

# TRADE OFF - INCOME GAINS AND INEQUALITY COSTS

Hochschule Bochum

## Academic Paper

submitted by

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# 1 Introduction

In today's world with ongoing worldwide economic crises like the COVID-19-pandemic or the current Russia-Ukraine-conflict, trade policies are seen and used as possible, important instruments to either help or punish specific countries' economies. Those crises caused a decline of social welfare in the majority of countries worldwide, forcing the politics and the science to react with the best possible policies and new concepts to improve the economic situation and especially the social welfare of countries.

Through new developed and improved trade models and the current worldwide economic situation, the interest in the impact of trade policies, especially of the trade liberalization, and the distribution of the gains from trade increased. While trade liberalization is commonly seen as economy and welfare enhancing, the majority of developing countries with low social welfare still tend to restrict their trade in favor of protectionism. To estimate the impact of trade liberalization and the trade-off between the income gains and inequality costs, Artuc, Rijkers and Porto reviewed recent and past trade models to measure income gains and inequality costs for 54 developing countries in their article from 2019. Using household survey data from 54 developing countries in combination with trade data and tariff data, they developed a new model to determine the income gains, inequality costs and therefore the inequality adjusted income gains of trade. With the model, they were able to answer the question, whether there are trade-offs between income gains and inequality costs in case of trade liberalization and whether the trade liberalization is beneficial for the studied countries' welfare in total.

This paper reviews the study by Artuc, Rijkers, and Porto 2019 and takes several critical aspects of the paper itself into consideration. The first section describes the data used in the study and describes the three parts, the household survey data, the tariff data and the trade data and how they were combined. The second section summarizes the methods and assumptions used in the study and explains the results including the complimentary robustness tests. After that, the next section will showcase several critical aspects in regard of the data used, the methods used to form their model and the interpretation of the results, to underline possible weaknesses and strengths of this study. Finally, a conclusion is given about the quality of the model and possible improvements for future use cases.

## 2 Data used by Artuc et al.

The study by Artuc, Rijkers and Porto used several data sets to enable the heterogenous view of households in regard of their expenditures, auto-consumption and incomes. One of the main datasets used were household surveys of 54 developing countries, which were taken between the years 1998 and 2015. The dataset covered all low income countries, where appropriate household survey data was available, and additionally contained the majority of lower middle income countries as well in Table 1 (Artuc, Rijkers, and Porto 2019, pp. 10-11).

Table A1  
Household Surveys

Country	Year	Obs	Survey
Benin	2003	5296	Questionnaire Unifié sur les Indicateurs de Base du Bien-Être
Burkina Faso	2003	8413	Enquête sur les Conditions de Vie des Ménages
Burundi	1998	6585	Enquête Prioritaire, Etude Nationale sur les Conditions de Vie des Populations
Cameroon	2001-2002	10881	Deuxième Enquête Camerounaise Auprès des Ménages
Central African Republic	2008	6828	Enquête Centrafricaine pour le Suivi-Evaluation du Bien-être
Comoros	2004	2929	Enquête Intégrale auprès des Ménages
Côte d'Ivoire	2008	12471	Enquête sur le Niveau de Vie des Ménages
Egypt, Arab Rep.	2008-2009	23193	Household Income, Expenditure and Consumption Survey
Ethiopia	1999-2000	16505	Household Income, Consumption and Expenditure Survey
The Gambia	1998	1952	Household Poverty Survey
Ghana	2005-2006	8599	Living Standards Survey V
Guinea	2012	7423	Enquête Légère pour l'Evaluation de la Pauvreté
Guinea-Bissau	2010	3141	Inquerito Ligeiro para a Avaliçao da Pobreza
Kenya	2005	13026	Integrated Household Budget Survey
Liberia	2014-2015	4063	Household Income and Expenditure Survey
Madagascar	2005	11661	Permanent Survey of Households
Malawi	2004-2005	11167	Second Integrated Household Survey
Mali	2006	4449	Enquête Légère Intégrée auprès des Ménages
Mauritania	2004	9272	Enquête Permanente sur les Conditions de Vie des Ménages
Mozambique	2008-2009	10696	Inquerito sobre Orçamento Familiar
Niger	2005	6621	Enquête Nationale sur les Conditions de Vie des Ménages
Nigeria	2003-2004	18603	Living Standards Survey
Rwanda	1998	6355	Integrated Household Living Conditions Survey
Sierra Leone	2011	6692	Integrated Household Survey
South Africa	2000	25491	General Household Survey
Tanzania	2008	3232	Household Budget Survey
Togo	2011	5464	Questionnaire des Indicateurs de Base du Bien-être
Uganda	2005-2006	7350	National Household Survey
Zambia	2004	7563	Living Conditions Monitoring Survey IV

Table A1 (Continued)  
Household Surveys (Continued)

Country	Year	Obs	Survey
Armenia	2014	5124	Integrated Living Conditions Survey
Bangladesh	2010	12117	Household Income and Expenditure Survey
Bhutan	2012	8879	Living Standards Survey
Cambodia	2013	3801	Socio-Economic Survey
Indonesia	2007	12876	Indonesian Family Life Survey
Iraq	2012	24895	Household Socio-Economic Survey
Jordan	2010	11110	Household Expenditure and Income Survey
Kyrgyz Republic	2012	4962	Intergrated Sample Household Budget and Labor Survey
Mongolia	2011	11089	Household Socio-Economic Survey
Nepal	2010-2011	5929	Living Standards Survey
Pakistan	2010-2011	16178	Social and Living Standards Measurement Survey
Papua New Guinea	2009	3776	Household Income and Expenditure Survey
Sri Lanka	2012-2013	20335	Household Income and Expenditure Survey
Tajikistan	2009	1488	Tajikistan Panel Survey
Uzbekistan	2003	9419	Household Budget Survey
Vietnam	2012	9306	Household Living Standard Survey
Yemen, Rep.	2005-2006	12998	Household Budget Survey
Azerbaijan	2005	4797	Household Budget Survey
Georgia	2014	10959	Household Integrated Survey
Moldova	2014	4836	Household Budget Survey
Ukraine	2012	10394	Sampling Survey of the Conditions of Life of Ukraine's Households
Bolivia	2008	3900	Encuesta de Hogares
Ecuador	2013-2014	28680	Encuesta de Condiciones de Vida
Guatemala	2014	11420	Encuesta Nacional de Condiciones de Vida
Nicaragua	2009	6450	Nicaragua - Encuesta Nacional de Hogares sobre Medición de Niveles de Vida

Table 1: Household Survey Data (Artuc, Rijkers, and Porto 2019, pp. 56-57)

To enable a comparability of the household survey data, the household survey data was harmonized by adopting and improving templates based on the work of Nicita, Olarreaga, and Porto 2014. Using those templates, they were able to map the information at the highest level of disaggregation to the different homogeneous categories (Nicita, Olarreaga, and Porto 2014, p. 255). While Nicita, Olarreaga and Porto only developed and used two templates regarding the incomes and expenditures of the households, Artuc, Rijkers and Porto added another template to harmonize information regarding the auto-consumption of the households as well, which explained 23 percent of the household income (Nicita, Olarreaga, and Porto 2014, p. 255; Artuc, Rijkers, and Porto 2019, p. 11).

There were three templates used, which were covering the expenditure of households, their auto-consumption and their income. Those templates contained several categories, which held a unique two or four-digit ID as seen in Table 2 for example (Artuc, Rijkers, and Porto 2019, p. 10).

The first template was the expenditure template, which contained the categories agriculture/food, manufacturing/household items, services and other expenditures. The group agriculture/food is split into staple and non-staple food and accounts on average for 45 percent of all household spending across all countries (Artuc, Rijkers, and Porto 2019, p. 12). The second group, manufacturing/household items contained energy, textiles/apparel, electric/electronics, household items/furniture and other physical goods. The service group contained transportation, health, education, communication and other services. Other expenditures shows remittances/transfers given, investment of any sort, festivities and other disbursement (Artuc, Rijkers, and Porto 2019, p. 58).

Expenditure								
1. Agriculture/Food								
11. Staple Food								
111. Cereals	112. Legumens	113. Fruits	114. Vegetables	115. Oils/Fats	116. Fish	117. Meat/Livestock	118. Dairy/Eggs	119. Other staple food
1111. Corn	1121. Beans	1131. Banana	1141. Tomato	1151. Vegetable Oils	1161. Fish	1171. Pork (Pig)	1181. Milk	1191. Other staple food
1112. Wheat	1122. Other	1132. Grapes	1142. Potato	1152. Animal Fats	1162. Shrimp	1172. Beef (Cattle)	1182. Eggs	1192. Other processed food
1113. Rice		1133. Citrus	1143. Greens	1153. Other oils/fats	1163. Other Crustacean	1173. Poultry (Chicken)	1183. Cheese	
1114. Other Cereals		1134. Apples	1144. Other Vegetables			1174. Other meat/animals	1184. Other Dairy	
		1135. Other Fruits						
12. Non Staple								
121. Alcohol	122. Tobacco	123. Oil seeds	124. Spices/herbs	125. Coffee/tea/cocoa	126. Nuts	127. Cotton	128. Other non-staple food	
1211. Wine	1221. Cigarettes	1231. Soya	1241. Cloves	1251. Coffee	1261. Cashew	127. Cotton	1281. Sugar (any kind)	
1212. Beer	1222. Other tobacco	1232. Other oil seeds	1242. Pepper	1252. Tea	1262. Coconut		1282. Other non-staple	
1213. Other alcohol		1243. Vanilla	1244. Saffron	1253. Cocoa	1263. Other nuts			
		1245. Qat (chat)	1246. Other spices					
2. Manufacturing/Household Items								
21. Energy 22. Textiles/Apparel 23. Electric/Electronics 24. Household items/Furniture 25. Other physical goods								
3. Services								
31. Transportation 32. Health 33. Education 34. Communication 35. Other Services								
4. Other Expenditures								
41. Remittances/transfers given 42. Investment of any sort 43. Festivities 44. Other Disbursement								

Table 2: Modified Expenditure template based on Nicita, Olarreaga, and Porto 2014 (Artuc, Rijkers, and Porto 2019, p. 58)

The next template regarding the auto-consumption of each household was split into agriculture/food and other goods. Agriculture/food contained staple and non-staple food and other goods contains energy, gathering, other goods collected for free and other goods produced

and consumed within the household (Artuc, Rijkers, and Porto 2019, p. 58). The final template, showcasing the income of each household, was split into agriculture/food, wages, sales of goods/services and transfers. The group agriculture/food included the same data as mentioned above. Wages contained agriculture/forestry/fishing, mining/oil/gas extraction, manufacturing, construction, transportation/communication/electric/gas/sanitary, wholesale/retail, finance/insurance/real estate, entertainment services, professional services and public administration. The group sales of goods/services contained the same categories as the wages group. The last group transfers included remittances/transfers received, profits of investment, government transfers, non-governmental transfers and others (Artuc, Rijkers, and Porto 2019, p. 59).

Besides the survey data, the authors of the paper also used datasets regarding the quantity and value of traded goods as well as import tariffs on goods for each country. The data regarding the quantity and value of traded goods for each country was sourced from the COMTRADE-Database by the Trade Statistics Section of United Nations Statistics Division. The tariff data was sourced from the TRAINS-Database by Trade Information Section of United Nations Conference on Trade and Development. Both datasets used the HS 6-digit code to uniquely identify every possible traded good. This HS 6-digit code was used to merge with the unique two and four-digit codes from the adopted survey templates. This harmonization led to the advantage over the most of other studies regarding the impact of trade liberalization as household heterogeneity was granted in the data for the model to use (Artuc, Rijkers, and Porto 2019, p. 10).

### 3 Methodology of Artuc et al.

To use the data explained above, Artuc, Rijkers and Porto needed a model to study the welfare effects of tariff changes. In the first instance, they adopted an extended agricultural household model to define the household welfare based on the work of Singh, Squire, and Strauss 1986 and Benjamin and Deaton 1993. The authors then derived the welfare effects using first order approximations based on the work of Deaton 1989; Porto 2006; Nicita, Olarreaga, and Porto 2014.

To determine the impacts of price changes and furthermore on the welfare effects for households, the authors first defined a maximized nominal income function for the household

$$y^h(\mathbf{p}, v^h) = w^h + \sum_i \pi_i^h(\mathbf{p}) - T^h + \Omega^h, \quad (1)$$

where the household income  $y^h$  depends on the vector of prices  $p_i$  and fixed amount of resources  $v^h$ . The labor income of household  $h$  as  $w^h$  is only from the labor market and  $\pi_i^h$  are farm enterprise profits obtained from selling the good  $i$ . Governmental taxes paid are represented as  $T^h$ . Other transfers and other income are showcased in  $\Omega^h$  (Artuc, Rijkers, and Porto 2019, pp. 4-5).

To also take the expenditures into consideration, the household expenditure function was defined as

$$e(\mathbf{p}, u^h) = \sum_i p_i c_i^h(\mathbf{p}). \quad (2)$$

In this equation,  $p_i$  is the price for good  $i$  and  $u^h$  is the required utility for the optimal consumption  $c_i^h$  (Artuc, Rijkers, and Porto 2019, p. 5).

While the income and expenditures of the household were already defined, the expenditures caused by trade could now be summarized in one equation. Therefore, the authors referenced to Dixit and Norman 1980 and Anderson and Neary 1996 to define their trade expenditure function as

$$V^h(\mathbf{p}, v^h, u^h) = y^h(\mathbf{p}, v^h) - e(\mathbf{p}, u^h). \quad (3)$$

The authors also referred to Porto 2006 while explaining, that the traditional expenditure function is defined as  $e^h - y^h$ , but by swapping the terms, they could see the results as changes in real household income (Artuc, Rijkers, and Porto 2019, p. 5).

To obtain estimates of welfare effects, which were applicable with the above explained data, the authors proposed two aspects to reach those goals. The first proposition assumed that the household is the price taker in consumer, producer and labor markets. Therefore, the impact of a price change on the household welfare could be defined as

$$\frac{dV_i^h}{e^h} = ((\phi_i^h - s_i^h) + \phi_w^h \frac{\partial w^h}{\partial p_i} \frac{p_i}{w^h}) d \ln p_i - \frac{dT^h}{e^h}. \quad (4)$$

The monetary transfer needed by household  $h$  to enable the same utility  $u^h$  as before the price change is showcased as  $dV_i^h$ . The share of the traded good  $i$  is  $s_i^h$ , while the share from the sales of good  $i$  is  $\phi_i^h$ . The labor income share is defined as  $\phi_w^h$  (Artuc, Rijkers, and Porto 2019, p. 6).

The second proposition contained multiple assumptions. First it assumed that the goods are homogenous and that the targeted countries are rather small and are therefore externally facing the international prices of  $p_i^*$ . There was also the assumption of the perfect price

transmission from tariffs to domestic prices. Finally, they assumed, that the loss of public revenue caused by the tariff cuts is compensated with the help of income tax increases. Based on this proposition, the estimable welfare effects were given as

$$\frac{dV_i^h}{e^h} = ((\phi_i^h - s_i^h) + \phi_{wi}^h) \frac{\tau_i}{1 + \tau_i} + \Psi_i^h. \quad (5)$$

The share of labor income  $\phi_{wi}^h$  is now specified for the sector  $i$  and  $\Psi_i^h$  is the tax increase for the household  $h$ . The level of tariff protection in sector  $i$  is assumed to be  $\tau_i$ . This equation only worked under the assumption, that the country reduced its own tariffs individually, therefore assuming a full unilateral tariff liberalization. While the possibility for a full import tariff liberalization could be showcased in the equation, the data did not contain information regarding the pass-through elasticities and therefore needed to be simplified as shown above (Artuc, Rijkers, and Porto 2019, p. 7).

Finally, to measure the welfare effects of the entire tariff protection and not only for single sectors, the equation could be summed up as

$$\hat{V}^h = \frac{dV^h}{e^h} = \sum_i \frac{dV_i^h}{e^h}. \quad (6)$$

The proportional change of real household income can be displayed as  $\hat{V}^h$ . This equation can also be used to estimate the counterfactual real income under the assumption that  $x_0^h$  is the observed ex-ante level of real household income to define the equation as

$$\hat{x}_1^h = x_0^h(1 + \hat{V}^h). \quad (7)$$

In this equation,  $\hat{x}_1^h$  is the counterfactual real income. As the authors used an agricultural household model, there were some differences to standard trade models since the data in form of household surveys did not contain returns to capital or corporate profits. The authors named the Stolper-Samuelson effects as an example of effects, which show the differential impacts on returns to capital vs labor or to skilled vs unskilled labor, which could not be captured in this study. However, they argued that topics like poverty, inequality and household welfare are usually based on household surveys, therefore it was beneficial to use a model, which is able to use this dataset. Another benefit was named in the household heterogeneity regarding the income and the consumption, which led to results regarding the total gains as well as for inequality costs since the model could differentiate between rich and poor households (Artuc, Rijkers, and Porto 2019, pp. 8-9).

As seen in the data, there was still a need of weighted average tariff rates for every single category of the harmonized dataset. Those tariff rates were defined as

$$\tau_i = \sum_{c,n \in i} \tau_{c,n} \frac{m_{c,n}}{\sum_{c,n \in i} m_{c,n}}. \quad (8)$$

Every category of the HS 6-digit classification is represented as  $n$  for the 2- and 4-digit category  $i$  from the survey. The imports of good  $n$  are for the country  $c$  are given as  $m_{c,n}$ . The resulting average tariffs were 14.4 percent for non-staple agricultural goods and 10.8 percent for staple agricultural goods. The category manufactures yielded an average tariff of 10.9 percent. To determine the impact of the elimination of those tariffs on the prices, the authors set the equation as

$$\Delta \ln p_i = \frac{p_i^* - p_i^*(1 + \tau_i)}{p_i^*(1 + \tau_i)} = - \frac{\tau_i}{1 + \tau_i} \quad (9)$$



and referred back to the assumption of the full price transmission (Artuc, Rijkers, and Porto 2019, p. 11).

The authors reviewed the equation 4 with weighted household survey data. Excluding the top and bottom 0.5 percentile to reduce the measurement error, they showed averages for six biggest household expenditures, which were Staple Agriculture, Non-Staple Agriculture, Manufactured Goods, Non-Traded Goods, Other Goods and Home Consumption. The biggest expenditure was seen in the category food with an average of 45 percent of all household spendings. The authors argued that this was expected as the survey data held an average poverty rate of 35 percent and an average GDP per capita of US\$ 1879 (Artuc, Rijkers, and Porto 2019, p. 12).

Regarding the compensation of the tariff revenue loss, the authors assumed before that the government would impose a proportional income tax, which was displayed as

$$\psi_i^h = -\frac{\tau_i}{1 + \tau_i} \frac{M_i}{\sum_h y^h}. \quad (10)$$

The revenue loss is shown as  $\psi_i^h$  and the value of imports is shown as  $M_i = p_i^*(1 + \tau_i)m_i$  (Artuc, Rijkers, and Porto 2019, p. 13).

To define the income gains from trade, which are portrayed as the proportional change in aggregate household real expenditures after the import tariff liberalization as in Arkolakis, Costinot, and Rodríguez-Clare 2012, the equation was

$$G = \frac{\sum_h (x_1^h - x_0^h)}{\sum_h x_0^h} = \frac{x_0^h}{\sum_h x_0^h} \hat{V}^h. \quad (11)$$

As  $\hat{V}^h$  was explained above as the proportional change in real expenditures of household  $h$ ,  $G$  can be seen as the weighted average of the welfare effects. Using this equation on the harmonized survey data, tariff liberalization induced a gain of 2.5 percentage points in real expenditures for 45 countries, where the gains were positive. Ten countries faced a loss of an average of 0.9 percent of real expenditures. In total, the average for all countries was 1.9 percent, which implicated that the developing countries seem to gain from trade (Artuc, Rijkers, and Porto 2019, p. 14).

To inspect the distributional effects of trade, the authors first estimated kernel averages of the gains from trade dependent on the initial well-being of the household per capita expenditure. Then they estimated bivariate kernel densities of the distribution of gains from trade and household per capita expenditure. Using the pro-poor Index of Nicita, Olarreaga, and Porto 2014, they divided the countries in to two groups, pro-poor and pro-rich. The pro-poor Index is the proportional change of low 20 percent income household minus the high 20 percent income households. If the index is positive, the tariff liberalization can be seen as pro-poor as the poor household gain proportionally more than the rich households. The opposite would indicate a countries' tariff liberalization as pro-rich. As a result, 17 countries were classified as pro-poor and the remaining 37 countries had a pro-rich gain distribution (Artuc, Rijkers, and Porto 2019, p. 15).

To tackle the possible trade-off between income inequality and average incomes, the authors referred to the Atkinson social welfare function from Atkinson 1970:

$$W = \frac{1}{H} \sum_h \frac{(x^h)^{1-\varepsilon}}{1-\varepsilon}. \quad (12)$$

The social welfare is  $W$  and  $\varepsilon \neq 1$  is the inequality aversion parameter, which can be seen as a weighting for the well-being of low income households. One benefit of this equation was that it could be also defined as

$$W = \mu * (1 - I), \quad (13)$$

in which  $\mu$  is mean income and  $I$  is the atkinson inequality index, which is defined as

$$I = 1 - \left( \frac{1}{H} \sum_{h=1}^H (x^h / \mu)^{1-\varepsilon} \right)^{1/(1-\varepsilon)}. \quad (14)$$

The authors used the two equations above to define an equation for the inequality adjusted income gains as

$$G(\varepsilon) = \frac{W_1(\varepsilon) - W_0(\varepsilon)}{W_0(\varepsilon)}. \quad (15)$$

The ex-ante social welfare is  $W_0$  and  $W_1(\varepsilon)$  is the counterfactual social welfare under the tariff liberalization. As above-mentioned in equation 14, this equation can be decomposed into

$$G(\varepsilon) = G(0) + \frac{\mu_1}{\mu_0} \frac{I_0(\varepsilon) - I_1(\varepsilon)}{1 - I_0(\varepsilon)}, \quad (16)$$

to display that the inequality adjusted gains are simply the income gains of trade  $G(0)$  with an adaptation for changes in inequality or also called equality gains in the second term of the equation (Artuc, Rijkers, and Porto 2019, pp. 17-19).

To determine the possibility of a trade-off between the income gains  $G(0)$  and the equality gains, which are represented as  $\frac{\mu_1}{\mu_0} \frac{I_0(\varepsilon) - I_1(\varepsilon)}{1 - I_0(\varepsilon)}$ , those terms have to have opposite signs. This would be the case if the trade would decrease the equality gains, which would mean the inequality would increase, while the income gains would increase. The other possible case for a trade-off would be an increase in equality gains and a decrease in income gains. Those trade-offs appeared for the majority of the countries, in case of this study for 45 countries. The remaining 9 countries did not face a trade-off. However, 27 of the trade-off countries could face, depending on the inequality aversion parameter  $\varepsilon$ , severe reversals in the preference of trade policy (Artuc, Rijkers, and Porto 2019, p. 19).

As mentioned above, the authors differentiated the results into three categories. The first category were no trade-off countries, which means that those countries faced the same development in the income and the equality gains in case of a liberalization. In total, the authors saw 8 countries in this category, from which 4 countries showed a positive development of income and equality gains in favor of liberalization. Those 4 countries were the Central African Republic, Guinea-Bissau, Jordan and Yemen. However, the left 4 countries were Comoros, Ghana, Madagascar and Rwanda and would face losses that were independent of the inequality aversion parameter  $\varepsilon$  and therefore indicated a favor for protectionism (Artuc, Rijkers, and Porto 2019, p. 20).

The next category was seen as trade-off countries without trade policy preference reversals. As mentioned before, only 18 countries faced a trade-off soft enough to indicate for only one trade policy for all inequality aversion parameter  $\varepsilon$ . From those countries, only 2 countries showcased a favor for protectionism while the remaining countries tended to a strong domination in regard of a trade liberalization (Artuc, Rijkers, and Porto 2019, pp. 20-21).

The last group of countries were countries, which faced severe trade policy preference reversals caused by the trade-off. Those countries preferences changed in regard of the weighting of the well-being of low income households, which was defined as  $\varepsilon$ . Those 27 countries showcased that for a low  $\varepsilon$ , most countries favored the protectionism and with an ongoing increase of  $\varepsilon$  the countries tended to favor the liberalization instead (Artuc, Rijkers, and Porto 2019, pp. 22-24).

The authors viewed the results as follows, even with an  $\varepsilon = 1.5$ , which is close to the Gini coefficient, there were 30 countries with a trade-off in favor of liberalization. 28 of the studies' countries would experience inequality adjusted gains from liberalization and only seven countries with trade-offs would prefer the protectionism because in their case, tariffs would lead to higher inequality-adjusted welfare. However, in total, the trade liberalization was expected to increase the welfare in 39 countries and reduce it in only 9 countries for plausible levels of the inequality aversion parameter  $\varepsilon$ , which could be seen in Figure 1 as well. Therefore, the authors asked themselves why the majority of countries still prioritize protectionism over liberalization, they can not answer this question directly and see a possible answer in the political, economic considerations of the single countries. In total those results showed, that protectionism seems to be loaded with high costs in regard of the social welfare (Artuc, Rijkers, and Porto 2019, pp. 24-26).

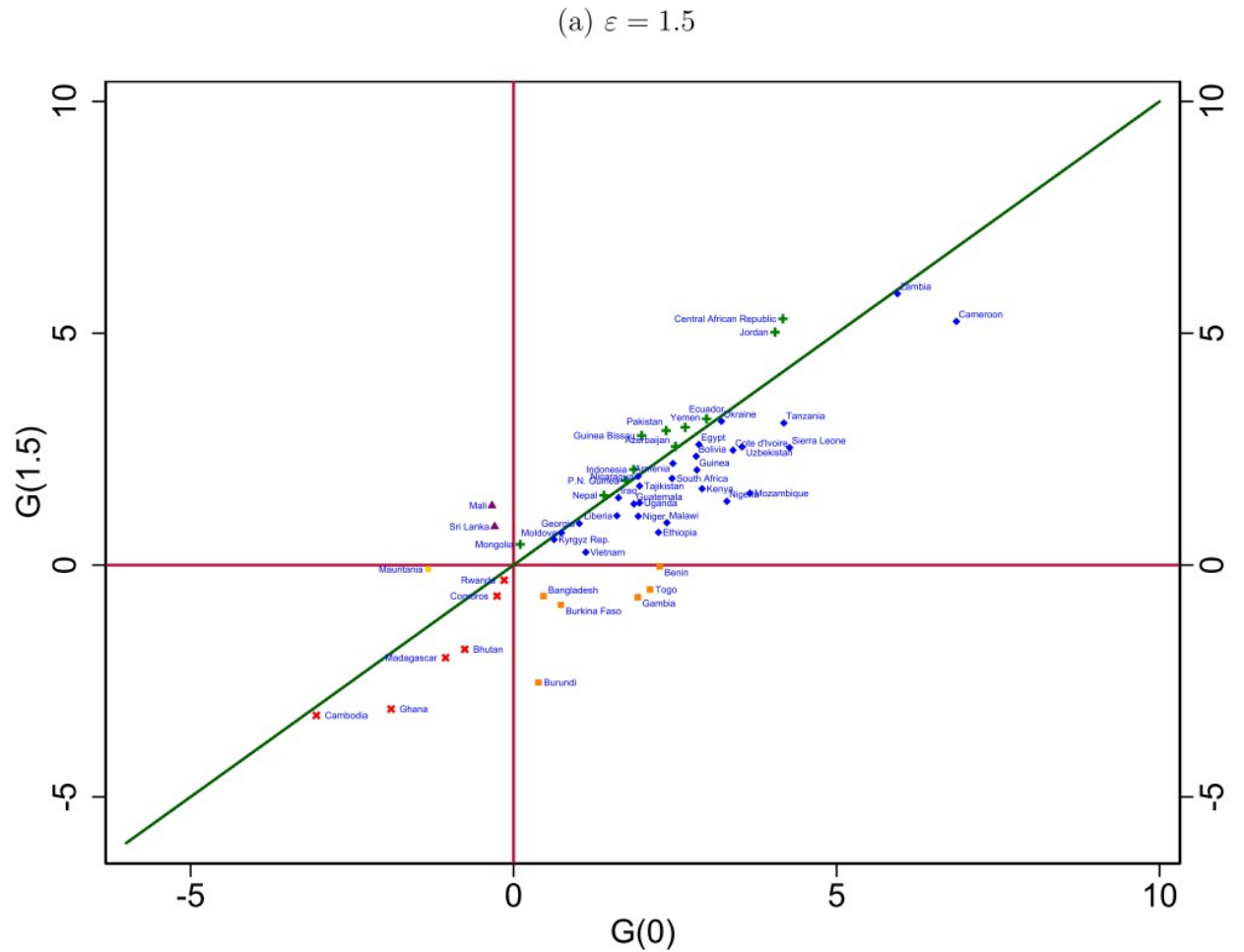


Figure 1: Scatter plot to display the countries favorable trade policy (Artuc, Rijkers, and Porto 2019, p. 43)

To underline their results, the authors used two different permutations of their model to check the model's robustness, which they confirmed by the very similar pattern of the inequality-adjusted gains. Another point of their robustness check was in the form of reevaluation of two alternative assumptions about the tariff redistribution. The first assumption of changes was the exclusion of tariff revenue from the model, however the correlation of equality gains and income gains was still negative. The second reevaluation was a change in the compensation of the tariff losses by governmental progressive taxes instead of proportional taxes, however the pattern did not show any impact and the trade-off countries were still dominated in favor of liberalization (Artuc, Rijkers, and Porto 2019, pp. 28-29). Another form of robustness test was done by using the model to evaluate three different protectionist scenarios instead, the first one increased the tariffs by 10 percent uniformly, the second one was a relative increase of 10 percent and the last one was an increase to 62.4 percent for all tariffs. However, all three scenarios confirmed the results, that in this case 43 to 48 countries' inequality-adjusted income gains would decrease with increased protection as shown in Table 3. This underlined the assumption, that the majority of countries is actually financially hurt by their ongoing protectionism (Artuc, Rijkers, and Porto 2019, pp. 29-30).

Protectionist Scenarios				
	Baseline (Liberalization)	10% relative increase	10% absolute increase	Increase to 62.4%
N winners	45	6	11	11
N losers	9	48	43	43
Average (Inequality Adjusted) Gains from trade reform				
G(0)	1.9 %	-0.2 %	-1.3 %	-5.7 %
G(1)	1.5 %	-0.2 %	-1.3 %	-7.2 %
G(1.5)	1.3 %	-0.2 %	-1.3 %	-7.8 %
G(2)	1.1 %	-0.2 %	-1.3 %	-8.3 %
G(10)	-0.4 %	-0.2 %	-1.7 %	-17.9 %
Countries without tradeoffs	11	8	9	10
of which prefer freer trade	5	6	7	9
Countries with tradeoffs	43	46	45	44
of which prefer freer trade				
$\epsilon = 1$	39	42	39	37
$\epsilon = 1.5$	36	43	38	37
$\epsilon = 2$	35	41	36	37
$\epsilon = 10$	27	33	36	42
Total number of countries that prefer freer trade				
$\epsilon = 0$	45	48	43	43
$\epsilon = 1$	44	48	46	46
$\epsilon = 1.5$	41	49	45	46
$\epsilon = 2$	40	47	43	46
$\epsilon = 10$	32	39	43	51

Table 3: Results of three Protectionist Scenarios (Artuc, Rijkers, and Porto 2019, p. 55)

Finally, to summarize their study's results, the authors came to the conclusion, that their model confirmed the negative correlation between income gains and equality gains, which leads to a trade-off in the case of liberalization. While liberalization led to income gains in 45 countries in their study, 9 countries would faced losses instead. To finish, they gave their thought that based on their study, the majority of developing countries would profit of liberalization and that the ongoing trend of protectionism is causing significant welfare losses in developing countries (Artuc, Rijkers, and Porto 2019, p. 30).

## 4 Critical aspects

To determine the significance of the study by Artuc, Rijkers, and Porto 2019, a closer review regarding possible weaknesses of the study has to be done.

To start the critical review of the study, first, the data must be inspected. One of the main issues or possible weaknesses of the data is the range of years, in which the household surveys were taken. As the earliest household surveys were taken in 1998 for Burundi, Rwanda, The Gambia, the most recent one was taken in 2015 in Liberia. The outdated part of the data might dilute the results and assumptions regarding the impact of liberalization for those "outdated" countries as the time between the usage of those single household surveys and the time they are used in the model ranges up to twenty-one years (Artuc, Rijkers, and Porto 2019, pp. 56-57).

In those decades, worldwide economic shifts, economic crises and other factors appeared and could change the household surveys' outcome a lot. It is also unknown if the authors of this study adapted the survey data by including the inflation of the single countries. While the data definitely showed possible directions for trade-offs between income gains and equality gains, the authors could have tried to add commonly known economic developments into the data as the inflation rate for example, to increase the relevance of their results.

Another possible weakness in the usage of survey data is the accuracy of the household's answer and therefore the significance of the data itself. Several authors and politicians mentioned the lack of some features and the relatively high error rates and the even higher non-answer rates for conducted household surveys. Therefore, the literature and policy try to overcome those disadvantages by linking survey data with administrative data. However, especially in developing countries, which were the main focus of this study, administrative data is lacking (Meyer, Mok, and Sullivan 2015, pp. 255-256).

Another potential source of the needed data could result from a new concept of machine learning predictions, where information about poverty, wealth and possibly income and consumption can be sourced from mobile phone data. By using collected metadata from mobile phones for an algorithm to predict outcomes like poverty and wealth, up-to-date data can be collected within 3-4 weeks and costs of only \$ 12,000. This method could improve the current lack of relevance of household survey data for the developing world, but is not implemented yet by most countries (Blumenstock, Cadamuro, and On 2015, p. 1076).

Therefore, the authors could not have used a better possible dataset for especially the heterogeneous analysis of households' incomes and expenditures. This can be also confirmed by the authors themselves as they updated this study in 2022 with the same dataset of household surveys (Artuc, Porto, and Rijkers 2022, pp. 14-15). The lack in the recurrence of household surveys in developing countries while still being used as main source, leads to the conclusion that household survey data is still the most detailed data possible, especially in the case of developing countries where other possible data like administrative data is still an exception.

As the household survey data seems to fit for the study, the remaining parts of the dataset need to be inspected. First to be reviewed is the used data sourced from the COMTRADE-Database, which covers the quantity and the value of the traded goods. While it is seen as a viable choice for sourcing unit values and quantities of traded goods, the aggregation in the COMTRADE-Database can include a bias. Berthou and Emlinger 2011, p. 107 claim, that the 'procedure may bias unit value when some quantities are missing at a higher level of disaggregation (e.g. missing quantity increases unit value after aggregation).'

Another weakness of this data lies in the used estimation process to counter the lack of quantity information. About 60 percent of the estimated values are based on the Standard Unit Value by product category, which leads to a mismatch of the estimated unit value and the countries' characteristics like production costs or specialization of production (Berthou and Emlinger 2011, p. 107). Therefore, Artuc, Rijkers, and Porto 2019 should use another source for the quantity and value of traded goods like the Traded Unit Values database, which offers a higher reliability of the unit values to improve the accuracy for the results of their work in total (Berthou and Emlinger 2011, p. 113).

The remaining third part of the data is sourced from the TRAINS-Database and contains information regarding tariffs and the countries' trade policies. While this data is used a lot in literature regarding the impacts of certain trade policy measures, there seems to be no critical aspect given in recent literature, as the last negative remark is given back in 2001, that the data is not complete and shows incomplete time series (Olarreaga and Nicita 2001, p. 6). This could lead to the assumption, that the TRAINS data seems to be reliable and complete as of today and therefore was the right data source to be used by Artuc, Rijkers, and Porto 2019.

As the authors themselves mentioned, their model relies on the extended agricultural household model by Singh, Squire, and Strauss 1986 and Benjamin and Deaton 1993. This leads to an inability of the model to capture the differential impacts on the impacts of capital vs labor or skilled vs unskilled labor. However, not only the model can not capture those details as the data itself lacks information about capital and corporate profits, so that just by choosing this dataset, the authors decided against the differential analysis of these points as they argue, that especially when regarding the poverty or the welfare from countries, household survey data is still the most frequently used source of data (Artuc, Rijkers, and Porto 2019, p. 9).

The final point, which could be misleading, is the assumption about the results of this study, that trade liberalization is an easy solution for enhancing the social welfare of countries. This study tried to predict the impact of trade liberalization based on the assumption, that those welfare enhancing effects especially for the low income household are instantly receivable. However, there is the thought in literature, that the impact of trade liberalization on low income households depends on the environment and policies of the country itself. Therefore, a need for additional policies can be needed to enhance or even enable the positive impact for the poor households of a country. This important role of complementary politics is also underlined by the evidence, that shows that especially low income households have lower chances per se to protect themselves socially and to enhance the possibility to exploit the anticipated benefits caused by the liberalization (Winters, McCulloch, and McKay 2004, p. 107). Even under the circumstances above, the author of this literature concludes, that while trade liberalization might not be the most powerful or direct tool to address welfare of a country, it is one of the easiest tools to use with a positive outcome. So in the end, even while the isolated view of trade liberalization can lead to not reaching the anticipated benefits, it is still a useful and easy to execute tool to increase the welfare of low income households and battle poverty of a country (Winters, McCulloch, and McKay 2004, p. 108).

## 5 Conclusion

By summarizing and reviewing the study by Artuc, Rijkers, and Porto 2019, the following conclusion can be given regarding their model, the chosen data set and the results of the study.

While the data set is based on household surveys from 54 developing countries, which range back to 1998 in the most extreme cases, the data still seems to be the best possible dataset for this use case as especially the chosen developing countries suffer a lot under the lack of data in other form like administrative data. Therefore, the used dataset meets all the requirements and can be assumed as the most recent and fitting data for their own developed model. This just showcases, that especially countries, which would probably benefit by a trade policy change towards freer trade, lack the monitoring and collection of data or the technology itself, which needs to be improved to increase the quality of possible estimations regarding the countries' economy, especially on the scope of households to battle poverty and to push the trade policy into a welfare-enhancing way.

However, this can not be said as well for the used COMTRADE data, which is criticized in recent literature for its' aggregation process, where a lack of quantity information can lead to higher trade values or even to disconnecting the unit value from the countries context of production cost and specialization in production. This results in a lower reliability of the used trade units and showcases, why there are more reliable and accurate databases like the Traded Unit Values database for example. Artuc, Rijkers, and Porto 2019 should have used one of those databases instead to improve the significance of their results. As the review of the TRAINS database did not show any recent issues or alternatives in recent literature, it has to be assumed to be a fitting data for the appliance of the study by Artuc, Rijkers, and Porto 2019.

Another specific weakness and also strength of their developed model lies in their use of the extended agricultural household view as base view, which denies possible analyses regarding standard trade theory like Stolper-Samuelson effects for example. However, Artuc, Rijkers, and Porto 2019 mentioned that they chose this household model to enable the new view of scope of households to get results addressing the heterogeneity of households. This problem also appears in the selected data of the household surveys itself, as this data lacks information about returns to capital and corporate benefits, which would be needed for several models regarding the standard trade theory. The authors also compare their results in robustness tests with other studies, where standard trade models were used and showed the same pattern in the results and confirmed the negative correlation between income gains and equality gains.

While the authors of the main study conclude that trade liberalization would be welfare enhancing itself based on the results, other literature refers to the potential need of complementary policies to achieve the anticipated welfare changes, especially for the low income households, there might be a need to enable some form of protection and enhance the chance to receive and exploit the income gains through additional policies. But even though as Artuc, Rijkers, and Porto 2019 tend to view trade liberalization in isolation in their model, their results underline the potential of trade liberalization and showcases its beneficial side. Even critics of the isolated view of trade liberalization underline the statement, that it is one of the easiest to commit to tools to possibly tackle poverty and enhance social welfare, but with the possibility in the dependence of complementary policies to enhance the equal and anticipated distribution of the income gains.

So in total, the study by Artuc, Rijkers, and Porto 2019 showcases a new concept of model to investigate the impact of trade policies on the income gains and equality gains of countries, which enables the scope of households and their heterogeneity. Using this model on the best possible data from household surveys, they found out that, liberalization causes trade-offs between income gains and equality gains. Those trade-offs were explained with the found negative correlation between income gains and equality gains, which was proven in their study as well. Their second and final conclusion of the results, that trade liberalization is welfare enhancing in most cases, seems to be confirmed as well as other literature with standard models tend to show the same conclusion. The study gives a concrete direction for most developing countries regarding their trade policy and offers the possibility for the estimation of impacts caused by trade policies like the liberalization and the protectionism. However, to increase the accuracy and significance of the study, the temporal restriction of the household surveys needs to be updated and better data for the trade and value data has to be used to come to more recent and significant conclusions regarding the question, whether or whether not developing countries should move towards trade liberalization instead of the ongoing protectionism in the majority of countries.



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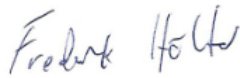
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## DECLARATION

I herewith declare that I have composed the present thesis myself and without use of any other than the cited sources and aids. Sentences or parts of sentences quoted literally are marked as such; other references with regard to the statement and scope are indicated by full details of the publications concerned. The thesis in the same or similar form has not been submitted to any examination body and has not been published. This thesis was not yet, even in part, used in another examination or as a course performance.

January 25, 2023

Frederik Hölter

A handwritten signature in blue ink, appearing to read 'Frederik Hölter', written in a cursive style.