. This high correlation between the independent variables will cause fluctuations in the models and give unstable outcomes as changes in one of the variables will disturb the other, causing changes in the other variable too. This situation is encountered in this study's empirical regression, which will be presented and discussed later. To account for the issue of multicollinearity and avoid it, the less significant variable for the model should be removed. This will be tested later in the next section with regressions. In addition, an action of the remedy is to conduct a variance inflation factor (VIF) for each of the independent variables, which will detect multicollinearity while holding all other variables in the regression into account.¹³ A simple way to detect and eliminate insignificant variables of the model. This VIF matrix will be presented in Appendix C.

¹³ The higher the VIF-value, the higher the correlation between that variable and all other variables.

6.3 Regression Analysis

First, the empirical results will be presented to examine the expected relationship.

Table 5 will present the fixed-effects model, not taking autocorrelation or heterogeneity into account. Thereafter, Table 6 shows the robust fixed-effects model in which the standard errors are adjusted to account for heteroscedasticity and autocorrelation.

Table 5 Regression output for Fixed-Effect Model

The dependent variable is *Poverty* (poverty headcount ratio).
Estimated using a fixed-effects model.

Variables	(1)	(2)
Tariff	0.24202*** (0.09075)	0.57911*** (0.10123)
TariffxHigh	-0.20189* (0.10413)	-0.49057*** (0.11686)
Unemployment	0.13284*** (0.02953)	0.16671*** (0.03561)
Water	-1.11949*** (0.05305)	-1.00502*** (0.05502)
InDensity	-9.2557*** (1.7859)	-8.0207*** (2.0003)
Education	0.0077 (0.0107)	
Constant	148.52*** (6.463)	131.99*** (6.851)
Number of obs	941	1075
R-squared	0.6012	0.5190

Note: Poverty headcount ratio is the dependent variable.

Standard errors are shown in parentheses underneath the coefficient estimates.

The presented R^2 is the *within R-squared*. *** P<0.01, ** P<0.05, * P>0.1

Table 5 above presents the regression coefficient estimates of the fixed-effects model. The first column (1) provides the coefficient estimates when all explanatory variables are included in the model. The first row gives the coefficient estimates of my independent variable tariff rate. As I have created an interaction term called *TariffxHigh*, which represents the share of high-income countries' observations and their tariff rates, the first

variable, *Tariff* itself, has the base case of low-income countries. Interpreting these two coefficient estimates, as expected, there is a positive relationship, significant at all alpha levels, between the tariff rates imposed on low-income countries and the rate of poverty. While for high-income countries, the interaction term coefficient estimate has a negative relationship with the rate of poverty, which is significant at an alpha level of 0.1. This does support the literature and hypothesis that trade has a positive effect on poverty reduction but is merely beneficial for the already developed countries.

Interpreting the tariff coefficient estimates given in the table, the effect of a percentage-point increase in the tariff rate in a low-income country would yield an increase in the poverty headcount ratio in the country by 0.2420 units (0.5791 units in column (2)). The effect of a percentage-point increase in the tariff rate in a high-income country would be an increase in the poverty headcount ratio by 0.0401 units¹⁴ (0.0885 units¹⁵ in column (2)). This provides evidence of a positive effect of higher tariff rates on higher poverty rates, which was expected and supports the theory of greater trade contributing to poverty reduction. Moreover, the effect differs slightly between the different income groups. With a difference of approximately 0.202 units larger effect on the low-income countries, evidence implies that higher tariff rates will affect the lower incomes poverty headcount ratio more than in high-income countries.

Moreover, the given regression coefficient estimates of *Unemployment* and *Water* both result in the expected direction of relationships, and both are statistically significant at any given alpha level. People of working age who are without work, available for work and have taken specific steps to find work, are defined as unemployed by the OECD (2022). The unemployment rate is then an indication of the number of unemployed as a percentage of the labour force, which is the total number of unemployed together with the number of those employed. Concluding that the higher share of a population that is unemployed and without a salary, the less are the chances to provide themselves with necessities, which increases the risk and rate of poverty. However, access to improved drinking-water sources indicates clean water and sanitation, hopefully, shelter and nutrition, and the more that are allowed access, the less will live under poverty conditions.

¹⁴ The calculation follows as: $(0.24202 + (-0.20189)) = 0.04013$ units.

¹⁵ The calculation follows as: $(0.57911 + (-0.49057)) = 0.08854$ units.

The last two explanatory variables, *lnDensity* and *Education*, did not provide the expected outcomes, resulting in the opposite direction of relationship to poverty than I expected. A highly significant negative relationship between (the natural logarithm of) population density and poverty is given, indicating that for each unit that population density increases (with denser living areas), the poverty headcount ratio will decrease by about 9.2557 units (approximately 8.0207 units in column (2)). This contradicts the theory of less dense, more area per individual yielding higher standards of living. Also, I expected *Education* to be highly significant and negatively related to the poverty headcount according to theory, but I find the coefficient estimates of education to be slightly positively related to the rate of poverty and specified as insignificant.

As found earlier in the correlation matrix, the explanatory variables *Water* and *Education* showed a high positive correlation to each other, creating multicollinearity and thereby disturbing each other in the regression. As *Education* is insignificant in my fixed-effects model above, I dropped this variable and reran the regression once. The number of observations increased by 134 units, holding the same directions of the relationships of the variables, and leading to only slight changes in the coefficient estimates. All variables and coefficient estimates presented in the second column (2) are now highly significant at any given alpha level, as the p-value is 0.000 for all presented estimates. Nevertheless, noticing the change in R-square, the independent variables managed to explain 60.12% of the variance in the dependent variable in the column (1) regression but then decreased to explaining 51.90% of the poverty headcount ratio variance after rerunning the regression without controlling for education, column (2).

To test whether the regression above is providing reliable statistics and appropriate coefficient estimates, I computed the Modified Wald statistics for GroupWise heteroscedasticity to test whether homoscedasticity or heteroscedasticity exists in the variance in the error term of the regression equation. I do assume that there is heteroscedasticity as the observed values in my data set has a large range between the highest and lowest value, which allows for a wider spread of the residuals and risk of unequal scatter. This creates a problem of unreliable regressions as the OLS regressions commonly assume constant variances: homoscedasticity (Baum, 2000).

The modified Wald test, presented in Appendix D, allows for the rejection of the null hypothesis of homoscedasticity, indicating that heteroscedasticity is present in the regression model, violating the constant variance assumption and disturbing the validity of the statistical results. Moreover, any serial/autocorrelation would bias the standard errors of the model, causing the outcomes to be less efficient. Therefore, I necessarily tested for autocorrelation with the Woolridge test for autocorrelation in panel data, with the null hypothesis of no autocorrelation problem of the first order. Truly, the test allows for rejection of the null hypothesis, presented in Appendix E, concluding violation of the no-autocorrelation assumption and assuming autocorrelation in the regressions, which leads to inefficiency of the estimates.

With that sorted, I need to account for heteroscedasticity and autocorrelation in order to validate my model, which is done in Table 6 presented below. The same fixed-effects model with the same data set is regressed, only now accounting for heteroscedasticity and autocorrelation with robust standard errors.

Table 6 Regression output for Robust Fixed Effect Model
The dependent variable is *Poverty* (poverty headcount ratio).
Estimated using a fixed-effects model accounting for autocorrelation and heteroscedasticity by using the robust standard errors.

Variables	(1)	(2)	(3)
Tariff	0.24202 (0.28993)	0.57911 (0.39399)	0.59210 (0.40401)
TariffxHigh	-0.20189 (0.32560)	-0.49057 (0.40884)	-0.46268 (0.41201)
Unemployment	0.13284*** (0.0473)	0.16671*** (0.05344)	0.16319*** (0.05529)
Water	-1.11949*** (0.17323)	-1.00502*** (0.2670708)	-1.1382*** (0.22793)
lnDensity	-9.2557** (3.8388)	-8.0207 (5.196803)	
Education	0.0077 (0.0161)		
Constant	148.52*** (17.092)	131.99*** (19.181)	110.82*** (22.202)
Number of obs	941	1075	1075
R-squared	0.6012	0.5190	0.5110

Note: Poverty headcount ratio is the dependent variable. Robust standard errors are shown in parentheses underneath the coefficient estimates. The standard errors are adjusted for heteroscedasticity by clusters in ID (Country). The presented R^2 is the within R-squared.
*** P<0.01, ** P<0.05, * P>0.1

The first column (1) in Table 6 above presents the regression model with all five explanatory variables, including the interaction term of *TariffxHigh* income countries, meaning that the *Tariff*-variable alone represents the base of low-income countries. All independent variables succeed in explaining 60.12% of the variance in the dependent variable, yet unfortunately, *Education*, *Tariff*, and *TariffxHigh* resulted in insignificant coefficient estimates at any level of alpha.

Once again, I drop *Education* as an explanatory variable from my regression model as it is insignificant and multicollinear with *Water* as measured earlier, thereby disturbing each other's coefficient estimates. The second column (2) now presents insignificant coefficient estimates of *lnDensity*, which earlier was significant at alpha level 0.05. Yet,

Tariff and *TariffxHigh* are both insignificant as well, leading me to the second elimination of variable *lnDensity*, resulting in the third column (3), where *Tariff* and *TariffxHigh* are still unfortunately insignificant, while the *Unemployment* rate and access to *Water* sources continue to have highly significant coefficient estimates at any level of alpha throughout all regressions, with the respectively expected effects on poverty. These variables managed to explain 51.10% of the variance in the dependent variable.

Interpreting the coefficient estimates given in column (3), the effect of a percentage-point increase in the tariff rate on low-income countries is estimated to increase the poverty headcount ratio by approximately 0.5921 units, and the effect of a percentage-point increase in tariffs for a high-income country would yield an increase in the poverty headcount ratio by 0.1294 units.¹⁶ Even with the robust standard errors, the estimated coefficients indicate a larger effect, of 0.4627 units larger, of tariff rates on the poverty headcount ratio in the lower income countries.

The overall interpretation of the regressions is that without robust standard errors, the fixed-effects models yield significant relationships between the dependent and independent variables, though the statistics are not reliable or validated. By accounting for problems of heteroscedasticity and autocorrelation, the regression results using robust standard errors give insignificant results on the relationship of trade affecting poverty, indicating that there is no evidence of the tariff rate impacting the poverty headcount ratio. What can be argued is that although not rejecting, thereby accepting, the null hypothesis of no impact being found between trade and poverty, the rate at which we reject the alternative hypothesis that there is an impact is unknown. Also, whether the result is insignificantly different from zero since the insignificance does not necessarily state no effect at all between the variables but may rather indicate an indirect effect between trade and poverty rather than a direct effect.

With these robust standard error regressions, the estimates are not of as high power since my data set has a large number of missing values and may cause a risk of type errors such as rejecting the wrong hypothesis. As described above, the robust regression conducted

¹⁶ The calculation follows as: $(0.59210 + (-0.46268)) = 0.12942$ units.

in my study may have made a Type II error, referred to as false-negative, where the null hypothesis is not rejected but is actually false. This insignificance raises discussions for new questions and areas to explore within this research question. I would consider further outside factors that should be controlled for, as this outcome is contrasting with theories and previous research.

Furthermore, my empirical result concluded positive coefficient estimates for the effect of *Education* on poverty headcount ratio were unexpected and insignificant for both conducted regressions, with and without robust standard errors. According to literature, education has been proven to be involved in the relationship between trade and poverty. The EU Commission (2015) found at an individual micro-level, looking at the socio-economic and demographic circumstances for households, that strong evidence is directed at the determining factors of education as a risk of poverty. Hence, the unexpected outcome of the effect of *Education*.

To identify an effect and to compare differences, I did conduct a Pooled OLS regression that is presented below in Table 7. The results are presented below, and the outcomes are investigated in to find any different implications.

Table 7 Regression output for Pooled OLS Regression Model
The dependent variable is *Poverty* (poverty headcount ratio).
Estimated using pooled ordinary least squares estimation.

Variables	(1)
Tariff	0.1483* (0.0598)
TariffxHigh	-0.0602 (0.0555)
Unemployment	0.1731*** (0.0288)
Water	-0.9972*** (0.0322)
lnDensity	0.5159*** (0.1304)
Education	-0.0311*** (0.0096)
Constant	98.815***
Number of obs	941
R-squared	0.7404

Note: Poverty headcount ratio is the dependent variable. Standard errors are shown in parentheses underneath the coefficient estimates. *** P<0.01, ** P<0.05, * P>0.1

The coefficient estimates presented above shows high significance between the relationship of all the independent variables to the dependent variables of poverty headcount ratio, and the tariff rate on low-income countries has a lower significant effect with a coefficient estimate of approximately 0.15 units. Unfortunately, the tariff rate regarding high-income countries is insignificant, yet interpreting the coefficient estimates then the effect of a percentage-point increase in tariffs for high-income countries would yield in an increase in the poverty headcount ratio by 0.088 units.¹⁷ Indicating merely a difference in the effect between high- and low-income countries.

The independent variables are found to explain 74.04% of the variance in the dependent variable, which is higher compared to the regressions obtained from the fixed-effects variable in Table 6. The overall significant is greater in the Pooled OLS regression, yet

¹⁷ The calculation follows as: $(0.1483) + (-0.0602) = 0.0881$ units.

the tariff rate for the high-income countries is insignificant and the difference between the two income groups is low.

Moreover, the risks of using Pooled OLS with a panel data set is the biased estimations and endogeneity that will appear. Pooled OLS does not distinguish between time effects and cross-sections and may for that reason be perceived as inappropriate. Additionally, evidence of the F-test, Breusch-Pagan Lagrangian and Hausman specification tests all speak for Fixed-effects model, rather than the Pooled OLS. Therefore, the results and interpretation from Table 6 the robust fixed-effects model is validated and the most robust for this study.

7. Conclusion and Implications

The aim of this study has been to examine the effect of international trade on poverty reduction and investigate whether the impact differs between developed and developing countries, using panel data to regress the fixed-effects models.

Too little to no support was found on tariff rates having an impact on the poverty headcount ratio, indicating that no direct effect can be concluded through the estimations. Moreover, the evidence cannot prove that the effect of trade on poverty differs between high- and low-income countries as the coefficient estimates showed insignificance. The coefficient estimates on tariffs' effect on the poverty headcount differed by 0.4627 units between low- and high-income countries, with low-income countries estimated with the higher effect. This can be interpreted as the population of lower-income countries suffering more from poverty by higher tariff rates in comparison to high-income countries. In line with findings of tariff rates generally being higher for the developing countries, referring to low- and middle-income countries as well as the least developed countries, than those of the advanced economies, and theories determining that the predicted impact is not the same for poorer countries, I do expect the low-income countries to experience greater harm if the rate of trade were to decrease. However, this study fails to provide enough evidence to conclude these expectations as the empirical results are found to be insignificant.

When estimating the outcomes from the fixed-effects model without robust standard errors, the regression succeeded in finding a positive effect of trade that was highly significant on poverty reduction. Aligning with earlier research evidence on greater trade fuelling economic growth and opportunities and through that diminishing the number of people living in poverty. Therefore, there may be a risk for Type II error in the robust standard errors fixed effects model – failing to reject a false null hypothesis which in this case concludes that the alternative hypothesis of there being an impact is wrongly rejected instead.

Possible explanations as to why the unexpected outcomes could be the largely unbalanced data set as it does not give a completely fair representation of each country's situation. As theory has concluded, different countries benefit differently and are impacted in different ways. Also, other control variables and measurements of trade and poverty may be necessary to include to achieve a more stable regression and in-depth investigation.

However, there are possibilities of indirect effects and other variables, which are not controlled for, to have more significance on the effect of this relationship since previous studies and theories have proven to support the expectations of trade eradicating poverty. As earlier literature has shown that trade does influence poverty and the aim of eradicating poverty in all its form, with emphasis on the non-structural and nonautomatic relationship but rather is motivated by a range of variables and indirect effects from growth and opportunities on the market, I am confident that further research is necessary and of interest.

7.1 Future Research

Considering the limitations of my data set with many missing values, further control variables and other measurements should be included in future research. For the future, I would have gone more in depth on trade theories and find the connection to poverty and relate the effects. To further investigate this topic and its relationship, it is necessary to understand the countries' industry structure with employment and wage systems as it is vital for finding the correct variables that will affect trade. One needs to investigate the economies' production structure and capacities and account for the negative implications of the trade liberalisation process (Holthoff, 2009). Earlier studies in this field have established the difficulty in regressing an econometric model for this relationship due to

its complexion and endogenous variables. Moreover, the measurements to isolate the effect of trade liberalisation may be complicated to obtain.

To prove a difference between different income groups may need distinct theoretical frameworks to build on, for example, follow a Tobit Model where observations are of a range of the lower and upper bound. Furthermore, alternative dependent variables would be of interests as well as other measurements for trade should be of interest as the tariff rate, according to theory, impacts the rate of importation. Investigating the trade value or the rate of trade within a specific industry sector may yield more in-depth findings on the relationship and may yield contributions to new policy implementations to eradicate the issue of poverty.

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Appendix

Appendix A Countries excluded from the dataset

Country/Region	Income group
American Samoa	Upper Middle Income
Antigua and Barbuda	High Income
Channel Island	High Income
Gibraltar	High Income
Hong Kong SAR	High Income
Isle of Man	High Income
St. Kitts and Nevis	High Income
Macao SAR	High Income
St. Martin	High Income
Monaco	High Income
Marshall Islands	Upper Middle Income
Northern Mariana Islands	High Income
New Caledonia	High Income
North Korea (Democratic People's Republic)	Low Income
French Polynesia	High Income
Solomon Islands	Lower Middle Income
South Sudan	Low Income
Turks and Caicos Islands	High Income
British Virgin Islands	High Income
Virgin Islands in the US	High Income
Kosovo	Upper Middle Income

Source: Adapted from the World Bank Country Metadata Bank (2022)

Appendix B Correlation Matrix

The simple correlation matrix obtained by *corr* command in STATA.

	High	Low	Poverty	Tariff	Un-employment	Water	lnDensity	Education	Tariff x High
High	1.0000								
Low	-1.0000	1.0000							
Poverty	-0.5244	0.5244	1.0000						
Tariff	-0.3256	0.3256	0.4626	1.0000					
Unemployment	0.1683	-0.1683	-0.0340	-0.0725	1.0000				
Water	0.6155	-0.6155	-0.8469	-0.4929	0.1533	1.0000			
lnDensity	-0.0124	-0.0124	-0.0957	-0.2248	-0.0062	0.1995	1.0000		
Education	0.5287	-0.5287	-0.6225	-0.5361	0.1017	0.6572	0.0040	1.0000	
Tariff x High	0.4662	-0.4662	-0.0528	0.5664	0.0450	0.0706	-0.2563	-0.0396	1.0000

Appendix C Variance Inflation Factor

Variable *Poverty* as the response-dependent variable.

Variable	VIF	1/VIF
Tariff	2.88	0.347656
Water	2.33	0.428268
Education	2.11	0.474724
TariffxHigh	2.08	0.480218
lnDensity	1.18	0.845456
Unemployment	1.03	0.973680
Mean VIF	1.94	

Appendix D Modified Wald test

Modified Wald test for groupwise heteroscedasticity in fixed effect regression model

H0: $\sigma^2_i = \sigma^2$ for all i

chi2 (97) = 3.2e+26

Prob > chi2 = 0.0000

Appendix E Wooldridge test for autocorrelation

Wooldridge test for autocorrelation in panel data

H0: no first-order autocorrelation

F(1, 60) = 76.915

Prob > F = 0.0000
