The Rise of Income Inequality and The Possible Role of Trade in The Process

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Master Thesis

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Abstract

The aim is to analyse the effects of trade on the distribution of income (income inequality); using a fixed effect model for the panel of 14 OECD countries. The GINI coefficient is the dependent variable and trade is the main independent variable. The results give us grounds to assume that importing agricultural products enhances income equality and importing manufactures decreases income equality. Trade as a whole does not have any significant effect on income inequality. In two regressions inflation rate and education spending have inequality decreasing effect.

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1. Introduction

Income inequality (measured by the GINI coefficient) has been increasing in many countries across the world for at least past three decades. This phenomenon has led many scholars to look at this matter; its causes and its effects. The reason why one may be interested in the level of income inequality and its course is the effect they may have on the society as a whole. Based on Pickett and Wilkinson (2009) one can argue that there is a positive relationship between the increased income inequality and many social problems like crime, drug abuse, poor health etc. So it is important to find out more about the variables causing the income inequality to rise. Moreover the issue of wealth inequality was referred to as "most serious challenge for the world" at the World Economic Forum in Davos 2011. Besides that in order to design policies to influence the course and the level of income inequality, one needs to know more about its causes.

The past few decades have also witnessed an increase in the volume of trade across the world. Using the neo-classical trade theories one can make a connection between the two, namely the increased income inequality and the increase in the volume of trade. Depending on the factor abundance of a country, trade can influence the distribution of income. This point is further discussed in the theoretical part, but in brief for the developed economies more trade may lead to more inequality according to Stolper-Samuelson theorem (a part of Heckscher-Ohlin (HO)). Trade benefits the abundant factor of production in a country through specialisation. Countries specialise in the production of commodities which intensively use their relatively abundant factor of production. Developed nations in comparison with developing nations have relatively more skilled labour. So the wage rate for the skilled labour in de developed economies goes up relative to that of the unskilled labour.

But as stated by Krugman and Lawrence (1993) a major part of developed economies' trade is with other developed nations where factor abundance is comparable. Moreover Meschi and Vivarelli (2007) test the effects of trade on the level of inequality for the developing nations and find out that HO does not hold, so would the HO predict the results for the developed nations?

Another theory about how the income distribution evolves as a country's economy develops is that of Kuznets. According to Kuznets (1955) developed nations should experience a decline in the level of inequality as their economies grow further. So there are contradicting theories about the distribution of income and how it evolves.

This thesis is an attempt to contribute to the literature concerning the economic causes of the rise of income inequality and to help in shedding some light on the contradictory views. The main point of concentration is the role of trade on the income inequality. In a number of ways this thesis is also an attempt to be different from the work already done in this area. First of all the dataset, the Standard World Income Inequality Dataset (SWIID) is used for the regression analysis, while most of other papers use the Luxembourg Income Study (LIS) data. Secondly, trade is not only taken as a whole (total import and total export), but also it is split into two sectors: manufactures and agriculture. This may tell us more about the effects of trade in different sectors on the income inequality.

The main question is to analyse how and to what extend is the income inequality (measured by the GINI-coefficient) influenced by trade. To answer this question, I apply a panel analysis using a fixed effect model and the data on 14 member states of Organisation for Economic Co-operation and Development (OECD) for the period 1980-2009. Besides trade there are a number of other variables, which serve as control variables and are discussed in the section about the data.

This thesis is structured the following way. It starts with a section about the main dependent variable namely the GINI coefficient. Here it is explained how this coefficient is measured and what does it mean. The third section discusses the theoretical basis for the analysis about the GINI coefficient. Section four is about the current situation in the countries – the descriptive statistics. Section five elaborates on the existing literature. Section six is about the data used for the regressions, section seven elaborates on the methodology. Section eight is shows the findings of the regression analysis and finally section nine draw the conclusions about the findings.

2. The GINI-coefficient

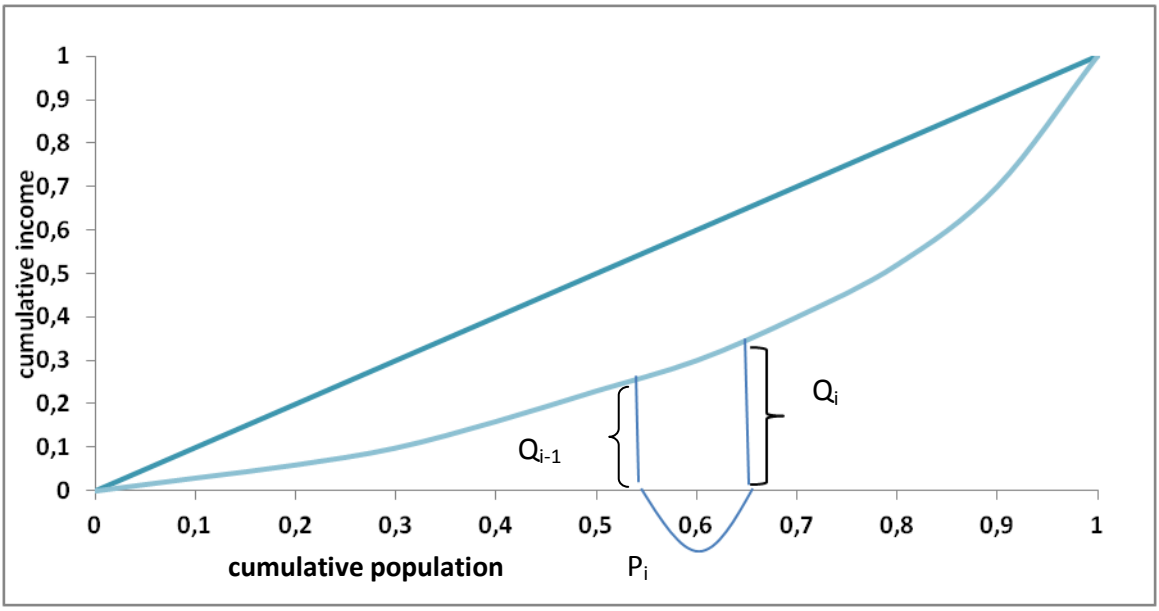
The coefficient developed by Corrado Gini and named after him is a measure of inequality and has been used in different fields of science. In the field of economics, the GINI coefficient refers to the distribution of income in a country and has become synonymous with a measure of income inequality.

The calculation of the GINI coefficient is best explained using a cumulative graph – see figure 1. In order to calculate the GINI coefficient one needs to look into two aspects, the population (number of households) on the one hand and the earnings on the other. First the households of a country are aligned according to their earnings, beginning with the households with relatively low income (starting from the left) and ending with households earning the most. So there is a ranked lined constructed on basis of household earnings. The next step is to divide the ranked line into a number of segments – say ten segments. The households are bunched and segmented in order to make the calculations convenient. In the example here each segment (quintile) contains 10 % of the total number of households of the country. So the first quintile contains the least earners and tenth quintile contains the wealthiest (in terms of income) of households. The case of perfect income equality is used as a kind of benchmark for the calculation of the GINI coefficient. Perfect income equality is when in a country each quintile would earn an equal share of the total income – In the example used here each quintile would earn 10% of the total income.

The data is then put on a cumulative graph, with cumulative population on the horizontal axis and the cumulative income on the vertical axis. In case of perfect equality the cumulative 20% of the population (the first 20%) earns 20% of the total income and the cumulative 40% earns 40% of the total income and so on. The line associating the cumulative income share going to different household groups (quintiles) is called the Lorenz curve. The Lorenz curve for the perfect equality is represented by the straight line at a 45^0 angle connecting the lower left corner to the upper right corner. Usually it is never the case where each section of the society earns the same amount of income. Nevertheless as stated earlier it serves as a benchmark for the calculation of the GINI coefficient. The actual Lorenz curve lies

below the straight line. The difference between the actual Lorenz curve and the one of perfect equality forms a basis for calculating the GINI coefficient. In principle the larger the area between the two Lorenz curves the more unequal the distribution of income in a country is.

Figure 1: The GINI coefficient using the Lorenz Curve



For the GINI coefficient the area between the curves is divided by the total area under the perfect equality line (=0,5). Letter "B" in figure 1 representing the area between the lines and letter "T" representing the area under the perfect equality line.

GINI-coefficient = B/0.5 = 2B

More formally the value of the GINI coefficient is calculated using the following formula:

GINI= 1- $\sum P_i(Q_i+Q_{i-1})$

P_i= cumulative population share

Q_i= cumulative income share

Another way of expressing perfect income equality is when there is no difference between the perfect equality line and the actual income distribution line. In that case the GINI coefficient is equal to zero, because the difference between the

two lines is zero. Another case is where the GINI coefficient takes the value of one representing perfect income inequality, where one quintile earns the total income and the rest of the quintiles have no income. This is the case where the area between the curves entices the entire area (=0,5) under the perfect equality Lorenz curve. In this way the GINI coefficient evaluates the distribution of income and for most cases ranges between 0.2 and 0.8.

3. Theory

3.1. Kuznets' curve

According to Kuznets (1955) there are at least two factors which influence the distribution of gross income, namely the savings and the economic growth. The inequality in savings according to him is sharper than the inequality in the distribution of income. So a major share of savings is done by the group of people in the upper most income categories. This savings' imbalance can have a cumulative effect which means that an increasingly large part of income-generating assets would be in the hands of the wealthiest of the country. This group and their descendents enjoy a larger income share thanks to their relatively large share of income from savings and other assets.

The other determinant of the income distribution; namely the economic growth determines also the activities in different sectors. In the early stages of economic growth the increase in demand stimulates the demand for capital due to the labour-saving technologies. The increased demand for the capital relative to labour causes the rent (the compensation for capital) to rise. In the early stages of economic growth the difference between the wage and rent increase. The income inequality increases in the early stages of economic growth. So the rise of the GINI coefficient in the developing economies is understandable based on this argument.

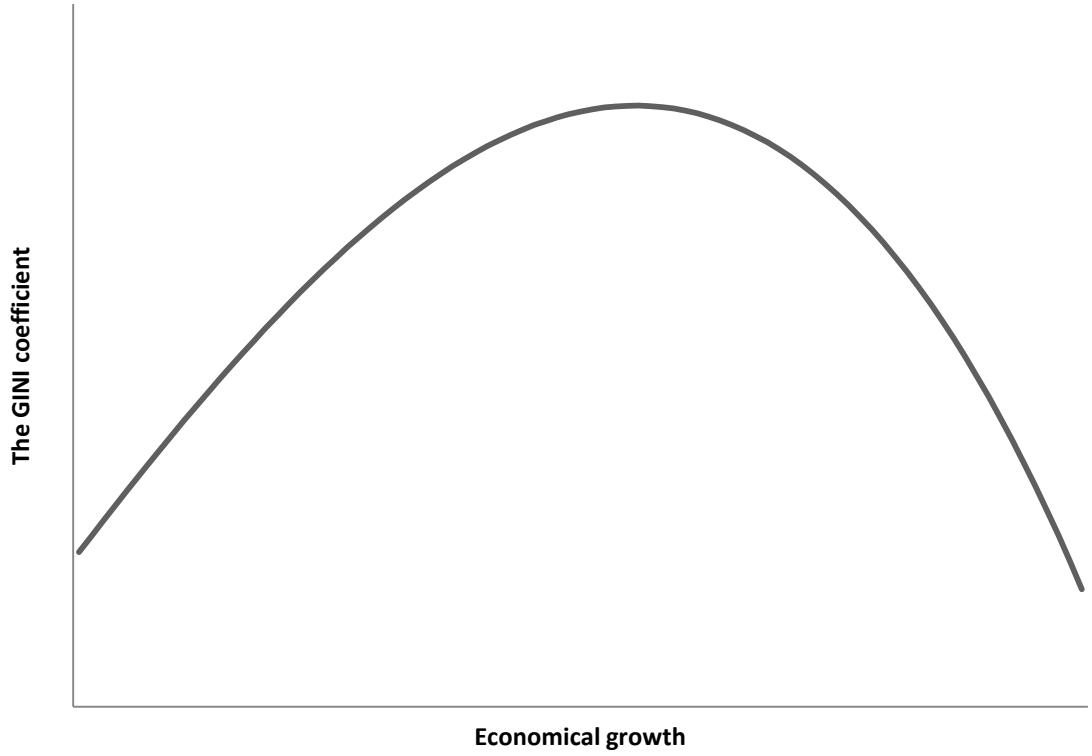
As the economical growth continues and reaches advanced stages the distribution of income also tends towards more equality. So the economical growth and the GINI coefficient have a non linear relationship. At the early stages of development of an economy, agriculture serves as the prominent sector in terms of income generation and employment. The people who work in the agricultural sector live in the rural areas. The per capita income and the productivity are low just like

the level of inequality. As the industry thrives in the urban areas, it attracts the labour away from the rural area. The industry has a relatively higher productivity and so also higher income is earned by the workers employed in the industrial sector. The movement of people continues from the agricultural activities to the industrial ones and the level of inequality rises, because people who have moved to the urban areas and work in the industrial sector have a relatively higher income. So the rise in the per capita product (income) is associated with a higher level of inequality in the early stages of economical development and the shift in sectors of economy.

With the passage of time the average per capita income rises as more and more people start to work in the industrial sector. At this stage the level of inequality decreases in comparison with the earlier stages. Thus the later stages of economical development are associated with a lower level of inequality given the level of per capita product.

Figure 2 depicts such a relationship between the economical growth and the distribution of income. This called the Kuznets's inverted-U referring to the shape of the graph.

Figure 2: Kuznets's inverted U



Source: Arbitrary numbers

At the beginning there is a positive relationship between the economic growth and the levels of inequality and this relationship is reversed at the later stages of development.

Earlier work like that of Milanovic (1995) and Jha (1996) support the existence of an inverted-U, but there are also papers rejecting the presence of such a curve. Bourguignon and Morrison (1990) find for example that the significance of income factor decreases when one adds variables like education level. Another point not in support of Kuznets is the recent increase in the level of inequality in many of industrialised countries, especially UK and the USA (Deiniger and Squire 1998).

If there is a Kuznets' curve for the data in this thesis than one must expect that the growth rate of the GDP (as a variable) would have an inequality decreasing effect. This conclusion is based on the assumption that all of the 14 countries considered in the analysis are industrialised countries and a further economical growth would have a negative effect on the value of the GINI coefficient.

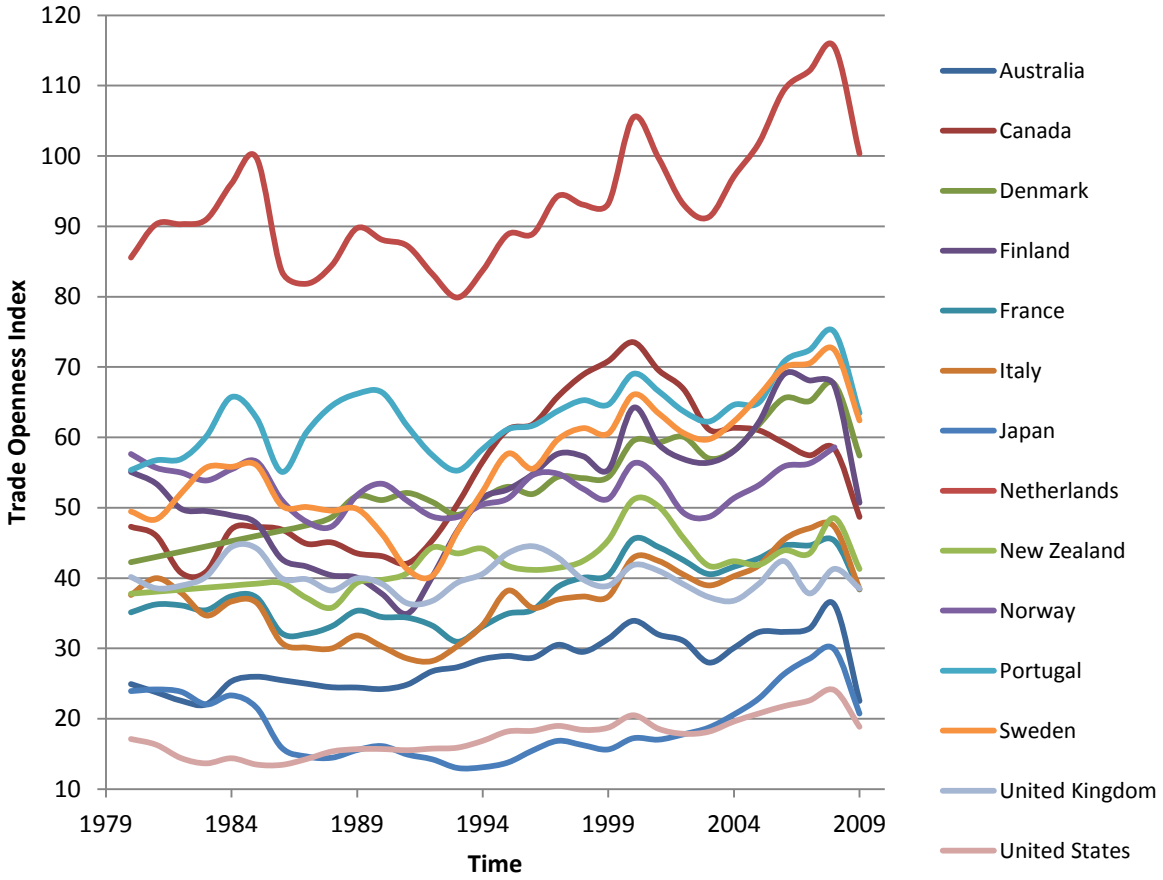
As evident from the data of the 14 countries in this thesis, the value of the GINI coefficient has been increasing for the most of the countries. Thus, one would expect that the growth rate of the GDP has a non-significant effect on the distribution of income.

If the predictions of the Kuznets curve do not explain the development in the distribution of income, one could ask the question which other variables could be of significant influence on the distribution of income. This question is relevant, because it can help in developing better policy measures regarding the distribution of income.

3.2. Trade

For the past few decades trade has been an important part of the economy for many countries. Figure 3 below shows the trade in relation with the GDP for the 14 OECD countries. Trade in volume and value forms a considerable part of the OECD countries' economy. Figure 3 is an illustration of the role trade in these countries economies.

Figure 3: Trade openness index



Source:OECD

This means that trade as an economic factor plays an increasingly important role in terms of job creation, income generation, firm location etc. Using the neoclassical trade theory one can make a connection between trade and the distribution of income. Suppose there are two types of workers the low skilled ones and the high skilled ones. The economy produces two types of goods using either the low skilled labour or the high skilled labour intensively for each good. Developing countries have low skilled labour in abundance and developed (for example OECD countries) have high skilled labour in abundance. When OECD countries engage in trade with developing countries, they export high-skilled-intensive goods to the developing countries and import low-skilled-intensive goods form the developing countries. The price of high-skilled-intensive goods relative to that of low-skilled-intensive goods increases, because the demand for high-skilled –intensive goods has increased. This is a stimulus for the OECD countries to increase the production of

high-skilled-intensive goods. According to the Stolper Samuelson theorem in the OECD countries the rise in the relative prices of high-skilled-intensive goods in comparison with that of low-skilled-intensive goods causes the wages of high-skilled workers to rise. At the same time the wages of low-skilled workers drop. So based on the Stolper-Samuelson theorem one can conclude that with trade the income inequality increases in the OECD countries. So importing low-skilled-intensive goods from the developing nations can in part be accountable for the rise in the income inequality in the OECD countries.

But as presented earlier Krugman and Lawrence (1993) show that a major part of the trade in OECD countries takes place with countries where the factor abundance is comparable and where the wage differential is of no considerable size. This is also the conclusion of Marrewijk (2007) where it is shown that the United States' import from the developing nations is about 1% of its total import and about 0.13% of its total GDP. So trade with developing countries in itself is highly unlikely to be the only source of ever increasing income inequality or the relative rise in the wages of the high-skilled labour. The book further suggests that perhaps technological changes and sector adjustments could be partly accountable for the rise in the income inequality.

In this thesis an effort has been made to include the effects of sector adjustment on the development of the GINI coefficient, by looking at trade not as a whole, but for two different sectors.

3.3. The New Economic Geography

Yet another line of argument about the increase in the level of income inequality is that of the New Economic Geography (NEG). The NEG approach looks at the change in the location choice of firms and its effect on the regional development. In order to minimise the transportation costs firms choose the location of their production and distribution unit, where the accessibility to the output and the input markets is the greatest. This process is responsible for the regional concentration of firms and households. According to Krugman (1991) and Head and Reis (2001) this process is instrumental for the regional economic divergence. For the analysis in this thesis the focus is on the impact of this process on the wages.

Redding and Venables (2004) demonstrate that wages are lower in countries that do not have easy access to markets. Firms are reluctant to settle in a country that has relatively remote access to the input and the output markets. The demand for labour in these countries is negatively affected by the firm's location choice. In the case of the panel used for this thesis, one can argue that a country in continental Europe is a preferred location choice for a firm than say New Zealand, because a considerable part of trade of European countries takes place within Europe and New Zealand is physically isolated from most of the countries. Based on the NEG approach one would expect lower wages in New Zealand than in an European country.

As Redding and Schott (2003) indicate, the difference between wages is not only across countries, but also within them. They look into the wage differentials between different regions in United Kingdom. They find out that there is a relationship between the economical development of different regions and the difference between relative wages. The NEG approach is relevant for the distribution of income and the increase in the level inequality, because it illustrates the role of regional economic development on the increased wage differential across regions.

4. The descriptive variables

In this section I give an overview about the recent evolution in inequality in a the countries in my sample. Table 1 summarises the change in the value of the GINI coefficient for all the 14 countries. One can see that except for Demark and France the rest of the countries have experienced an increase in income inequality. Australia, the Netherlands and Italy all show a rise ranging from 5 to 8 per cent, but for most of the other countries the increase in the level of inequality runs well into the double digits, with New Zealand at the top with an increase of almost 40%. Figure X gives a better view of how the income inequality has developed during the last three decades.

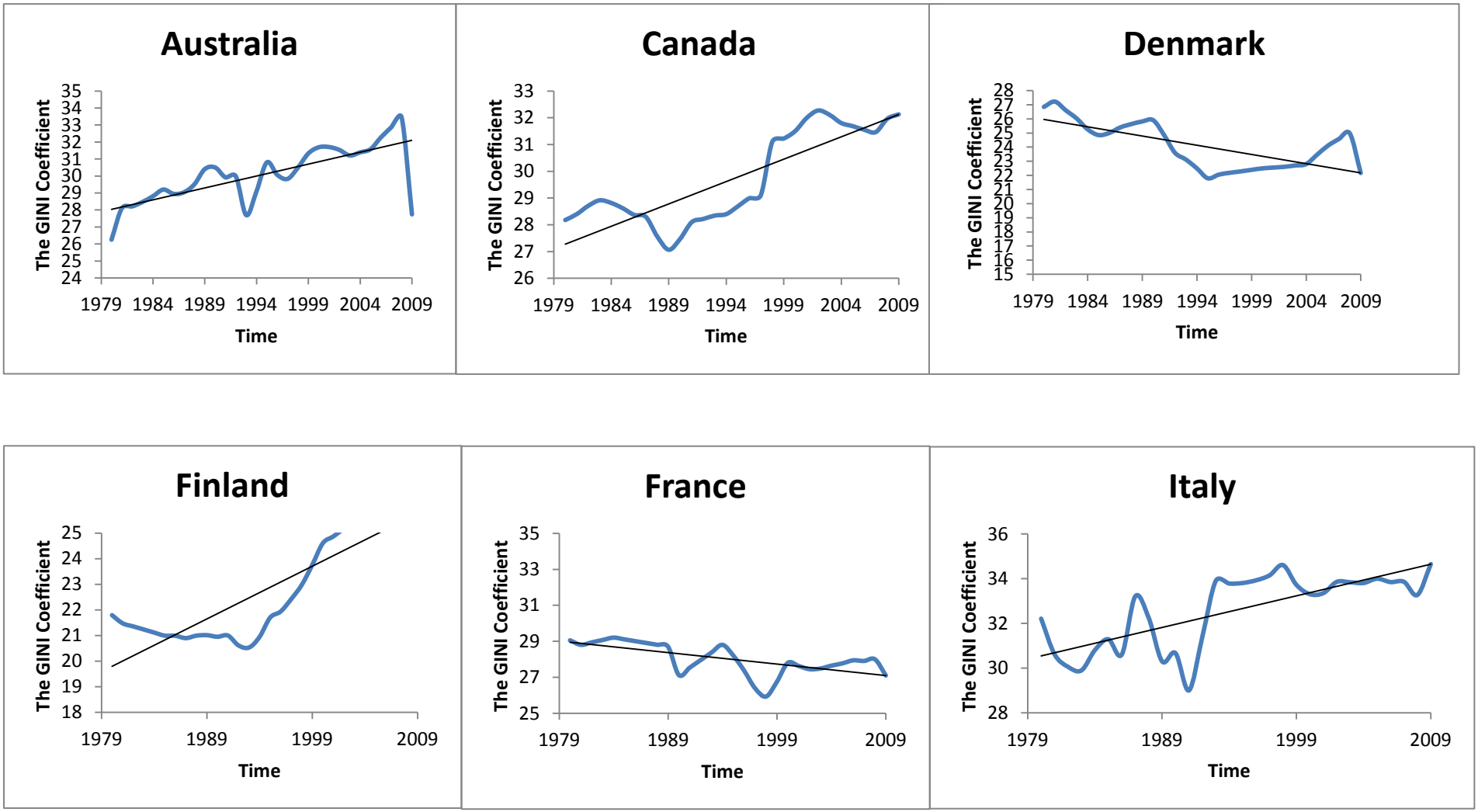
Table 1: The percentage change in the value of the GINI coefficient

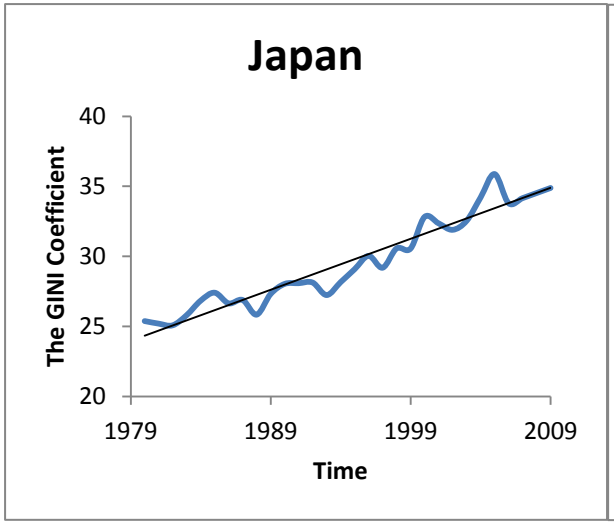
Country name	Period	Percentage change in the value of the GINI coefficient	Average value over the period
Australia	1980-2009	5,67	30,07
Canada	1980-2009	14,00	29,70
Denmark	1980-2009	-17,42	24,06
Finland	1980-2009	18,21	22,78
France	1980-2009	-6,73	28,02
Italy	1980-2009	7,57	32,59
Japan	1980-2009	37,47	29,62
The Netherlands	1980-2009	4,89	26,06
New Zeeland	1980-2009	39,47	31,65
Norway	1980-2009	12,81	23,69
Portugal	1980-2008	17,04	33,53
Sweden	1980-2009	14,98	22,13
United Kingdom	1980-2009	37,92	32,61
United States	1980-2009	28,88	34,87

Table 1. Source: SWIID database

Figure 3 on the next page shows the evolution of the GINI coefficient in the last three decades. One can see that the increase in the level of inequality for countries like Japan, Sweden, United States and United Kingdom follow a somewhat smooth line while for other countries it fluctuates. The starting points are also different for each country. Most of the countries start from around 20 except for Italy, Portugal and the United states. Although different starting point most of them rise in a smooth line.

Figure 3: The evolution of the GINI coefficient 1980-2009 for 14 OECD countries




Japan
The GINI Coefficient
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1979
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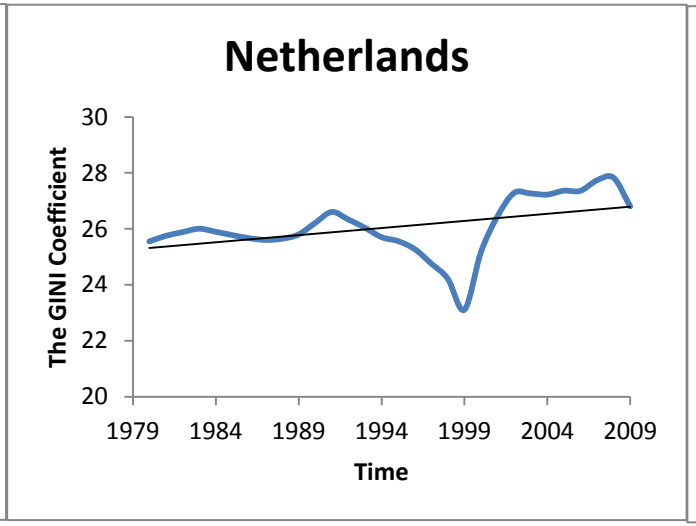
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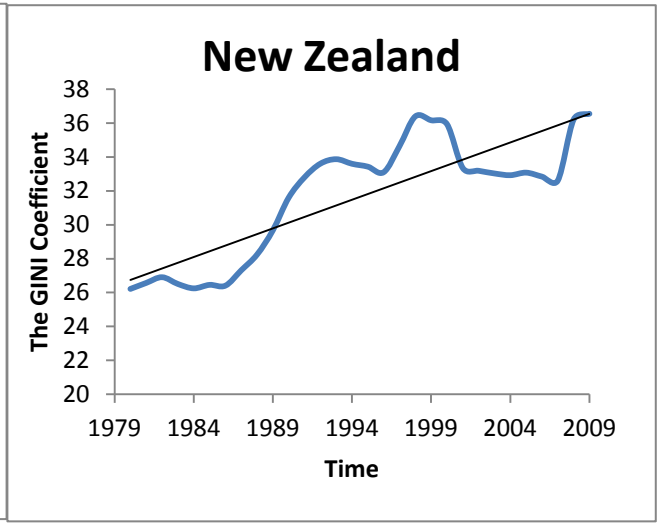
New Zealand
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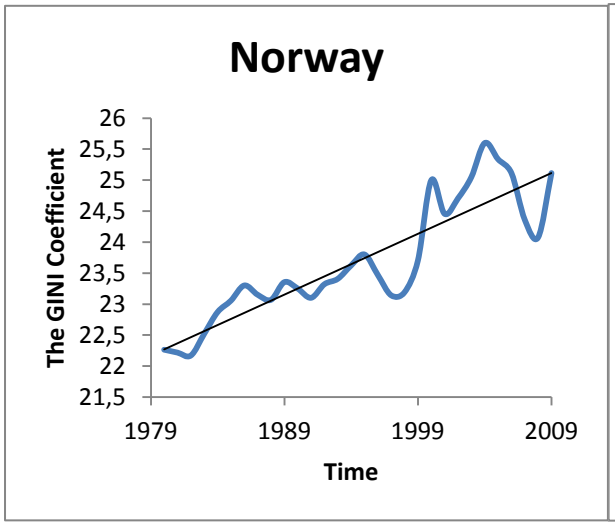
Norway
The GINI Coefficient
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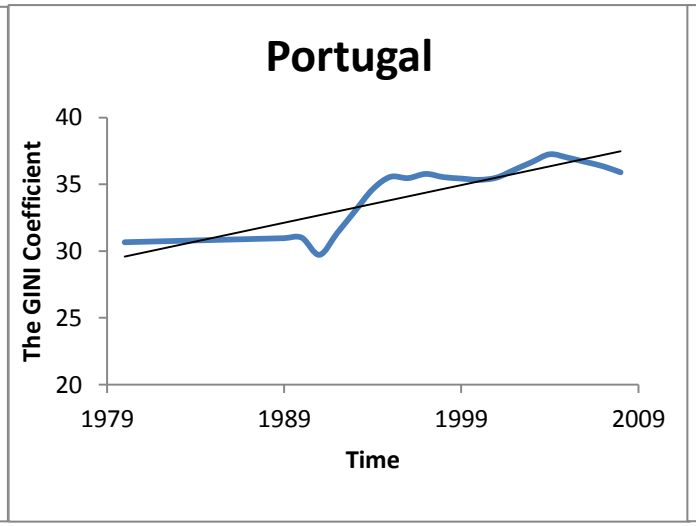
Portugal
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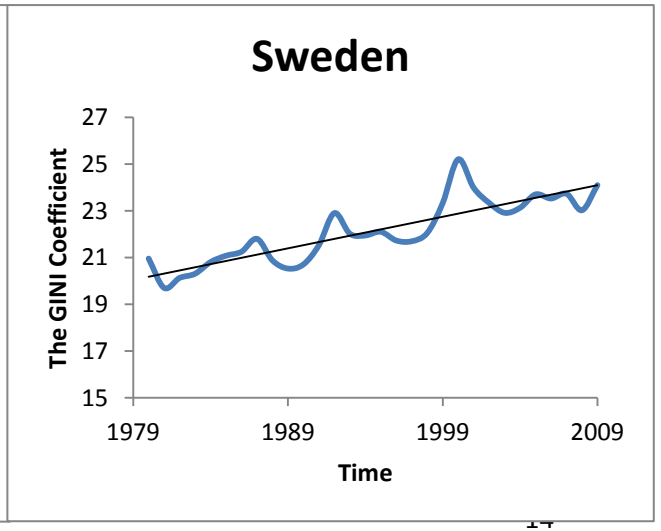
Sweden
The GINI Coefficient
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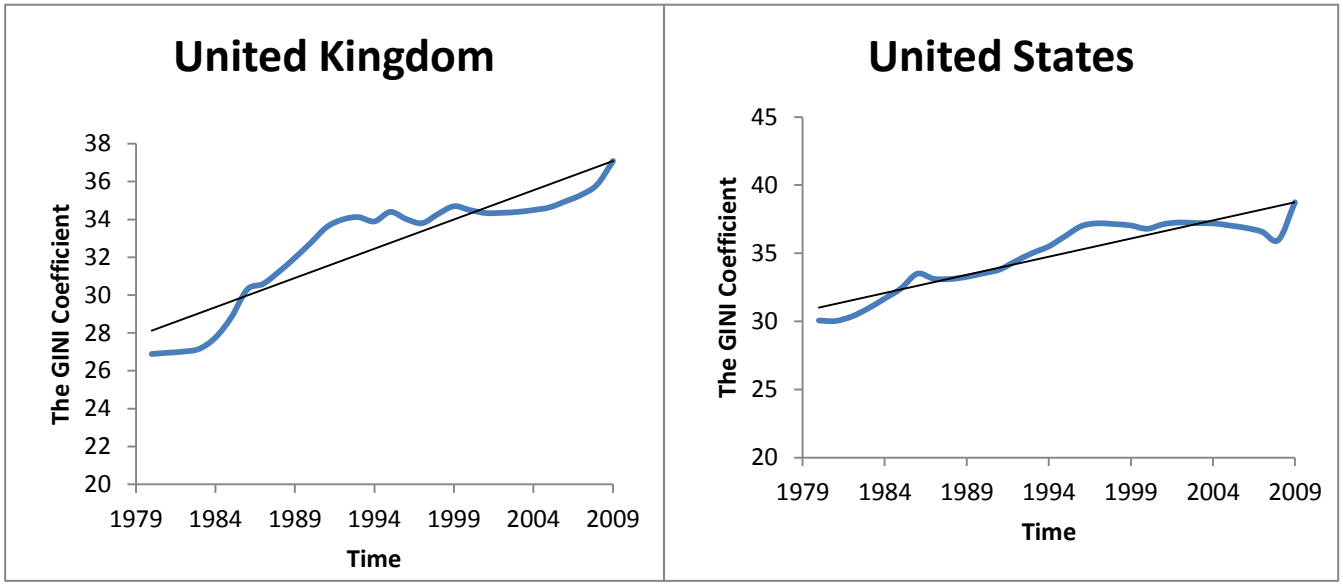
Time



Source: SWIID

The findings in the above figure are also supported by a recent report of OECD about the distribution of income[1]. According to this report the average GINI coefficient for the OECD countries was 0.28 in the mid 1980's and it rose to 0.31 in the late 2000's (This is an average for 22 OECD countries). This reports touches also on points, which are also relevant to this thesis, for example globalisation (trade), the rise of income inequality and the development of wages. These three points will be discussed later in this section. We begin by giving a more detailed description of the development in the value of the GINI coefficient. This is important, because although one can speak of an overall increase in the value of the GINI coefficient, nevertheless the development per country has not followed the same course.

Starting in the late 1970's the GINI coefficient in the United States of America (USA) and the United Kingdom started to rise (rise in income inequality). The GINI coefficient continued to rise in these two countries, but this increase was later also witnessed in the other OECD countries. One important difference between the findings of the OECD report and the data used in this thesis is that the report names Denmark as one of the countries with the most increase in the level of inequality, while I see a decrease in the level of inequality in Denmark.

In most of the OECD countries the rise in the GINI coefficient is due to the widening gap between the rich and the poor. The International Monetary Fund's (IMF) world economic outlook 2007[2] reports of this widening gap between the income of the very rich and the very poor for almost all countries, with a few exceptions. So the increase in the level of inequality is due to the ever increasing extremes in the spectrum of income distribution. Atkinson (2009) finds out that there is a sharp increase in the earnings of people having a top income. This is rather a global trend in the income distribution which is also witnessed in the OECD countries.

In the OECD countries wage earnings form a major part of household income. The OECD report, which was referred to earlier in this section estimates that wage earnings constitutes more than 70% of households' income. The distribution of wages and its development play a major role in the increase in the level inequality. This point will be further discussed in the section about the choice of control variables. But in the theoretical

[1] Growing income inequality in OECD countries: What drives it and how can policy tackle it? Forum, Paris, 2nd May 2011

[2] IMF world economic and financial surveys, world economic outlook 2007, Globalisation and inequality

section I already pointed out that the NEG approach gives an insight into to the rise the wage differentials.

As also illustrated in the section about trade, the share of trade in the economies of OECD countries have increased substantially. The IMF outlook 2007 shows also the ever increasing trade openness.

To summarise this section one can argue that income inequality has been rising for most of the countries in the past few decades. Moreover several studies report a widening of the earnings' gap between the poor and the rich. At least in the OECD countries the wage distribution has been considered as one of the major driving forces behind the rise in the income inequality.

5. Literature review

For the statistical analysis a time series panel data set is put together. The data set includes data from 14 OECD countries for the period 1980-2009. The independent variable is the GINI coefficient for the net income.

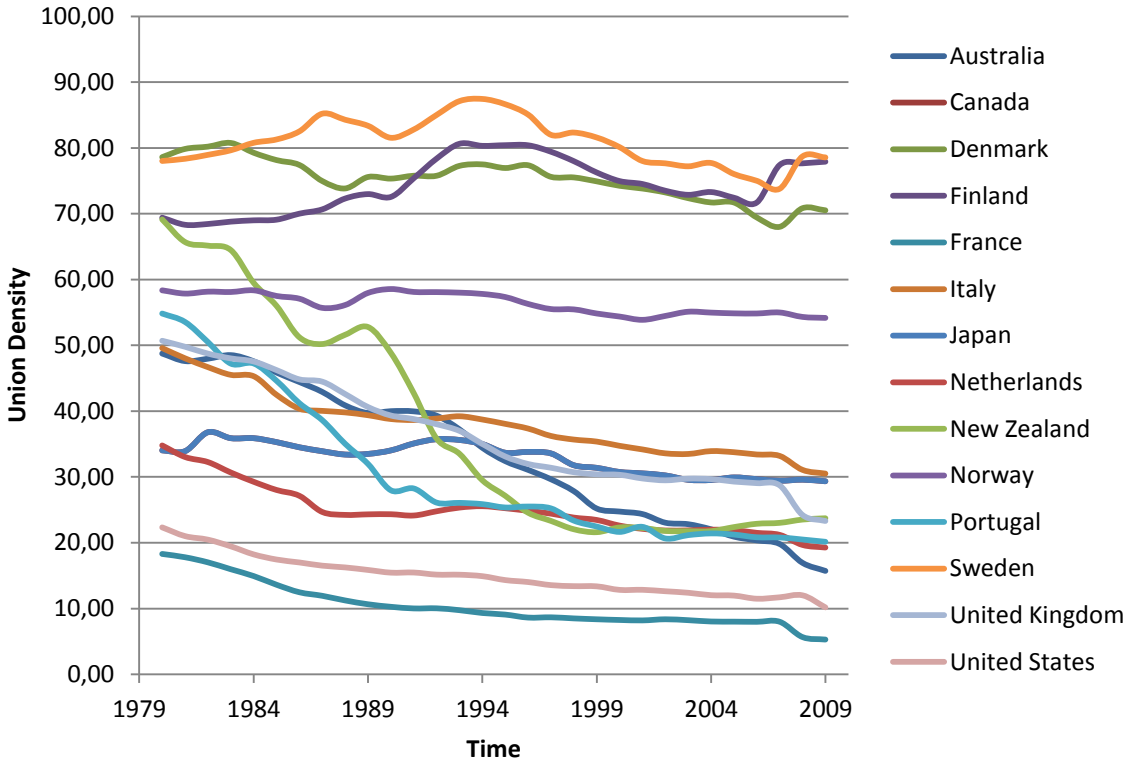
Besides trade which is the main independent variable, there are a number of other independent variables. These control variables are chosen based on the findings of the past research on the distribution of income. In Table 2 on the next page one can find a list of these variables and a brief summary of the findings of the past research about them. One can find more details about the variables in the appendix.

But the existence of previous literature is only in part the reason for the choice of control variables. As mentioned in the section (descriptive statistics), wage distribution is considered to be a major driving force behind the increased income inequality. At least in OECD countries wage earnings forms a considerable (>70%) of the households' income. For the regression analysis the control variables are chosen based partly on their role in shaping the level of wages and thus also inequality.

These control variables are discussed in some details in this section. Union density is a measure of membership of trade unions by the employees. It indicates the participation rate of the employees for the trade unions. A relatively high union density means that trade union represent a relatively high number of employees (a greater section of the labour market). According to wage negotiating theories a relatively high union density gives also the unions more power (a bigger mandate) in the wage negotiations with the employers. The

trade unions' demand for higher wages is more likely to be accepted when they represent a large part of the labour market. In that case they have more instruments at hand to demand a higher wage, for example organising strike actions. Figure 4 below shows that in at least 10 of the 14 countries there has been a decrease in union density.

Figure 4: Union Density in 14 OECD countries

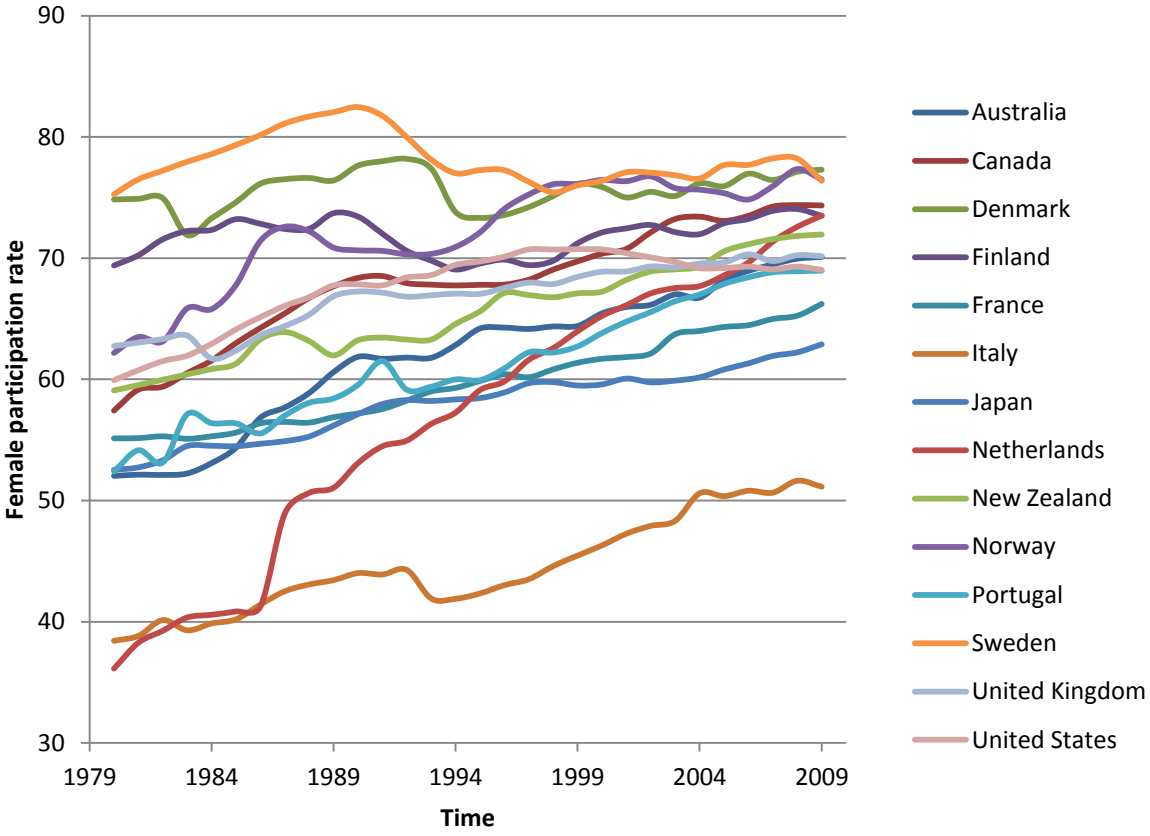


Source: ICTWSS database on labour unions

The unions represent mostly employees earning low to moderate wages. So a relatively higher unions density can through channels of wage negotiations work inequality decreasing as it ensures that a higher wages is paid to workers than when the workers would negotiate individually for their wage. This implicates that union density as a control variable should have a inequality decreasing effect. But, a high wage demand can also be a reason for the employers to hire relatively smaller number of employees. In this case a relatively high union density can lead to a hike in unemployment rate. In this way relatively high union density is inequality increasing. So based on this one cannot be very sure about the effect of the changing union density on income inequality.

Another variable considered to boost the households' income is the rise in the number of female workers. In the past few decades the female participation rate has been rising in most of the OECD countries – see figure 5.

Figure 5: Female participation rate in 14 OECD countries (age group 15-64)



Source: OECD

Bowlder and Nunziata (2007) argue that a relatively high union density causes the inflation rate to increase. Inflation rate in itself influences income inequality.

The other control variable related to the labour unions is the wage coverage rate which is a measure of the extent of the wage negotiation by the labour unions. So a relatively high union membership is instrumental, it also matters how large the coverage rate is. So a relatively high union membership is of little significance if the negotiated wage is valid only for one or a few sectors. A higher coverage rate has the same effect as a relatively high union membership.

According to Harkness (2010) an increase in female participation rate has an inequality reducing effect. The earnings of the female head of the family add to the family

wage earnings. But, the OECD report[3] on the income inequality tells another story. Most female employees take part time jobs and that is the reason that their contribution to the wage earnings of the family is not always substantial.

As mentioned in the section about descriptive statistics, wages form a significant part of household income in the OECD countries. The above mentioned variables namely the union density, wage coverage rate and the female participation rate as discussed above influence wages. The other control variables as shown in table 2 include social security spending, education spending, inflation and GDP per capita growth rate. The social security spending is a control variable which measures the extent of income redistributive mechanism in different countries. As can be seen in table 2 on the one hand social security spending is seen as a proxy for the inequality itself, on the other hand its effect on income inequality is said to depend on the area which it is spent on.

Previous literature on the education spending show also conflicting results about its effect on the inequality – see table 2. Inflation as summarised in table 2 influence income inequality positively or negatively depending on the initial level of inflation. But as discussed in the earlier part of this section, union density and wage coverage can cause the inflation rate to hike. This is also a channel through which both union density and wage coverage can influence income inequality.

The interconnectedness of the variables: union density, wage coverage, unemployment rate and inflation can lead to their interaction. That is why the regression in the later parts of this thesis

[3] Growing income inequality in OECD countries: What drives it and how can policy tackle it? Forum, Paris, 2nd May 2011

Table 2: Summary of the literature on the control variables

Control variable	Paper	Findings
Female participation rate	**(Harkness 2010)**	**A higher female participation rate reduces income inequality.**
GDP growth rate	**(Kuznets 1955)**	**The income distribution increases first and then decreases as a country develops economically**
Inflation	**(Galli and Hoeven van der 2010)**	**Initial level of inflation low - reducing it, reduces also income inequality. Initial level of inflation is low - reducing it, increases income inequality.**
Population growth rate		**Influences GDP per capita.**
Spending in social security	**(Osberg and Smeeding 2003)**	**If social spending effects the GINI coefficient depends on the area of social spending. Different areas of social security have varying effect on the distribution of income.**
	(Milanovic 2000)	**More unequal societies choose for bigger redistribution.**
Spending in education	**(Checchi 2005)**	**Perfect correlation between the GINI coefficient and the inequality in education**
	(Knight and Sabot 1983)	**In the early stages of economic development, skilled labour is scarce so relatively high wages for the skilled labour. In the long run skilled labour becomes more abundant, so the wages for**

		the skilled labour decrease.
	(Spencer 1973)	**No relationship between the distribution of income and education.**
Union density	**(Checchi and Garcia Penalosa 2010)**	**Conflicting results about the effects on the GINI coefficient**
	(Nickell 1997)	**A higher union density leads to a higher rate of unemployment and in that way it is inequality increasing.**
	(Bowlder and Nunziata 2007)	**High levels of union density leads to higher rate of inflation (see inflation).**
Unemployment rate	**Related to union density**	
Wage coverage	**Related to union density**	

6. Data

Many scholars carrying out research about the distribution of income have chosen to work with the data of the Luxembourg Income Study (LIS) or the Luxembourg Wealth Study (LWS). The LIS reports of more than 600 scholarly papers which have used its data. In this thesis it is chosen to work with the data on the distribution of income from the Standardised World Income Inequality Database (SWIID). The main reason behind working with a new database is to contribute in assessing the reliability of the past research. Using a new database to carry out the regression analysis can either add reliability or emasculate the findings based on alternative datasets. It is of added value to look and to analyse a matter from different angles and using different datasets. Moreover the high degree of comparability of data contained in the SWIID makes it exceptionally suitable for a cross country analysis, which is intended in this thesis. The SWIID contains data from 1960-2008

and the analysis in this thesis is about the period 1980-2009, so for all 14 countries the data on the GINI coefficient for 2009 is extrapolated. The complete information about the other data used in this thesis is added in the appendix.

The initial intention for the analysis was to look at the trade not as a whole, but to look at it per sector. So trade as the main independent variable would have been divided into different sectors, to find out more on the effects of trade in different sectors on the GINI coefficient.

Unfortunately due to the challenges faced in finding reliable data on trade in different commodity groups or sectors, it was chosen for only two sectors. So trade in agricultural products and manufactures act as the main independent variables. The trade openness index (TOI) is considered as the variable representing the trade as a whole. Most of the variables are in their natural log form. By taking the log of a variable skewness and heteroskadicity are reduced, this can give us more reliable results. Also the correlation between the independent variables is looked into.

Table 4 in the Appendix displays a table with the results of the correlation. The correlation coefficient is low between most of the variables. Only the variables and their natural log show high correlation, but they are not used together in a regression anyway. Having a low correlation coefficient for the independent variables is one of the assumptions of regression, so this is an indication of the quality of the data.

7. Statistical methodology.

As mentioned earlier a fixed effect model is used to carry out the regressions. In this section the endeavour would be to explain the reason behind the choice of methodology. As the main focus of this thesis is to look at the effects of time varying variables on the income distribution, the fixed effect model has qualities which can be of help in answering the question raised in this thesis. The main interest is to look at the variables which vary over time. It is assumed that all 14 countries in this analysis possess a unique characteristic which may or may not impact the variables. A fixed effect model corrects the time invariant effects.

In case of the 14 countries in the analysis of this thesis the unique individual time invariant characteristics of each country may represent their cultural background.

Perhaps one of the drawbacks of using a fixed effect model is that one cannot use "time invariant" causes of the development in the income distribution. For example if the cultural characteristics of a country is responsible for how the GINI coefficient has developed in that country, then one would be unable to provide an efficient answer to that question using a fixed effect model.

To help better understand one can take a look at a fixed effect equation.

$GINI(it) = \beta(1)X(it) + \beta(2)Y(it) + \alpha i + E(it)$ equation (1)

GINI (it) the dependent variable

X(it) the first time varying independent variable

β(1) The coefficient of the first independent variable

Y(it) The second time varying independent variable

B(2) The coefficient of the second independent variable

αi The term which catches the time invariable effects. It is the intercept of the regression line

E(it) The error term

i = 14 referring to the number of countries analysed here

t = The time period

In the above equation (α) is a kind of catch all variable for all the unobserved fixed effects.

8. Findings

Table 3 shows the results of 10 regressions with a varying combination of variables. In all cases the natural log of the GINI coefficient is the dependent variable. The appendix includes a detailed description of all the variables listed here as well as their definition, source and in some cases the mode of calculation.

In above regressions trade is treated in two different ways. In regressions (1), (2), (5), (7) and (8) trade openness index is the variable which represents trade. In the remaining regressions trade is divided into the trade (import and export) of agricultural products and the manufactures. This also mentioned in the section about the literature review. The main

aim for taking this step is to look at the effect of trade in different sectors (having different factor intensity) on the GINI coefficient.

Another variable which also appears in two different ways in the regressions is the unemployment rate. On the one hand it is taken as the unemployment rate as a whole and on the other hand it is split into male and female unemployment rates. The main reason behind this is to find out if the unemployment rate of different sexes have varying effects on the GINI coefficient.

In the literature review it is also mentioned that the variables union density, wage coverage rate and inflation are somewhat related. Considering this point in the regressions these variables are also included in the regressions in absence of each other.

In regressions (1) and (2) none of the variables have a significant effect on the GINI coefficient. In regressions (3) where trade is split into different categories the export of agricultural products is inequality decreasing at a 10% significance level and that is also true for the inflation rate. At the same time the import of manufactures have a inequality increasing effect at a 5% significance level. In regression (3) and (4) where the unemployment rate is split into male and female unemployment rate agricultural export is again inequality decreasing but now at a 5% significance level and the import of manufactures is inequality increasing at 1% significance level. Further, male unemployment level is inequality increasing at a 10 % significant level. Regression (5), (6), (7) and (8) where as mentioned variables unemployment rate, union density, wage coverage rate and inflation are observed in absence of each other none of the variables have a significant effect on the level of inequality.

The results of regression (9) and (10) are comparable to that of regression (3) and (4) with slight difference in the level of significance. The only difference is that in regression (9) the growth rate of GDP per capita shows an inequality decreasing effect at a 10% significance level.

Table3: Regression Results

VARIABLES	1	2	3	4	5	6	7	8	9	10
Trade Openness Index	0.000190	7.55e-05			0.000683		-0.000698	-0.000861		
	(0.000622)	(0.000808)			(0.00121)		(0.000915)	(0.00108)		
Agricultural Export/GDP			-0.0646*	-0.0801**		-0.0200			-0.0605*	-0.0707**
			(0.0352)	(0.0369)		(0.0289)			(0.0331)	(0.0316)
Manufactures Export/GDP			-0.0324	-0.0390		-0.0526			-0.0521	-0.0587
			(0.0259)	(0.0353)		(0.0384)			(0.0358)	(0.0409)
Agricultural Import/GDP			-0.0305	-0.0123		-0.0116			-0.0128	-0.000360
			(0.0787)	(0.0817)		(0.0783)			(0.0888)	(0.0907)
Manufactures Import/GDP			0.0718**	0.0805***		0.0456			0.0670*	0.0728**
			(0.0265)	(0.0261)		(0.0338)			(0.0320)	(0.0309)
GDP per capita	-0.00272	-0.00196	-0.00399	-0.00284	-0.000770	-0.00150	-0.00252	-0.00216	-0.00353*	-0.00273
	(0.00224)	(0.00239)	(0.00235)	(0.00228)	(0.00226)	(0.00207)	(0.00145)	(0.00161)	(0.00182)	(0.00190)
Unemployment Rate	0.0530		0.0626*				0.0431		0.0492	
	(0.0353)		(0.0325)				(0.0335)		(0.0315)	
Female Unemployment Rate		-0.0146		-0.0357				0.00838		-0.0152
		(0.0398)		(0.0487)				(0.0431)		(0.0440)
Male Unemployment Rate		0.0648		0.0956*				0.0340		0.0623
		(0.0404)		(0.0448)				(0.0412)		(0.0403)
Female Participation Rate 15-64	-0.00862	0.00245	-0.0249	-0.0236	-0.150	-0.155	0.00691	0.0492	0.0152	0.0420
	(0.131)	(0.148)	(0.134)	(0.144)	(0.133)	(0.148)	(0.167)	(0.200)	(0.176)	(0.208)
Union Density	0.00366	0.00806	0.000178	0.00756	-0.0362	-0.0463				
	(0.119)	(0.117)	(0.115)	(0.112)	(0.117)	(0.124)				
Wage Coverage Rate	-0.0890	-0.0963	-0.0877	-0.0994	-0.107	-0.0960				
	(0.0800)	(0.0790)	(0.0750)	(0.0732)	(0.0780)	(0.0795)				
Inflation Rate	-0.00431	-0.00323	-0.00562*	-0.00409			-0.00508	-0.00454	-0.00620	-0.00522
	(0.00271)	(0.00283)	(0.00301)	(0.00284)			(0.00344)	(0.00336)	(0.00366)	(0.00354)
Education Spending	-0.0988	-0.107*	-0.0549	-0.0634	-0.0780	-0.0433	-0.104	-0.107	-0.0602	-0.0648
	(0.0604)	(0.0530)	(0.0575)	(0.0519)	(0.0799)	(0.0718)	(0.0674)	(0.0612)	(0.0650)	(0.0590)
Social Security Spending	0.0157	0.0178	-0.0281	-0.0279	0.0959	0.0699	0.0129	0.0144	-0.0121	-0.0125
	(0.0734)	(0.0656)	(0.0814)	(0.0701)	(0.0723)	(0.0665)	(0.0808)	(0.0763)	(0.0861)	(0.0794)
Constant	3.848***	3.823***	3.426***	3.455***	4.301***	4.181***	3.415***	3.343***	2.918**	2.805**
	(0.623)	(0.628)	(0.859)	(0.864)	(0.634)	(0.908)	(0.586)	(0.749)	(0.986)	-1.118
Observations	363	362	363	362	381	381	365	364	365	364
R-squared	0.552	0.560	0.580	0.595	0.519	0.528	0.511	0.515	0.538	0.546
Number of country1	14	14	14	14	14	14	14	14	14	14

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

9. Conclusion

The findings in the previous section show that the trade openness index in none of the ten regressions have a significant influence on the GINI coefficient. The reason behind this could be the trade partners of the OECD countries. OECD's trade with developing nations is a minor part of the total trade share. The OECD countries engage in trade to a large extent with each other. The factor abundance (the pool of low skilled and high skilled labour) is comparable in OECD countries. That is why trade as a whole does not lead to an added demand for high skilled labour as argued by HO theorem. Trade does not affect the level of inequality. This is in line with the findings of the IMF world economic outlook 2007[4]. The IMF outlook 2007 reports that the role of trade in the rise of income inequality although greater in the developed nations, still is negligible.

At the same time in four of the above regressions agricultural export has a inequality decreasing effect and the import of manufactures has an inequality increasing effect. One of the reasons behind the inequality decreasing effect of agricultural could be the European Unions' subsidy policy. Although not mentioned in the other sections of this thesis, the agricultural subsidy programme of the European Union and most of other OECD members is widely known. So the subsidy schemes stimulates the farmers to produce more than the domestic demand and the excess demand is then exported. In reality the agricultural subsidy system is probably an inequality decreasing variable. This is merely a suggestion and this thesis does not have the theoretical basis to support this argument.

The reason behind the inequality increasing effect of import of manufactures can perhaps be due to the shift in the sectors in many developed economies. In most of the OECD member countries service sector employs a considerable part of high skilled labour. The relatively low skilled labour is employed by the manufacturing industry. So according to HO theorem the import of manufactures makes the low skilled labour in OECD countries less in demand. The same way there is a shift from

[4] IMF world economic and financial surveys, world economic outlook 2007, Globalisation and inequality

the agriculture to the manufacturing in the developing countries, in the OECD countries the shift is from the manufacturing industry to the service sector.

Also according to the NEG approach the services units of the firms are located in the OECD countries and the production units in the developing countries. This is due to the relative abundance of high skilled labour in the OECD countries and the relative abundance of low skilled labour in the developing countries. This added demand for the high skilled labour in the OECD countries drives their wages up widening the pay gap between the high skilled an low skilled labour.

As the regression analysis has shown that trade as a whole does not have a significance role in driving the income inequality up, but focussing on trade in individual sectors can reveal a significant effect on the income inequality. That is why more focussed study is needed in order to show the effect of trade in individual sectors or commodities on income inequality.

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Appendix
The list of variables

Trade openness index: The trade-to-GDP-ratio is the sum of export and import divided by the GDP.
Source: http://stats.oecd.org/index.aspx?

Globalisation -Trade indicators (TIP)-MacroTrade Indicators): "integration" in the world economy. It measures a country's "openness" or represents the combined Weight of total trade in its economy, a measure of the degree of dependence of domestic producers on foreign markets and their trade orientation (for exports) and the degree of reliance of domestic demand on foreign supply of goods and services (for imports). The trade-to-GDP-ratio is often called the "trade openness ratio". However, the term openness to international competition may be somewhat misleading. In fact, a low ratio for a country does not necessarily imply high (tariff or non-tariff) obstacles to foreign trade, but may be due to the factors mentioned above, especially size and geographic remoteness from potential trading partners. For example, it is generally the case that exports and imports play a smaller role in large economies than they do in small economies. It should be noted that this indicator may also be expressed as average of exports and imports (not as the sum of both).

Trade (import and export of Merchandise): Two systems of recording merchandise exports and imports are in common use. They are referred to as *general trade* and *special trade* and differ mainly in the way warehoused and re-exported goods are treated. General trade figures are larger than the corresponding special trade figures because the latter exclude certain trade flows, such as goods shipped through bonded warehouses.To the extent possible, total merchandise trade is defined according to the general trade definition. It covers all types of inward and outward movement of goods through a country or territory including movements through customs warehouses and free zones. Goods include all merchandise that either add to or reduce the stock of material resources of a country by entering (imports) or leaving (exports) the country's economic territory. For further explanations, see United Nations International Trade Statistics, Concepts and Definitions, Series M, No 52, Revision 2. Exports are valued at transaction value, including the cost of transportation and insurance to bring the merchandise to the frontier of the exporting country or territory (f.o.b. valuation). Unless otherwise indicated, imports are valued at transaction value plus the cost of transportation and insurance to the frontier of the importing country or territory (c.i.f. valuation). In absolute value
Source: wto
http://stat.wto.org/StatisticalProgram/WSDBViewData.aspx?Language=E

GDP growth rate: Gross domestic product expenditure approach growth rate in percentage
source:oecd
http://stats.oecd.org/Index.aspx?DatasetCode=SNA_TABLE1

GDP per head growth rate: Gross domestic product per head Growth rate in percentage.
source:oecd
http://stats.oecd.org/Index.aspx?DatasetCode=SNA_TABLE1

Female participation rate: The participation rate of the female population in the labour market, in percentage. It is divided into different age groups.

Source: oecd
http://stats.oecd.org/Index.aspx?DatasetCode=SNA_TABLE1

Union Density rate Union Density, net union membership as a proportion wage and salary earners in employment
Source: ICTWSS data base
http://www.uva-aias.net/208

Wage coverage rate: Employees covered by wage bargaining agreements as a proportion of all wage and salary earners in employment with the right to bargaining, expressed as percentage, adjusted for the possibility that some sectors or occupations are excluded from the right to bargain (removing such groups from the employment count before dividing the number of covered employees over the total number of dependent workers in employment WSEE; see Traxler, 1994)

Source: ICTWSS data base
http://www.uva-aias.net/208

Unemployment rate: The rate of unemployment expressed in percentages (Total and for both sexes)
Source: oecd

Social security spending: Total and per different programs)
Source: wdi data base

Spending on education: Education expenditure refers to the current operating expenditures in education, including wages and salaries and excluding capital

investments in buildings and equipment. Expressed as percentage of Gross National Income (GNI)

Source: wdi data base

Different categories of import and export: Agriculture and manufactures

Table 4: correlation between the variables

	LN gini netto	LN (agricultural export/GDP)	LN (manufactures export/GDP)	LN (agricultural import/GDP)	LN (manufactures import/GDP)	LN GDP per capita	LN unemployment rate	LN female participation rate 15-65	LN union density	LN wage coverage rate	Inflation rate	LN education spending /GDP	Education spending /GDP	LN (socical security expenditure /GDP)
LN gini netto	10.000													
LN (agricultural export/GDP)	0.2112	10.000												
LN (manufactures export/GDP)	0.2021	-0.1657	10.000											
LN (agricultural import/GDP)	0.3158	-0.2364	0.9596	10.000										
LN (manufactures import/GDP)	0.3480	-0.1576	0.9247	0.9242	10.000									
LN GDP per capita	0.0613	-0.0113	0.0011	0.0013	0.0230	10.000								
LN unemployment rate	0.2423	0.1652	0.0658	0.0944	0.1604	-0.0416	10.000							
LN female participation rate 15-65	-0.3642	0.1732	-0.2038	-0.3545	-0.1604	0.0586	-0.3427	10.000						
LN union density	-0.6372	0.0297	-0.4533	-0.5409	-0.5931	-0.0066	-0.1850	0.3101	10.000					
LN wage coverage rate	-0.5476	-0.3029	-0.3556	-0.3669	-0.4452	-0.0468	0.1743	-0.1329	0.3683	10.000				
Inflation rate	-0.0188	0.1276	-0.2577	-0.1617	-0.2455	-0.0362	0.0243	-0.2090	0.1410	0.1302	10.000			
LN education spending/GDP	-0.4866	0.0894	-0.2198	-0.3144	-0.1623	-0.0788	0.0598	0.5445	0.3758	0.1354	-0.1999	10.000		
Education spending/GDP	-0.5118	0.0990	-0.2309	-0.3297	-0.1953	-0.0603	0.0327	0.5494	0.4247	0.1332	-0.1962	0.9902	10.000	
LN (socical security expenditure/GDP)	-0.5023	-0.1285	0.0619	-0.0756	-0.0046	-0.0291	0.1699	0.3098	0.2507	0.5062	-0.3742	0.5671	0.5690	10.000

Source: database of this thesis