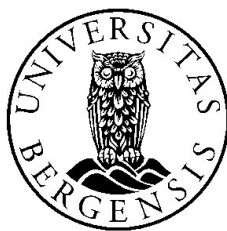


# **Minimum Wage, Minimum Effect**

*Minimum Wages and Income Inequality in Advanced Democracies*

Simen Aasheim Johannessen



Master thesis

Spring 2019

**Department of Comparative Politics  
University of Bergen**

## Abstract

Rising income inequality is one of the greatest challenges that advanced democracies currently face. This thesis analyses to what extent statutory minimum wages can contribute to tackling this challenge. In the existing literature this is debated, but recent empirical findings suggest that increasing the minimum wage reduces income inequality. But these findings are mostly based on the United States as well as developing countries. More research on developed countries is therefore important for policy makers when they discuss how to limit the growth in income inequality. This is exactly what this thesis does, by studying the effect of minimum wages in 28 OECD countries between 1995 and 2015, using time series cross-section analysis. In contrast to the existing literature, the results do not confirm that minimum wages limit growth in income inequality. In addition, this thesis analyses the effects of minimum wages on different parts (deciles) of the income distribution. This way I am able to examine what is behind the lack of an effect on overall inequality. In fact, the results show that even though raising minimum wages does increase the income earned by the poorest, it also reduces it for the second lowest group in the income distribution. Furthermore, higher minimum wages actually increase income in the eight richest decile. These results are consistent with theoretical arguments about how minimum wages can affect different parts of the income distribution, having to do with how employers respond to minimum wages as well as household composition.

## Acknowledgements

Først og fremst så vil jeg takke min veileder Georg Picot. Uten dine tilbakemeldinger og gode innspill så ville det ikke vært mulig å skrive denne masteroppgaven. Jeg vil her gjerne også takke CHAD og CPE for å la meg presentere oppgaven og for gode innspill.

Det kan være ensomt å sitte lange dager på lesesalen og skrive en masteroppgave, men takket være mine fantastiske medstudenter på Sofie Lindstrøms hus så var det ikke noe problem. Spesielt takk til Idunn Johanne Nørbech for å være en fantastisk roommate!

Jeg må også takke mamma, pappa og mine to søstre Thea og Celina. Uten deres støtte og gode humør hadde jeg aldri vært der jeg er.

Det er en som fortjener en større takk enn de andre, og det er hun som har holdt ut med meg selv når jeg har sittet på lesesalen til langt på natt. Mitra, takk for at du gjør livet mitt helt fantastisk.

Takk for meg!

Simen Aasheim Johannessen

# Table of Content

<b>ABSTRACT</b> .....	<b>II</b>
<b>ACKNOWLEDGEMENTS</b> .....	<b>III</b>
<b>TABLE OF CONTENT</b> .....	<b>IV</b>
<b>LIST OF TABLES</b> .....	<b>VI</b>
<b>LIST OF FIGURES</b> .....	<b>VI</b>
<b>1 INTRODUCTION</b> .....	<b>1</b>
1.1 WHY STUDY MINIMUM WAGE EFFECTS ON INCOME INEQUALITY? .....	2
1.2 WHY USE TIME SERIES CROSS-SECTION ANALYSIS .....	4
1.3 CONTRIBUTIONS .....	5
1.4 STRUCTURE .....	6
<b>2 THEORY AND EARLIER RESEARCH</b> .....	<b>7</b>
2.1 STATUTORY MINIMUM WAGES, INCOME, AND INCOME INEQUALITY.....	7
2.2 THEORETICAL PERSPECTIVES AND EXISTING EMPIRICAL FINDINGS .....	10
2.2.1 COMPROMISING THE WAGE STRUCTURE .....	10
2.2.2 RIPPLE EFFECT.....	12
2.2.3 MINIMUM WAGES AND UNEMPLOYMENT .....	13
2.2.4 DO THOSE BENEFIT WHO NEED IT? .....	16
2.2.5 SUMMARY AND HYPOTHESES .....	17
<b>3 EMPIRICAL STRATEGY AND METHODS</b> .....	<b>22</b>
3.1 TIME SERIES CROSS-SECTIONAL MODELLING .....	22
3.2 ESTIMATION TECHNIQUES .....	24
3.3 ASSUMPTIONS IN TIME SERIES CROSS-SECTION MODELLING .....	28
3.4 CHALLENGES RELATED TO TIME SERIES CROSS-SECTION ANALYSIS .....	32
3.5 CHAPTER SUMMARY .....	33
<b>4 DATA AND OPERATIONALIZATION</b> .....	<b>35</b>
4.1 SAMPLE .....	35
4.2 DEPENDENT AND MAIN INDEPENDENT VARIABLE .....	38
4.3 CONTROL VARIABLES.....	45
4.4 CHAPTER SUMMARY.....	48
<b>5 ANALYSIS AND RESULTS</b> .....	<b>51</b>
5.1 MINIMUM WAGES AND INCOME INEQUALITY IN THE OECD .....	51
5.2 THE EFFECTS OF CHANGES IN THE REAL MINIMUM WAGE ON THE GINI INDEX .....	54
5.3 WHAT EFFECT DOES CHANGES IN MINIMUM WAGES HAVE IN COMPARISON TO THE OTHER VARIABLES? .....	58
5.4 INTERACTION EFFECT .....	60
5.5 THE EFFECT OF MINIMUM WAGE CHANGES ON INCOME DECILES .....	62
5.6 ROBUSTNESS TESTS .....	67
5.7 CHAPTER SUMMARY.....	72
<b>6 DISCUSSION</b> .....	<b>74</b>
6.1 HOW DOES MINIMUM WAGES AFFECT THE POOREST HALF? .....	75
6.2 THE IMPLICATIONS OF MINIMUM WAGES ON THE RICHEST .....	76
6.3 ARE POLICYMAKERS BETTER OFF BY FOCUSING ON OTHER VARIABLES? .....	77
6.4 CONTRIBUTION TO THE LITERATURE.....	77
<b>7 CONCLUSION</b> .....	<b>79</b>

7.1 RESULTS.....	79
7.2 IMPLICATIONS .....	80
7.3 RECOMMENDATIONS FOR FURTHER RESEARCH.....	80
7.4 CONCLUDING REMARKS .....	81
<b>8 BIBLIOGRAPHY .....</b>	<b>82</b>
<b>9 APPENDIX .....</b>	<b>91</b>

## List of tables

Table 4.1 Sample Selection.....	36-37
Table 4.2 Descriptive statistics for the GINI index.....	40
Table 4.3 Descriptive statistics for the income deciles.....	42
Table 4.4 Descriptive statistics for real hourly statutory minimum wages.....	44
Table 4.5 Descriptive statistics for the control variables.....	48
Table 4.6 Expected effect of the independent variables.....	49-50
Table 5.1 Regression results, changes in real minimum wages on changes in the GINI index.....	57
Table 5.2 Hypotheses being tested.....	62
Table 5.3 Regression results using two-way fixed effects.....	68-69
Table 5.4 Regression results with the outliers removed.....	69-70
Table 5.5 Regression results with missing values imputed.....	71

## List of figures

Figure 2.1 Expected mechanisms of increasing statutory minimum wages.....	19
Figure 4.1 Lorenz curve.....	40
Figure 5.1 Average change in minimum wages and the GINI index, 1995-2015.....	52
Figure 5.2 Change in minimum wages and the GINI index, 1995-2015.....	54
Figure 5.3 Coefficient plot using standardized variables.....	59
Figure 5.4 Interaction plot of the relationship between minimum wage value and changes in minimum wages on income inequality.....	61
Figure 5.5 Coefficient plot of the effect of minimum wages on the 50% poorest.....	63
Figure 5.6 Coefficient plot of the effect of minimum wages on the 50% richest.....	65

*“The goals associated with the minimum wage are widely accepted as right and proper. However, there is much less agreement about whether the minimum wage is effectively at attaining these goals”*

- David Neumark and William L. Wascher (2008, 1)

## 1 Introduction

Rising income inequality is one of the biggest challenges facing advanced democracies in our time (Piketty 2014, 1; Dabla-Norris et al. 2015, 4; Kenworthy and Pontusson 2005, 449). Its social, health-related, economic and political consequences make it an important topic to study, and has indeed resulted in much attention in the academic literature and political debate lately (Tilly 2003; Atkinson et al. 2017, 304; Solt 2008; Wilkinson and Pickett 2006; Levin-Waldman 2018, 17). The problem arises when the focus shifts from why it is a problem, to what can be done to halt its progression. Political actors propose solutions to how the growth in income inequality should be hindered, but they often do this with limited knowledge and/or support from the academic literature. In this thesis I will look into one of the proposed tools to limit the growth in income inequality: statutory minimum wages. Raising the level of minimum wages is one of the tools that politicians have argued for, lately in the US, Spain and the UK (Atkinson 2015, 1; Bellafante 2019; Alderman 2019; The Economist 2019). However, whether or not this actually has the intended effect is heavily debated within the academic literature. There is also a problem with the studies on this topic. Almost all of them focus on developing countries or the United States and are conducted as case studies (Marginean and Chenic 2013, 97-98). This reduces their relevance for other countries, especially developed democracies, and politicians are therefore proposing solutions based on varying results that are gathered from countries that their own cannot be compared to. The goal of this thesis is to contribute to this literature and provide policy makers in the developed states with the knowledge they need in order to make well informed decisions when trying to hinder the rise of income inequality. The research question is therefore: *“Is raising statutory minimum wages an effective tool to limit the growth in income inequality in developed democracies?”*. To answer this, a quantitative time series cross-section analysis will be conducted, looking at what effect changes in the minimum wages have had on income inequality in countries in the Organization for Economic Co-operation and Development (OECD) over time.

## 1.1 Why study minimum wage effects on income inequality?

The main motivation behind the research question is that the rising levels of income inequality is regarded as one of the biggest challenges facing advanced democracies, and that more research on potential solutions is therefore important. As Dabla-Norris et al. (2015, 4) from the International Monetary Fund (IMF) puts it: “Widening income inequality is the defining challenge of our time”. This trend is also true for the OECD, where their own studies show that income inequality has risen in most of its member countries between 1985 and 2011/2012 (OECD 2014, 1). Their findings show that the only countries where income inequality has declined during this time period are Greece and Turkey, while it has been quite stable in Belgium, Netherlands and France. In the other 17 OECD member countries that they look at, income inequality has increased from 1985 to 2011/2012.

But why does growing income inequality matter? As mentioned earlier, high levels of income inequality can have a negative effect on several aspects of society. Even though some authors argue that the consequences are driven by other factors, such as wealth (Lynch et al. 2000), poverty (for a discussion about this, see Atkinson 2015, 23-25), or that income inequality has a positive effect on economic growth (Schneider 2012, 419-420), the literature on the negative effects of heightening income inequality is substantial. Regarding its effect on health, Wilkinson and Picketts (2006) meta study of 168 analyses looking at the connection between income distribution and population health show that in 70 percent of the analyses income inequality is shown to have a negative effect on public health. Based on this, increased levels of income inequality would have a negative impact on people’s health. The social consequences of income inequality are complex and can be seen in many levels of society. Stiglitz (2014, 4) focus on the effects widening inequality has on equal opportunity as the biggest challenge. As an example, he shows that the quality of the education that a child receives is heavily influenced by their parent’s income and education. Rözer and Volker (2016) on the other hand, shows that it has a negative effect on social trust, which in turn can have negative an impact on health. The economic consequences are the most debated, and Levin-Waldman (2018) and Mo (2000) shows that widening income inequality has a negative effect on economic growth. Ostry, Berg and Tsangarides (2014, 26) agree with this, showing that an increase in redistributive policies also increase economic growth, at least if it is not extremely high. Dabla-Norris et al. (2015, 6-7) further develops this argument, pointing out that economic growth decreases by 0.08



percentage when the income share of the top 20 percentage increases by 1% and that economic growth increases by 0.38% when the income share of the bottom 20 percentage is increased by 1%. The most important aspect to consider in this thesis is the political consequences. Here, Solt (2008) shows that higher levels of income inequality reduce political interest, frequency of political discussion and participation in elections for all groups of society, except the wealthiest thereby creating more political inequality. The political inequality is further strengthened by the economic inequality, as the top income groups in a country have more political influence (Sawyer 2015, 888; Arestis 2018, 33). In addition to all of these, there are many studies where income inequality is argued to cause a mass of other societal problems, like increased crime, teenage pregnancy and obesity (Atkinson 2015, 12). Income inequality is growing in advanced democracies, and the consequences can be massive – research on how to limit it is therefore highly important.

Changes in statutory minimum wages are interesting because of how often policymakers put it forward as a political solution to this problem, while at the same time other politicians disregard the positive impact it can have completely (European Commission 2016, 72; Levin-Waldman 2001). The same disagreement can also be seen among scholars (Lin and Yun 2016). Moreover, the literature looking at the relationship between minimum wages and income inequality is lacking studies on advanced democracies as a whole. Rather, most of the existing research are case studies or focus on developing countries. Statutory minimum wages are a policy that the government is in control of, and it is crucial to give them the relevant and much needed knowledge they need to be able to make well informed decisions if their goal is to reduce the growth in income inequality.

It is clear that income inequality is an important topic, and that the consequences if we fail to reduce it can be fatal. In the discussion of income inequality and its solutions, statutory minimum wage is often times presented as a political tool effective in negating the growing income inequality. However, if policy makers shall be able to make well informed decisions it is important to gain more knowledge. A quantitative study looking at the effect of minimum wages on income inequality in a substantial number of developed democracies, will be an important contribution to the debate, and give insight to the phenomenon in a larger context. This master thesis will contribute with knowledge on the effect of minimum wages on income inequality in parts of the world where the current research is limited, and offer more insight into the general trends across country borders.

## 1.2 Why use time series cross-section analysis

Time series cross-section analysis (TSCS) uses data that are collected on two dimensions, in this thesis these are the OECD member countries and years between 1995 and 2015. This makes it possible to estimate both the effect minimum wages have on income inequality within a country over time, and between countries at any given year. When combined, this measurement has several advantages compared to other methods.

First, it is better at capturing complex structures. There are several reasons for this, most prominently because it can control for omitted variables (Hsiao 2007, 4-5). When using other methods, where this is not the case, this is often argued to be one of the reasons that researchers find significant effect – if that is the case, the findings would not be valid. Second, it improves certainty related to the causal relationship. Because there are several data points over time, one can more specifically estimate how the dependent and independent variable is connected, and that the causal relationship is in the expected order (Skog 2004, 78). It also improves the statistical analyses by providing a more degrees of freedom, these are mainly there because the number of units are measured by multiplying number of countries and year (Hsiao 2003, 3; Midtbø 2007, 118). Lastly, and most important for this thesis is that it is well suited to analyze dynamic effects (Hsiao 2003, 4; Dougherty 2016, 529; Kellstedt and Whitten 2018, 284). TSCS models do this to some degree by themselves by analyzing the within effect, but one can also improve this further by applying different statistical tools. This thesis looks at the effect of changes in minimum wages on changes in income inequality, it is therefore crucial to use a method that are able to focus on the changes over time – which TSCS analysis does.

The drawback with using TSCS analysis is mainly data related, namely that it is difficult to find data that are collected in many countries over a long time period. This is indeed a problem with the models in this thesis, as comparable data on income inequality is lacking.

### 1.3 Contributions

The goal of the thesis is to examine to what extent minimum wages can contribute to tackling the rising income inequality. There are several ways this relationship can be studied, but due to methodological choices and data availability all but one was disregarded. The ones considered in this thesis was the effect of the introduction of minimum wages, the effect of minimum wage value and the effect of changes in minimum wages. Looking at the introduction of minimum wages was discarded because of data availability. Most OECD countries introduced minimum wages in the 1990s, and unfortunately the available income inequality data is lacking before this time period. Studying the values would also have been interesting, but would have caused problems with autocorrelation and non-stationarity. In itself, this could have been fixed in several ways, but the choice was to fix these issues by differentiating the variables<sup>1</sup>. This changes the variables from measuring the value to measuring the change in the value. However, this also improves the relevance of the study as there have been limited research done on the effect of changes in minimum wages compared to its value. In addition, it limits the scope of the study down to only focus on the effect minimum wages has on growth in income inequality instead of focusing on its effect on the income inequality itself.

There are several analyses being conducted, time series cross-sectional analysis is used in all of them. First, it is used to estimate the effect changes in minimum wages have on overall income inequality. A relationship between the two cannot be confirmed, which indicates that policy makers in advanced democracies should be careful when basing their arguments on existing literature based on other countries. Second, ten analyses were conducted in order to measure changes in minimum wages effect on the income share of the different groups within the income distribution (income deciles). These results show that minimum wages have an insignificant effect on most, but there are also some interesting findings. Raising minimum wages significantly increase the income share that the poorest 10% earns, while decreasing it for the decile with the second lowest income share. This indicates that minimum wages benefits the poorest while it pulls down the wages of people earning just above it. In addition, changes in minimum wages has a increasing effect on the eighth decile, which based on the theory can be because it is given to people that live with a richer spouse. Combined, these results suggest

---

<sup>1</sup> Differentiating the variables implies that the lagged values are subtracted from the values themselves. This will be further explained in the empirical strategy and methods chapter.

that a raise in minimum wages does not decrease growth in income inequality, but that it benefits the poorest 10%.

## 1.4 Structure

The thesis is structured in the following way; In chapter 2, the necessary concepts will be defined, followed by a presentation and discussion of the theoretical perspectives and existing empirical literature; This will be followed by chapter 3, where the choice of method and estimation techniques will be presented and discussed; Chapter 4 focus on the data used in the analyses, it will here be both presented and discussed; In chapter 5, the results of the analyses will be presented; The results will further be discussed in chapter 6; Lastly, in chapter 7 the thesis will end with a conclusion where the research question will be answered and the implication of the study will be discussed.

## 2 Theory and earlier research

In this chapter necessary concepts, theoretical perspectives and existing research will be presented. This chapter will lay the necessary foundation for the debate and examine why there should (or should not) be a relationship between minimum wage and income inequality. The concepts that will be defined are statutory minimum wages, income and income inequality, and will be presented in that order. More details about how they are measured will be presented in the data and measurement chapter (chapter 5). After the concept are presented, the theory related to the relationship between minimum wages and income inequality will be discussed, and existing findings will be presented.

### 2.1 Statutory minimum wages, income, and income inequality

Statutory minimum wage refers to a minimum rate allowed to pay to employees, which is decided politically and implemented by law. It covers all employees regardless of the sector they work in, even though the minimum wage rate in some cases can vary between sectors (European Commission 2016, 73-74; Infante, Marinakis and Velsaco 2003, 3-4). In some countries the minimum wage payment can also vary based on age, in these cases younger people receive lower minimum wages than the rest of the working population. (Infante, Marinakis and Velsaco 2003, 4). Eventual changes in the minimum wage will also have to be politically decided. It is important not to get it confused with collectively bargained minimum wages, where the minimum wage is decided in an agreement between the state, employers and organized employees (labor unions). Here, the minimum wage only affects selected sectors within the labor market (European Commission 2016, 74)<sup>2</sup>. Eventual changes will be decided in a new agreement done collectively by the same actors (Infante, Marinakis and Velsaco 2003, 2). There are two reasons that statutory minimum wages are the concept of interest in this thesis. First, it is where political actors have the most direct control over eventual changes, or lack of them. To some degree they can affect the collectively bargained minimum wage as well, but this is much more limited because they have to cooperate with the market actors. Second,

---

<sup>2</sup> The amount of workers covered by collectively bargained minimum wages can differ, as an example the collectively bargained minimum wage in Belgium covers 96% of its work force (Plasman 2015, 2). On the other hand, it only covers just above 10% in the US work force (Visser, Hayter and Gammarano 2017, 5)

statutory minimum wages cover all workers in a country. This makes it easier to study, as one does not have to take into account which sectors that are covered by the minimum wage. It is also important to note that many countries practice a mix of statutory and collectively bargained minimum wages. In these cases, it is only the statutory minimum wage rates that will be taken into account.

There is also a difference, especially in data, between hourly and annual minimum wages. In this thesis the hourly minimum wage will be used, which will be further explained in the data and measurements paragraph in the essay. It is also important to note that minimum wages can be measured in several ways. The most basic one is by looking at the minimum wage amount – the lowest payable rate that is allowed in a country. One can also measure it controlled for price levels within a country, the so called real minimum wage. This would make it easier to compare between countries because it takes the varying price levels between countries into account. If the goal is to compare it to other wages within a country, it can be measured by controlling it for the median or average wage in that specific country.

The second important concept to define is income, which is referring to the total amount of money received through wage earnings, capital income and state benefits (Piketty 2014, 18). This will be measured at the household level, which implies that the income of everyone within a household will be combined. If a person has low income, but at the same time has a spouse that earns more, their income should be measured together – the same can be said for people living with richer parents (Atkinson 2015, 30). This has quite a few implications on the study, but is at the same time important to be able to provide results that actually matters for people. This is also in agreement with the definition promoted by Kenworthy (2008, 2). She argues that income should be measured at the household level because its more precise to look at the income of a family when its pooled together. Splitting them up would limit the actual importance of their income, and provide a more theoretical approach than a realistic one. The income will also be measured after taxes, which also follow the recommendations made by Kenworthy in her conceptualization. This is also on the basis of making it realistic by looking at the income that actual matters for people. It will also take into account the effect of taxes, which then will remove the necessity to use it as a control. Lastly, the income is equalized, which implies that all the income has been calculated according to household size. This is important because a family of four need more money than a person living alone. At the same time, equalization does not add the same amount of needed income for each person that is added

to a household. When more people live together the amount of money they need does not multiple – as an example, one person living alone need one stove, but two people living together does not necessary need two (Atkinson 2015, 31). This income definition is also in line with the one used by Atkinson (2015, 29-33) in his book “Inequality: what can be done?”.

Lastly, income inequality will be defined as the difference in income, still at the household level and after taxes, between different groups within a country. These groups can be divided in multiple ways – for example by gender, age or country they live in (Atkinson 2015, 39-44). In this thesis, the different groups are based on the income of citizen within each country. How much of the total income in a country is earned by the different percentiles when they are categorized from poorest to richest – how high income has the rich in comparison to the poor? How this is operationalized and measured will be further described in the data and measurement chapter.

## 2.2 Theoretical perspectives and existing empirical findings

The debate regarding how minimum wages affect income inequality is a long lasting one, but it is still highly relevant. Minimum wages have been put forward by policy makers and supra national organizations as a way to reduce the growth in income inequality that western democracies are subject to (European Commission 2016, 72; Levin-Waldman 2001). Whether or not it actually has this effect is highly debated within the academic literature. In this part of the thesis the theoretical perspectives and earlier findings will be presented to shed light on this debate. First, the main arguments used in the literature stating that minimum wages can decrease income inequality will be presented, followed by the most used arguments used by the scholars against its decreasing effect. Because most of the arguments are not based on substantial theories, but rather findings and arguments in the existing literature, the empirical findings will be presented throughout the chapter together with the suited arguments. At the end of this chapter, a summary of the argumentation will be given together with a discussion of other important factors that might affect the findings in this thesis. The five hypotheses will be presented in the summary together with their related arguments.

### 2.2.1 Pulling wages together

There is quite a bit of literature where it is argued that minimum wages decrease the level of income inequality, or its growth, in a country. There are mainly three mechanisms used to argue this case: increasing minimum wages will increase the income of the poorest in the work force; increasing minimum wages will reduce the income of the richest in a country; increasing minimum wages will also increase the wages of the people earning just above the minimum wage rate.

The first, and most frequent argument, is that increasing minimum wages will increase the earnings of the households that has the lowest wages (Levitan and Belous, 1979; Volscho 2005, 346-347). By definition, minimum wages are designed to increase the wage of low earners within a country. Because the main component of the income of a household is its wages (Volscho 2005, 344), rising it for the poorest will also increase their income and thereby



resulting in a lower income gap between low and high income groups. This will in turn reduce the overall income inequality between low- and high earners in a country.

The second mechanism that can be found in the literature is tightly linked to the first one, and argues that a wage increase for the bottom earners, created by the increase in minimum wages, leads to lower income for business owners and stakeholders at the firms they work at. When the wages increase, businesses would have to pay out more money in accordance with the new minimum wage rate, which in turn will reduce their profit (Volscho 2005, 346). This will reduce the earnings of people owning firms or stakes in them. Because this is a group that normally has a high income level, this will result in a reduction in the income inequality because the gap between high- and low income groups is mitigated.

Of course, these mechanisms can affect the income inequality independently of each other, but their effects become more prominent when one looks at them together. The first one increases the income of the poorest while the second reduces it for the richest. This implies that the income of the top and bottom income earners get pulled together – which can also be referred to as a compression of the income. As a result, the overall growth in income inequality in a country decreases.

Because of their close relationship, these two mechanisms are usually analyzed together, and earlier empirical findings reflect this. Most empirical studies are focusing on the overall effect, rather than looking at the individual mechanisms specifically. Still, these look whether or not minimum wages reduce the overall income inequality which is highly dependent on these two mechanisms. Lin and Yun (2016) studies how minimum wages affect the overall earning inequality in China and focuses on the first mechanism. They do this by conducting an OLS and IV panel data regression, and their results show that an increase in minimum wages reduces the earning inequality in China. They argue that this is because the wage gap between the lowest and middle decile earners was reduced because of the increase in wages for the ones at the bottom on the wage scale (Lin and Yun 2016, 23)<sup>3</sup>. Levin-Waldman and Lerman (2017) agrees with this finding, but look at a different income inequality measurement. Their logistical regression analysis on the US shows that raising minimum wages reduce income inequality

---

<sup>3</sup> Income deciles refer to the different income groups. Income decile one is the ten percentage with the lowest income, while income decile ten refers to the ten percentage with the highest wages. This will be further described in section 4.3.5.

because it narrows the gap between the median and average income groups in a country. In other words, it increases the lowest income groups more than it increases the top ones, because the average income is more affected by the top income earners.

Slonimczyk and Skotts (2012) study of mismatch shows that a rise in the minimum wage in the USA resulted in reduced levels of income inequality. Rinz and Voorheis (2018, working paper) support this finding and argue that an increase in the income growth of the lowest earning workers results in a reduction of the levels of income inequality. Dickens and Manning (2004) looked at the effect of introducing a national minimum wage in the United Kingdom in 1999. they found that the introduction of statutory minimum wages reduced income inequality, but only for workers directly affected. They also found that the effect declined in the years after, because the minimum wage rate stagnated. Hence, it can be argued that the stagnation of change in the statutory minimum wage resulted in a reduced effect on the growth on income inequality. Brito, Foguel and Kerstenetzky (2017) also found this effect in Brazil, where the introduction of a statutory minimum wage resulted in a reduction of income inequality.

### 2.2.2 Ripple effect

The two mechanisms that have been mentioned so far, are the ones that are most often used when arguing how, and why, minimum wages will reduce income inequality. The third one is less used and direct than the two, but can be just as important. Here, changes in minimum wages is argued to not only affect the people that receive it, but also the wages of other employees within the labor market. This is based on the wage-contour theory that states that some wage rates work as references points for wages received by employees with similar characteristics and that work in a similar sector (Levin-Waldman and Whalen 2007, 62-63; Grimshaw 2011, 23). As an example, if the employees at a grocery store receives a wage increase because of a minimum wage raise, the wages for people working in other grocery stores is thought to change accordingly. Card and Krueger (1995; Volscho 2005, 347) show that increasing minimum wages has this effect and they name it “ripple effect”. This is argued to to cause the wages of other employees earning above the minimum wage threshold to rise according to the change in the minimum wage rate. Spriggs and Klein (1994) argue the same, and even point this out as the most important effect that minimum wages have in regards to income inequality. These

findings are also supported by Pollin et al. (2008) that look at several studies analyzing at this phenomenon in the US. Their results suggest that a raise in minimum wages has a positive effect on the wages of employees all the way up till the fourth income decile (Pollin et al. 2008).

If this is the case, more low earning people will be affected positively by an increase in the minimum wage. This will in turn make statutory minimum wages an even better tool for lowering the income inequality. There has also been some criticism against this effect, some scholars even show that minimum wages have the opposite effect with pulling the wages of people earning just above it down. Shelkova (2014) shows this effect in her study of earnings in the US between 1990 and 2002, stating that minimum wages increase the wages of the people that receives it, but pulls down the wages of other low wage workers that earn just above it. In this study, this counter argument is weaker than it would be if the focus was on the introduction of minimum wages, because a raise in minimum wages still would raise the potential point that peoples wages are pulled down towards. Still, if Shelkovas findings are applicable to the OECD member countries one might argue that while the minimum wage increases the income of people receiving it, it causes a reduction of the income of other low-wage earners.

### 2.2.3 Minimum wages and unemployment

The literature that have been addressed thus far makes it seem like the relationship is pretty straightforward, and that when policy makers argue in favor of minimum wages, this is well documented. But there is also a lot of literature stating other vice – that income inequality either increases income inequality or has no effect on it at all. This will now be presented.

One mechanism that has been used to argue against the effect of statutory minimum wage on income inequality is that it causes a rise in unemployment. This mechanism has been widely disputed in academic literature, especially after its prime in the 1990's, but it is still relevant to this topic today. (Volscho 2005, 344). This is based on the supply and demand formula, associated with the neoclassical political economic literature. According to this view there is a relationship between wages and employment. If wages increase, the rate of employment will decrease – and vice versa. Within this formula, there exists an equilibrium where wages are at a perfect level, and everyone is employed. If minimum wage gets put into the equation it can

affect this relationship by pushing wages higher than the equilibrium, and unemployment may rise (Kwon 2014, 62; Apergis and Theodosiou 2008, 40-41; Levin-Waldman 2018, 23; Kaufman 2012, 504; Edwards and Gilman 1999, 20). Higher levels of unemployment will first and foremost affect low wage workers (Grimshaw 2011, 8)<sup>4</sup>, and therefore result in them having to get social benefits or receive no income at all. If the rates of social benefits is lower than their original wages their income will be lowered – and the income inequality will rise<sup>5</sup>. When looking at empirical evidence this is the most researched mechanism regarding minimum wages. Neumark and Waschner (2008, 141-190) find this effect, showing that minimum wages increase the wages of the people who keep their jobs, but at the same time bring people into unemployment. Gavrel, Lebon and Rebières (2012, 697-698) study using a theoretical framework show the same result regarding unemployment, but they focus on an increase in minimum wage. Here, they find that increasing the minimum wage results in higher unemployment. Sen, Rybczynski and Van De Waal (2011) show the same trend, but for teen employment in the US. An increase in minimum wage from 5.15\$ to 7.25\$ has resulted in a drop between 3% and 5% in teen employment, and an increased number of families living under the low income cut-off.

There are also scholars that argue that minimum wages only cause a rise in unemployment if they exceed a specific threshold. The argument here is that a raise in minimum wages do not increase the unemployment per say, but that it will cause higher unemployment if the minimum wage rate gets too high (Gautie 2010; Grimshaw 2011, 25). This is because it then will limit the possibility of job creation, especially because the wages get too high for higher employment to be liable. On the other hand, this argument is countered by Grimshaw (2011, 25) that argues that most countries do not have high enough minimum wages to create this problem.

The effect of minimum wages on employment rates is a disputed topic, both in the past from the Keynesian school of economics and more lately in large parts of the empirical findings related to the relationship between minimum wages and employment. The Keynesians argued against the negative effect of minimum wage on unemployment by referring to the multiplication effect. According to them, increasing the wages of low income employees will

---

<sup>4</sup> According to the International Labour Office (2010, 34), the risk of being unemployed can be two or three times higher among low wage workers in the EU.

<sup>5</sup> The median net replacement rate in 2007 when unemployed in the OECD countries was 52% after one year, 40% after two years and keep dropping down to 9% after 5 years (OECD 2007).

increase their purchasing power. This will in turn lead to them being able to buy more goods from other firms, which will increase their profits. When their profits rise they will be inclined to employ more people, and at the same time buy more goods (Volscho 2005, 347; Aspergis and Theodosios 2008, 41). This results in money getting “multiplied” because it is used several times, and give more businesses a higher profit. If this is correct, minimum wages might actually increase employment, or at least not decrease it. At the same time, this can also result in higher incomes for the business owners, and thereby limit the possibility for the minimum wage to reduce the overall growth in income inequality.

Even though it is not necessarily based on the same economic view as the Keynesians, much of the new empirical findings show the same effect of minimum wages on unemployment, or at least that the neo-classical scholars are wrong. For example, Doucouliagos and Stanley (2009), and Card and Krueger (1995) find no connection between the minimum wage and increased unemployment in their meta analysis. Slonimczyk and Skotts (2012) findings even show that the rate of unemployment declined when the minimum wage level was increased in their study of the USA. Finally, Marginean and Chenic (2013, 101) find three different debates regarding how minimum wages can increase unemployment: geographical, demographical and sectorial. They look at all of these, and find no support for any of the arguments, and they conclude that this debate should be put to rest, as it is no longer relevant. In addition to this, there are also arguments being made about whether the idea of higher wages increasing unemployment are true historical. Edwards and Gilman (1999, 20-21) show that massive shifts in wage structures have happened in the past without having detrimental effects on the labor market, they especially point to changes in the gender wage differential. Overall, the argument that minimum wages can cause higher unemployment has been weakened in the last decades. Whether or not there is a cut-off point or not has seen less criticism, and can therefore be the most important unemployment argument in regards to income inequality.

## 2.2.4 Do those benefit who need it?

In recent years, after their negative effect regarding employment have been somewhat debunked by new empirical studies and data, the focus of those arguing against minimum wages has shifted towards that minimum wages do not help the ones with the lowest income, and that they therefore cause no reduction in the level of income inequality. This argument is split into two parts. The first one is about unemployed people, and the second is the question of who it is that receive minimum wages. The arguments regarding unemployed people are based on that the people that have the lowest income in a country are not employed at all<sup>6</sup>. This would imply that increasing minimum wages would in fact not help the lowest income group, and therefore consequently do not decrease income inequality effectively (Freeman 1996, 643-644). Minimum wages might still help reduce the gap between median and top income groups, but might actually increase it in regards to the group with the lowest income in a country. On the other hand, this argument might not be as strong in all countries, mainly because the social benefits rate differs heavily (Matsaganis, Ozdemir and Ward 2013). This would imply that people need to be in work, and that living on benefits alone is near impossible in a lot of countries. The same applies for all the people being unemployed and not receiving any social benefits (Matsaganis, Ozdemir and Ward 2013). It is also important to note that the unemployment rate differs heavily between the different OECD member countries. According to their 2018 data, the lowest is 2.2% of the labor force in the Czech Republic and the highest is 19.3% of the labor force in Greece, this might affect the findings regarding this (OECD, 2019). If the unemployment rate is only 2% there would still be a lot of the lowest decile income earners that receive minimum wages, while very few of them would receive it when the unemployment exceeds 10%.

The other part of this argument, regarding who receives minimum wages, mainly focuses on that the group of people that normally receive minimum wages do not really need it, and that giving it to them would not result in lower income inequality. Most people that receive minimum wages are teenagers living with their parents or people living with a higher earning spouse (Levin-Waldman 2018, 4). Because of income being measured on a household level, giving these groups higher wages would not reduce income inequality. It might actually

---

<sup>6</sup> As an example, Norway's statistical central bureau (SSB, 2016) show that most low income households are found outside of the labor market.

increase it, if the people that receive higher wages live in a family that already has high income. Grimshaw (2011, 1) agrees with the idea behind this argument. According to him, low paid workers are not only referring to people lacking skill or education, but also to teenagers using low paying jobs it as a stepping stone towards a better paid job in the future. On the other hand, in work poverty shows that low income also is a problem among people having jobs. In the EU, 9.5% of the working population had earnings below the poverty line in 2015 (Ghenta 2017, 48). Even though Halleröd, Ekbrand and Bengtsson (2015) show that this problem is most prominent among people that for different reasons move in and out of employment, it definitely shows that there are recipients of minimum wages that actually need it. Based on this, who receives minimum wages can highly affect the effect it has on income inequality. This is also problematized by Marginean and Chenic (2013, 101) that argue that all studies on the effect of minimum wages should be conducted at the national or regional level, because the minimum wage has such a different effect in different countries. If this is true, this study might struggle to find robust evidence as it looks at several countries together.

## 2.2.5 Summary and hypotheses

After looking at the theoretical perspectives and empirical findings, it is clear that there is more evidence in favor of minimum wages reducing income inequality than there is against it. This is especially true if one focuses more on the most recent empirical findings, rather than the earlier ones. On the other hand, it is also clear that there is a lot of scholars that disagree with this, arguing that raising the minimum wage does not limit the growth in income inequality. Based on this, one can expect to find minimum wages to have a reducing effect on growth in income inequality. But, whether this effect would be present might be dependent on several factors – most prominently whether the minimum wage is given to those in need of it and if the minimum wage gets too high.

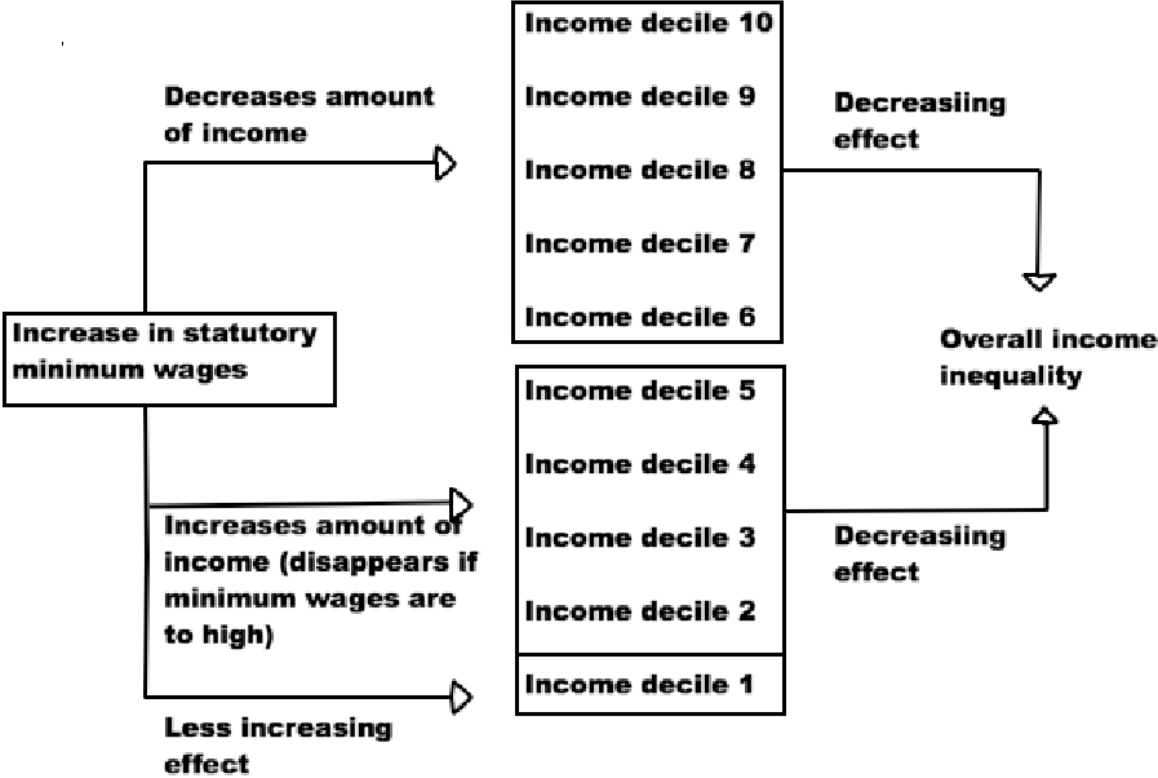
To sum it all up, there is a lot of debate regarding how changes in minimum wages will affect income inequality. Some of the arguments, like employment and the “ripple effect”, have evidence on both sides – which might indicate that the effect might be weak or non-existing. The other arguments look stronger, but will at the same time be dependent of each other. For an increase in wages to be an effective tool in regards to income inequality, it has to be given

to those with a low income. From the looks of it, this seems like the most important aspect of the debate. If the minimum wage is given to people with low income, it may be able to reduce income inequality, but if it is given to people living in high income families it will not. Regarding this, there might be differences between countries. In some countries one might be able to live only on benefits, while this might be impossible in other countries. It is also clear that there is a lack of evidence from cross-country studies in western democracies, as the existing literature is mainly focusing on the United States and developing countries as single cases (Marginean and Chenic 2013, 97-98). This makes it difficult to know if the same effects will be found in this study, especially if one takes into account that minimum wages have different effect dependent on the circumstances in the country it is introduced in (Gerritsen and Jacobs 2016). It can also be hard to single out the effect of minimum wages as there are many factors affecting it. These are of course included in the models as control variables, but some might be impossible to measure. As mentioned above, there might also be a problem that minimum wages do not work in the same way in all countries.

The expected relationship between increases in minimum wages and income inequality can be seen in multiple ways. In this thesis, the focus is on the mechanisms that have been confirmed the most within the academic literature and the least disputed. Based on this, the effects one can expect to find are shown in figure 2.1. First and foremost, the three mechanisms that are argued to make minimum wages decrease income inequality make up most of the model, the only effects that are seen as possible limiting on it is that raising minimum wages might be less effective if the value already are high, and that minimum wages might not help the poorest decile population. There were of course other arguments presented, but these are not included based on being rejected in the recent literature or because they have received very limited attention.



**Figure 2.1: Expected mechanisms of increasing statutory minimum wages**



*Note: The income deciles refer to the percentage of income that each ten percentage of the population have, if one split them up based on income from low to high. Income decile 1 refers to the poorest, while income decile 10 refers to the richest.*

Based on the model above, and the literature presented as a whole, five hypotheses have been developed. These are the hypotheses least disputed in academic literature, and also the most supported by empirical findings. This does not mean that the other mentioned mechanisms does not matter, but rather that the effect they have is more uncertain and therefore will not be hypothesized.

The first hypothesis is based on the theory regarding wage compromising as a whole and the most recent empirical contributions. As were discussed, there is a lot of debate regarding the effect of minimum wages, but lately most of the scholars have found it to reduce income inequality, which also is in line with the mechanisms stating that it increases the wages of the bottom income groups while decreasing that of the top income households. Even though the

results are mostly received through case studies and a lot of them look at developing countries, the hypotheses is:

*Hypothesis 1: Increasing the real statutory minimum wage will result in an overall decline in the growth in income inequality.*

Further, the more specific hypotheses are based on the mechanisms argued to cause the overall effect. The first one, stating that increases in minimum wages will result in an increase in the income for the lowest earners together with the “ripple effect”, lays the foundation for the second hypothesis. It is:

*Hypothesis 2: Increasing the real statutory minimum wage will result in an increase in the percentage of income earned by people with beneath average income.*

Similar to the second hypothesis, the third one is based on the mechanism that states that the income of the richest people will decrease when minimum wages raises, because they have to pay out higher wages. It goes as follows:

*Hypothesis 3: Increasing the real statutory minimum wage will result in a decrease in the percentage of income earned by people with above average income.*

The fourth and fifth hypotheses are based on the literature that argues that minimum wages do not have a reducing effect on income inequality. Earlier findings and statistics show that the poorest people in a country are unemployed, and this would make raises in the minimum wage unhelpful to them. Keep in mind that the unemployment rate differs between countries and therefore some people that are included in the lowest decile group might be employed<sup>7</sup>. Never the less, the fourth hypothesis is:

*Hypothesis 4: Increasing the real statutory minimum wage will not increase the income earned by the group with the the 10% lowest income as much as the other groups having incomes below average.*

---

<sup>7</sup> To counter this, the unemployment rate for each country at the different years are also included as a control in the final models.

The fifth, and last, hypothesis is based on the unemployment argument. This is the most discussed effect that minimum wages might have, and a lot of it has been disproven in the most recent empirical studies. Still, the part that has been the least criticized is that when the minimum wage reaches a certain point it can increase unemployment. This goes against hypothesis 2, and there is therefore a chance that the opposite effect will be found. Still, there is limited empirical studies that goes directly against that minimum wages can cause unemployment if they are too high, and the last hypothesis is therefore:

*Hypothesis 5: Increasing the real statutory minimum wage will have a lower reducing effect on income inequality when the minimum wage rate is higher.*

In the following chapter, the method and empirical strategy that will be used to analyze these hypotheses will be presented.

## 3 Empirical strategy and methods

Analyzing the effect that changes in minimum wages have on income inequality in advanced democracies is a huge challenge to take on, and as shown in the literature review it can be done in multiple ways. The chosen method in this thesis is time series cross section analysis (TSCS), and in the first part of this chapter the choice of method will be discussed. It will here be argued that it is a superior method when analyzing effects of changes over time, compared to other statistical techniques. In addition to this, which estimation technique that is most appropriate to use will be discussed, followed by a presentation of the other choices that were made in regards to the modelling. Lastly, assumptions, preconditions, challenges and problems related to TSCS analysis will be presented and discussed.

### 3.1 Time series cross-sectional modelling

The method is similar to panel data analysis, but there is one important difference. Panel data analysis almost always refers to survey respondents, where there is a high number of units observed over a small space of time. In TSCS on the other hand, there is a smaller number of units observed but over a longer time period (Beck 2008, 1-2). The data used in TSCS is cross sectional and time series data combined into one. It contains repeated observations for the same units – In this case, observations for 17 OECD countries ( $i = 1, \dots, N$ ) between the years of 1995 and 2015 ( $t = 1, \dots, N$ ) (Hsiao 2003, 1). This allows for more complex and realistic models than cross sectional and time series data can provide on its own (Verbeek 2012, 372; Skog 2004, 74-76).

Using TSCS provides several advantages compared to other methods where the same data can be analyzed. First, it improves certainty related to the causal relationship. Because there are several data points over time, one can more specifically show how the dependent and independent variable is connected, and that the causal relationship is in the expected order (Skog 2004, 78). This removes the problem with spurious relationships, where the connection is reversed and that the dependent variable is in fact influencing the independent. Using panel data also makes it possible to analyze dynamic effects (Hsiao 2003, 4; Dougherty 2016, 529; Kellstedt and Whitten 2018, 284). This can be done by using lagged variables, that creates a

possibility to analyze an effect even when the change in dependent variable happens at a later time (Skog 2004, 78). Lastly, it massively increases the number of observations (Hsiao 2003, 3). Where cross sectional analysis has N units and time series have T units, panel data have N\*T units (Midtbø 2007, 118). If there is 10 countries (N) that are being analyzed and the data covers 10 years (T), the total number of observations will be  $10*10 = 100$ . This also increases the degrees of freedom (Hsiao 2003, 3). The high number of observations that TSCS modelling provides helps getting more reliable estimates for the dependent variable (Baltagi 2013, 7). All TSCS models are created using the “plm” and “lme4” packages in R studio (Bates et al. 2015; Croissant and Millo 2008)<sup>8</sup>.

### **Change on change**

In regards to this thesis, the most important contribution by the TSCS models is that it is well suited to analyze dynamics of adjustment (Baltagi 2008, 7-8). Because one looks at variables over time, it is possible to look at the effect of the changes themselves (Dougherty 2011, 530-531). This is somewhat automatically done when conducting a TSCS analysis because the effect of the variables is measured at different times, but can also be made even better by differing the variables. This implies that instead of looking at how the value of the independent variable affect the value of the dependent, one look at how the change in the independent variable affects the change in the dependent. By doing this, the effect of the original size of the minimum wage get removed, and the focus can instead be exclusively on the effect of the change itself. This of course also come with some negatives, primarily that it reduces the number of observations because the first observation for each country will be removed because it does not have an earlier value that can be subtracted from it.

Differing can be done in multiple ways in terms of how long time span one want between the observation. In order to keep as many observations as possible and to be able to look at the small changes that happens from year to year, the change chosen for the models in this thesis is one year. In other words, the one time lagged value is subtracted from the value itself. This is done individually for each of the variables, by using the R-package “dplyr”.

---

<sup>8</sup> The R-script can be provided by contacting the author.

## **Interaction effect**

To test the fifth hypothesis, where it is argued that a raise in minimum wages will have a lower reducing effect on income inequality if the minimum wage rate is high, there is also a need to include an interaction effect in the model. When an interaction effect is present, the focus is on what effect the independent (X) variable have on the dependent (Y) one as a function of a second independent (Z) variable (Midtbø 2012, 136). This is an important difference in comparison to the other analyses, where the effect of interest is X on Y controlled for Z. It is also important to note that the same control variables will be included in the model looking at the interaction effect as in the other models. Including an interaction term might also cause multicollinearity, which according to Wooldridge (2009, 197) can be limited by using centred variables. This was done in the model, and the process behind it is further described later in this chapter. Some authors argue that the process of centring the variables does not solve the problem completely (Pennings, Keman and Kleinnijenhuis 2006, 166), and the presents of multicollinearity was therefore also tested after the centring to make sure that it was removed – which was the case.

## **3.2 Estimation techniques**

When creating the models there are also other choses that have been made in order to maximize the quality of the analysis. The main one when conducting a TSCS analysis is whether to use fixed or random effects, and it is therefore discussed first. Afterwards, robust estimations, mean adjusted variables and standardized coefficients will also be presented.

### **Fixed effects (FE) or random effects (RE) model**

TSCS models are structured hierarchical due to repeated observations of the same units (Bell and Jones 2015, 135). This makes the error term vary over time and capture the unobserved effects on the dependent variable, which can be used to our advantage. This is one of the biggest benefits related to using TSCS analysis, but how the error terms should be treated are debated

in the methodological literature. This can be done in multiple ways, but the discussion is mainly about whether one should use fixed- or random effects (Clark and Linzer 2014, 1). These estimation techniques will be presented and discussed in the following section.

In fixed effects (FE) models, the unobserved effects are built into the model. This is done by including dummy variables for each units, and the error term is then treated as the coefficient of these individual-specific dummy variables (Dougherty 2016, 533-536). Because it then is controlled for, using this estimation technique will remove all individual specific effects – thereby isolating the over-time variation, removing time constant variables, and eliminate the intercepts (Derpanopoulos et al. 2017, 2; Dougherty 2016, 533). When all the dummy variables are included, it of course also decreases the degrees of freedom (Dougherty 2016, 533). Random effects (RE) models on the other hand, treats the individual specific effects like random variables drawn from a random population (Hsiao 2003, 34; Dougherty 2016, 537-538). This is often argued to be more biased than the FE model, but does not remove the information that FE does (Bell and Jones 2015, 134).

RE models are seen as the favorable one in most regards because of the valuable information that is kept, but it is FE that are most often used in the existing literature (Bell and Jones 2015; Dougherty 2016, 539). This is mainly because there is argued to be assumptions that have to be met in order to use RE. The first one is that the unobserved variables can be treated as being drawn randomly from the population, and the second is that the unobserved variables are distributed independently of the independent variables (Dougherty 2016, 537-538). In regards to the first one, the population in this thesis is advanced democracies in the world, while the sample is 27 OECD countries with minimum wages. Of course, there could be made an argument about it being a random sample, but at the same time this would be just as easy to argue against. The second assumption is tested using the Durbin-Wu-Hausman (DWH) test. This estimates whether the grouped coefficients in the FE model and RE model are significantly different, if that is the case FE should be applied (Dougherty 2016, 537-541). The DWH test for the main model used in this thesis had a p-value of 0.007, which indicates that the two models are significantly different and implies that FE would be preferred.

However, even though there are some scholars that argues that these preconditions are important when selecting between the FE and RE, the literature on RE being better in almost all circumstances is taking over. This is especially true for political science (Beck and Katz

2007).

For instance, Clark and Linzer argues that FE being preferred because the correlation between FE and RE is too low only holds under extreme circumstances, and should not be seen as a reason not to use random effects (Clark and Linzer 2015, 407). This is supported by Plümper and Troeger (2019, 23, 39) that show that the DWH test wrongfully favors the FE even when it provides worse estimates than both RE and normal OLS. Further, Bell and Jones (2015, 139, 149) show that using RE almost always is preferred, and that the information that FE removes severely harms the analysis. Gelman and Hill (2007, 245-246) makes an even stronger statement, arguing that one should always use RE models.

In light of the literature and arguments presented in this section, random effects have been chosen as the best fitting estimation technique for the models in this thesis. As Bell and Jones (2015, 133) puts it: “RE can provide everything that FE promises and more”. Furthermore, even though the RE model is seen as the best one in the recent methodological literature, there are still a lot of scholars that recommends FE when the assumptions are not met. To be certain that the analyses presented in this thesis are not biased in any way because of possible omitted variables, a FE model will be presented as a robustness test at the end of the analysis and results chapter.

### **Within, between or mixed estimations**

When conducting a random effects TSCS analysis one have to decide whether one want to look at the within, between or mixed effect. As mentioned earlier the between effect is by default removed when using fixed effects. When using within effects the only changes that are in focus are the ones that finds place within a country over time. This is closer to conducting several separate time series, as one does not care whether higher minimum wages in general causes income inequality, but only if it does it within the specific countries. On the other hand, between effects only look at the effect the independent variables have on the dependent within each year across all included countries. Here, whether it has an effect within a country is of no interest. Lastly, the two can be combined using mixed effects. Here, a weighted average of the within and between effect is calculated and used as the coefficient. This means that both the effects



within countries over time and between them in each year is relevant. In TSCS analyses the recommended one is to use mixed effects, which will also be done in this thesis.

### **Robust estimations**

One important modelling tool that is being used in all the models are robust estimations, standard errors clustered at the country level (Studenmund 2011, 351-352). This helps to remove several of the problems related to the TSCS assumption, especially non-stationarity, heteroskedasticity and autocorrelation. As heteroskedasticity cause problem with the standards errors (SE), but not with the coefficients, using robust estimations alters the SE in a way that makes them more accurate without altering the coefficients them self. The SE might still be biased, but are in general seen as more correct (Studenmund 2011, 352).

### **Mean adjusted coefficients**

The data has also been mean adjusted, which is done by subtracting the mean from every value (Midtbø 2012, 49). This implies that the intercept refers to when all variables in the models are at their mean value, instead of standard zero adjusted which means that the intercept is the value of the dependent variable when all other variables are at zero. Knowing what the income inequality value are when all other variables are at their mean is regarded as more useful than knowing what it is when all others are zero, which is more unrealistic. This is also in line with the argument made by Midtbø (2012, 99-100) which argues that mean centering the variables make the intercept more meaningful.

### **Standardized coefficients**

To be able to compare the effect of variables measured on different scales the standardized coefficients are also presented in addition to the mean adjusted ones. Standardized coefficients are created by subtracting the mean from each variable (mean adjust) and dividing them by the standard deviation (Imai 2017, 112). Standardized coefficients will in this thesis be used in addition to the mean centered ones. This is because even though they make it possible to

compare the effect of the different independent variables, they are also contested in the methodological literature (Midtbø 2012, 125-126). They will therefore be used solely for comparison, and the mean centered coefficients will be used to look at the other important aspects of the analysis.

### 3.3 Assumptions in Time Series Cross-Section modelling

As in all quantitative methods, TSCS have presumptions that have to be met in order to conduct a reliable analysis. Because TSCS models uses a combination of cross sectional and time series data, presumptions for both types have to be tested (Beck 2008). In addition, preconditions regarding the OLS regression also have to be used. The presumptions are presented below, each of the sections includes information about what they are, how they are tested and, if present, how they are treated in the models.

#### **Stationarity**

The first assumption one have to take to account is that the data has to be stationary. This is the case when means, variance and covariance for all variables are independent of time (Dougherty 2016, 481). If any of them are not constant over time for a variable, it is considered non stationary. This is exceptionally important in this study where there are several variables that are known to increase for every year, often exemplified with GDP per capita (Verbeek 2012, 297). All variables were tested using the “adf.test” function in R, and most of them were non-stationary. This can be treated in several ways, most prominently by averaging the variables, including a time trend variable or differencing the data. In this thesis, the variables were differenced in the same way mentioned when creating the change on change variables. After that change were made, none of the variables showed signs of non-stationarity.

#### **Autocorrelation**

The most problematic assumption related to panel data models is that there should be no serial

dependence, also referred to as autocorrelation in the disturbance term (Dougherty 2016, 445; Hsiao 2003, 57). If this is present, the variable is correlated with its own value the year before and the error term will therefore be correlated with itself (Worrall 2008, 794). This happens because values have limited changes especially if the time periods are close together (Midtbø 2012, 112). This does not affect the coefficients in the models, but yields the OLS analysis ineffective and estimates the wrong error terms (Dougherty 2016, 447-448). This can be tested by using a panel Breusch–Godfrey test, where the null hypothesis is that there is no serial dependence (Monogan 2015, 97). When present, it can be corrected by using robust estimation (panel corrected standard error), differencing the variables or by averaging them. Autocorrelation was present in the models, and robust estimations were therefore included and the variables were differenced.

## **Heteroscedasticity**

In TSCS regression models, the disturbance of the residuals has to be homoscedastic, there is therefore a need to test for heteroskedasticity (Verbeek 2012, 373-374). Being homoscedastic implies that the variance around the regression line is the same for all values of the independent variable (Batalgi 2008, 87). If for example the variance is higher at one end of the line heteroskedasticity is present. When present, it causes the standard errors to be wrong. This can be tested both by looking at a residual plots and using the Breusch-Pagan statistical test. Both of them were used, and it showed clear signs of heteroscedasticity. It can be treated in several ways – most prominently by changing the included variables in the models or by using robust estimations. The later one was used in the models presented in this thesis, both because it is recommended, and because it helps with other assumptions that the data does not meet<sup>9</sup>.

## **Panel heteroskedasticity**

When using TSCS, there might also be panel heteroskedasticity. This is the case if the residual variance across units over time varies because of characteristics unique to each unit (Worrall 2008, 794). This can be treated in the same way as heteroscedasticity, namely by using robust

---

<sup>9</sup> Robust estimations are used in all the models. This is done by utilising the commands in the “Sandwich” package found in R.

estimation, and this was done in the models used in this thesis.

### **Heterogeneity bias**

Hsiao (2003, 8) presents another assumption associated with panel data – heterogeneity bias. This is based on that: “economic data are generated from controlled experiments in which the outcomes are random variables with a probability distribution that is smooth function of the various variables describing the conditions of the experiment” (Hsiao 2003, 8). In most panel datasets this is unfortunately not the case because the data is not collected in a controlled environment, but are observations from the real world. This is also true for the data in this thesis, and in it self not a problem as one does not want to include all factors that can affect the dependent variable, but rather include all the essential ones (Hsiao 2003, 8). But this can cause a problem with parameter heterogeneity which occur because different units share common parameters that they are not expected to share. The variables that are included in the models in this thesis are theory based, and are the ones that are expected to have an essential effect on the outcome. When all the essential variables are present it of course removes the omitted variable bias, but there is still some effects that cannot be observed.

### **Multicollinearity**

Multicollinearity is present if the independent variables are highly correlated with each other. This can be tested by checking the correlation between the independent variables, but is most often done by using a Variance Inflation Factor (VIF) test, which formally tests for multicollinearity (Verbeek 2012, 44-45). The problem with this is that there isn't any agreement in regards to what exactly should be the cut off point between variables being multicollineary or not. Often it is said that a value higher than 10 indicates multicollinearity, and when testing the independent variables used in this study, none of them showed sign of it. The highest value was change in GDP per capita that had a score of 4.6.

## **Normality**

In all linear regression models their normality is assumed. According to this, the residuals have to be normally distributed (Skog 2004, 249). In this thesis they are normally distributed, at least when they have been differed, but one can see that there are a few to many values ranging close to zero. This is not a huge problem, especially because RE models perform well within the TSCS framework even when this presumption is violated (Beck and Katz 2007; Bell and Jones 2015, 136).

## **Linearity**

In all linear regressions one of the defining preconditions is that the relationship between the variables has to be linear – the function is required to be able to be written in a straight line. If this is not present it can lead to weak estimates of the true effect (Skog 2004, 239). This can be tested by looking at the residual plots, and when present it is treated by including new variables.

## **Outliers**

Another problem one might encounter is heavy outliers. These are values that do not fit in with the rest of the values in the data, and are especially problematic if they have a strong effect on the estimate. These can be found by looking into the data. Some outliers were found in regards to their value on the GINI index, and a robustness check was conducted with them removed.

### 3.4 Challenges related to time series cross-section analysis

The problems that occur when conducting a TSCS analysis is mainly data related, namely that it is difficult to find data that are both present over time and for all the entities (Verbeek 2012, 372). This was also true for this analysis, resulting in there being quite a few missing observations. Because of this the dataset is considered an unbalanced one, which in it self is not not regarded as a problem as long as the values are not structurally missing (Dougherty 2016, 530). The missing data in the dataset used in this analysis is only present because data is collected more regular in some countries than in others and because minimum wages have been introduced at different times. It is not correlated with the values that the countries have in the respective years. Having an unbalanced dataset is therefore not seen as a problem, even though having more data available would be preferred. Imputing the missing values were also considered, and the results of models using the imputed dataset will be presented as a robustness test in section 6.6.

Another problem related to statistical analyses is that some choices can alter the effect or the significance of variables. This is mainly a problem if the theory is weak, which is not the case in this thesis. But there can be some concerns because of the lack of earlier statistical analysis on the relationship between minimum wages and income inequality. Because of this, testing the robustness of the results are important. This is done by conducting analysis with minor changes to variables or estimation techniques and check whether or not the results are the same. As robustness tests, analysis were conducted using FE, removing outlier and using imputed data – all of these is presented at the end of the “analysis and results” chapter.

#### **Causal relationship**

To end the chapter, a few words causality is suited. As shown in this chapter, TSCS analysis is the preferred method for testing the hypotheses, to further be able answer the research question. This is also partly because it is strong compared to other statistical analysis when it comes to proving a causal relationship. There are three criteria that have to be met in order to show a causal relationship; the first one is that there has to be a correlation between the independent and the dependent variable; the second is that the independent variable need to have happened

before the dependent one; the third is that all other explanations have to be ruled out (Oppewal 2010). Using TSCS analysis results in all of these being met. The first one is tested in the analysis itself, TSCS looks for correlation between X and Y, controlled for the other variables. The second one is both met in the statistical analysis and by providing good theoretical and empirical knowledge. TSCS analyses incorporates time series data, especially the within effect will here show that the correlation one finds are based on the correct relationship where X happens before Y. In regards to the existing literature, it is clear that minimum wages affect income inequality – and not the other way around. The third one is met by basing the choice of control variables on theory and earlier findings. All of the important variables that have a significant effect on income inequality is included in the analysis to rule them out. But this is also where it is hardest to be certain, when the data is not collected through experimental design it is impossible to remove all other explanatory factors.

In addition to this, it is important to note that even though TSCS are well suited for revealing causal effects, it has limitations when it comes to causal mechanisms. However, exploring the causal effects is both necessary for further research looking at the mechanisms, and as an addition to the majority of the existing literature which does look at the mechanisms. In regards to this, including the income decile analysis is partly done to look at the underlying effects that is behind the potential change in income inequality, but it cannot be said to be the causal mechanisms, those would for example be why changes in the minimum wage affect the different income deciles – this study is rather exploring whether or not one can confirm that there is a connection between the two.

### 3.5 Chapter summary

In this chapter, the method that will be used to look at the hypotheses and thus answer the research question has been presented. TSCS modelling is argued to be especially good at estimating dynamic effects which is well suited to estimate the effects of interest in this thesis. In addition, it was decided that using a random effects model was the preferred approach, as recent methodical literature strongly criticise using fixed effects. Lastly, it has been showed that the variables are being differenced in order to both fulfil the assumptions and in order to focus

solely on the effect of the changes themselves. In the next chapter the data used in the models will be presented and discussed.



## 4 Data and operationalization

It is hard to find data that is both present across time and in all the necessary countries, and the data used in this thesis is therefore collected from many different source. All of them will be presented in this chapter. The chapter will start with a discussion of the sample selection, followed by a presentation of all the variables. Why they are included, where they have been found and how they are measured, will be discussed for all of them.

### 4.1 Sample

#### **Selection of cases**

One of the defining parts of every study is its sample, and for all statistical analysis this can cause some problems related to selection bias (Hsiao 2003, 9-10). There are three main criteria that has affected the chose of sample countries. The fist one is that the goal is to analyze the effects of statutory minimum wages in advanced democracies, which therefore removes all non advanced democratic countries. The second limitation is that the country has to have statutory minimum wages, which of course makes the possible sample even smaller. The last limitation is the data availability, which when looking at differences across time is quite important. In order to get good data on statutory minimum wages, the OECD database had to be chosen. This is the only dataset that covers counties statutory minimum wages before 1999, and is generally the most used<sup>10</sup>. This therefore limited the sample to the OECD countries. To get reliable income inequality data, the World Income Inequality database (WIID) was the preferred data source, and data for all OECD member countries are also included here. As for the analyses where the income deciles are in focus, the sample had to be further limited down to countries that are also part of the European Union (EU) or European Economics Area (EEA), because this estimate only are available in the Eurostat database.

All of these combined, resulted in the sample for the analysis looking at the effect on the GINI index being countries that are part of the OECD and has statutory minimum wages. For the analyses where the income deciles are in focus, only countries that are both part of the OECD

---

<sup>10</sup> In the Eurostat database, data is only available for the years after 1999.

and EU or EEA, and has introduced statutory minimum wages, are included. These have not been chosen on basis of any particular values, but that they are the only one where all the crucial components that is needed in order to analyze the research question is present. All of the OECD countries are listed below, and whether or not they have statutory minimum wages and are part of the EU or EEA is also specified. In table 4.1 it becomes clear that there are 28 countries that qualify for the study related to the GINI index, while there are 19 countries included in the study of the effect on income deciles. It also has to be noted that in addition to this, Germany was dropped because they introduced statutory minimum wages in 2015 and therefore did not have enough data, and that the US was dropped because there were no available union density data.

**Table 4.1: Sample selection**

<b>OECD Country</b>	<b>Statutory minimum wages (GINI index model)</b>	<b>Introduction year of statutory minimum wages</b>	<b>Member of the European Union (EU) or the European Economic Area (EEA)</b>	<b>Included in the income decile models</b>
Australia	✓	1966	x	x
Austria	x	-	✓	x
Belgium	✓	1975	✓	✓
Canada	✓	1930	x	x
Chile	✓	1990	x	x
Czech Republic	✓	1991	✓	✓
Denmark	x	-	✓	x
Estonia	✓	1991	✓	✓
Finland	x	-	✓	x
France	✓	1970	✓	✓
Germany	✓*	2015	✓	✓*
Greece	✓	1991	✓	✓
Hungary	✓	1991	✓	✓
Iceland	x	-	✓	x

Ireland	✓	2000	✓	✓
Israel	✓		x	x
Italy	x	-	✓	x
Japan	✓	1968	x	x
Korea	✓	1988	x	x
Latvia	✓	1991	✓	✓
Lithuania	✓	1990	✓	✓
Luxembourg	✓	1973	✓	✓
Mexico	✓	1917	x	x
Netherlands	✓	1968	✓	✓
New Zealand	✓	1945	x	x
Norway	x	-	✓	x
Poland	✓	1970	✓	✓
Portugal	✓	1974	✓	✓
Slovak Republic	✓	1991	✓	✓
Slovenia	✓	1995	✓	✓
Spain	✓	1963	✓	✓
Sweden	x	-	✓	x
Switzerland	x	-	✓	x
Turkey	✓	1974	x	x **
United Kingdom	✓	1999	✓	✓
United States	✓	1938	x	x

*Note: Introduction year is based on data provided by in the ICTWSS database version 5.1 (Visser, 2016), OECD (1998) and Eurostat (Eurostat n.d.b). There have been several changes in minimum wages in many of the countries, the year listed is the one where the latest major change happened.*

*\* Germany first introduced statutory minimum wages in 2015, because of this the data is not available, and Germany is dropped from the analyses.*

*\*\* Turkey is not a part of either the EU or the EEA, but included in the Eurostat data. It has still been removed from the final dataset.*

### **Selection of time period**

In addition to selecting which countries that will be included in the sample, it is also important to decide what time period that will be in focus. The most important part of this was to be able to use as recent as possible data to be able to get the most relevant results. The years were limited by available data, and the analysis therefore reaches from 1995 to 2015. The starting point also differ between countries, as none of them are included in the years before they introduced statutory minimum wages (see table 4.1). The whole range of years is not either available for all countries, as there are some missing values.

## **4.2 Dependent and main independent variable**

In the following section, all the variables used in the different analyses will be presented. First, the dependent variables will be discussed, followed by the main independent variable. Further, the control variables will be presented. The descriptive statistics will be presented together with each of the main variables, and together for all of the control variables. As stated in the methods chapter, all the variables have also been differentiated, and it is that variable that is used in the models. The descriptive statistics for the differed variable is therefore also included for each of the variables.

### **GINI index**

In the analyses there are several dependent variables. The GINI index will be used to measure the effect of minimum wage changes on the overall income inequality. To measure the effect minimum wages has on the different income groups, the income deciles will be used – by doing this one can measure whether or not minimum wages actually have the expected causal effects on the different income groups as well as the overall effect.

Data on income inequality has been a problematic area for several decades, mainly because of shifting definitions and lack of data (Lin and Yun 2016, 9). This is also true for the OECD member countries, and might be one of the reasons that income inequality research in this area has received so little attention compared to its importance. The measurement that there is the

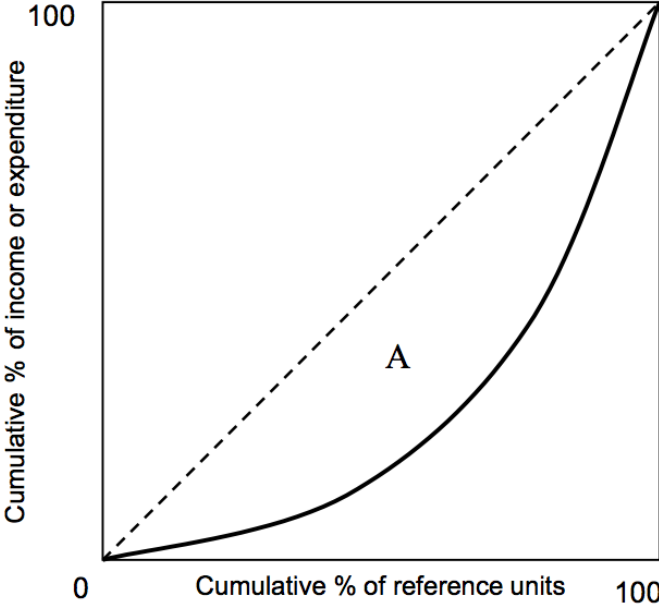
most data on is the GINI coefficient, and this is especially because several actors have tried to make this data better and more accessible in recent years, mainly by combining data from different sources that uses the same definitions. These sources include the World Income Inequality database (WIID) (UNU-WIDER 2018a) and the Standardized Income Inequality database (SWIID) (Solt 2019), where the main difference is that SWIID impute missing values. The choice was to use the WIID database as the source for the GINI index as it is the most frequently updated and because it is where the information about the data is most accessible. One could of course use a primary dataset, but the problem here is that it limits the data quite dramatically as there are large amounts of missing observations, as will become clear when the deciles are analyzed.

In the WIID dataset, there are GINI measurements from multiple sources combined together – both collected differently and using different income definitions. To be able to compare the data across both year and country borders, some of it therefore had to be removed. In order to do this the guidelines from WIID was followed. First, only data that are based on the same welfare definition, equivalence scale, area coverage, age coverage and population coverage were kept (UNU-WIDER “Frequently Asked Questions” n.d.). Further, all the data where net income was not used were removed. The last recommendation that is made by WIID is to only use one source when comparing different years, this was to some degree done. Only the OECD and Eurostat data were kept, these are based on the same income definitions, and are both known as reliable data sources. For country/years where both of them had data available, the ones from the OECD were used. To make sure that it did not alter the results to keep both sources, an analysis was also conducted using only the OECD data. The results were the same, but the number of observations of course dropped.

The Gini-coefficient measures how large the income inequality is in a country. It does this by comparing the cumulative proportions of the population, measured from the poorest to the richest, and the cumulative proportion of income they receive (UNU-WIDER 2018b, 17). When all the cumulative incomes are found for the different cumulative population, it is plotted. Then it gets compared to the Lorenz curve, shown in figure 4.1, and the difference between the two are the GINI coefficient. This number is between 0 and 1, where 0 indicates perfect equality, meaning that everyone has the same income. 1 corresponds to perfect inequality, where one person has all the income. The dotted line in figure 4.1 is perfect diagonal, therefore also an example of perfect equality. The GINI coefficient is multiplied by 100 to create the GINI index,

which results in the variable ranging from 0 to 100.

**Figure 4.1: Lorenzo curve**



*Source: UNU-WIDER (2018b, 17)*

The income definition used in this calculation is net income measured on the household level. This is in line with the recommendations given by UNU-WIDER (2018b) and the income definition that was presented earlier in the thesis. The descriptive statistics for the GINI index are presented in table 4.2.

**Table 4.2: Descriptive statistics for the GINI index**

Variable	Min	Max	Median	Mean	N
GINI index	22.00	38.90	30.70	30.43	449
Change in GINI index	-6.6	6.8	0	0.092	443

## Other income inequality measures

There were other potential income inequality measures that were examined, but seen as weaker than the GINI index. The gap between median and mean income in a country is a measure that could have been used, but this is even less accurate than the GINI. Quintile ratio that looks at the difference between the 20% with the highest income and the group with the 20% lowest, often referred to as the 80/20 measure, was the other. But this fell in the same category as the one above.

## Income deciles

Even though GINI was considered the strongest measure for the overall income inequality, it is still not perfect in terms of measuring the exact effect minimum wages has on specific groups of households. The other dependent variables, that is being included to measure the effect minimum wages have on the specific income groups, are the income deciles – found in the Eurostat dataset (Eurostat 2019). The income deciles are broken down into ten measures, each showing how many percentage of the total income that is going to each tenth of the population ordered by income. Decile one represents how much of the income that is earned by the poorest 10%, while decile ten shows the same for the richest ten percentages of the population. The income definition used by Eurostat in their data collection and measurement is the same as is used in this thesis, namely that it gross income measured on the household level and equalized (Eurostat n.d.a). The descriptive statistics for all the different quintiles, and changes in them, are listed in table 4.3. It has to be noted that the changes in decile 2 through 9 looks strange, all of them have negative 1 as minimum and plus 1 as max, and very similar mean and median. This measurement has been controlled in multiple ways, and looks to be the correct one<sup>11</sup>

---

<sup>11</sup> This has been checked multiple times. Both by looking at the actual data and by trying different formulas to calculate the changes. Min, max, median and mean are stable across all of them. The formula that was chosen to calculate the changes is based on the “dplyr” package, and presented below. It calculates each of the deciles independently, the example below is for the first decile.

```
data <- data %>%
  dplyr::group_by(country) %>%
  dplyr::arrange(year, .by_group = TRUE) %>%
  dplyr::mutate(decile1_change = decile1 - dplyr::lag(decile1)) %>%
  ungroup
```

**Table 4.3: Descriptive statistics for the income deciles**

<b>Variable</b>	<b>Min</b>	<b>Max</b>	<b>Median</b>	<b>Mean</b>	<b>N</b>
Decile 1	1.90	4.20	3.15	3.15	238
Decile 2	3.40	6.10	5.00	5.05	238
Decile 3	4.40	7.20	6.00	6.14	238
Decile 4	5.50	8.10	7.00	7.11	238
Decile 5	6.60	9.00	8.00	8.09	238
Decile 6	8.00	10.00	9.20	9.19	238
Decile 7	9.50	11.00	10.50	10.51	238
Decile 8	11.00	13.00	12.00	12.12	238
Decile 9	13.00	16.10	14.80	14.68	238
Decile 10	19.30	32.90	23.85	23.88	238
Change in decile 1	-0.90	1.30	0.00	0.05	219
Change in decile 2	-1.00	1.00	0.00	0.02	219
Change in decile 3	-1.00	1.00	0.00	0.03	219
Change in decile 4	-1.00	1.00	0.00	0.03	219
Change in decile 5	-1.00	1.00	0.00	0.02	219
Change in decile 6	-1.00	1.00	0.00	0.02	219
Change in decile 7	-1.00	1.00	0.00	0.01	219
Change in decile 8	-1.00	1.00	0.00	0.01	219
Change in decile 9	-1.00	1.00	0.00	-0.02	219
Change in decile 10	-5.90	3.30	-0.10	-0.16	219



## **Statutory minimum wages**

To measure the effect of minimum wages, there is of course a need to include that variable in the models. The measurement that was chosen here is the real statutory minimum wage rates for each country, at any given year. First and foremost, statutory minimum wages was chosen as it is the type of minimum wages where politicians have the most influence, and where the highest amount of employees are covered. But using statutory minimum wages on its own would be misleading, as changes in price levels and living standard would affect the actual level of minimum wages in a country, without being included in the analysis (Verbeek 2012, 297). The statutory minimum wage values have therefore been converted into real minimum wages.

In regards to statutory minimum wages, data from both Eurostat and OECD are available, but the Eurostat data have some issues. The first one is that real statutory minimum wages are not included, which of course makes it less suited to compare across countries and years. The second is that there are no available data before 1999, and that a lot of countries have missing data in the years that are included. There are also some missing observations in the OECD data, but this is more limited when compared to the Eurostat data. The OECD data also covers all years from 1995 to 2015, which is very important for this study. At the same time, the Eurostat data covers fewer countries than the OECD. Based on this, the OECD data were the preferred one, and therefore chosen (OECD 2018a).

There are two measures that are recommended when looking at minimum wages, based on what kind of study one are conducting. When the main focus is to look at cross country effects at one given year, the recommended one is to use the Kaitz index. This measure compares the minimum wage rate to the mean or median wages in a country at any given year. If the median wage in a country is 100 dollar and hour and the minimum wage is 50 dollars, the Kaitz index would be 0.50 (OECD 2018b). If the focus is on differences within a country across different years, it is recommended to real minimum wages. Here, the minimum wage rate is calculated together with the Consumer Price Index (CPI), and afterwards standardized by converting it to US dollars. That there are two different recommendations causes some problems for the choice of data in this thesis. As both cross country and time series data are being used, the best would be to use both the Kaitz index and real minimum wages. But the Kaitz index has a massive problem related to this thesis because it is highly affected by changes in the median/mean wage, and when median wages goes down the income inequality would increase at the same time that

the Kaitz index would indicate that minimum wages are higher compared to the median wage. This would make the results the opposite of what is preferred in this thesis, and the minimum wage rate converted using the Kaitz index was therefore ruled out. Real minimum wages are only affected by changes in the CPI level, and would therefore not have this problem. This results in real minimum wages being used, even though some may argue that the Kaitz index could have been used.

The statutory minimum wages are collected in all OECD countries, and then converted into real minimum wages by calculating it according to the CPI using 2017 as the base year. The real minimum wages are then standardized into US\$ using 2017 Purchasing Power Parities (PPP). Both annual and hourly minimum wages are available, where the annual is created using the other measure multiplied by the statutory work week (OECD 2015, 11). The hourly statutory real minimum wages were chosen to remove the potential effect different statutory work weeks could have on the results. Still, through out the thesis it will mainly be referred to as real minimum wages or statutory minimum wages. Its descriptive statistics are presented in table 4.4.

**Table 4.4: Descriptive statistics for real hourly statutory minimum wages**

	Min	Max	Median	Mean	N
Real hourly statutory minimum wages	0.988	11.220	5.973	6.467	449
Changes in real hourly statutory minimum wages	-0.253	0.984	0.054	0.087	444

### 4.3 Control variables

One of the biggest challenges when working with longitude data is that there might be systematic changes over time that affects the dependent variable (Skog 2004, 76-77). This goes hand in hand with the possibility of confounding factors, where there are unobserved variables that affects the dependent variable (Imai 2017, 372). To eliminate this control variables that are known to affect income inequality is being included in the models. Each of them will be presented in this section, and all of them will be used in all the analyses. All of these variables have also been converted by differing them.

#### **GDP per capita**

Gross Domestic Product (GDP) per capita is used to measure major macro economic changes both within and between countries. It is retrieved from OECD (2019a), and presented as 2010 constant prices in US\$. As with the other variables, this is further recoded into changes in GDP per capita by the author.

#### **Trade**

Trade is measured as total import as a percentage of GDP, a variable derived from the OECD database (OECD 2019b). This is an important variable because trade heavily influence employment. As (Autor, Dorn and Hanson 2016, 37) shows, employment in the U. S. have fallen in sectors that are exposed to import – this is even more important as the effect is even stronger when it comes to low wage workers.

#### **Employment in services**

The service sector is where most of the new jobs for low wage workers is created (Iversen and Wren 1998, 508, 510). When this sector expands, this creates a need for governments to choose between wage equality or higher employment, because it is impossible to achieve both without

causing budgetary restraints (Iversen and Wren 1998). This is clearly important for income inequality in a country and will at the same time affect how many people earning the minimum wage. Employment in services is measured as a percentage of the total work force that works within services, and is gathered from the the International Labour Organizations ILOSTAT database (International Labour Organization 2018).

### **Social expenditure**

There are two measurements that can be used when looking at how much countries spend on social services, social expenditure and de-commodification. The later measures whether one can uphold a sustainable standard of living independent of market participation (Esping-Andersen 1990). This was considered used, but because of lack of data availability it was discarded. Social expenditure, which measures how much that is used on social services within a country, was therefore the best option. This variable can be further narrowed down by selecting which type of expenditure that one wants to use. For the modelling in this thesis the cash benefits were seen as more relevant in comparison to using all social expenditure, in accordance with the expenditure only being public and as a percentage of GDP. This variable is from OECD (2019c), and measure the total amount of public spending on cash benefits.

### **Unemployment**

Because of minimum wages natural effect on people that are employed, and lack of direct effect on the unemployed population, the unemployment rate is also included as a control variable. How minimum wages affect unemployment is also the most discussed topic within the minimum wage literature, and controlling the effect for unemployment rate is therefore crucial. The data is gathered from the International Labour Organization (International Labour Organization 2019), and are measured as the total percentage of the labour force that are not employed. This implies that only people available to seek jobs are included, for example students are not even though they by definition are unemployed.

## **Union density**

Unions are an important factor when discussing inequality, and are known to influence low wage workers through collective bargaining. They are often in favor of compressing the wage levels, and the more people they are bargaining for the less inequality there should be (Kenworthy 2008, 3). Huber, Huo and Stephens (2017) also show that they can affect the share of income that is allocated at the top 1%. Union density is therefore a necessary control variable to include, and is measured as the amount of workers that are in a union as a percentage of wage earners in employment (Visser 2016). It has been gathered from the wisser database, and it is important to note that this is the variable with the most missing values. Other databases were therefore checked, but none of them had a more suiting variable, it was therefore kept as it is seen as highly important for the analysis.

## **Potential control variables not included**

There was also a debate about whether immigration in a country should be included as a control variable in the models. It has been argued in the past that it affects both unemployment and wages in a country negatively (Borjas 2003, 1335), but whether or not this is the case is highly disputed. Ottaviano and Peri (2012, 191) shows that the effect of immigration can be both positive and negative dependent of which estimation technique that is being used, but that it does not have much effect at all. Borjas (2003) agrees with them, arguing that immigration does not affect wages much at all. Based on the variable having limited effect on income inequality it was decided to leave it out. A model should not include all variables that might affect the dependent variable, but only the ones that actually has a significant effect on it (Hsiao 2003, 8). This is also important in order to avoid getting an over fitted model, which can be problematic in several ways (Wooldridge 2016, 184-185; King, Keohane and Verba 1994, 183). The descriptive statistics for all control variables included in the models are presented in table 4.5<sup>12</sup>.

---

<sup>12</sup> The real minimum wage value is also included as a control variable, but its descriptive statistics were shown earlier in the chapter, where the minimum wage data were discussed.

**Table 4.5: Descriptive statistics for the control variables**

	Min	Max	Median	Mean	N
GDP per capita	8019	1000934	26632	29818	449
Changes in GDP per capita	-4385.60	17799.90	1027.10	1121.30	449
Import	21.02	180.20	55.84	56.86	449
Changes in import	-24.54	23.40	0.699	0.950	449
Employment in services	426	2380	1593	1608	441
Changes in employment in services	-257.00	289.00	23.00	30.10	437
Cash benefits	8.801	32.213	20.135	23.209	442
Changes in social expenditures	-4.890	6.411	0.087	0.178	441
Unemployment	1.5	27.5	7.5	8.379	449
Changes in unemployment	-4.4	9.8	-0.1	0.009	439
Union density	6.312	56.350	20.327	23.466	312
Changes in union density	-18.184	3.891	-0.354	-0.608	281

#### 4.4 Chapter summary

In this chapter, the sample and variables used in the models have been presented and discussed. The sample is OECD member countries with statutory minimum wages between 1995 and 2015 for the models that look at the GINI index, and countries that are both member of the OECD and EU/EEA and has statutory minimum wages for the models with the income deciles in focus. The dependent variables is the GINI index and the different income deciles, the main explanatory variable is real minimum wages. The control variables are GDP per capita, import,

employment in the service sector, cash benefits, unemployment and union density. All of these variables have been differentiated, meaning that their lagged value has been subtracted from their value. In table 4.6 the overview of all these variables, and how they are hypothesized to affect income inequality, are listed. All of these expected effects will be tested in the next chapter.

**Table 4.6: Expected effects of the independent variables**

<b>Variables</b>	<b>Source</b>	<b>Hypothesized relationship to the GINI index</b>
<b>Expected effect on the GINI index</b>		
Change in real minimum wages	OECD 2018a	Negative
Real minimum wage value	OECD 2018a	Unknown
GDP per capita	OECD 2019a	Unknown
Import	OECD 2019b	Positive
Employment in services	International Labour Organization 2018	Positive
Cash benefits	OECD 2019c	Negative
Unemployment	International Labour Organization 2019	Positive
Union density	Visser 2016	Negative
<b>Expected effect on decile 1</b>		
Change in real minimum wages	OECD 2018a	Unknown
Real minimum wage value	OECD 2018a	Unknown
GDP per capita	OECD 2019a	Unknown
Import	OECD 2019b	Negative
Employment in services	International Labour Organization 2018	Negative
Cash benefits	OECD 2019c	Positive
Unemployment	ILO 2019	Negative
Union density	Visser 2016	Positive
<b>Expected effect on decile 2-5</b>		

Changes in real minimum wages	OECD 2018a	Positive
Real minimum wage value	OECD 2018a	Unknown
GDP per capita	OECD 2019a	Unknown
Import	OECD 2019b	
Employment in services	International Labour Organization 2018	Negative
Social expenditure	OECD 2019c	Positive
Unemployment	International Labour Organization 2019	Negative
Union density	Visser 2016	Positive
<b>Expected effect on decile 6-10</b>		
Changes in real minimum wages	OECD 2018a	Positive / Negative
Real minimum wage value	OECD 2018a	
GDP per capita	OECD 2019a	Unknown
Import	OECD 2019b	Positive
Employment in services	International Labour Organization 2018	Positive
Social expenditure	OECD 2019c	Negative
Unemployment	International Labour Organization 2019	Positive
Union density	Visser 2016	Negative



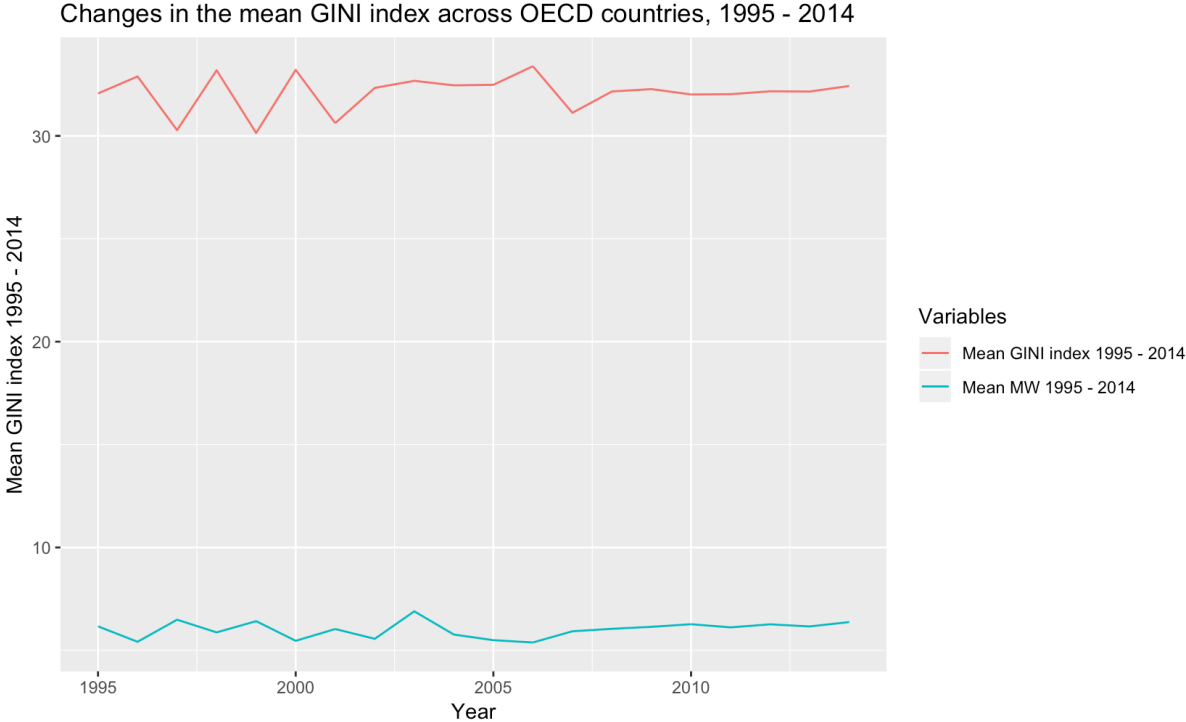
## 5 Analysis and Results

In this chapter, the results from the analyses will be presented. The chapter will begin with a descriptive overview of the relationship between minimum wages and income inequality in the OECD overall and within each of the countries. Afterwards, the TSCS analyses will be presented – first the one including the GINI index followed by the ones looking at the different income deciles. The results will be followed by the robustness tests before the chapter will end with a brief summary.

### 5.1 Minimum wages and income inequality in the OECD

The average development in the GINI index and real statutory minimum wages for all of the included OECD countries combined are presented in figure 5.1. At first glance it is clear that there is more fluctuation in the GINI than the statutory minimum wages, which is not surprising because the GINI is measured on a larger scale. At the same time, the figure does reveal that there is a correlation between the two. In 1996 the overall minimum wage values decrease compared to the year before, and at the same time one can see that the GINI index increase. In the year after, the minimum wage decreases and the GINI increase. This trend, that minimum wages and the GINI are negatively correlated, can be seen for each year until 2002. In 2003 the correlation becomes positive when both real minimum wages and the GINI index increase, while it afterwards moves in the same trend as earlier until 2007. In 2008 and onwards the changes in both of them get smaller and it is hard to see if there is any real correlation. Even though TSCS analysis does not look at the mean value for each year, this is an interesting starting point for the analysis. At least until 2007 there are a clear tendency towards statutory minimum wages and the GINI index moving in opposite ways.

**Figure 5.1: Average change in minimum wages and the GINI index, 1995-2015**



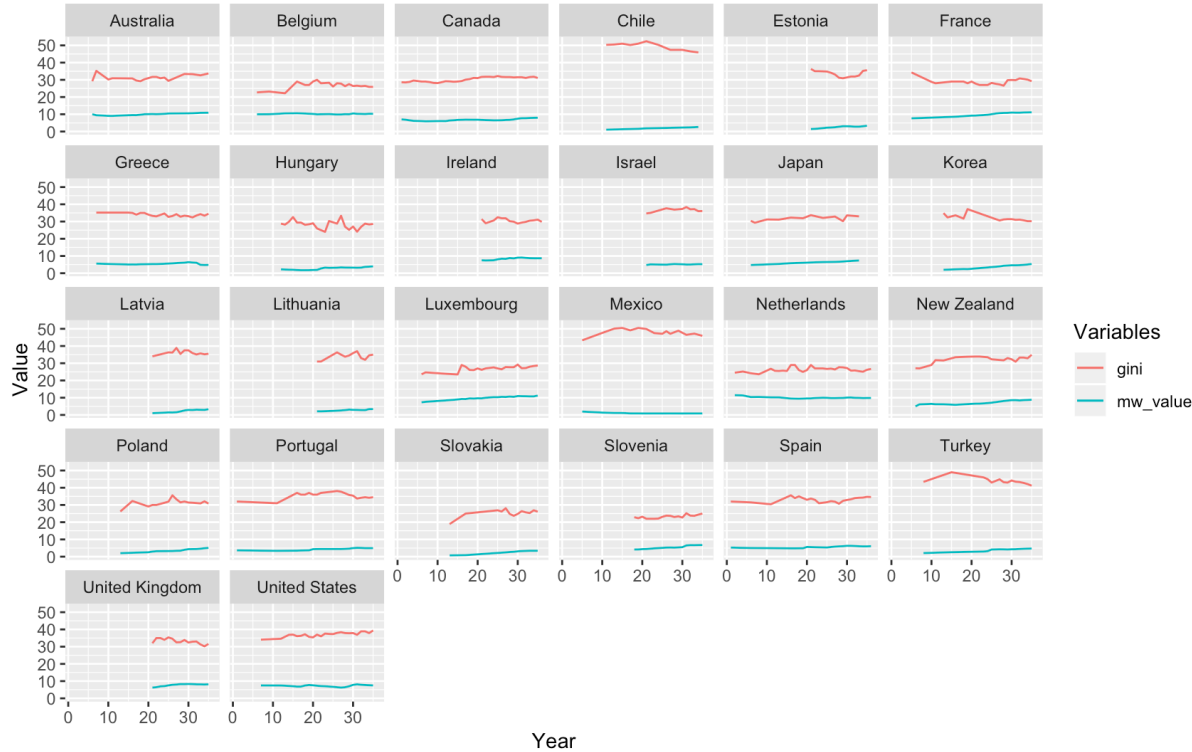
In order to look at this relationship more in detail, figure 5.2 shows the GINI index and real statutory minimum wage level for each of the included OECD countries for the same time period. First and foremost, it is clear that the relationship is not as stable across countries as it might have looked when only focusing on the averages, but the tendency one could see in figure 5.1 still holds for a lot of the countries. In Chile, the overall income inequality between 1995 and 2017 drops, while one can see a small increase in the real minimum wages in the country through out that time. In Estonia, the gap between the real minimum wage and the income inequality narrows down until the real minimum wage goes down and the GINI increases. In France the gap also decreases between 1995 and 2017, but the GINI has a more unstable pattern having multiple small adjustments. In Korea as well the two variables get closer, implying that increased levels of minimum wages are correlated with reduced levels of income inequality, but there is a large jump in the GINI index which can not be seen in the minimum wages. In the Netherlands minimum wages get lower while the GINI increase somewhat, but this correlation is small and it shows the same signs as in France because there is a lot of movement in GINI index. New Zealand has seen a rise in both income inequality and real minimum wages, but the trend can still be seen. In the beginning the minimum wages go down while the GINI goes up, and when one can see a small increase in the minimum wage rate the income inequality goes a

bit down again. Turkey, the United Kingdom and the United States might be the countries where the correlation is the strongest. In Turkey and the UK the real minimum wage have increased in the last 20 years while the income inequality has been going down. In the US the opposite trend is clear, minimum wages have decreased while the GINI has increased.

In the rest of the countries the same overall trend can not be seen by looking at figure 5.2. There are some specific years that match the expected correlation, but at the same time there are others where it does not. However, most of the years that does not fall in line with the expectations do not show the opposite effect either, but rather no correlation between the two. In this descriptive overview it is of course important to keep in mind that none of the control variables are included and that TSCS analysis look at both the effect within a country and between them. The figure supports that a raise in minimum wages are associated with a decline in income inequality.

One can also see that Chile, Mexico and Turkey stand out because they have higher income inequality than the rest of the OECD. They all have values reaching a GINI index of 50 or higher, while non of the other countries have values exceeding 40. This might have an impact on the effect that changes in minimum wages have on income inequality, therefore an analysis without the three countries will be included as a robustness test at the end of the chapter.

**Figure 5.2: Change in minimum wages and the GINI index, 1995-2015**



**5.2 The effects of changes in the real minimum wage on the GINI index<sup>13</sup>**

The correlation between the two variables have been displayed, but is it caused by the changes in real minimum wages? This question will now be answered as the result of the time series cross section analysis will be presented. The hypothesis that are being tested, discussed in section 2.2, is *increasing the real statutory minimum wage will result in an overall decline in growth in income inequality.*

In table 5.1 the results of the TSCS models analyzing the relationship between real minimum wages and the GINI index is presented, here the dependent variable is the change in the GINI index from the year prior and the main independent variable is the corresponding change in real minimum wages. The table is divided into three models, where more control variables get introduced in each of them.

<sup>13</sup> All of the models looking at the effect on the GINI index have the OECD member countries as sample. All analyses are also done using robust estimations (robust standard errors), which will help control for stationarity, autocorrelation and heterosketasticity.

In model 1 only the main independent variable and the dependent is included, changes in real minimum wages have a negative coefficient. This implies that a raise in real minimum wages would make the increase in the GINI index smaller, but the effect is not significant. The number of observations is 405 and all 27 countries have been included. The constant is -0.003, which means that when changes in real minimum wages are at their mean, that is the value of the changes in the GINI index.<sup>14</sup> The R2 and adjusted R2 are very small, which means that changes in real minimum wages does not affect the changes in the GINI index much, if any at all. In addition, Akaike's Information Criterion (AIC) and Schwarz Bayesian Information Criterion (BIC) are also presented. They measure the goodness of fit, and the models with the lowest value is preferred. Both of them add a penalty as the models get larger, but this is done even stronger by the BIC (Verbeek 2012, 66-67). AIC has the value of 1539, while BIC is 1552.

In model 2 the economic control variables are also included. When they are included, the negative effect of changes in real minimum wages on the GINI index becomes stronger negative, but so does the standard error. The variable is still insignificant. Change in GDP has a small negative effect on the GINI index, a result that is not significant. Changes in unemployment also has a negative coefficient, but this is not significant either. Both change in import and change in people employed in the service sector has positive coefficients, but neither of them are significant. Both the total number of observations and countries included are the same as in model 1. The constant is -0.17, which will be the change in GINI when all other variables are at their mean, and this is not significant. R2 increases a little bit to 0.01, implying that the included variables contribute to 1% of the change in the GINI index. When looking at the adjusted R2, which take into account the size of the model, the result is still the same at zero. Both AIC and BIC increases a little to respectively 1579 and 1611. This implies that the explanatory power of the model has been reduced.

In the third model the political control variables are also included, which makes this the full model. This model is chosen as the preferred one because of the large increase in R2, adjusted R2, AIC and BIC, and because it has all the variables that has been recommended in the theory included. R2 are in this model 0.9 and adjusted R2 are 0.6, this is still quite small saying that the model only explains 6% of the change in the GINI index, but this is still in line with the

---

<sup>14</sup> As stated in the methods section, all variables have been mean adjusted.

expectations as one does not believe that changes in income inequality are created by minimum wage changes, but rather that it has some small effect on it. Still, it is quite surprising that it is such a low value as it does not correspond well with the results found in the rest of the literature. AIC is now at 1000 while BIC is 1039, this is a dramatic decrease compared to the two previous models and implies that the models explanatory power is strengthened. It is also important to note that the number of observations drops dramatically to 253 and that three countries get removed completely from the model. This is largely because of the change in union density control variable, which has a high number of missing values. There are especially many missing values for the US, Hungary and Israel – which therefore are removed completely<sup>15</sup>. Nevertheless, this variable is of such importance that it is important to keep it in the model, which can be seen from it being one of two variables with significant effect. In this model the negative coefficient of changes in real minimum wages increase substantially to -0.753, implying that increasing it would reduce the growth in income inequality, but the effect is still not significant. The newly included variable real minimum wage value have a positive effect, but are not significant either. The same is also true for change in import and change in employment in the service sector. Change in GDP per capita and change in social expenditure as cash benefits has a negative effect in this model, but only the GDP variable is significant. According to this, growth in GDP per capita will decrease the GINI index. This is quite surprising as one would not suspect economic growth to increase the income inequality, but it might be because most of the economic growth a country has goes to the richest part of the population. Change in union density also has a negative effect on changes in the GINI – this is in line with the theoretical expectations that the income inequality will decline when more people join labor market unions. The constant is -0.008 and not significant, which implies that one cannot be sure whether changes in the GINI index would be positive or negative when all other variables are at their mean.

---

<sup>15</sup> An analysis looking at the effect without the union density variable has been included as a robustness test.

**Table 5.1: Regression results, changes in real minimum wages on changes in the GINI index**

	<b>Model 1</b>	<b>Model 2</b>	<b>Model 3</b>
	<b>real minimum wages and GINI index</b>	<b>Including economic control</b>	<b>Including political control</b>
Changes in real minimum wages	-0.335 (0.356)	-0.382 (0.359)	-0.753 (0.571)
Real minimum wages	-	-	0.025 (0.026)
Change in GDP per capita	-	-0.0001 (0.0001)	-0.0002** (0.0001)
Change in import	-	0.001 (0.021)	0.014 (0.027)
Change in employment in the service sector	-	0.002 (0.001)	0.002 (0.002)
Change in social expenditure	-	-	-0.055 (0.185)
Change in unemployment rate	-	-0.17 (0.037)	0.109 (0.071)
Change in union density	-	-	-0.381** (0.155)
Constant	-0.0003 (0.044)	-0.002 (0.047)	-0.008 (0.0.60)
<b>Statistics</b>			
N	405	405	253
Countries	27	27	24
R2	0.002	0.01	0.09
Adjusted R2	0.00	0.00	0.07
AIC	1539.691	1579.37	1000.553
BIC	1552.707	1611.401	1039.421

*Note: Significant p-values \*=0,1, \*\*=0,5, \*\*\*=0,01. Dependent variable: Change in GINI index between two years. The presented values are the mean adjusted coefficients using robust estimation, the standard errors are shown in the brackets. Source: UNU-WIDER (2018a);*

*OECD (2018a); OECD (2019a); OECD 2019b; International Labour Organization (2018); International Labour Organization (2019); Visser (2016).*

### 5.3 What effect does changes in minimum wages have in comparison to the other variables?

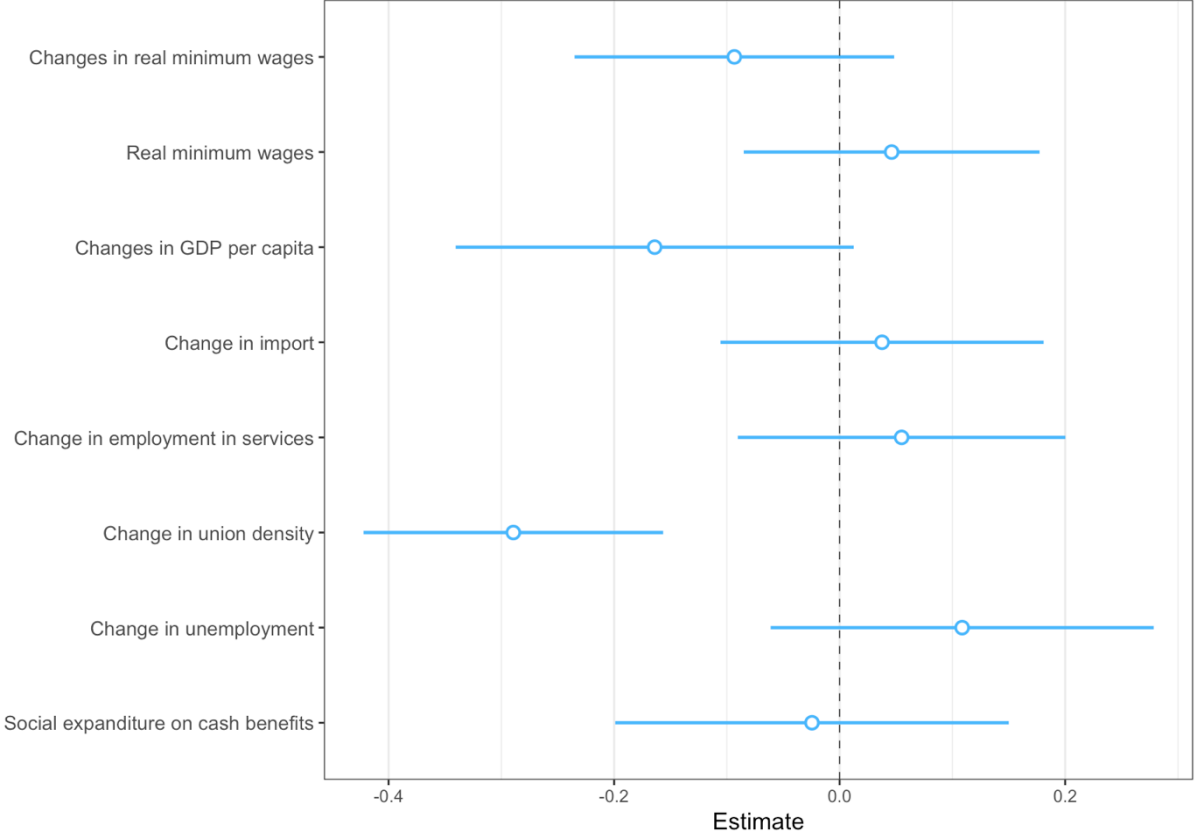
From the results above it is clear that changes in minimum wages does not have a significant effect on changes in GINI even though the coefficients were. From the analysis it looks like the effect of the minimum wage is much stronger than the effect of the other variables, but because they are measured on different scales this is not certain. The standardized coefficients will therefore be presented here, they are made in the traditional way by subtracting the mean from all the values and dividing them by the standard deviation. By doing this, the coefficients of the different variables can be compared, while the significance level will stay the same.

The results of the final model when using the standardized coefficients are presented in Figure 5.3. The placement of the circle indicates the strength of the effect – the further away it is from zero the stronger the effect is. The horizontal line indicates the 95% confidence interval, which means that the effect has a 95% chance to be within its borders. If this line crosses zero, one can not say for certain whether the effect is positive or negative, and thus it is not significant. In regard to this, it is important to note that the 95% coefficient intervals correspond to having a p-value of 0.05, and that is the reason why changes in GDP per capita is no longer significant. It clearly shows that changes in minimum wages does not have as strong effect compared to the others as one could expect from the first models, it is actually only the fourth strongest. The single variable that has the strongest effect is change in union density, which also is the only one that is significant at 5%. As mentioned above, union density to have a reducing effect on income inequality is not surprising, but it was not expected to be of such strength. This might be because people joining unions becomes a part of the work agreements right away, and that they therefore immediately get more income. The second strongest effect on income inequality is the economic growth, measured as change in GDP per capita, which at the same time is the only other variable that have a significant effect. That this variable has one of the strongest effect in regards to income inequality is still surprising. Unemployment changes is the third strongest with a little more than a third of the effect registered by changes in union density. The



rest of the variables only have small standardized coefficients, and none of them are significant. Even though the results show that the effect of minimum wages is insignificant, and that quite a few of the other variables have more influence on changes in income inequality they still show that the effect of changes in minimum wages is higher than many other variables that have been argued to be important for income inequality. This indicates that policy makers might be more successful in decreasing the growth in income inequality if they focus on minimum wages instead of reducing import and increase social expenditure on cash benefits. At the same time, it looks like they would have even more success if they instead focus on increasing the union density.

**Figure 5.3: Coefficient plot using standardized variables**



*Note: dependent variable is changes in the GINI index. The presented values are the standardized coefficients using robust estimation.*

The results are interesting, changes in real minimum wages does have the expected coefficient which suggests that a raise in it will reduce the growth in income inequality. But the findings cannot be generalized because of them being insignificant. One can also see that the change in union density is in line with the theoretical expectations. The same can be said for Change in import, change in employment in the service sector and change in unemployment. When they increase, all of them have a positive effect on changes in the GINI, unlike changes in union density their effect is not significant and their effect is therefore not certain. The actual minimum wage value is interesting as the results show that higher rates of real minimum wages would produce a higher growth in income inequality. Even though this effect is not significant, it goes against most of the earlier research which finds that higher minimum wages decreases the inequality. According to these results the first hypothesis have to be rejected, as a raise in real minimum wages having a reducing effect on the growth in income inequality can not be confirmed. Still, the coefficients are in line with the expectations, and one might be able to find an effect when looking at it more in detail which will be done when analyzing the effect on the income deciles.

#### 5.4 Interaction effect

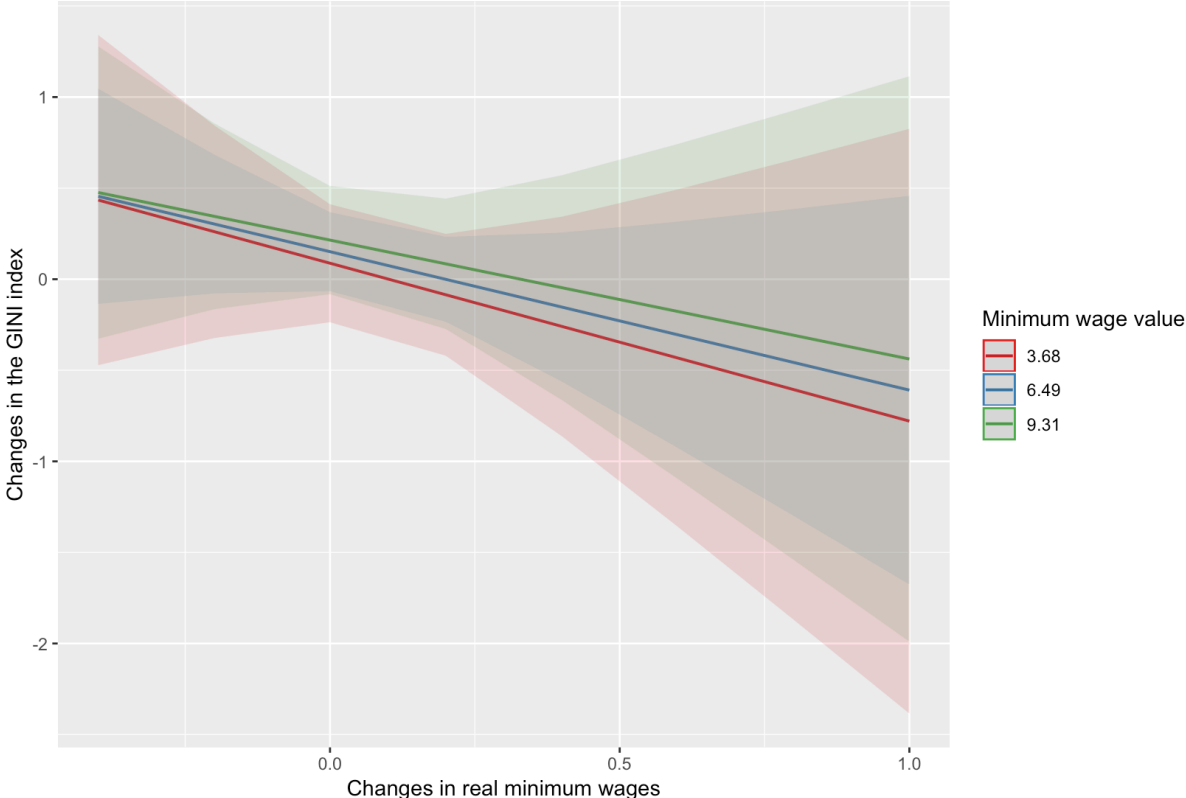
As stated above, changes in real minimum wages had a negative effect while the real minimum wage value itself had a positive in regards to changes in the GINI, and none of them were significant. This is interesting when looking at hypothesis 5, *Increasing the real statutory minimum wage will have a lower reducing effect on income inequality when the minimum wage rate is higher*, because it supports the idea that positive changes in minimum wages reduce income inequality, while the value itself does not. This is based on the part of the employment literature where it is argued that small minimum wages might not cause a jump in unemployment, but that higher minimum wages will. The result of the model including the interaction effect is shown in figure 5.4. Here, the different effect changes in minimum wages have on income inequality at three different minimum wage values are included. The three different values are based on the median (6.49), median with one standard deviation subtracted (3.68) and median with one standard deviation added (9.31)<sup>16</sup>.

---

<sup>16</sup> The same trend can be seen if more minimum wage values are included in the graph, but this was not done because it makes it harder to distinguish between them, and that using the median +/- one standard deviation shows most of the variation in the data.

The figure clearly shows that the reduction changes in minimum wages have on changes in the GINI index get smaller as the minimum wage value increases. On the other hand, the confidence intervals clearly show that this effect is not significant. Because of that hypothesis 5 also have to be rejected, as the models were not able to confirm that higher minimum wage values made changes in minimum wages have more effect. The findings presented here is still very interesting, especially combined with the knowledge that higher minimum wage values in itself has a positive correlation with growth in income inequality. They show that higher values in itself might increase income inequality and at the same time lowered the effect of increasing the minimum wage. Still, even though the figure supports the hypothesis it cannot be confirmed as the confidence intervals are overlapping.

**Figure 5.4: Interaction plot of the relationship between minimum wage value and changes in minimum wages on income inequality**



*Note: The dependent variable is changes in the GINI index. Analysis conducted using robust estimations.*

## 5.5 The effect of minimum wage changes on income deciles

From looking at the effect changes in minimum wages have on the GINI index it is clear that a relationship between the two cannot be confirmed, but is it possible to understand why this is the case by looking at the effect minimum wages have on the income share of the specific income deciles? By doing this, one can also examine whether minimum wages have an effect on the different income deciles, as it is proposed in the existing literature. This will be looked at in this part of the thesis, when the effect of changes in minimum wages on changes in income share of the different income deciles will be explored. The hypothesis that are being tested, which were presented in section 2.2, are listed in table 5.2.

**Table 5.2: Hypotheses being tested**

Hypothesis 2	Increasing the real statutory minimum wage will result in an increase in the percentage of income earned by people with beneath average income
Hypothesis 3	Increasing the real statutory minimum wage will result in a decrease in the percentage of income earned by people with above average income
Hypothesis 4	Increasing the real statutory minimum wage will not increase the income earned by the group with the the 10% lowest income as much as the other groups having incomes below average

Ten TSCS analyses were conducted in order to test these hypotheses. All variables were held constant through out them all, except the dependent. These changed between the different income deciles in all the analyses. The results from the analyses are presented in figure 5.5 and 5.6<sup>17</sup>. These results have been standardized using the same technique as in the model presented in figure 5.3, and it is important to note that the total number of observations in these models have been reduced to 152 because of the smaller sample that are included<sup>18</sup>. The first figure show how changes in real minimum wages affect the amount of income received for the households with the 50% lowest income in any given country, this is further split into five separate groups which each account for ten percentages. The second figure show the same results for the 50% with the highest income. As an example, decile 1 is the income share of the

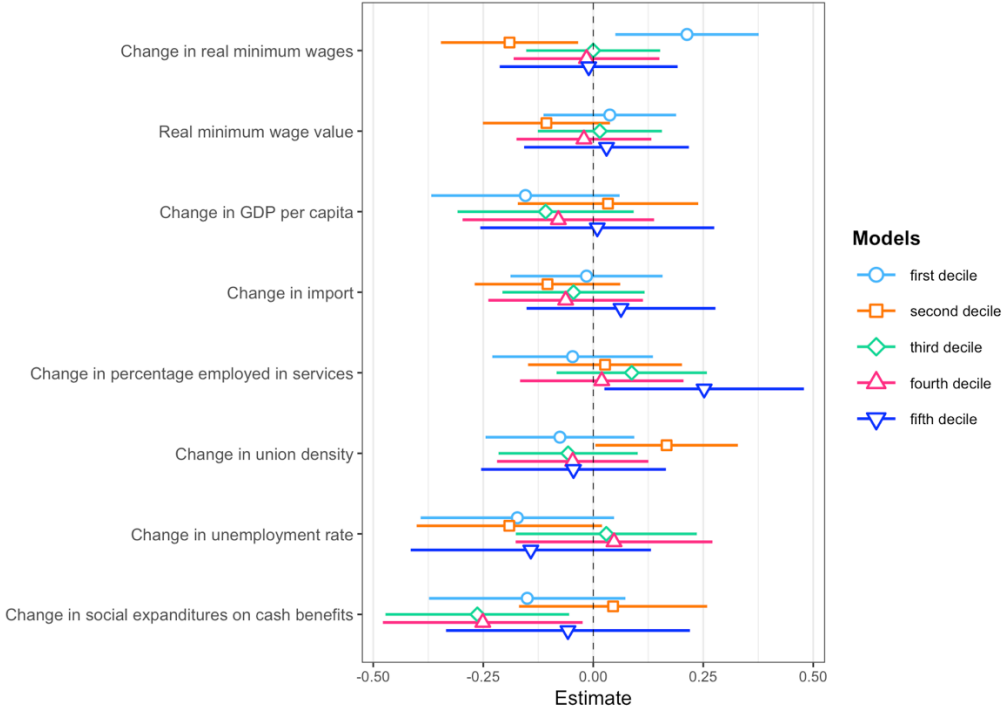
<sup>17</sup> The regression tables are attached in the appendix A through J.

<sup>18</sup> The sample covered in the models presented in this part only covers the European OECD countries because of lack of data on income deciles. This is explained more in detail in section 4.3.

ten percentage with the lowest income, while decile 10 is the income share of the richest ten percentages in a country.

Based on the theoretical perspective and earlier research that were presented in chapter 2, the expectation is that the income received by the lowest 50% would increase, while the income for the richest 50% would decrease – as stated in hypothesis 2 and 3. Further, because many of them are unemployed, the expectation is that minimum wages would not increase the income of the poorest decile as much as the other – developed in hypothesis 4. In regards to hypothesis 2, the results for the first decile are in line with the expectations, an increase in real minimum wages significantly increase the amount of income earned by the poorest 10%. The second decile on the other hand, receives a smaller raise in income received when minimum wages get increased, which is not in accordance with the expectations. For the third, fourth and fifth decile minimum wage raises does not have much effect at all, and none of them are significant. While the third one is approximately at zero, an increase in minimum wages actually has a small negative relationship to the fourth and fifth decile. This might indicate that these two groups do not receive minimum wages, and that their wages are somewhat pulled down towards the ones that receives it. Even though minimum wages do increase the wages for the poorest decile, the results overall do not support the second hypothesis. As for the fourth hypothesis, the effect changes in minimum wages had on the first decile is quite contradictorily compared to the expected effect. It does not look like minimum wage changes have any less effect on the poorest ten percentages, but quite the opposite.

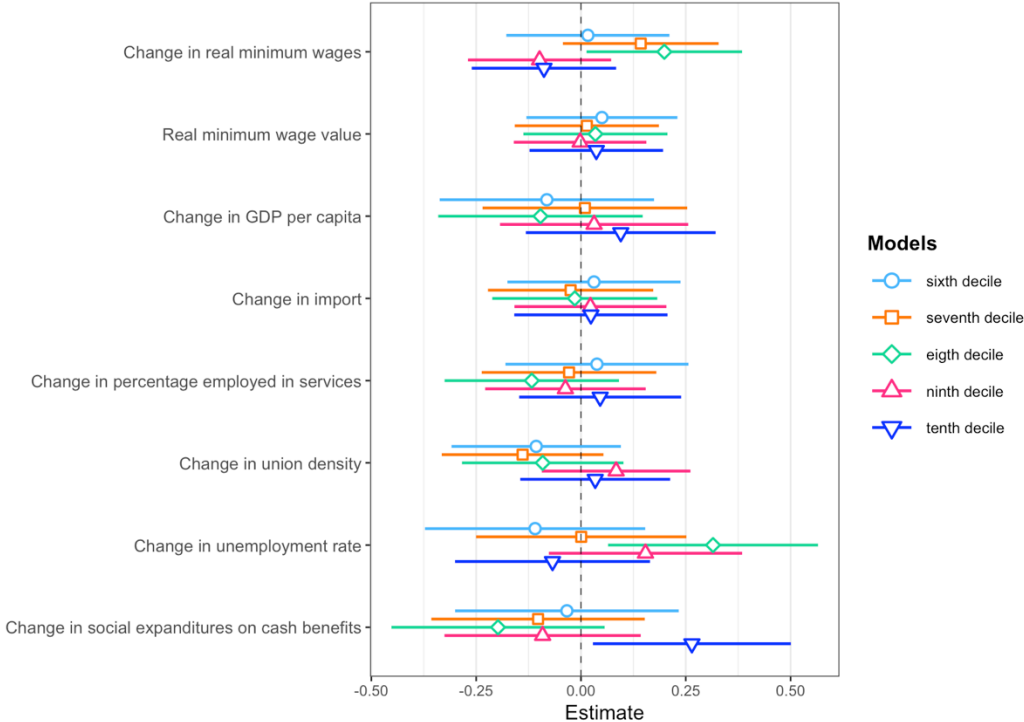
**Figure 5.5: Coefficient plot of the effect of minimum wages on the 50% poorest**



*Note: The dependent variables are the ones that are highlighted in the figure, ranging decile 1 – decile 5. The presented values are the coefficients using robust estimation, the standard errors are shown in the brackets.*

Figure 5.6 reveals that the amount of income earned by the sixth, seventh and eighth decile increase when real minimum wages increase. This is not in line with the hypothesis, but might indicate that there is a ripple effect in place. Also, these groups might not be rich enough to be employers, and would therefore not be negatively affected by a raise in the minimum wage. On the other hand, an increase in wages received by the poorer might increase their wages as well, through a ripple effect. For the sixth and seventh decile this effect is not significant, but it is for the eighth. This can also be because of people living with a richer spouse or their parents fall into this decile, and therefore supports the argument that minimum wages are not necessarily given to those that actually need it. The effect on the two last deciles are not significant either, but the coefficients are in line with the expectations in hypothesis 3 – an increase in real minimum wages would result in a decrease, or smaller increase, in their income. This indicates that these two groups are the only ones that have high enough income to have people employed or to own stocks in firms.

**Figure 5.6: Coefficient plot of the effect of minimum wages on the 50% richest**



*Note: The dependent variables are the ones that are highlighted in the figure, ranging decile 6 – decile 10. The presented values are the coefficients using robust estimation, the standard errors are shown in the brackets.*

Overall there are some very interesting findings. When looking at the significant effects, it clearly shows that minimum wages helps the poorest people, but at the same time pulls the wages of the ones earning just above the minimum wage downwards. It also increases the income of the eight decentile, which are in line with the arguments being made about people receiving minimum wages even though they are not poor.

If one focus on both the significant and insignificant results, there are also some interesting trends in regards to both hypothesis 2 and 3. The effect on the poorest and the two richest deciles are in line with hypothesis 2 and. The third to sixth decile does not see much change, which is not unexpected either – this might be because they are too rich to receive minimum wages and/or that the ripple effect counteract the eventual negative effect minimum wages would have on them. On the other hand, changes in minimum wages on the second, seventh and eighth decile are surprising – it would reduce the second deciles income and increase it for the two other. This is not in line with the expectations, but can at the same time be explained. The decrease in

second deciles income might be because of an increase in unemployment, even though this would be very surprising in light of the most recent empirical findings. It is then also strange that this does not effect the poorest decile, but it might be because a high number of them already are unemployed. The increase that the seventh and eighth decile see might be explained by the ripple effect, or that an income increase for this group is a trend that are countered by the higher wages that decile 9 and 10 have to pay out.

Finally, if one looks at minimum wages effect on all of the different income deciles it shows why an effect was not found. First and foremost, the deciles where minimum wages have a significant effect is split – there are one that would reduce income inequality, while there are two that would increase it. In addition to this there are a lot of insignificant effects, and the coefficient of the minimum wage point in both directions here as well. This show, at least to some degree, why an overall effect could not be found.

As for the control variables, the effect of them on the different income deciles are also mixed. The minimum wage value has a positive coefficient in regards to all of the top 50% income groups, while it has a more varying effect on the poorest 50%, non of them are significant. This might explain some of the surprising negative effect it had on overall income inequality because it mainly increases the income of the richest. Change in GDP per capita has a more negative than positive effect on both the richest and poorest, but this effect seems to be weaker when looking at the 20% with the highest income. As there were no theoretical expectations in regards to this variable this is not surprising, but it seems strange when compared to the significant negative effect it had on changes in overall income inequality. Import on the other hand is as the theory states – it reduces the income growth of the poorest, while it increases it for the households with the highest income. The effect is not significant on any of the deciles, but the trend is as one would believe. Change in employment in the service sector does have an overall positive effect on the groups with below half of the income and an overall negative effect on the richest. This is not expected, as it both is the opposite of the findings when looking at the overall income inequality in the OECD and the existing literature. Then again, this effect is only significant when looking at decile 5 which might be the case because it is in the middle of the distribution. Union density had the strongest effect of all the variables on the overall income inequality, but it is not easy to see the same effect on the different deciles. Here, it has a reducing effect on all the deciles except the second, ninth and tenth. The only significant coefficient is the positive on the second decile, which might explain some of the overall negative effect it has



on income inequality, but a lot of the other effects it has is harder to explain. The second to last control variable, change in unemployment, is more in line with what the theory states. It has quite a strong negative effect on decile one, two and five and almost no effect on decile three and four. At the same time, it has more mixed effect on the richest 50% of the population. These results are similar to the one found in the TSCS analysis looking at the GINI index, where a raise in unemployment rate would increase income inequality. This is also in line with the theoretical perspectives, because people with low wages and that are low skilled will be more heavily affected by unemployment. The last control variable, change in social expenditure on cash benefits, looks to have an overall negative effect on most of the income deciles, and this is even significant for the third and fourth. The exceptions to this is the second and tenth decile, where the relationship is positive. One would expect this variable to decrease income inequality, but the trends found here does not support this.

## 5.6 Robustness tests

In order to test the robustness of the results, several analyses were conducted with some changes to the modelling. This will be done on the models looking at the overall effect, because it is the main one. The robustness tests are a FE model, a model where the outliers are removed, and a model where the missing values of the control variables have been imputed. They are presented in this order.

### **FE model**

The fixed effect model is made using both time and unit fixed effects, so called two-way. The models, using both mean adjusted and standardized coefficients, are presented in table 5.3. The main variable of interest, changes in real minimum wages, stays approximately the same. The coefficient is still negative, implying that a raise in it would reduce income inequality. It is not significant in these models either, which also is in line with the ones where random effects were applied. The main difference to this variable is that the standard errors increase substantially in comparison the coefficient itself. The real minimum wage value changes its sign from positive to negative when using fixed effect, but stays insignificant. Changes in GDP per capita on the

other hand, stays the same in terms of having a negative coefficient, but it also loses its significance level. Change in import is the second variable where one sees a change in the sign, similar to real minimum wage value it goes from positive to negative and stays insignificant. The results regarding change in employment in the service sector and change in social expenditure as cash benefits are in line with the earlier findings, both of them keep the same sign and significance level. In regards to the two variables that had the strongest effect on changes in the GINI index, change in union density and change in unemployment, they also keep their sign and relative strength compared to the. The only main difference here is that change in unemployment goes from being non significant to being significant with a p-value beneath 0.05. The statistics are also similar, with the only difference being that the adjusted R2 becomes even lower<sup>19</sup>. All in all, this first robustness test shows that the most important variables stay the same, while there are only minor changes to some control variables that are not significant, and changes in significance level of two other. Because the main variables keep the same effect, this robustness test strengthens the analysis.

**Table 5.3: Regression results using two-way fixed effect**

<b>Variable</b>	<b>Model 3 using mean adjusted variables</b>		<b>Model 3 using standardized variables</b>	
Changes in real minimum wages	-0.277	(0.590)	-0.034	(0.073)
Real minimum wage value	-0.004	(0.227)	-0.007	(0.413)
Changes in GDP per capita	-0.00002	(0.0001)	-0.018	(0.064)
Change in import	-0.012	(0.041)	-0.32	(0.109)
Change in employment in the service sector	0.001	(0.002)	0.038	(0.061)
Change in union density	-0.288**	(0.132)	-0.219**	(0.101)
Change in unemployment	0.160*	(0.082)	0.160*	(0.082)
Change in social expenditure as cash benefits	0.010	(0.188)	0.005	(0.084)
<b>Statistics</b>				
N	253		253	

<sup>19</sup> This is not surprising when fixed effects removes degrees of freedom from the models.

Countries	24	24
R2	0.06	0.06
Adjusted R2	0.00	0.00
AIC		
BIC		

*Note: Significant p-values \*=0,1, \*\*=0,5, \*\*\*=0,01. Dependent variable: Change in GINI index between two years. The presented values are the mean adjusted and the standardized coefficients using robust estimation, the standard errors are shown in the brackets. Source: UNU\_WIDER (2018a); OECD (2018a); OECD (2019a); OECD 2019b; International Labour Organization (2018); International Labour Organization (2019); Visser (2016).*

### Removing outliers

As pointed out in the beginning of the chapter, Mexico, Turkey and Chile were outliers in regards to their score on the GINI index<sup>20</sup>. As outliers are considered one of the main challenges one face when using random effects, an analysis were they were removed were conducted, and the results are presented in table 5.4. As one can see, the results are quite similar to the ones in the main model were the outliers were included. All variables keep the same significance level, and the only differences one can see from the original analysis is small changes in the coefficients. Because it is so similar it is clear that the outliers did not affect the models significantly, and that there therefore was not any reason to remove them. This results strengthen the robustness of the analysis.

**Table 5.4: Regression results with the outliers removed**

<b>Variable</b>	<b>Model 3 using mean adjusted variables</b>		<b>Model 3 using standardized variables</b>	
Changes in real minimum wages	-0.836	(0.573)	-0.104	(0.071)
Real minimum wage value	0.003	(0.025)	0.005	(0.045)

<sup>20</sup> These countries are by default not included in the decile analysis, because they are not a part of the EU or the ETA.

Changes in GDP per capita	-0.0002*	(0.0001)	-0.139*	(0.064)
Change in import	0.013	(0.028)	0.013	(0.028)
Change in employment in the service sector	0.001	(0.002)	0.034	(0.060)
Change in union density	-0.361**	(0.155)	-0.274**	(0.1118)
Change in unemployment	0.114	(0.073)	0.114	(0.073)
Change in social expenditure as cash benefits	-0.012	(0.186)	-0.005	(0.083)
Constant	0.032	(0.056)	0.020	(0.035)
<b>Statistics</b>				
N	244		244	
Countries	22		22	
R2	0.09		0.09	
Adjusted R2	0.06		0.06	
AIC				
BIC				

*Note: Significant p-values \*=0,1, \*\*=0,5, \*\*\*=0,01. Dependent variable: Change in GINI index between two years. The presented values are the mean adjusted and the standardized coefficients using robust estimation, the standard errors are shown in the brackets. Source: UNU\_WIDER (2018a); OECD (2018a); OECD (2019a); OECD 2019b; International Labour Organization (2018); International Labour Organization (2019); Visser (2016).*

### **Imputed variables**

Because of the amount of missing values in the dataset there were also conducted an analysis using imputed data, all other estimation techniques were kept the same as in the original model. Because the missing values recorded in the variable measuring changes in minimum wages mainly are because the countries have not introduced it yet this was not imputed. All other variables were, this includes the GINI index and all control variables. The technique used is multiple imputation<sup>21</sup>. The results are presented in the table below. This is the robustness test which cause the most changes on the regression result. The main explanatory variable, changes

<sup>21</sup> This was done using the R-package "MICE".

in real minimum wages keeps its negative coefficient, but it becomes smaller, it is still insignificant. As for the control variables, both change in import and change in unemployment becomes significant. Import has a reducing effect on income inequality, while unemployment increases it. The two other variables that see important changes is change in union density and change in GDP per capita – they both lose their significance. When using imputed values, the number of observations of course increases a lot to 403, but the R2 and adjusted R2 actually becomes smaller. Still, this does criticize some of the findings, but it does not challenge that changes in real minimum wages have an insignificant effect.

**Table 5.5: Regression results with missing values imputed**

<b>Variable</b>	<b>Model 3 using mean adjusted variables</b>		<b>Model 3 using standardized variables</b>	
Changes in real minimum wages	-0.216	(0.351)	-0.028	(0.045)
Real minimum wage value	0.015	(0.019)	0.028	(0.035)
Changes in GDP per capita	-0.00001	(0.001)	-0.011	(0.082)
Change in import	-0.026*	(0.015)	-0.073*	(0.043)
Change in employment in the service sector	-0.003	(0.002)	-0.137	(0.078)
Change in union density	-0.022	(0.024)	-0.072	(0.077)
Change in unemployment	0.152**	(0.065)	0.172**	(0.074)
Change in social expenditure as cash benefits	-0.101	(0.133)	-0.057	(0.074)
Constant	-0.001	(0.041)	-0.0003	(0.013)
<b>Statistics</b>				
N	403		403	
Countries	27		27	
R2	0.05		0.05	
Adjusted R2	0.03		0.03	

*Note: Significant p-values \*=0,1, \*\*=0,5, \*\*\*=0,01. Dependent variable: Change in GINI index between two years. The presented values are the mean adjusted and the standardized coefficients using robust estimation, the standard errors are shown in the brackets. Source:*

*UNU\_WIDER (2018a); OECD (2018a); OECD (2019a); OECD 2019b; International Labour Organization (2018); International Labour Organization (2019); Visser (2016).*

## 5.7 Chapter summary

In this chapter the TSCS analyses estimating the effect of minimum wages on income inequality and the income share of different deciles within the income distribution has been presented. In addition, the descriptive overview of the correlation between minimum wages and income inequality were also shown. Five hypotheses were tested, and the results for each of them are summarized below.

Hypothesis 1, *Increasing the real statutory minimum wage will result in an overall decline in the growth in income inequality*, could not be confirmed as the effect of changes in real minimum wages on the GINI index was not significant. Still, the coefficient pointed to a reducing effect.

Hypothesis 2, *Increasing the real statutory minimum wage will result in an increase in the percentage of income earned by people with beneath average income*, could not not be confirmed either. The first decile had a significant effect in accordance with the expectations, but the effect on the second decile was the opposite. Changing real minimum wages did not have a significant effect on the other income deciles.

Hypothesis 3, *Increasing the real statutory minimum wage will result in a decrease in the percentage of income earned by people with above average income*. The only significant effect minimum wage had on the 50% richest was that it increased the income earned by the eight decile. This is not in line with the expectation, and it had no significant effect on the other deciles.

Hypothesis 4, *Increasing the real statutory minimum wage will not increase the income earned by the group with the the 10% lowest income as much as the other groups having incomes below average*, could not be confirmed either. The results was quite the opposite, where the lowest earners had a significant increase in income earned when real minimum wages was raised.

When minimum wages was increased, it either reduced or had no significant effect the income of the other groups earning below average.

In regards to hypothesis 5, *Increasing the real statutory minimum wage will have a lower reducing effect on income inequality when the minimum wage rate is high*, the result is the same. Even though the coefficient pointed towards it being right, the effect was not significant.

Even though none of the hypotheses could be confirmed, there is still a lot of important findings to discuss – both in regards to the hypotheses and the other theoretical perspectives that were presented in the chapter 2. This discussion will find place in the next chapter.

## 6 Discussion

Overall, this thesis presents some interesting results. Some results are in line with expectations made based on previous research and academic literature, and some results challenge those expectations. In regards to the effect changes in minimum wages had on the overall income inequality, the results show that a relationship between the two cannot be confirmed. When real minimum wages are increased, growth in inequality is not reduced. This contrasts the existing literature, where the majority of recent empirical studies find minimum wages to have a reducing effect on income inequality. This also implies that the results do not support the expectation in this thesis either, presented in hypothesis 1, where a raise in minimum wages was thought to raise the income of the ones earning below average while reducing it for the richest 50 percent. Combined, this was expected to result in a decrease in growth in income inequality.

There can be several reasons behind this unexpected result. First, the effect of minimum wages might not be stable in different areas of the world. Most of the existing literature either has developing countries or the United States as their sample, and there can be differences between those countries and advanced democracies, which make minimum wages less effective in the later. The majority of the existing empirical literature also based their findings on case studies, and there is a possibility that national differences have an impact on the effect of minimum wages, and that it therefore is difficult to find a significant effect when studying large groups of countries. This is in line with the argument made by Marginean and Chenic (2013, 101). They advice research on minimum wages to be conducted independently for each country, because of the cross country differences.

Based on this, it can be argued that minimum wages do not have the same effect in advanced democracies as it has in less developed countries, even though the results cannot confirm this either. It might also be that the effect of minimum wages is too unstable across countries to find a relationship when conducting a cross country analysis. No matter what the reason is, these results suggest that policy makers in advanced democracies should be hesitant when looking to research done on other countries than their own when arguing that minimum wages will reduce income inequality.



## 6.1 How does minimum wages affect the poorest half?

In addition to studying the overall effect, there was also conducted analyses looking at the effect minimum wages has on the income share of different groups in the income distribution (deciles). The results from these analyses both reveal some interesting findings, and provide an explanation to why an overall relationship between changes in minimum wages and growth in income inequality could not be established.

As for hypothesis 2, which stated that an increase in real minimum wages should increase the amount of income earned by the poorest 50% in a country, the results showed that this is not the case. Or at least, the relationship between the two could not be confirmed. Most of the deciles did not get significantly affected by changes in minimum wages, and the effect on the second decile, which were significant, was opposite of the expectation. Still, increasing minimum wages did have a significant effect in increasing the growth in the income earned by the poorest 10%, which is in line with the expectations in hypothesis 2. According to this, only the poorest people within a country actually benefit from it. This result also goes against hypothesis 5, where the argument was that because of being unemployed the poorest people would not receive as much help from minimum wages as others. However, as mentioned in the theory chapter, this is not that surprising as this hypothesis was the most uncertain.

The surprising result is that an increase in minimum wages reduced the income earned by the second poorest decile, which goes against both the literature regarding the direct effect of minimum wages, and the ripple effect. Still, these results are in line with Shelkova's (2014) findings. She argues that minimum wages increase the income of those who receives it, but that it reduces the wages of people earning just above it. Since increasing the minimum wage only helped the poorest 10%, it would therefore pull the income earned by the second poorest 10% down. This is an unexpected finding, as it is one of the least recognized effects regarding the consequences of minimum wages this effect might be stronger in advanced democracies compared to other areas of the world where minimum wages have been studied more extensively.

## 6.2 The implications of minimum wages on the richest

In regards to The effect of minimum wages on the income share of the top 50 % in the income distribution, most of the, most of the results were insignificant. Still, one finding was statistically significant, and very interesting. When minimum wages get increased, this results in the eight income decile receiving more of the total income share. This is not in line with the theoretical expectation, presented in hypothesis 3, but at the same time it fits with another one of the arguments that were discussed in the theory chapter. Namely, whether or not minimum wages are given to those that are in actual need of it. It was argued that quite a substantial part of minimum wages is given to people living with a richer spouse, or their parents. Because income is measured at the household level, increasing minimum wages for people that live together with someone that has high income would actually increase income inequality even though they might have a low income themselves. This can explain what is happening with the eight richest decile, namely that minimum wages increase their income because low and high wage earners are living together. Even though this was not hypothesized, because of being a disputed topic in the literature, who receives minimum wages was put forward as an important factor in regards to whether or not increasing them would reduce income inequality.

Even though the results of the analyses looking at the effect changes in minimum wages has on the income share of the different income deciles was not in line with expectations, the implication of the findings are still important. They suggest that there can be differences between developed democracies and other countries that makes minimum wages affect the income distribution differently. Still, I would argue that the most important contribution these results have is that they demonstrate the importance of studying the income deciles in detail – something that is currently lacking in academic research on minimum wage.

The effect minimum wages have on the income deciles has also given more insight to why an overall effect could not be confirmed. Most importantly of course, is the fact that two out of three significant effects minimum wages was found to have, are actually increasing the income inequality. When it does not have any effect on the other deciles, and that most of their coefficients did not point to a strong reducing effect, this could of course also help explain why there were no overall findings either.

### 6.3 Are policymakers better off by focusing on other variables?

There are also some important findings in regards to the control variables that were included in the models. Most noticeable, the results show that union density had the strongest decreasing effect on income inequality out of all the variables. This is in line with the theoretical expectations, and would suggest that policy makers can reduce the growth in income inequality more effectively by focusing on other policy areas than the minimum wages. However, when examining the income groups more in detail union density only had a significant effect on the second decile, where it increased their earnings. Still, this supports the theory stating that union density will reduce income inequality.

Economic growth, measured as change in GDP per capita, also had a significant effect reducing growth in income inequality. This is more surprising, as one could expect it to benefit people that already have a high income. However, it was only significant at 10%, which normally is not considered high enough in social science. When looking at the income deciles this is further demonstrated, as economic growth had no significant effect on any of them. All the other control variables had insignificant effects on the overall income inequality, and mostly insignificant effects in all of the decile models. There were of course some exceptions, but nothing that points to them being of special importance. The same can be said for the interaction effect. Even though the coefficient pointed towards changes in minimum wages being less effective when the minimum wage rate was high, this was not a significant effect.

### 6.4 Contribution to the literature

This thesis provides two important contributions to the literature on minimum wages and income inequality. First, it has opened up a new world to research on minimum wage and income inequality by showing that it is possible to study their effects in advanced democracies. Even though there have been studies looking at countries that are a part of this group, this study shows that it is indeed possible to analyze the effect in several advanced democracies together. By doing this, this thesis has shown that the effect minimum wages have in advanced democracies is different to the effect found in developing countries in previous studies.

Minimum wages cannot be confirmed to have a stable effect across all developed democracies either, as the results dispute existing findings from the United States and Great Britain.

Furthermore, I have examined the relationship between minimum wages and the income share that different groups in the income distribution earns. This has to some degree been done earlier, for example by looking at the effect on the top 1% income earners or by looking at the effect on the poorest 10% in a country. Still, this thesis provides detailed analysis on the effect minimum wages have on all of the income deciles which is essential if one wishes to understand the effects minimum wages have. In regard to this, this study shows that the effect of minimum wages might not be as straightforward as one could have thought. It also reveals that there are some gaps in the literature in regards to the effect of minimum wages on some of the income deciles.

## 7 Conclusion

In this thesis I have tried to explore whether raising the minimum wage has any effect on growth in income inequality in advanced democracies. The research question I attempted to answer is:

*“Is raising statutory minimum wages an effective tool limiting the growth in income inequality in developed democracies?”.*

To conclude, I will first present my results and their implications. This will be followed by recommendations for further research based on my findings in this thesis, and some concluding remarks.

### 7.1 Results

To answer the research question, five hypotheses were developed based on theoretical perspectives and existing empirical literature. The goal was to look at whether increasing the minimum wage would reduce the growth in overall income inequality (H1), if it would increase the income earned by people having below average income (H2), or reduce it for people earning above average (H3). Further, if increasing minimum wages would have a smaller effect on the poorest 10% of the population (H4), or if changing minimum wages had a weaker effect in countries where the minimum wage rate is high (H5).

In order to analyse these hypotheses, a random effects time series cross section analysis (TSCS) was conducted containing the OECD member countries between 1995 and 2015 as sample. In regards to hypothesis 1, the results show that increasing the minimum wage does not reduce the overall income inequality significantly. Thus, hypothesis 1 is weakened by the results found in this thesis. Hypothesis 2 and 3 could not be confirmed either due to lack of significance and corresponding results. In regards to hypothesis 4, the results found demonstrated an effect opposite to what was expected, and this hypothesis is therefore also weakened. In terms of the interaction effect, no significant effect was found, and hypothesis 5 therefore remains unconfirmed. Still, the results revealed some interesting findings. Most prominently, increasing

the minimum wage was found to cause the lowest income decile to gain income, while at the same time reducing the income of the second lowest income decile.

## 7.2 Implications

This study has provided policymakers in advanced democracies with more knowledge on the effects of minimum wages in their part of the world. Even though the analyses cannot confirm decisively that raising the minimum wage do not reduce growth in income inequality, it fails to prove that it will. The results also suggest that there might be some differences in how minimum wages work in different states, and I would therefore recommend them not to base their arguments on findings based on studies on other countries than their own. Based on the findings in this thesis, policymakers should be better off by focusing on other, more well-established, tools than minimum wage to mitigate growth in income inequality. For example, increasing union density was found to have a significant effect in reducing the overall income inequality in this study

## 7.3 Recommendations for further research

This study has shed some light on other elements regarding minimum wages and income inequality that should be further examined. First and foremost, as mentioned in the discussion, there should be conducted more research looking at the specific income deciles in detail. The results regarding the second and eighth income decile are especially interesting, and should be researched further in the future. By focusing on the effect minimum wages have on all the income deciles, researchers can provide policymakers with more specific knowledge about its potential consequences. This will also improve the literature regarding the relationship between minimum wages and income inequality, which is a topic that has received limited attention in the past.

Lastly, the introduction of statutory minimum wages should also be examined. This has been done in existing literature, but, but a cross country study of the effect is lacking. This might be because of the limited available data dating back before 1990, which also challenged the

analyses of this thesis. Still, the data has seen massive improvements in the last couple of years, and if the trend stays the same one could expect to soon be able look at the introduction of minimum wages quantitatively as well. This would improve the literature massively, as knowledge about the consequences of introducing minimum wages is just as important as knowledge regarding the effects of changing it.

## 7.4 Concluding remarks

To conclude, this study fails to demonstrate that raising statutory minimum wages reduces the growth in income inequality in advanced democratic countries. The answer to the research question is therefore negative, raising the minimum wages is not proven to be an effective tool to reduce growth in income inequality in advanced democracies. As always, policies that aim to reduce income inequality remains an interesting and important topic.

## 8 Bibliography

- Alderman, Liz. 2019. "Spain's Minimum Wage Just Jumped. The Debate is Continuing". *New York Times*. Url: [https://www.nytimes.com/2019/03/07/business/spain-minimum-wage.html?emc=edit\\_th\\_190308&nl=todaysheadlines&nid=679166020308](https://www.nytimes.com/2019/03/07/business/spain-minimum-wage.html?emc=edit_th_190308&nl=todaysheadlines&nid=679166020308)
- Arestis, Philip. 2018. "Importance of Tackling Income Inequality and Relevant Economic Policies". Edited by Philip Arestis and Malcolm Sawyer in *Inequality: Trends, Causes, Consequences, Relevant Policies: 1-42*.
- Aspergis, Nicholas and Ionnis Theodosiou. 2008. "The Employment – Wage Relationship: Was Keynes Right After All?" *American Review of Political Economy* 6 (1): 40-50. Url: <https://sites.bemidjistate.edu/arpejournal/wp-content/uploads/sites/2/2015/12/v6n1-apergistheodosiou.pdf>
- Atkinson, Anthony B. 2015. *Inequality: What Can Be Done?*. Cambridge: Harvard University Press.
- Atkinson, Anthony B., Chrysa Leventi, Brian Nolan, Holly Sutherland and Iva Tasseva. 2017. "Reducing Poverty and Inequality Through Tax Benefit Reform and the Minimum Wage: The UK as a Case-Study". *The Journal of Economic Inequality* 15: 303-323. Doi: <https://doi.org/10.1007/s10888-017-9365-7>
- Autor, David H., David Dorn and Gordon H. Hanson. 2016. "The China Shock: Learning From Labor-Market Adjustment to Large Changes in Trade". *Annual Review of Economics* 8: 205-240. url: <https://doi.org/10.1146/annurev-economics-080315-015041>.
- Baltagi, Badi H. 2008. *Econometric Analysis of Panel Data, 4<sup>th</sup> edition*. Chichester: Wiley.
- Baltagi, Badi H. 2013. *Econometric Analysis of Panel Data, 5<sup>th</sup> edition*. Chichester: Wiley
- Bates, Douglas, Martin Waechler, Ben Bolker and Steve Walker. 2015. "Fitting Linear Mixed-Effects Models Using lme4". *Journal of Statistical Software* 67, (1): 1-48. Doi: 10.18637/jss.v067.i01.
- Beck, Nathaniel. 2008. "Time-Series-Cross-Sectional Methods". *Oxford Handbooks Online*. Doi: 10.1093/oxfordhb/9780199286546.003.0020
- Beck, Nathaniel and Jonathan N. Katz. 2007. "Random Coefficient Models for Time-Series-Cross-Section Data: Monte Carlo Experiments". *Political Analysis* 15, (2): 182-195. Doi: 10.1093/pan/mp1001.



- Bellafante, Ginia. 2019. "The \$15 Minimum Wage Is Here. Why We Need \$33 an Hour". *New York Times*. Url: <https://www.nytimes.com/2019/01/04/nyregion/the-15-dollar-minimum-wage-is-not-enough.html>
- Bell, Andrew and Kelvyn Jones. 2015. "Explaining Fixed Effects: Random Effects Modeling of Time-Series Cross-Sectional and Panel Data". *Political Science Research and Methods* 3, (1): 133-153. Doi: 10.1017/psrm.2014.7.
- Borjas, Georg J. 2003. "The Labor Demand Curve is Downward Sloping: Reexamining the Impact of Immigration on the Labor Market". *The Quarterly Journal of Economics* 118, (4): 1335-1374. Url: <https://www.jstor.org/stable/25053941>
- Brito, Alessandra, Miguel Foguel and Celia Kerstenetzky. 2017. "The Contribution of Minimum Wage Valorization Policy to the Decline in Household Income Inequality in Brazil: A Decomposition Approach". *Journal of post Keynesian Economics* 40 (4): 540-575. Doi: 10.1080/01603477.2017.1333436
- Card, David Edward, and Alan B. Krueger. 1995. *Myth and Measurement: The New Economics of Minimum Wage*. Princeton University Press: New Jersey.
- Clark, Tom S. and Drew A. Linzer. 2015. "Should I Use Fixed Effects or Random Effects?". *Political Science Research and Methods* 3, (2): 399-408. Doi: 10.1017/psrm.2014.32.
- Croissant, Yves and Giovanni Millo. 2008. "Panel Data Econometrics in R: The plm Package". *Journal of Statistical Software* 27, (2): 1-43. Doi: 10.18637/jss.v027.i02
- Dabla-Norris, Era, Kalpana Kochhar, Nujin Suphaphiphat, Frantisek Ricka, Evridiki Tsounta. 2015. "Causes and Consequences of Income Inequality: A Global Perspective". *IMF SDN/15/13*. Url: <https://www.imf.org/external/pubs/ft/sdn/2015/sdn1513.pdf>
- Derpanopoulos, George, Erica Frantz, Barbara Geddes and Joseph Wright. 2017. "Are Coups Good for Democracy? A Response to Miller (2016)". *Research and Politics*: 1-4. Doi: 10.1177/2053168017707355
- Dickens, Richard and Alan Manning. 2004. "Has the National Minimum Wage Reduced UK Wage Inequality?". *Royal Statistical Society* 167, (4): 613-626. Doi: 0964-1998/04/167613
- Doucouliagos, Hristos and T. D. Stanley. 2009. "Publication Selection Bias in Minimum-Wage Research? A Meta-Regression Analysis". *British Journal of Industrial Relations* 47, (2): 406-428. Doi: 10.1111/j.1467-8543.2009.00723.x
- Dougherty, Christopher. 2011. *Introduction to Econometrics 4<sup>th</sup> edition*. United States: Oxford University Press.

- Dougherty, Christopher. 2016. *Introduction to Econometrics 5<sup>th</sup> edition*. United States: Oxford University Press.
- Edwards, Paul and Mark Gilman. 1999. "Pay Equity and the National Minimum Wage: What Can Theories Tell Us?". *Human Resource Management Journal* 9, (1): 20-38. Url: <https://doi.org/10.1111/j.1748-8583.1999.tb00186.x>
- Esping-Andersen, Gøsta. 1990. *The Three Worlds of Welfare Capitalism*. Princeton: Princeton University Press.
- European Commission. 2016. "Labour Market and Wage Developments in Europe: Annual Review 2016". Doi:10.2767/232054
- Eurostat. 2019. "Distribution of Income by quantiles – EU-SILC survey". Url: <http://appsso.eurostat.ec.europa.eu/nui/submitViewTableAction.do>
- Eurostat. n.d.a "Income and Living Conditions (ilc)". Url: [https://ec.europa.eu/eurostat/cache/metadata/en/ilc\\_esms.htm](https://ec.europa.eu/eurostat/cache/metadata/en/ilc_esms.htm)
- Eurostat. n.d.b "Minimum Wages (earn\_minw)". Url: [https://ec.europa.eu/eurostat/cache/metadata/en/earn\\_minw\\_esms.htm](https://ec.europa.eu/eurostat/cache/metadata/en/earn_minw_esms.htm)
- Freeman, Richard B. 1996. "The Minimum Wage as a Redistributive Tool". *The Economic Journal* 106, (436): 639-649. Url: <https://www.jstore.org/stable/2235571>
- Gautie, Jerome. 2010. "France: Towards the End of an Active Minimum Wage Policy?" In *The Minimum Wage Revisited In the Enlarged EU*, edited by Daniel Vaughan-Whitehead, 153-185. UK: Edward Elgar Publishing
- Gavrel, Frédéric, Isabelle Lebo and Thérèse Rebière. 2012. "Minimum Wage, On-The-Job Search and Employment: On the Sectorial and Aggregate Equilibrium Effect of the Mandatory Minimum Wage". *Economic Modelling* 29: 691-699. Doi: 10.1016/j.econmod.2012.01.005
- Gelman, Andrew and Jennifer Hill. 2007. *Data Analysis Using Regression and Multilevel/Hierarchical Models*. Cambridge: Cambridge University Press.
- Ghenta, Mihaela. 2017. "Characteristic of In-Work Poverty – a Comparison Between Romania and the European Union". *Journal of Economic Development, Environment and People* 6, (3): 47-56. Url: [com.pva.uib.no/docview/1944800525?accountid=8579](http://com.pva.uib.no/docview/1944800525?accountid=8579)
- Gerritsen, Aart, and Bas Jacobs. 2016. "Is the Minimum Wage an Appropriate Instrument for Redistribution?". CESifo Working Paper Series 4588, CESifo Group Munich. Url: <https://ideas.repec.org/p/ces/ceswps/4588.html>
- Grimshaw, Damian. 2011. "What Do We Know About Low-Wage Work and Low-Wage Workers? Analyzing the Definitions, Patterns, Causes and Consequences in

- International Perspective”. *International Labour Organization* 28: 1-62. Url: <https://EconPapers.repec.org/RePEc:ilo:ilowps:994648583402676>
- Halleröd, Björn, Hans Ekbrandt and Mattias Bengtsson. 2015. “In-Work Poverty and Labour Market Trajectories: Poverty Risks Among the Working Population in 22 European Countries”. *Journal of European Social Policy* 25, (5): 473-488. Doi: 10.1177/0958928715608794.
- Hsiao, Cheng. 2003. *Analysis of Panel Data*. Cambridge: Cambridge University Press
- Imai, Kosuke. 2017. *Quantitative Social Science: An Introduction*. Princeton: Princeton University Press
- Infante, Ricardo, Andrés Marinakis and Jacobo Velasco. 2003. “Minimum Wage in Chile: An Example of the Potential and Limitations of this policy instrument”. *International Labour Office Geneva* 52: 1-24. url: [https://www.ilo.org/wcmsp5/groups/public/---ed\\_emp/documents/publication/wcms\\_142316.pdf](https://www.ilo.org/wcmsp5/groups/public/---ed_emp/documents/publication/wcms_142316.pdf)
- International Labour Office. 2010. “Global Wage Report 2010/11: Wage Policies in Times of Crisis”. Url: [https://www.ilo.org/global/publications/books/WCMS\\_145265/lang--en/index.htm](https://www.ilo.org/global/publications/books/WCMS_145265/lang--en/index.htm)
- International Labour Organization. 2018. “Employment by sector – ILO modelled estimates, Nov. 2018”. Url: [https://www.ilo.org/ilostat/faces/oracle/webcenter/portalapp/pagehierarchy/Page3.jspx?MBI\\_ID=33&\\_afLoop=399837107794199&\\_afWindowMode=0&\\_afWindowId=1aizl20oa4\\_1#!%40%40%3F\\_afWindowId%3D1aizl20oa4\\_1%26\\_afLoop%3D399837107794199%26MBI\\_ID%3D33%26\\_afWindowMode%3D0%26\\_adf.ctrl-state%3D1aizl20oa4\\_57](https://www.ilo.org/ilostat/faces/oracle/webcenter/portalapp/pagehierarchy/Page3.jspx?MBI_ID=33&_afLoop=399837107794199&_afWindowMode=0&_afWindowId=1aizl20oa4_1#!%40%40%3F_afWindowId%3D1aizl20oa4_1%26_afLoop%3D399837107794199%26MBI_ID%3D33%26_afWindowMode%3D0%26_adf.ctrl-state%3D1aizl20oa4_57)
- International Labour Organization. 2019. “Unemployment Rate – ILO modelled estimates, Nov. 2018. Url: [https://www.ilo.org/ilostat/faces/oracle/webcenter/portalapp/pagehierarchy/Page3.jspx?MBI\\_ID=2&\\_afLoop=409508735332836&\\_afWindowMode=0&\\_afWindowId=swy366jcz\\_1#!%40%40%3F\\_afWindowId%3Dswy366jcz\\_1%26\\_afLoop%3D409508735332836%26MBI\\_ID%3D2%26\\_afWindowMode%3D0%26\\_adf.ctrl-state%3Dswy366jcz\\_57](https://www.ilo.org/ilostat/faces/oracle/webcenter/portalapp/pagehierarchy/Page3.jspx?MBI_ID=2&_afLoop=409508735332836&_afWindowMode=0&_afWindowId=swy366jcz_1#!%40%40%3F_afWindowId%3Dswy366jcz_1%26_afLoop%3D409508735332836%26MBI_ID%3D2%26_afWindowMode%3D0%26_adf.ctrl-state%3Dswy366jcz_57)
- Iversen, Torben and Anne Wren. 1998. “Equality, Employment, an Budgetary Restraint: The Trilemma of the Service Economy. *World Politics* 50, (4): 507-546. Doi: 10.1017/S0043887100007358.

- Huber, Evelyne, Jingjing Huo and John D. Stephens. 2017. "Power, Policy and Top Income Shares". *Socio-Economic Review* 0, (0): 1-23. Doi: 10.1093/ser/mwx027.
- Kaufman, Bruce E. 2012. "Wage theory, New Deal labor policy, and the Great Depression: Were Government and Unions to Blame?". *ILRReview* 65 (3): 501-532. Doi: 2162-271X/00/6501
- Kellstedt, Paul M. and Guy D. Whitten. 2018. *The Fundamentals of Political Science Research*, 3<sup>rd</sup> edition. Cambridge: Cambridge University Press.
- Kenworthy, Lane and Jonas Pontusson. 2005. "Rising Inequality and the Politics of Redistribution in Affluent Countries". *Perspectives on Politics* 3, (3): 449-471. Doi: 10.1017/S1537592705050292.
- Kenworthy, Lane. 2008. *Jobs with Equality*. Oxford: Oxford University Press
- King, Gary, Robert O. Keohane and Sidney Verba. 1994. *Designing Social Inquiry: Scientific Inference in Qualitative Research*. Princeton: Princeton University Press.
- Kwon, Hyon Soo. 2014. "Economic Theories of Low-Wage Work". *Journal of Human Behavior in the Social Environment* 24(1): 61-70. Url: <https://www.jstor.org/stable/368901810>
- Levitan, Sar A., and Richard S. Belous. 1979. *More Than Subsistence: Minimum Wages for the Working Poor*. Baltimore: Johns Hopkins University Press.
- Levin-Waldman, Oren M. 2001. *The Case of the Minimum Wage: Competing Policy Models*. Albany: State University of New York Press.
- Levin-Waldman, Oren M., and Charles Whalen. 2007. "The Minimum Wage is a Middle-Class Issue". *Challenge* 50, (3): 59-71. Doi: 10.2753/0577-5132500304
- Levin-Waldman, Oren M., and Paul Lerman. 2017. "Is the Minimum Wage an Effective Response to Income Inequality?". *Challenge* 60, (6): 574-595. Doi: 10.1080/05775132.2017.1399635
- Levin-Waldman, Oren M. 2018. *Restoring the middle class through wage policy*. Palgrave Macmillian: Cham, Switzerland.
- Lin, Carl and Myeong-Su Yun. 2016. "The effects of the minimum wage on earnings inequality: Evidence from China". *IZA discussion paper* 9715. Url: <https://www.iza.org/publications/dp/9715/the-effects-of-the-minimum-wage-on-earnings-inequality-evidence-from-china>
- Lynch, John W., George David Smith, George A. Kaplan and James S. House. 2000. "Income Inequality and Mortality: Importance to Health of Individual Income, Psychosocial

- Environment, or Material Conditions”. *British Medical Journal* 320, (7243): 1200-1204. Doi: <https://doi-org.pva.uib.no/10.1136/bmj.320.7243.1200>
- Marginean, Silvia, and Alina Stefania Chenic. 2013. “Effects of Raising Minimum Wage: Theory, Evidence and Future Challenges”. *Procedia Economics and Finance* 6: 97-98. Doi: 10.1016/S2212-5671(13)00119-6
- Matsaganis, Manos, Erhan Ozdemir and Terry Ward. 2013. “The coverage rate of social benefits”. *Research Note to the European Commission*. Url: <https://ec.europa.eu/social/BlobServlet?docId=11523&langId=en>
- Midtbø, Tor. 2007. *Regresjonsanalyse for Samfunnsvitere: Med Eksempler I SPSS*. Oslo: Universitetsforlaget
- Midtbø, Tor. 2012. *STATA: En Entusiastisk Innføring*. Oslo: Universitetsforlaget
- Monogan, James E. 2015. *Political Analysis Using R*. Switzerland: Springer International Publishing.
- Mo, Pak Hung. 2000. “Income Inequality and Economic Growth”. *KYKLOS* 53: 293-316. Url: <https://doi.org/10.1111/1467-6435.00122>
- Neumark, David and William L. Waschner. 2008. *Minimum Wages*. The MIT Press: Cambridge.
- OECD. 1998. “Making the Most of the Minimum: Statutory Minimum Wages, Employment and Poverty” in *OECD Employment Outlook 1998*, 31-79. Url: [https://dx.doi.org/10.1787/empl\\_outlook-1998-en](https://dx.doi.org/10.1787/empl_outlook-1998-en)
- OECD. 2007. “Generosity of Unemployment Benefits”. Url: <https://www.oecd.org/employment/emp/43654254.pdf>
- OECD. 2014. “Focus on Inequality and Growth: Does Income Inequality Hurt Economic Growth?”. Url: <https://www.oecd.org/social/Focus-Inequality-and-Growth-2014.pdf>
- OECD. 2015. “Focus on: Minimum Wages After the Crisis: Making Them Pay”. url: <http://www.oecd.org/social/Focus-on-Minimum-Wages-after-the-crisis-2015.pdf>
- OECD. 2018a. "Earnings: Real minimum wages". *OECD Employment and Labour Market Statistics* (database). Doi: <https://doi.org/10.1787/data-00656-en> (accessed on October 10, 2018).
- OECD. 2018b. "Earnings: Minimum wages relative to median wages". *OECD Employment and Labour Market Statistics* (database). Doi: <https://doi.org/10.1787/data-00313-en> (accessed on 10 October 2018)
- OECD. 2019a. “Gross Domestic Product (GDP) (indicator)”. Doi: 10.1787/dc2f7aec-en (Accessed on 03 February 2019).

- OECD. 2019b. "Trade in Goods (indicator)". Doi: 10.1787/1ea6b5ed-en (Accessed on 03 February 2019).
- OECD. 2019c. "Social Expenditure – Aggregated data (indicator)". *OECD Social Expenditure Database*. Doi: 10.1787/a31cbf4d-en (Accessed on 20 April 2019)
- Oppewal, Harmen. 2010. "Concept of Causality and Conditions for Causality". *Wiley International Encyclopedia of Marketing*. url: <https://doi.org/10.1002/9781444316568.wiem02059>
- Ostry, Jonathan D., Andrew Berg and Charalambos G. Tsangarides. 2014. "Redistribution, Inequality, and Growth". *IMF Discussion Note SDN/14/02: 1-30*. Url: <https://www.imf.org/external/pubs/ft/sdn/2014/sdn1402.pdf>
- Ottaviano, Ginmarco I. P. and Giovanni Peri. 2012. "Rethinking the Effect of Immigration on Wages". *Journal of the European Economic Association* 10, (1): 152-197. Doi: 10.1111/j.1542-4774.2011.01101.x
- Pennings, Paul, Hans Keman and Jan Kleinnijenhuis. 2006. *Doing Research in Political Science: An Introduction to Comparative Methods and Statistics*. 2<sup>nd</sup> edition. London: Sage
- Piketty, Thomas. 2014. *Capital: In the Twenty-First Century*. Great Britain: The Belknap Press of Harvard University Press.
- Plasman, Robert. 2015. "The Minimum Wage System in Belgium: The Mismatch in Brussels' region". *University of Brussels, department of Applied Economics*. 1-23. Url: <https://ec.europa.eu/social/BlobServlet?docId=13934&langId=en>
- Plümper, Thomas and Vera E. Troeger. 2019. "Not so Harmless After All: The Fixed Effects Model". *Political Analysis* 27: 21-45. Doi: 10.1017/pan.2018.17.
- Pollin, Robert, Mark Brenner, Stephanie Luce and Jeanette Wicks-Lim. 2008. *A Measure of Fairness: The Economics of Living Wages and Minimum Wages in the United States*. Ithaca: Cornell University Press.
- Rözer, Jesper Jelle, and Beate Volker. 2016. "Does Income Inequality Have Lasting Effects on Health and Trust?". *Social Science and Medicine* 149: 37-45. Doi: <https://doi.org/10.1016/j.socscimed.2015.11.047>
- Rinz, Kevin and John Voorheis. 2018. "The distribution effects of minimum wages: Evidence from linked survey and administrative data" Center for administrative records research and applications, working paper number CARRA-WP-2018-0. Url: <https://www.census.gov/content/dam/Census/library/working-papers/2018/adrm/carra-wp-2018-02.pdf>

- Sawyer, Malcolm. 2015. "Confronting Inequality: Review Article on Thomas Piketty on "Capital in the 21<sup>st</sup> Century". *International Review of Applied Economics* 29, (6): 878-889. Doi: 10.1080/02692171.2015.1065227
- Schneider, Simone M. 2012. "Income Inequality and its Consequences for Life Satisfaction: What Role do Social Cognitions Play?". *Social Indicators Research* 106, (3): 419-438. Doi: 10.1007/s11205-011-9816-7
- Sen, Amindya, Kathleen Rybczynski and Corey Van De Waal. 2011. "Teen Employment, Poverty, and the Minimum Wage: Evidence from Canada". *Labour Economics* 18: 36-47. Doi: 10.1016/j.labeco.2010.06.003
- Shelkova, Natalya Y. 2014. "Low Wage Labor Markets and the Power of Suggestion". Available at SSRN. Url: <http://dx.doi.org/10.2139/ssrn.2478219>
- Skog, Ole Jørgen. 2004. *Å Forklare Sosiale Fenomener: En Regresjonsbasert Tilnærming*. Oslo: Gyldendal Akademisk.
- Slonimczyk, Fabian and Peter Skott. 2012. "Employment and distribution effects of the minimum wage". *Journal of Economic Behavior and Organization* 84: 245-264. Doi: 10.1016/j.jebo.2012.03.005
- Solt, Frederick. 2008. "Economic Inequality and Democratic Political Engagement". *American Journal of Political Science* 52, (1): 48-60. Url: <https://www.jstore.org/stable/225193796>
- Solt, Frederick. 2019. "Measuring Income Inequality Across Countries and Over Time: The Standardized World Income Inequality Database Version 8.0".
- Spriggs, William E., and Bruce E. Klein. 1994. *Raising the Floor: The Effects of the Minimum Wage on Low Wage Workers*. Washington, DC: Economic Policy Institute.
- Stiglitz, Joseph E. 2014. "The Price of Inequality: How Today's Devided Society Endangers Our Future". *Sustainable Humanity, Sustainable Nature: Our Responsibility*. 1-21. Url: <http://www.pas.va/content/dam/accademia/pdf/es41/es41-stiglitz.pdf>
- Studenmund, A. H. 2011. *Using Exonometrics: A Practical Guide*. USA: Pearson Education.
- The Economist. 2019. "How High Can Britain's Minimum Wage Go?". Url: <https://www.economist.com/britain/2019/03/28/how-high-can-britains-minimum-wage-go>
- Tilly, Charles. 2003. "Inequality, Democratization, and De-Democratization". *Sociological Theory* 21, (1): 37-43. Url: <https://www.jstor.org/stable/3108607>
- UNU-WIDER. 2018a. "World Income Inequality Database (WIID4)". Url: <https://www.wider.unu.edu/database/world-income-inequality-database-wiid4>

- UNU-WIDER. 2018b. "World Income Inequality Database (WIID) Version 4: User Guide and Data Sources". *United Nations University*: 1-46. Url: <https://www.wider.unu.edu/sites/default/files/WIID/PDF/WIID4%20User%20Guide.pdf>
- UNU-WIDER. N.D. "Frequently Asked Questions" Red 04.01.2019. Url: <https://www.wider.unu.edu/about/frequently-asked-questions>
- Verbeek, Marno. 2012. *A Guide to Modern Econometrics*, 4<sup>th</sup> edition. Chichester: John Wiley and Sons.
- Visser, Jelle. 2016. "Database Version 5.1 – September 2016 – CODEBOOK". Amsterdam: Amsterdam Institute for Advanced Labour Studies AIAS. url: <http://uvasias.net/en/ictwss>
- Visser, Jelle. 2016. "ICTWSS Database". Amsterdam Institute for Advanced Labour Studies.
- Visser, Jelle, Susan Hayter and Rosina Gammarano. 2017. "Labour Relations and Collectively Bargaining: Trends in Collective Bargaining Coverage: Stability, Erosion or Decline?". *International Labour Office*.
- Volscho, Jr., Thomas W. 2005. "Minimum Wages and Income Inequality in the American States, 1960-2000". *Social Stratification and Mobility* 23: 343-368. Doi: 10.1016/S0276-5624(05)23011-1
- Wilkinson, Richard G., and Kate E. Pickett. 2006. "Income Inequality and Population Health: A Review and Explanation of the evidence". *Social Science and Medicine* 62: 1768-1784. Doi: 10.1016/j.socscimed.2005.08.036.
- Wooldridge, Jeffrey M. 2009. *Introducing Econometrics: A Modern Approach*, 4<sup>th</sup> edition. USA: South-Western College Publishing.
- Wooldridge, Jeffrey M. 2016. *Introducing Econometrics: A Modern Approach*, 6<sup>th</sup> edition. USA: Cengage Learning.
- Worrall, John L. "Racial Composition, Unemployment and Crime: Dealing with Inconsistency in Panel Designs". *Social Science Research* 37: 787-800. Doi: 10.1016/j.ssresearch.2008.01.001



## 9 Appendix

### A: Regression results on the income share earned by decile 1

Variable	Decile 1 model	
Changes in real minimum wages	0.213*	(0.155)
Real minimum wage value	0.038	(0.048)
Changes in GDP per capita	-0.154	(0.099)
Change in import	0.013	(0.028)
Change in employment in the service sector	-0.047	(0.061)
Change in union density	-0.076	(0.058)
Change in unemployment	-0.173	(0.073)
Change in social expenditure as cash benefits	-0.150	(0.167)
Constant	0.058***	(0.056)
<b>Statistics</b>		
N	152	
Countries	17	
R2	0.14	
Adjusted R2	0.09	
AIC		
BIC		

*Note: Significant p-values \*=0.1, \*\*=0.05, \*\*\*=0.01. Dependent variable: Change in the income share of decile 1. The presented values are standardized coefficients using robust estimation, the standard errors are shown in the brackets. Source: Eurostat (2019); OECD (2018a); OECD (2019a); OECD 2019b; International Labour Organization (2018); International Labour Organization (2019); Visser (2016).*

**B: Regression results on the income share earned by decile 2**

<b>Variable</b>	<b>Decile 2 model</b>	
Changes in real minimum wages	-0.190*	(0.115)
Real minimum wage value	-0.106**	(0.043)
Changes in GDP per capita	0.034	(0.106)
Change in import	-0.104	(0.093)
Change in employment in the service sector	0.027	(0.045)
Change in union density	0.167	(0.150)
Change in unemployment	-0.191**	(0.091)
Change in social expenditure as cash benefits	0.045	(0.103)
Constant	0.014	(0.020)
<b>Statistics</b>		
N	152	
Countries	17	
R2	0.09	
Adjusted R2	0.04	
AIC		
BIC		

*Note: Significant p-values \*=0.1, \*\*=0.05, \*\*\*=0.01. Dependent variable: Change in the income share of decile 2. The presented values are the standardized coefficients using robust estimation, the standard errors are shown in the brackets. Source: Eurostat (2019); OECD (2018a); OECD (2019a); OECD 2019b; International Labour Organization (2018); International Labour Organization (2019); Visser (2016).*

### C: Regression results on the income share earned by decile 3

Variable	Decile 3 model	
Changes in real minimum wages	0.0001	(0.046)
Real minimum wage value	0.015	(0.045)
Changes in GDP per capita	-0.108	(0.086)
Change in import	-0.045	(0.093)
Change in employment in the service sector	-0.087*	(0.053)
Change in union density	-0.057	(0.096)
Change in unemployment	0.030	(0.113)
Change in social expenditure as cash benefits	-0.263	(0.183)
Constant	0.006	(0.019)
<b>Statistics</b>		
N	152	
Countries	17	
R2	0.05	
Adjusted R2	0.00	
AIC		
BIC		

*Note: Significant p-values \*=0.1, \*\*=0.05, \*\*\*=0.01. Dependent variable: Change in the income share of decile 3. The presented values are the standardized coefficients using robust estimation, the standard errors are shown in the brackets. Source: Eurostat (2019); OECD (2018a); OECD (2019a); OECD 2019b; International Labour Organization (2018); International Labour Organization (2019); Visser (2016).*

#### D: Regression results on the income share earned by decile 4

Variable	Decile 4 model	
Changes in real minimum wages	-0.015	(0.046)
Real minimum wage value	-0.021	(0.038)
Changes in GDP per capita	-0.079	(0.105)
Change in import	-0.063	(0.083)
Change in employment in the service sector	0.019	(0.049)
Change in union density	-0.047	(0.071)
Change in unemployment	0.047	(0.110)
Change in social expenditure as cash benefits	-0.251	(0.170)
Constant	0.030	(0.020)
<b>Statistics</b>		
N	152	
Countries	17	
R2	0.04	
Adjusted R2	0.00	
AIC		
BIC		

*Note: Significant p-values \*=0.1, \*\*=0.05, \*\*\*=0.01. Dependent variable: Change in the income share of decile 4. The presented values are the standardized coefficients using robust estimation, the standard errors are shown in the brackets. Source: Eurostat (2019); OECD (2018a); OECD (2019a); OECD 2019b; International Labour Organization (2018); International Labour Organization (2019); Visser (2016).*

### E: Regression results on the income share earned by decile 5

Variable	Decile 5 model	
Changes in real minimum wages	-0.010	(0.082)
Real minimum wage value	0.030	(0.040)
Changes in GDP per capita	0.009	(0.057)
Change in import	0.063	(0.103)
Change in employment in the service sector	0.252	(0.169)
Change in union density	-0.045	(0.068)
Change in unemployment	-0.142	(0.113)
Change in social expenditure as cash benefits	-0.058	(0.019)
Constant	0.058***	(0.056)
<b>Statistics</b>		
N	152	
Countries	17	
R2	0.04	
Adjusted R2	0.00	
AIC		
BIC		

*Note: Significant p-values \*=0.1, \*\*=0.05, \*\*\*=0.01. Dependent variable: Change in the income share of decile 5. The presented values are the standardized coefficients using robust estimation, the standard errors are shown in the brackets. Source: Eurostat (2019); OECD (2018a); OECD (2019a); OECD 2019b; International Labour Organization (2018); International Labour Organization (2019); Visser (2016).*

## F: Regression results on the income share earned by decile 6

Variable	Decile 6 model	
Changes in real minimum wages	0.016	(0.067)
Real minimum wage value	0.050	(0.066)
Changes in GDP per capita	-0.081	(0.102)
Change in import	0.031	(0.080)
Change in employment in the service sector	0.038	(0.091)
Change in union density	-0.107	(0.125)
Change in unemployment	-0.109	(0.109)
Change in social expenditure as cash benefits	-0.034	(0.089)
Constant	-0.016	(0.025)
<b>Statistics</b>		
N	152	
Countries	17	
R2	0.02	
Adjusted R2	0.00	
AIC		
BIC		

*Note: Significant p-values \*=0.1, \*\*=0.5, \*\*\*=0.01. Dependent variable: Change in the income share of decile 6. The presented values are the standardized coefficients using robust estimation, the standard errors are shown in the brackets. Source: Eurostat (2019); OECD (2018a); OECD (2019a); OECD 2019b; International Labour Organization (2018); International Labour Organization (2019); Visser (2016).*

### G: Regression results on the income share earned by decile 7

Variable	Decile 7 model	
Changes in real minimum wages	0.143*	(0.079)
Real minimum wage value	0.014	(0.054)
Changes in GDP per capita	0.009	(0.046)
Change in import	-0.025	(0.057)
Change in employment in the service sector	-0.028	(0.074)
Change in union density	-0.139	(0.110)
Change in unemployment	0.001	(0.078)
Change in social expenditure as cash benefits	-0.102	(0.070)
Constant	0.014	(0.020)
<b>Statistics</b>		
N	152	
Countries	17	
R2	0.05	
Adjusted R2	0.00	
AIC		
BIC		

*Note: Significant p-values \*=0.1, \*\*=0.05, \*\*\*=0.01. Dependent variable: Change in the income share of decile 7. The presented values are the standardized coefficients using robust estimation, the standard errors are shown in the brackets. Source: Eurostat (2019); OECD (2018a); OECD (2019a); OECD 2019b; International Labour Organization (2018); International Labour Organization (2019); Visser (2016).*

## H: Regression results on the income share earned by decile 8

Variable	Decile 8 model	
Changes in real minimum wages	0.199**	(0.043)
Real minimum wage value	0.034	(0.058)
Changes in GDP per capita	-0.097*	(0.049)
Change in import	-0.015	(0.081)
Change in employment in the service sector	-0.117	(0.116)
Change in union density	-0.091	(0.055)
Change in unemployment	0.315	(0.123)
Change in social expenditure as cash benefits	-0.198**	(0.086)
Constant	0.007	(0.056)
<b>Statistics</b>		
N	152	
Countries	17	
R2	0.07	
Adjusted R2	0.01	
AIC		
BIC		

*Note: Significant p-values \*=0.1, \*\*=0.05, \*\*\*=0.01. Dependent variable: Change in the income share of decile 8. The presented values are the standardized coefficients using robust estimation, the standard errors are shown in the brackets. Source: Eurostat (2019); OECD (2018a); OECD (2019a); OECD 2019b; International Labour Organization (2018); International Labour Organization (2019); Visser (2016).*



### I: Regression results on the income share earned by decile 9

Variable	Decile 9 model	
Changes in real minimum wages	-0.099	(0.106)
Real minimum wage value	-0.002	(0.035)
Changes in GDP per capita	0.031	(0.104)
Change in import	0.023	(0.084)
Change in employment in the service sector	-0.037	(0.096)
Change in union density	0.084*	(0.044)
Change in unemployment	0.154	(0.107)
Change in social expenditure as cash benefits	-0.092	(0.116)
Constant	-0.004	(0.021)
<b>Statistics</b>		
N	152	
Countries	17	
R2	0.04	
Adjusted R2	0.00	
AIC		
BIC		

*Note: Significant p-values \*=0.1, \*\*=0.05, \*\*\*=0.01. Dependent variable: Change in the income share of decile 9. The presented values are the standardized coefficients using robust estimation, the standard errors are shown in the brackets. Source: Eurostat (2019); OECD (2018a); OECD (2019a); OECD 2019b; International Labour Organization (2018); International Labour Organization (2019); Visser (2016).*

## J: Regression results on the income share earned by decile 10

Variable	Decile 10 model	
Changes in real minimum wages	-0.088	(0.058)
Real minimum wage value	0.037	(0.048)
Changes in GDP per capita	-0.095	(0.090)
Change in import	0.024	(0.109)
Change in employment in the service sector	0.046	(0.072)
Change in union density	0.034	(0.073)
Change in unemployment	-0.068	(0.107)
Change in social expenditure as cash benefits	0.265	(0.129)
Constant	-0.032	(0.025)
<b>Statistics</b>		
N	152	
Countries	17	
R2	0.05	
Adjusted R2	0.00	
AIC		
BIC		

Note: Significant p-values \*=0.1, \*\*=0.05, \*\*\*=0.01. Dependent variable: Change in the income share of decile 10. The presented values are the standardized coefficients using robust estimation, the standard errors are shown in the brackets. Source: Eurostat (2019); OECD (2018a); OECD (2019a); OECD 2019b; International Labour Organization (2018); International Labour Organization (2019); Visser (2016).