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The effect of trade openness and relative capital endowments on income inequality

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1. Introduction

"Wage gap between CEOs and US workers jumped to 670-to-1 last year" (Rushe, 2022) is a headliner of *The Guardian* of June 2022. For every dollar a worker of one of the top 300 companies in the United States made, a CEO of one of these same companies made 670 dollars. This ratio was 604 to 1 in 2020, so it significantly increased in 2021. These CEOs make about 10.6 million dollars a year, while a median worker received 23,968 dollars. Obviously, there is nothing wrong with a CEO making over ten million dollars a year, but at the same time there are around 37 million people in the United States who live in poverty (US Census Bureau, 2022).

These inequalities can be found all over the world, another example is India, according to Schmall and Yasir (2022) India has the fastest growing economy compared to all other major economies this year. Even though the economy as a whole is growing rapidly, this is not beneficial for all inhabitants of India. There are not enough jobs, and poor residents are getting hit by high inflation, especially in food prices. This research will help to find what is driving this inequality, more specific, the effect of factor endowments and trade openness on income inequality.

This is a relevant study as poverty is still a big problem, not only for developing countries, but for developed countries as well. This poverty can be tackled by looking into income inequality. An example of this is given by a report from the Institute for Policy Studies (Collins, 2022). They find that when taxing billionaires with a wealth tax of only 5%, people with wealth above 50 million dollars with a wealth tax of only 3% and millionaires with a wealth tax of just 2% would raise $2.52 trillion per year. This amount would be enough to help 2.3 billion people out of poverty.

1.1 Previous literature

The effect of both trade openness and relative capital endowments on the income inequality of a country has been investigated before. There are no conclusive results when considering the effect of trade openness on income inequality. A paper by Silva (2007) shows that for the developing country of Mozambique, the effect of trade can differ per region. Another paper by Polpibulaya (2015) shows that for multiple developed countries, the effect of trade on income inequality is negative. Even though there is no conclusive effect found, the majority of existing literature reports a negative relation between trade openness and income inequality.

As for the effect of relative factor endowments on income inequality, less research is done so far. A recent paper by Xiong (2020) shows that when a region is very capital-intensive, income inequality is higher, whereas for a more skill- and technology-intensive region, income inequality is lower. This corresponds to income inequality increasing when relative factor endowments also rise. Even though not all the existing papers find this relation, most of the existing literature finds evidence to support this conclusion.

1.2   Research question and hypotheses

Not only the separate effect of factor endowments and trade openness will be investigated, as this is already partly available in other previous research. But also, the combined effect of these two will be looked at, as this is not yet known. Therefore, the main research question that will be investigated in this paper is as follows:

"What is the interaction effect of trade openness and factor endowments on income inequality between 2014 and 2020?"

Before finding an answer to the effect of the interaction term of trade openness and factor endowments on income inequality, first the separate effect of these two will be investigated. By using previous literature, the following hypotheses can be formed, to help answer the main research question:

1. Trade openness has a negative effect on the income inequality of a country.
2. Relative capital endowments have a positive effect on the income inequality of a country.
3. The interaction effect of trade openness and relative capital endowments on the income inequality of a country is negative.

1.3   Further course of the paper

In this thesis, first, some previous literature that has been done on the topic of income inequality will be discussed. Next, the data that is used to answer the research question will be presented, as well as the method that are used to analyzes the data. After this, the results of these methods will be shown. Finally, a conclusion regarding the main research question will be drawn and at the end also some improvements for further research will be given.

2. Literature review

2.1 Studies on the effect of trade openness

Starting with the effect of trade openness on income inequality, an older paper by Chakrabarti (2000) finds an inverse relationship between trade and income inequality. He uses a sample containing 73 countries, for the year 1985. He concludes that more participation in international trade lowers the income inequality within a country.

Another paper by Silva (2007) investigates the effect of trade on income inequality in Mozambique, a developing country. She finds that the effect of trade on income inequality is different if the north of Mozambique is compared to the south of Mozambique. In the south, an increase in trade leads to an increase in income inequality, but in the north an increase in trade leads to a decrease in income inequality. This means that the effect of trade on inequality is complex, and that it can even variate by region.

Other papers which investigate the effect of trade openness do not look at a specific country. An example is Polpibulaya (2015), who finds that between 1960 and 2005, a general increase in trade openness leads to an increase in income inequality. But when she separates developed from undeveloped countries in her sample, she finds that this increase was only in developing countries. For developed countries this is not the case, and here even was an insignificant decrease in income inequality when trade openness increased.

So far, there have been papers that focus on one country or on multiple countries, but none of the papers are really up to date. Chakrabarti (2000) uses a sample with data for the year 1985 and Polpibulaya (2015) uses a more recent data set, but still the most recent year discussed in this paper is 2005.

A more recent paper is that from Keller and Utar (2016), they also look at the relationship between trade and income inequality in a country. But as the opposite of Silva (2007), they do not look at a developing country, but at Denmark, a developed country. They conclude that between 1999 and 2009 in Denmark about 16 percent of the increase in income inequality comes from a rise in import competition.

Lastly, the paper by Mitra and Hossain (2018) investigates the effect of trade openness on income inequality in the United States. Their findings are that in the short run trade

openness decreases income inequality, but in the long run it increases income inequality in the United States.

2.2 Studies on the effect of relative capital endowments

The first paper on relative factor endowments is by Leamer, Maul, Rodriguez, and Schott (1999). They find that countries that are abundant in their use of land, consequently, have fewer capital stocks and have a higher income inequality. This is a result of the country trying to get out of the market for important everyday products such as food or drinks, but in turn producing more human-capital abundant products, resulting in a higher income inequality.

Another paper that focusses on the relationship between relative factor endowments and income inequality is from Lim and McNelis (2014). They find that countries that are capital abundant, present a positive relation between relative factor endowments and income inequality. Therefore, when a country produces in a more capital-intensive way, the income inequality rises. Overall, they find that capital abundant countries have a limited distribution of income in the form of salaries.

Finally, a paper from Xiong (2020) is discussed, as she also investigates the effect of factor endowments on income inequality. She finds that a more capital abundant region has higher income inequality compared to a more skill and technology abundant region. Another finding from this research is that in China, a total trade increase does not result in a worsening of the income distribution within regions. But income distribution within regions in China is affected by the export, but this depends on the relative abundance of the factor endowments in these regions.

3. Data

For this research, a lot of data needs to be collected. Most of the data that will be used, is provided by *The World Bank*. The data used is from the years 2014 through 2020, and all 133 countries in the dataset are shown in Appendix A. The years in this dataset are used because these are the most recent years that are available, to be able to renew existing literature. Furthermore, the countries in the dataset were all countries for which data was available. In the following sections all variables that will be used in this paper will be explained.

3.1 Variables of interest

First, income inequality will be looked at. A way to interpret income inequality is by looking at the Gini index, which is available in a data set from The World Bank (Gini index, 2022a). Investopedia (What Is the Gini Index?, 2022a) states that the Gini index measures how the income is distributed across a certain population. For this research, the Gini index of multiple countries will be looked at. This index is a coefficient that is always between 0 and 1. In the dataset it is changed to be between 1 and 100. If the Gini index is 100, this means the income inequality is perfect, in other words, one person has all the income of the country. A Gini index of zero means the income distribution is perfectly equal, which means that every person in the country has the same income.

The second variable that will be used are the relative capital endowments of a country, which normally equals capital divided by labor. As a measure for the relative capital endowments, the gross domestic product (GDP) per capita will be used. GDP per capita is used as a way to measure the value per person, which can be seen as the per capita income of a country. The data needed regarding GDP per capita comes from The World Bank (Glossary | GDP per capita, 2022b). The Bank of England (What is GDP?, 2022) states that the GDP is a measure of health and size of an economy. To gain the GDP per capita, the total GDP is divided by the number of people in the population.

IGI Global (What is Trade Openness, 2022) defines trade openness as the fraction of how free a country is, looking at trade relations to other countries. The dataset for trade openness also comes from The World Bank (Trade (% of GDP), 2022c). Trade

openness is defined as the total trade of a country – obtained by adding total export and total import together – as a share of GDP.

3.2 Control variables

To gain data on the population growth of a country, another dataset from The World Bank (Population growth (annual %), 2022d) will be used. The population is based on the entire population, with all residents included, regardless of legal status or citizenship. The population growth is the increase of this population, expressed as a percentage.

For education there are multiple datasets provided by The World Bank that could be used. For example, the primary school enrollment, expressed as a percentage in a country. However, it has been shown that it is better to look at secondary or tertiary schooling if the effect on income inequality is researched. Abdullah, Doucouliagos, and Manning (2015) find that the differences in schooling between the countries are bigger when people are older. But Rodríguez-Pose and Tselios (2009) find that on the short-run and long-run the association of secondary schooling and inequality is the strongest for secondary education. Therefore, enrollment for secondary school will be used as control variable. The secondary school enrollment is the percentage of people, regardless of age, who participated in secondary school. This also implies that the first level education was already successfully completed, according to The World Bank (School enrollment, secondary (% gross), 2022e).

As total tax revenue, all mandatory transfers to the government for public purposes, will be looked at. Some mandatory transfers are not included by The World Bank (Tax revenue (% of GDP), 2022f), for example penalties and fines. This tax revenue is divided by GDP to gain a relative number per country.

Investopedia (What Is Inflation?, 2022b) states that inflation, measured by consumer price index (CPI) is the annual percentage change for the average consumer in the costs of acquiring a basket of goods and services. A dataset by The World Bank (Inflation, consumer prices (annual %), 2022g) will be used to gather data about the inflation rate for the countries of interest.

3.3 Descriptive statistics

Now that all variables are presented, the descriptive statistics that correspond to these variables will be shown. The descriptive statistics of the total sample of 133 countries, with observations for the years 2014 until 2020 are shown in Table 1.

Table 1 – descriptive statistics

Variable	Mean	Standard deviation	Minimum	Maximum
Gini index	36.277	7.509	23.2	63
Trade openness (% of GDP)	87.271	52.948	0.785	380.104
GDP per capita (current $)	14072.68	20139.81	315.778	123678.7
Population growth (annual %)	1.286	1.122	-1.719	4.568
Enrolment secondary education (% gross)	90.434	28.921	18.204	163.934
Tax revenue (% of GDP)	17.272	6.535	0.000	62.801
Inflation rate (annual %)	4.853	21.774	-3.233	557.202

Note: This table contains the descriptive statistics for the sample of 133 countries for 7 years, creating 931 observations in total. The variables of which the descriptive statistics are shown, are presented in column 1. The mean value is presented in the second column, and the standard deviation is presented in the third column. The final two columns present the minimum and the maximum value within the sample.

Table 1 that the average Gini index for all 133 countries equals 36.277. This is a relatively low Gini index, which represents a lower income inequality. The average trade openness of all countries over the years equals 87.271% of the GDP of a country. Finally, the average GDP per capita, which is used as a proxy for the relative capital endowments equal $14,072.68 in current dollars, with the lowest GDP per capita being $315.778 and the highest GDP per capita being $123678.7.

4. Methodology

For this research, a regression model is used that is fitted to panel data. This regression model is used to determine the coefficients of variables that change the Gini index. The model describes the relationship between the independent variables, trade openness and relative capital endowments and the dependent variable, income inequality. There are also other variables which are not a variable of interest, but still have an influence on income inequality. These variables will be used as control variables. As the effect of trade openness on income inequality, as well as the effect of relative capital endowments on income inequality has already been investigated, this research also looks at the joint effect of both. This is called the interaction effect and means that the one independent variable has a different effect on the outcome depending on the values of the other independent variable (Frost, 2022).

In total, three models will be discussed. In the first model, the separate effects of trade openness and relative capital endowments on income inequality will be investigated. In the second model, the interaction effect of these two variables are added to the model. In the final model, time fixed effects will also be added. This is done to control for factors that are equal for all countries and are the same over time. To control for other factors that might also have an influence on the income inequality of a country, some control variables will be added to all three of the models. These control variables are population growth, enrollment for secondary education, tax revenue as a percentage of GDP, and the inflation rate of a country.

The first control variable that is used is population growth. Butler, Wildermuth, Thiede, and Brown (2020) find that population growth and income inequality are negatively associated. But they also conclude that this varies by the geographic region from a country, baseline level of inequality, and baseline population size. Therefore, population growth and income inequality do not always have a negative association, it depends on multiple factors. But it is clear that there is an effect of population growth on income inequality, so population growth will be used as a control variable.

The second control variable will be education, more specific: enrollment for secondary education. Abdullah, Doucouliagos, and Manning (2015) find that education increases the income share of the bottom earners, and decreases the income share of the top earners. Especially in Africa, education has been highly effective in the struggle against

income inequality. It is shown that there is an effect of education on inequality, Rodríguez-Pose and Tselios (2009) found that this is the highest for secondary education, which is why enrolment into secondary education will be controlled for.

Recent work from Sidek (2021) shows that government expenditure leads to lower income inequality. Sidek shows that government spending to reduce income inequality was a driving force for developing countries to lower the income inequality. For developed countries, the spending first led to more inequality, but in the long run had a positive effect on the distribution of income. Therefore, the government expenditure – as shown by total tax revenue – will also be controlled for.

There are many papers that have researched the link between inflation and income inequality. Almost every research finds a connection, for example Bulíř (2001) finds in their research that is based on the Kuznets model, that a reduction in inflation lowers the income inequality in a country, especially when there is hyperinflation. Another research by Monnin (2014) concludes that with rising inflation, the inequality in a country decreases. But at an inflation rate of 13% the inequality is at a minimum, and with an inflation bigger than 13% the inequality even rises. Therefore, as last control variable, inflation will be used.

Adding all of these variables together in one empirical model, gives the following regression equation:

Income inequality$_{it}$ = α + β$_1$ * trade openness$_{it}$ + β$_2$ * relative capital endowments$_{it}$ + β$_3$ * trade openness$_{it}$ * relative capital endowments$_{it}$ + β$_4$ * population growth$_{it}$ + β$_5$ * education$_{it}$ + β$_6$ * tax revenue$_{it}$ + β$_7$ * inflation rate$_{it}$ + time fixed effects + ε$_{it}$ (1)

In this regression equation, income inequality is the outcome variable or the dependent variable. The alpha (α) stands for the constant term, which would be the value of the Gini index if all other variables would have the value of 0. Next, trade openness, relative capital endowments and the interaction term of the two are the independent variables of the model. Furthermore, the control variables are added. And finally, time fixed effects are added by adding the years of the data to the model. The betas (β) stand for the coefficients of the variables, meaning that this is the value a variable should be multiplied with. Finally, the epsilon (ε) stands for the error term that remains. This error term is added to control for factors that are not added to the model but might still influence the income inequality of a country.

5. Results

In this section, the results of all three regression models will be discussed. Firstly, the results of the first model will be discussed. This model has the Gini index as the dependent variable, and trade openness and relative capital endowments as the independent variables. Finally, control variables are added. The results of this model are shown in Table 2.

Table 2 – regression results

	Gini index
	(1)
Trade openness	-0.022
	(0.015)
Relative capital endowments	-0.000***
	(0.000)
Population growth	0.217
	(0.325)
Education	-0.028
	(0.020)
Tax revenue	-0.030
	(0.063)
Inflation	-0.005
	(0.044)
Constant	42.808***
	(2.660)
R^2	0.2449
Observations	345

Note: This table shows the results of a panel data regression with Gini index as the dependent variable and trade openness and relative capital endowments as independent variables. Population growth, secondary education enrolment, tax revenue, and inflation rate are used as control variables. In column 1 the coefficients are presented. Robust standard errors are shown between brackets. Stars are used to indicate significance levels. (* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$)

The results in column 1 of Table 2 show that when the trade openness of a country increases, the Gini index decreases. This would mean that when a country has a higher import and export, the income inequality of a country would become lower, resulting in a more equal distribution of incomes. However, this result is not statistically significant. Therefore, there is not enough information to draw a proper conclusion about this effect. This means that the first hypothesis that states that trade openness has a

negative effect on income inequality cannot be rejected, as there is not enough evidence for this.

Next to this, the effect of relative capital endowments can be interpreted from column 1 of Table 2. It shows that when the relative capital endowments increase by one unit, this has a very small negative effect on the Gini index. The full coefficient of the relative capital endowments is -0.0000706. However, an increase of one unit for relative capital endowments is negligible, as this number generally does not increase with just one unit. The mean value or relative capital endowments of the entire sample is a little higher than 14,000. Therefore, calculating the effect of the relative capital endowments with a minimal increase of 10,000 would make more sense. If this is the case, and relative capital endowments increase with 10,000, the Gini index of a country would decrease with 0,76, ceteris paribus. This result is statistically significant at a 1% significance level. It is still not a very big effect, but it shows a more logical interpretation of the coefficient. It means that when relative capital endowments increase, the Gini index decreases. This means that the second hypothesis that states that relative capital endowments have a positive effect on income inequality must be rejected, as the evidence shows an opposite effect.

Secondly, the results for the second model will be discussed. This model also has the Gini index as the dependent variable, however, the independent variable of this model is the interaction term of trade openness and relative capital endowments. In this model, some control variables are also added. The results of this model are shown in Table 3.

Table 3 – regression results

	Gini index
	(1)
Trade openness	-0.041**
	(0.016)
Relative capital endowments	-0.000***
	(0.000)
*Trade openness * relative capital endowments*	0.000***
	(0.000)
Population growth	0.139
	(0.332)
Education	-0.031

	(0.020)
Tax	-0.016
	(0.064)
Inflation	-0.012
	(0.044)
Constant	44.834***
	(2.749)
R^2	0.3361
Observations	345

Note: This table shows the results of a panel data regression with Gini index as the dependent variable and the interaction term of trade openness and relative capital endowments as independent variable. Population growth, secondary education enrolment, tax revenue, and inflation rate are used as control variables. In column 1 the coefficients are presented. Robust standard errors are shown between brackets. Stars are used to indicate significance levels. (* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$)

The results presented in column 1 of Table 3 show the coefficient for the interaction effect of both trade openness and relative capital endowments on the Gini index, as well as the separate coefficients. To better be able to interpret these results, the found coefficients of interest – only those of trade openness, relative capital endowments, and the interaction term – will be entered into regression equation (1). This gives the following formula:

Income inequality$_{it}$ = 44.834 − 0.041 * trade openness$_{it}$ − 0.000 * relative capital endowments$_{it}$ + 0.000 * trade openness$_{it}$ * relative capital endowments$_{it}$ + … + ε_{it}

(2)

It is found that for countries with a value of 0 for relative capital endowments, the Gini index decreases with 0.041 when trade openness increases by one unit, ceteris paribus. This result is statistically significant at a 5% significance level. However, since a value of 0 for relative capital endowments is unlikely, this coefficient is not interpretable.

Table 3 also shows that for countries with a value of 0 for trade openness, the Gini index decreases just a tiny bit when the relative capital endowments increase by one unit, ceteris paribus. This result is statistically significant at a 1% significance level. However, again in this case, since a value of 0 for trade openness is improbable, this coefficient also cannot be interpreted.

Finally, the interaction term is to be interpreted. The full coefficient for this interaction term is 0.000000556. As for both variables of interest, a one unit increase is not likely, the interpretation will focus on different values. To determine the interaction effect of the two variables, two different cases will be compared to each other. In the first case, both variables will have the value of 0. This is not likely to happen, but it will give a good comparison to another case. In the next case, the value of 100 will be entered for both variables. This value is highly likely for trade openness, and a little less likely for relative capital endowments, but still possible. Therefore, entering 100 into the equation will give a good comparison to determine the interaction effect.

Using regression equation (2), it is found that when all variables have the value of 0, the Gini index equals the constant, which is 44.834. Next, filling in the value of 100 for both trade openness and relative capital endowments into the regression equation with full coefficients, will change the equation into the following:

Income inequality$_{it}$ = 44.834… − 0.041… * 100 − 0.000… * 100 + 0.000… * 100 * 100 + … + ε   (3)

Solving the equation gives a value of 40.757 for the Gini index. This means that when trade openness and relative capital endowments both increase by 100, the Gini index still decreases. Therefore, the interaction effect of both variables on the Gini index is negative. As all three coefficients of interest are at least statistically significant at a 5% level, this result is found to be statistically significant. This presents evidence in favor of the final hypothesis, but a conclusion about this will be drawn after having analyzed the final model.

The final model will look approximately the same as the previous model, only with this model, time fixed effects are added. The results of this model, with again the Gini index as dependent variable and the interaction effect between trade openness and relative capital endowments as independent variable, are shown in Table 4.

Table 4 – regression results

	Gini index
	(1)
Trade openness	-0.019
	(0.020)
Relative capital endowments	-0.000***

	(0.000)
*Trade openness * relative capital endowments*	0.000***
	(0.000)
Population growth	-0.462
	(0.403)
Education	0.008
	(0.027)
Tax	-0.008
	(0.067)
Inflation	0.013
	(0.042)
Year	-0.202***
	(0.066)
Constant	445.653***
	(132.828)
R^2	0.0777
Observations	345

Note: This table shows the results of a panel data regression with Gini index as the dependent variable and the interaction term of trade openness and relative capital endowments as independent variable. Population growth, secondary education enrolment, tax revenue, inflation rate, and time fixed effects are used as control variables. In column 1 the coefficients are presented. Robust standard errors are shown between brackets. Stars are used to indicate significance levels. (* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$)

The final analysis will be the same as the previous analysis, as it again investigates the interaction effect of trade openness and relative capital endowments on income inequality, only in this case time fixed effects are added. Again, first the separate coefficients of the two variables will be interpreted, followed by the coefficient of the interaction term.

The results presented in column 1 of Table 4 show the coefficient for the interaction effect of both trade openness and relative capital endowments on the Gini index, as well as the separate coefficients. Again, to make the analysis of all coefficients of interest easier and better to understand, they will be entered into regression equation (1), which gives the following equation:

Income inequality$_{it}$ = 445.653 − 0.019 * trade openness$_{it}$ − 0.000 * relative capital endowments$_{it}$ + 0.000 * trade openness$_{it}$ * relative capital endowments$_{it}$ + … + ε_{it}

(4)

When looking at the coefficient for trade openness, it shows that for countries with a value of 0 for relative capital endowments, the Gini index decreases when trade openness increases. This appears to be a negative relationship, however, this result is not statistically significant. Therefore, no conclusive answer can be given about the effect of trade openness on income inequality in this case.

For relative capital endowments, results from Table 4 also show that for countries with a value of 0 for trade openness, the Gini index decreases just a tiny bit when the relative capital endowments increase by one unit, ceteris paribus. This result is statistically significant at a 1% significance level. Again, however, a value of 0 for trade openness is not probable, which means that this coefficient also cannot be correctly interpreted.

Lastly, the coefficient for the interaction term is shown in the table. The full coefficient for this interaction term is 0.000000559. This coefficient is very similar to the one from the model without time fixed effects. To still interpret this coefficient, a same manner will be used as in the previous analysis. First, the value of 0 is filled in into regression equation (3) for trade openness and relative capital endowments, and this outcome is compared to the outcome when the value of 100 is filled in for both.

Using regression equation (3), the found Gini index equals 445.653. This seems rather high, but this is lowered by the coefficient of year, which is at least -0.202 * 2014. Now, when filling in 100 for both trade openness and relative capital endowments, the regression equation with full coefficients will look as follows:

Income inequality$_{it}$ = 445.653… – 0.019… * 100 – 0.000… * 100 + 0.000… * 100 * 100 + … + ε_{it} (5)

Solving this equation gives a value for the Gini index of 443.710. This is lower than when both variables equal 0, meaning that the Gini index decreases when both variables increase. The interaction effect of trade openness and relative capital endowments on income inequality is negative. As two out of three coefficients are statistically significant, there is partly enough evidence to support this finding. Adding together the analysis of the models with and without time fixed effects, presents enough evidence to not be able to reject the final hypothesis, that states that the interaction effect of trade openness and relative capital endowments is negative.

6. Conclusion

The main research question of this paper is *"What is the interaction effect of trade openness and factor endowments on income inequality between 2014 and 2020?"* To find an answer to this question, multiple hypotheses were evaluated. The first hypothesis states that trade openness has a negative effect on the income inequality of a country. The results show a negative effect, but this result is not significant. Therefore, this hypothesis cannot be rejected.

Next, the effect of relative capital endowments on income inequality was investigated. This was done by testing the second hypothesis, which states that relative capital endowments have a positive effect on the income inequality of a country. It is found that increasing relative capital endowments has a very small negative effect on income inequality, and this result is also statistically significant. Therefore, the second hypothesis must be rejected.

The last hypothesis that has been discussed looks at the interaction effect of trade openness and relative capital endowments on income inequality. The hypothesis specifically states that this interaction effect is negative. To test the hypothesis, two models were used. One model contained only the interaction effect as independent variable and some control variables, and the other one also contained time fixed effects. The results of both models show that the interaction effect of trade openness and relative capital endowments on income inequality is negative. This would mean that in both cases the final hypothesis should not be rejected. However, this conclusion is mostly based on the model without time fixed effects, as all coefficients of interest are statistically significant on at least a 5% significance level.

Altogether, it is found that trade openness and relative capital endowments have a negative effect on income inequality, although not all significant. However, the conclusion about the interaction effect is based on significant results. These results show that when both trade openness and relative capital endowments increase, the Gini index of a country decreases, making the income inequality more equal.

7. Discussion

7.1 Validity and results

For this research, a panel dataset has been used to investigate the effect of trade openness and relative capital endowments on the income inequality of a country. To do this analysis, a regression was ran that is specifically suited for panel data. Also, time fixed effect were added, to analyze the effect through the years even better. Furthermore, a bigger part of the data is provided by The World Bank, which is also a reliable source. Consequently, the methodology and data are reliable and therefore, the results that come from this are well-founded.

The results are generalizable, as the data contains many countries all over the world. It can be said that the investigated effect gives a good overall view of all types of countries in the world. Because of this, it might be the case that for specific countries, a different effect can be found. However, as the effect is calculated for multiple countries altogether, the results of this study are generalizable.

The results show a negative (insignificant) effect of trade openness on income inequality. This negative effect is in line with the already known literature. However, this paper also finds a negative effect of relative capital endowments on income inequality, which is not in line with the known literature, as previous literature finds a positive effect.

Furthermore, it is found that the interaction effect of trade openness and relative capital endowments on income inequality is negative. This means that if trade openness and relative capital endowments increase, the Gini index decreases, resulting in a lower income inequality. Generalizing this into the real world, this means that if the import and export of a country as well as the capital to labor ratio of a country increases, the income inequality becomes more equal.

This effect means that countries with high export and import, and a higher capital to labor ratio, have a more equal income distribution. As developing countries often have higher trade tariffs, they end up trading less than developed countries (United Nations, 2022). This paper shows that when developing countries decide to start trading more, this can help solving the high income inequality, resulting in more economic growth.

7.2 Limitations and suggestions

To find the interaction effect of trade openness and relative capital endowments on income inequality, one simplification was made. As a proxy for relative capital endowments, which normally is the ratio of capital to labor, this research has used GDP per capita. This is an estimation of relative capital endowments, meaning that the found effect is not the true effect, making this research a little less valid.

Another limitation of this study is the lack of previous research done on the interaction effect of trade openness and relative capital endowments. On the one hand, it makes the topic more interesting to investigate, but on the other hand, it makes it more difficult to understand the relationship between the two variables and form fitting hypotheses about the topic.

There are two possible suggestions for further research. This paper focuses on the effect of trade openness and relative capital endowments on the income inequality, for a big variety of countries. Therefore, the found effect is the overall effect for all these countries. In the future, it might be interesting to look at effect of these variables on income inequality, only differentiating between rich and poor countries. As the economies of those types of countries differs, the effect on income inequality likely differs as well. Investigating these separate effects can help inform poor countries on how to improve their income inequality.

Next to this, it might also be interesting to look at within-country differences, to see if certain areas are more sensitive to changes in the trade openness and relative capital endowments than others. This can help gain a better understanding of differences between regions and possibly improving the income inequality.

8. Bibliography

Abdullah, A., Doucouliagos, H., & Manning, E. (2015). Does education reduce income inequality? A meta-regression analysis. *Journal of Economic Surveys, 29*(2), 301-316.

Bulíř, A. (2001). Income inequality: does inflation matter?. *IMF Staff papers, 48*(1), 139-159.

Butler, J., Wildermuth, G. A., Thiede, B. C., & Brown, D. L. (2020). Population Change and Income Inequality in Rural America. *Population Research and Policy Review, 39*(5), 889-911.

Chakrabarti, A. (2000). Does trade cause inequality?. *Journal of Economic Development, 25*(2), 1-22.

Collins, C. (2022). *Report: Taxing the World's Richest Would Raise $2.52 Trillion a Year*. Institute for Policy Studies. Retrieved from https://ips-dc.org/report-taxing-extreme-wealth/

Frost, J. (2022). *Understanding Interaction Effects in Statistics*. Statistics By Jim. Retrieved from https://statisticsbyjim.com/regression/interaction-effects/

Gini index. (2022a). The World Bank. Retrieved from https://data.worldbank.org/indicator/SI.POV.GINI

Glossary | GDP per capita. (2022b). World Bank. Retrieved from https://databank.worldbank.org/metadataglossary/statistical-capacity-indicators/series/5.51.01.10.gdp#:%7E:text=GDP%20per%20capita%20is%20the,Long%20definition

Inflation, consumer prices (annual %) | Data. (2022g). The World Bank. Retrieved from https://data.worldbank.org/indicator/FP.CPI.TOTL.ZG

Keller, W., & Utar, H. (2016). *International trade and job polarization: Evidence at the worker-level* (No. w22315). National Bureau of Economic Research.

Leamer, E. E., Maul, H., Rodriguez, S., & Schott, P. K. (1999). Does natural resource abundance increase Latin American income inequality?. *Journal of development Economics*, *59*(1), 3-42.

Lim, G. C., & McNelis, P. D. (2014). Income inequality, trade and financial openness.

Mitra, R., & Hossain, M. S. (2018). Does Trade Openness Increase Income Inequality in the United States?. *The Empirical Economics Letters, 17*(10), 1185-1194.

Monnin, P. (2014). Inflation and income inequality in developed economies. *CEP Working Paper Series.*

Polpibulaya, S. (2015). Trade Openness and Income Inequality.

Population growth (annual %) | Data. (2022d). The World Bank. Retrieved from https://data.worldbank.org/indicator/SP.POP.GROW?name_desc=false.

School enrollment, tertiary (% gross) | Data. (2022e). The World Bank. Retrieved from https://data.worldbank.org/indicator/SE.TER.ENRR

Rodríguez-Pose, A., & Tselios, V. (2009). Education and income inequality in the regions of the European Union. *Journal of Regional Science*, *49*(3), 411-437.

Rushe, D. (2022). *Wage gap between CEOs and US workers jumped to 670-to-1 last year, study finds.* The Guardian. Retrieved from https://www.theguardian.com/us-news/2022/jun/07/us-wage-gap-ceos-workers-institute-for-policy-studies-report#:%7E:text=A%20study%20of%20300%20top,%2Dto%2D1%20in%202020.

Schmall, E., & Yasir, S. (2022). *India's Economy Is Growing Quickly. Why Can't It Produce Enough Jobs?* The New York Times. Retrieved from https://www.nytimes.com/2022/06/13/business/economy/india-economy-jobs.html

Sidek, N. Z. M. (2021). Do government expenditure reduce income inequality: evidence from developing and developed countries. *Studies in Economics and Finance, 38*(2), 447-503.

Silva, J. A. (2007). Trade and income inequality in a less developed country: the case of Mozambique. *Economic Geography, 83*(2), 111-136.

Tax revenue (% of GDP) | Data. (2022f). The World Bank. Retrieved from https://data.worldbank.org/indicator/GC.TAX.TOTL.GD.ZS

Trade (% of GDP) | Data. (2022c). The World Bank. Retrieved from https://data.worldbank.org/indicator/NE.TRD.GNFS.ZS

US Census Bureau. (2022). Income and Poverty in the United States: 2020. Census.Gov. Retrieved from https://www.census.gov/library/publications/2021/demo/p60-273.html

What is GDP? (2022). Bank of England. Retrieved from https://www.bankofengland.co.uk/knowledgebank/what-is-gdp#:%7E:text=Gross%20domestic%20product%20or%20GDP%20is%20a%20measure%20of%20the,one%20quarter%20or%20one%20year

What Is Inflation? (2022b). Investopedia. Retrieved from https://www.investopedia.com/terms/i/inflation.asp

What Is the Gini Index? (2022a). Investopedia. Retrieved from https://www.investopedia.com/terms/g/gini-index.asp

What is Trade Openness. (2022). IGI Global. Retrieved from https://www.igi-global.com/dictionary/trade-openness/72919#:%7E:text=Trade%20openness%20refers%20to%20the,and%20exports%20of%20an%20economy.

Xiong, Y. (2020). International trade, factor endowments, and income inequality: evidence from chinese regional data. *Emerging Markets Finance and Trade, 56*(14), 3405-3424.

9. Appendix

9.1 Appendix A

Table 5 - all countries used in the dataset

Albania	Greece	Panama
Angola	Guatemala	Paraguay
Argentina	Guinea	Peru
Armenia	Guinea-Bissau	Philippines
Australia	Honduras	Poland
Austria	Hungary	Portugal
Bangladesh	Iceland	Romania
Belarus	Indonesia	Russian Federation
Belgium	Iran, Islamic Rep.	Rwanda
Benin	Ireland	Sao Tome and Principe
Bhutan	Israel	Senegal
Bolivia	Italy	Serbia
Botswana	Kazakhstan	Seychelles
Brazil	Kenya	Sierra Leone
Bulgaria	Kiribati	Slovak Republic
Burkina Faso	Korea, Rep.	Slovenia
Cabo Verde	Kyrgyz Republic	Somalia
Cameroon	Lao PDR	South Africa
Canada	Latvia	Spain
Chad	Lesotho	Sri Lanka
Chile	Liberia	St. Lucia
China	Lithuania	Sudan
Colombia	Luxembourg	Sweden
Comoros	Malawi	Switzerland
Costa Rica	Malaysia	Tajikistan
Cote d'Ivoire	Maldives	Tanzania
Croatia	Mali	Thailand
Cyprus	Malta	Timor-Leste
Czech Republic	Marshall Islands	Togo

Denmark	Mauritania	Tonga
Djibouti	Mauritius	Tunisia
Dominican Republic	Mexico	Turkey
Ecuador	Moldova	Uganda
Egypt, Arab Rep.	Mongolia	Ukraine
El Salvador	Montenegro	United Arab Emirates
Estonia	Mozambique	United Kingdom
Eswatini	Myanmar	United States
Ethiopia	Namibia	Uruguay
Fiji	Netherlands	Vanuatu
Finland	Nicaragua	Vietnam
France	Niger	Yemen, Rep.
Gabon	Nigeria	Zambia
Georgia	North Macedonia	Zimbabwe
Germany	Norway	
Ghana	Pakistan	

Note: This table contains all the countries of which data is used.