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Equality – a cure for carbon?

A study of the relationship between gender and income equality and carbon emissions in industrialised countries.

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Abstract

Global climate change is probably the biggest challenge of our century, and even though research has attempted to uncover the social forces driving the emission of carbon, there is a lack of consensus among scholars. Some empirical research states that carbon emissions are lower in countries where women have higher political status. Others suggest that it is higher income inequality that explains the large emissions. This raises the following questions: Can countries different levels of carbon emissions be explained by their domestic level of equality? If so, what type of equality is the main driving force?

This study uses a sample of 35 industrialised countries to investigate if the variation of carbon emission, in a period of 6 years, can be explained by the level of gender and income equality. Two models are constructed, in specific: an ordinary least squares regression model and an autoregressive model. In both models, I find that the level of emission is lower within countries with a higher score in the Global Gender Gap index, controlling for various other factors. However, the results do not with certainty establish a connection between higher income equality and lower levels of carbon emissions. The findings suggest that reducing the inequality between men and women may benefit efforts to reduce carbon emissions caused by industrialised countries. Yet, even though lower income inequality may be a goal in itself, its effect on the level of carbon emissions cannot be confirmed.

Key words: carbon emissions, eco-feminism, income equality, climate change, gender equality
Words: 9991

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1 Introduction

1.1 *Background*

Climate change is often referred to as the most pressing political and scientific challenge of the century (Bulkeley and Newell, 2015: 1). In the synthesis report on Climate Change published by IPCC (Intergovernmental Panel on Climate Change) in 2014, the following statement is made:

"Continued emission of greenhouse gases will cause further warming and long-lasting changes in all components of the climate system, increasing the likelihood of severe, pervasive and irreversible impacts for people and ecosystems. Limiting climate change would require substantial and sustained reductions in greenhouse gas emissions which, together with adaptation, can limit climate change risks." (IPCC, 2014:8)

The statement above captures the importance of reducing greenhouse gas emissions, such as the emissions of carbon dioxide, if severe disturbance in the ecosystem is to be avoided. Even though research suggests that the carbon emissions caused by industrial activity and the burning of fossil fuels may set to fall in 2015 (Weiss, 2015), the level of global emissions is still higher than what can be considered sustainable (Wilkinson and Pickett, 2010: 217). For most of the century, climate change has been assumed to be a problem for scientists. Although in the 1990's, the idea that including non-scientists, such as humanists and economists, might contribute to our understanding of the environmental crisis was increasingly acknowledged (Seager, 1993: 281-282). Thus, this opened up for an emergence of studies investigating the economic and political mechanisms causing environmental degradation (Berthe and Elie, 2015:191; Ergas and York, 2012: 965). Within theoretical fields such as social psychology, environmental sociology, and political science, the possible connection between gender equality and environmental degradation have been identified (Bord and O'Connor, 1997: 830). On the other hand, environmental economists have argued that income equality may mitigate environmental degradation (Boyce, 1994: 169-170). Yet, what type of equality is eligible if we aim to limit industrialised countries emission of carbon?

1.2 *Objective, aim and research question*

In this study, the aim is to investigate the possible connection between gender and income equality and the countries per capita level of carbon emission. Thus, it aims to analyse the following research question:

"Can industrialised countries level of carbon emissions be explained by their domestic level of gender and income equality?"

The question is the result of a curiosity regarding why northern European countries are not among the forty worst emitters in the world. This in spite of both having access to natural resources such as oil and gas, and having obtained a high-standard of living. Urry (2007) suggests that this might be due to the countries relatively high levels of equality (Urry, 2007: 115). Although it remains unclear what definition of equality Urry considers, this study's focus will be on investigating whether high gender equality and/or high income equality is associated with lower levels of carbon emission. The variables are chosen as they represent two different dimensions of equality and theoretical explanations of what drives environmental degradation. Also, there is a lack of research that investigates both variables in connection to environmental issues. This may be of interest, considering that existing research argues that states with lower income inequality between households are more likely to have public social expenditure, public childcare expenditure and strong equal treatment laws. Furthermore, stronger equal treatment laws are associated with a larger percentage of women as managers, a more equal share of earned income between men and women, and state childcare expenditure (Walby, 2009: 309). Thus, this suggests that gender inequality and income inequality might be correlated, which makes it interesting to investigate both in relation to countries emission of carbon.

1.3 *Structure*

For the purpose of clarification, the structure of this study will be as follows:
First, the theoretical and empirical arguments behind the hypothesises of this study will be presented. Subsequently, two statistical models are constructed in order to assess the effects of income equality and gender equality on the countries per capita level of carbon emissions. In specific, a pooled ordinary least squares model and an autoregressive model. In this section, I will also present all variables included in the regression analyses as well as discuss issues related

both to the chosen statistical models and the collection of data. Finally, the statistical results are compared and discussed.

1.4 *Case selection*

This study analyses a sample of 35 industrialised countries (i.e. Annex B countries[1]) over a time period of six years (2006-2011). The countries chosen are among the 38 industrialized countries that agreed to a target for their greenhouse gas emissions in the Kyoto Protocol in 1997 (Bulkeley and Newell, 2015: 27). The strategic selection is made due to several reasons. First of all, this study aims to investigate if the variation of carbon emissions between industrialised states is associated with differences in gender and income inequality. Previous studies have investigated the connection between environmental degradation and income and gender equality. Although, they have either included countries with great diversity (Ergas and York, 2011: 970; Noorgard and York, 2005: 512) or limited the study to only consider a specific country or region (Baek and Gweisah, 2013: 1434). Thus, there is a lack of research that investigates if the variables may explain the variation of carbon emissions between states, which in a greater extent share similar features in regard to economic development and modernisation. Furthermore, the pledge to limit domestic carbon emissions indicate, at least to some extent, that the selected countries share a political interest in the reduction of carbon emission and are aware of the negative impacts of such. It is further often argued that the responsibility for climate change lies in the hands of the Global North. In other words, since the wealth of of the Global North is considered to have been realized through the emissions of carbon, in effect to industrialisation, these countries are believed to have an "ecological debt" to the Global South (Bulkeley and Newell, 2015: 50). Thus, it is often claimed that these countries should take the most responsibility for limiting the global emissions of carbon. Improving our understanding of what factors is associated with different levels of emissions within these countries is therefore of particular interest.

[1] The Annex B countries included: Australia, Austria, Belgium, Bulgaria, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Latvia, Lithuania, Luxembourg, Netherlands, New Zealand, Norway, Poland, Portugal, Romania, Russia, Slovakia, Slovenia, Spain, Sweden, Switzerland, United Kingdom, and United States. However, Liechtenstein, Monaco and Ukraine are not included in the study due to lack of data.

2 Previous research and theoretical framework

2.1 *Gender equality*

2.1.1 Linking women's status to environmental outcomes

Existing research implies that women's status is positively associated with environmental outcomes. For example, Noorgard and York (2005) investigates the relationship between female representation in national parliaments and state participation in international environmental treaties. Their findings suggest that states with a greater proportion of women in national parliaments are more prone to environmental treaty ratification, controlling for other factors (Noorgard and York, 2005: 506-512). A similar conclusion is drawn by Ergas and York (2012) in a study investigating the connection between female status and carbon emissions. When analysing a sample of 104 nations, they find that a larger percentage of female legislators in national parliament is associated with lower levels of production-based carbon emission per capita (Ergas and York, 2012: 965-970). Both these studies use female representation as a proxy for the overall gender equality in society (Noorgard and York, 2005: 511; Ergas and York, 2012: 974). However, there are other studies which uses a somewhat broader measure of female status. In a study conducted in 2015, McKinney and Fulkerson test the eco-feminist assumption that the status of women is a cause and an effect of environmental conditions (Fulkerson and McKinney, 2015: 293). They measured female status by three indicators: the number of year's women have had the right to vote, the percentage of female legislators in governmental bodies and a gender equality rating. The rating ranged from 1-6 and represented the extent to which domestic policies and programs promoted equal access for women and men to education, health and the economy (ibid., p. 304-305). Their results confirmed previous studies, suggesting that greater female representation in governmental bodies is associated with lower climate footprint, and that ecological losses weaken women's status. Similar to the other studies, they controlled for possible effects of domestic and global drivers such as urbanization, GDP per capita, democracy, the dependency of export and foreign direct investments and to some extent, differences within production. However, these studies do not control for the possible effects of other aspects of equality (such as income equality), nor examine whether the results hold for other dimensions of gender equality, such as within the economic sphere.

2.1.2 Why gender matters in environmental issues

In research investigating differences in women and men's environmental attitudes, the existence of a "gender gap" has been established (Bord and O'Connor, 1997: 830). Sociological studies in Europe have revealed that men in a higher degree than women, tend to identify culturally with high-powered technologies, and are preferring more carbon intensive leisure activities (Spitzner, 2009: 218-220). Thus, implying that environmental consciousness is not a part of the male norm. In several different studies, it is concluded that women tend to show significantly more concern toward different kinds of environmental pollutions and environmental crises (Bord and O'Connor, 1997: 880-882). Likewise, women have been found to be more negative toward the possibility of maintaining a resource heavy consumerist economy due to the environmental crisis (Spitzner, 2009: 218-219), and are more likely to change their own behaviour in order to decrease their contribution to global warming (Spitzner, 2006: 31-34). While some theorists argue how these "gender gaps" in environmental attitudes exists due to women and men's different ecological sensibilities (Bord and O'Connor, 1997: 834), others are in a higher degree emphasising women's competencies in caring labour, and social and environmental qualities, as the main causes for differences in attitude (Spitzner, 2009: 219).

Studies of political activism amongst women in the United States have demonstrated how it is most likely to emerge in connection to women's social roles (Thomas-Slayter et al, 1996: 303). Due to their traditional responsibility for family, community and health, women have been identified as the most reliable narrators for observing and assessing environmental change. Grassroots-groups and organisations created by women have also succeed in acknowledging issues such as pollution, nuclear energy and toxic waste management that, in general, is overlooked by mainstream environmental organisations (Thomas-Slayter et al, 1996: 297). Furthermore, these often succeed to connect immediate environmental or economic issues to broader political and philosophical concerns and demonstrate effective use of non-violent methods (Thomas-Slayter et al. 1996: 296). When analysing policy planning and political engagement in Europe, women are overrepresented among those who have been linking gender justice and environmental sustainability in research regarding fields such as economics, policy planning, transport and development studies (Spitzner, 2009: 219). Even among different groups of indigenous people, there are several examples of how women have been in the forefront of the political struggle of promoting preservation of their cultural and survival base, and in the end, the environment (Mies, 1993: 304). Thus, this illustrates how women have raised important questions about human's relation to nature and the resources that support lives and livelihood (Thomas-Slayter et al, 1996: 296). Parallels can be drawn to a claim made by the theorist Brú, that women's perception of environmental risks and factors represents the universalism of their social location (Thomas-Slayter et al, 1996: p.303).

Studies within the feminist literature have identified the state as both capitalistic and patriarchal, and further suggested that the balance of power within the state apparatus is influenced by, and influences, the balance of power in the wider society (Cravey, 1998: 523-537). These power relations can be expressed in various ways, such as in different material conditions and normative expressions, within political, economic and social institutions and societal structures, and through social practices. Feminist theorists have emphasized the importance of investigating political and societal institutions in relation to climate issues, since these institutions reflect and take part in the construction and reinforcement of values, norms and injustices (Kaijser and Kronsell, 2004: p.419). Eco-feminists argue that such institutions are important for understanding the issue of global warming. In contrast to those who argue that the responsibility of global warming lies in the hands of the Global North (Bulkeley and Newell, 2015: p.50), eco-feminists claim that it is specifically a problem caused mainly by decisions and actions taken by men. The argument is based upon the overrepresentation of men in institutions that also have been created by men, which creates an imbalance of power between men and women in society (Spitzner, 2009: 218). This imbalance of power also characterizes the relationship between man and nature (Mies, 1993: 319). In other words, sexism and environmental degradation is the result of the same structural oppression.

Some theorists within the field of feminist ecology have suggested that women and nature have an affiliation that has lasted throughout history (Merchant, 1979: 15). Others argue that it is a simplification, and that women's knowledge in areas of environment and health care are not due to their "intrinsic feminine quality" (Kaijser and Kronsell, 2014: 423). Rather, it is a result of gendered experience, daily practice and responsibility (Thomas-Slayter et al, 1996: 292). The devaluing of what have traditionally been considered "women's work" within the formal economic system is considered problematic in relation to environmental problems. These duties are seen as the link between humanity and the natural work, causing the devaluing of such to strengthen the structural division between man and nature, which is considered ecologically dangerous (Mellor, 2009: 255-256). The contraction of social welfare, withdrawal of public transport infrastructure, declining governmental support for schools and other care facilities, are all examples of how "women's work" is devalued in today's society. Such measures are increasing women's traditional unpaid labour within the reproductive sector, and further limiting women's ability mobility since they are overrepresented among pedestrians and users of public transport (Spitzner, 2006: 218-221). These issues are examples of the existing gender bias within both governmental and nongovernmental organizations, which according to eco-feminist theory, is a consequence of the patriarchy ideology and political framework in society that serves male interests (Thomas-Slayter et al, 1996: 306). Such gender biases are often found to be more distinct within institutions dominated by men (Spitzner, 2006: 31-34). The importance of solving such issues in regard to the environmental crisis, is stressed in the following statement made by Peggy Antrobus during the Global Assembly of Women for a Healthy Planet held in Miami 1991:

"The primary task for us women are to formulate analyses which will help us identify the root causes of our environmental problems. We must clarify the links between environmental degradation and the structures of social, economic and political power [...] the links between decisions made in boardrooms, parliaments and the military command centres and the conditions unde which we live [...] the links between the structure of our own subordination as women and the processes which this subordination serves to perpetuate all other systems of oppression." (Antrobus citied by Seager, 1993: 280-281)

In line with the theoretical arguments presented in this section, the first hypothesis is:

H1: There is a negative relationship between industrialized countries level of carbon emissions per capita and their domestic level of gender equality.

2.2 *Income equality*

2.2.1 Crucial or devastating?

Within the field of environmental economics, studies have investigated both the possible effects of economic inequality on environmental policies and pressures on a national level, and the environmental pressures aggregated from individual economic choice. The latter uses an individualistic approach, often analysing the relationship between income level and individual environmental pressures. For example, two studies argue that the relationship between these variables follows an inverted u-curve, thus the individual environmental pressure will at first increase with higher incomes, and eventually decrease. The assumption is made that this occurs since the demand for environmental quality increases exponentially as income exceeds a certain level (Heerink et al, 2001: 360-362) (Scruggs, 1998: 260-262). Even though the research contributes little to our understanding of how income is related to environmental degradation on a national level, the focus on individual income level and how it effects consumption is still relevant to this study. Considering that the measure of carbon emissions includes the emissions caused by the consumption of goods and services.

On a national level, there is no existing empirical or theoretical consensus on whether economic inequality improves or worsens environmental outcomes (Berthe and Elie, 2015: 191). In a study investigating the relationship between income inequality, economic growth, and carbon emissions in the United States within a time period of 30 years, it is concluded that greater economic equality is associated with more positive environmental outcomes (Baek and Gweisah, 2014: 1434-1435). Conversely, another study finds that there is a static trade-off between promoting income inequality and lowering carbon emissions in the short run. Even though the result indicates that greater inequality might be necessary if it should be possible to lower emissions, it is also concluded that the relationship will flatten for middle-to high income levels, and that the carbon emissions may even decline for high average incomes. Therefore, the proposal of combining growth and economic equality in order to reduce the level of carbon emissions is made (Ravallion et al, 2000: 659- 667). It should be noted that all studies presented in this sections lack an emphasises on other factors that might be associated with both higher levels of carbon emissions, and income inequality. Hence, analysing the link between income equality and the level of carbon emissions, while including other factors that may be associated with both variables, is of interest for further study.

2.2.2 Income equality as a potential saviour?

There are both economic and political theoretical explanations linking economic inequality to environmental deterioration. While the economic arguments are based on individual's consumption and energy use, the political arguments focus on the implementation of public policy aimed at protecting the environment (Berthe and Elie, 2015: 199). On a larger scale, empirical studies have suggested that economic inequality and environmental degradation might be mutually reinforcing since differences in social status will be more apparent in an unequal society, causing an exacerbating of social status competition. Such competition is often associated with changes in the individual consumption level, consumption content and behaviour. The connection between inequality and consumption is clear when examining the countries such as United States and Britain. In both countries, while inequality has been raising there have also been a long-term decline in savings and a rise in debt. Consequently, this indicates that greater inequality will cause individuals to adopt a more consumerist and individualistic behaviour toward the environment (Wilkinson and Pickett, 2010: 226-229), increasing individuals environmental pressure. The reinforcement of individualism and consumerism should also make environmental policies that increases prices of goods and services or requires changes in behaviour less likely to be implemented. Conversely, more equalitarian societies will be more prone to call for environmental policy (Berthe and Elie, 2015: 191).

According to Boyce (1994), environmental degradation will be less likely to occur if the distribution of wealth between individuals in society is more equal. Boyce's argument is built on the assumption that richer people tend to have more power than poorer individuals, this implies that money do not only result in a higher living standard but also an increase in political power (Boyce, 1994: 169-172). Also, since many aspects of the environment can be privatized, it gives more affluent groups the opportunity to substitute public environmental goods with private, if these were to deteriorate (Berthe and Elie, 2015: 194). Research has demonstrated how this phenomenon is noticeable in the collective regulation of the commons within socially unequal societies. Higher inequality may provide leaders with incentives to participate in common-pool resource management, but also discourage participation by poorer individuals and consequently prevent cooperation. This may worsen the environmental crisis since less cooperation has been found to prevent effective solutions to environmental issues (Baland et al, 2007: 1-4). Thus, this creates an opportunity for those who benefit from environmental degradation to impose the costs on poorer individuals (Boyce, 1994: 169-172), whom suffer the most from pollution and climate change due to their dependency on their close environment (Berthe and Elie, 2015: 191).

The connection between economic inequality and environmental degradation further exists as power inequality determine peoples access or lack of access to information provided by interest groups. In a largely unequal society, it is suspected that a less powerful person has limited information about environmental costs and therefor does not prioritize environmental quality (Boyce, 1994:174). Similar arguments are made by Downey and Strife (2010). They argue that in order to understand the underlying mechanisms to environmental degradation it is crucial to investigate the power disparities that exist between elites and non-elites. Environmental crises are seen to a large degree as a product of organizational, structural and network-based inequality (Downey and Strife, 2010: 155-187). However, others instead argue that economic inequality leads to environmental degradation since it reduces the willingness to pay for environmental responsibility. Consequently, the political focus will be on promoting growth rather than environmental protection (Magani, 2000: 440-443).

In this section, arguments suggesting that environmental degradation will worsen in a society with high income inequality, have been presented. Thus, the final hypothesis has been defined accordingly:

H2: There is a negative relationship between industrialized countries levels of carbon emission per capita and their domestic level of income equality.

3 Method

3.1 *Models*

In this study, pooled time series data is used for 35 countries covering the time period of 2006 to 2011. Pooled data is used since it effectively identifies individual and time effects which can not be identified by cross-sectional data only (Podestá, 2000: 6-8). The years are chosen since it is the only time period post the Kyoto Protocol for which data is available for all variables included in the model. To examine whether there is a connection between income inequality, gender inequality and countries level of carbon emissions, two different regression analysis are conducted. In both models, all control variables are included to control for other factors that may cause variation in carbon emission per capita, and to improve the model's ability to explain the variation in carbon emissions. By incorporating control variables that may be related to the dependent variables variable, we are able to make a more accurate estimation of the relationship between the variables and lower the risk of spurious relationships (Teorell and Svensson, 2012: 203-205).

The first model is a pooled Ordinary Least Squares (OLS) regression model using random effects. In this study, a random effects approach is to prefer over a fixed effects model. Even though a strategic selection of countries has been made within a fairly homogenous region, there may still be differences across countries which influence the level of carbon dioxide emissions. Random effects control for such differences more efficiently than fixed effects as it assumes that the variation across countries are more random and uncorrelated with the independent variables. A fixed effects model ignores the variation between countries to a higher degree and puts more weight on the variation domestically (Torres-Reyna, 2007: 7-26). As illustrated in the diagram in Appendix 6.1.2, countries levels of carbon emission vary little within the time-period of 2006 to 2011. Accordingly, a random effects model is better suited to the data. The OLS regression is illustrated below:

$$Y_{it} = \beta_0 + \beta_1 X_{it} + \cdots + \beta_k X_{k,it} + u_{it}$$

Where:

$Y_{i}t$ is the dependent variable, where t = time and i = country
B_0 is the intercept of the dependent variable
X_{it} is the independent variable.
B_1 is the coefficient for the independent variable.
U_{it} is the error term.

The pooled OLS regression model assumes that the individual-specific effects of each country is a random variable that is uncorrelated with the explanatory variables of all past, current, and future time periods of the same country (ibid, p. 9). When investigating a variable such as carbon emission per capita, this might be a disadvantage considering how countries previous levels of carbon emissions might condition the present level. Therefore, an autoregressive model using random effects will also be conducted. In this second model, the dependent variable is regressed on the previous values (Pennings et al, 2006:169). Thus, by modelling the current level of emission as a weighted linear sum of its previous levels, we are able to capture how much of the level that depends on previous values (Penny and Harrison, 2006:2). Subsequently, we are able to estimate to what extent the independent and control variables actually can explain the change in country levels of carbon emission per capita. The autoregressive model is illustrated in the function below:

$$y_t = \beta_0 + \beta_1 y_{t-1} + \epsilon_t.$$

Where:

Y_t is the dependent variable, where t = time.
B_0 is the intercept of the dependent variable
B_1 is the coefficient for our dependent variable.
X_{it} is the independent variable.
E_t is the error term.
Y_{t-1} represents the lagged dependent variable.

3.2 *Problems with pooled data*

In a multiple regression model where various variables are included, there are several potential problems that need to be taken into consideration. The potential problems considered most relevant to this study are autocorrelation, heteroscedasticity, structural issues and multicollinearity.

Autocorrelation appears when there is a relationship between the error terms in different periods. In other words, the similarity between observations as a function of the time lag between them. This is a common issue when using panel data and doing a strategic sample of countries (Teorell and Svensson, 2012: 209), and may cause an underestimation of the true variance in the model. In the pooled OLS regression model, this problem is avoided by including robust standard errors in the model. What robust standard errors do (also known as Huber-White standard errors) is that they adjust the unbalance in the variance such that they return to a constant value (homoscedastic errors) by using added weights (Williams, 2015: 1-5). In the autoregressive model, this issue is automatically solved since the model assumes that the output variable depends linearly on its own previous value and on a stochastic term (i.e. a random value) (Penny and Harrison, 2006:2).

When conducting a multiple regression analysis, it is assumed that the variance of the error terms is constant. Heteroscedasticity refers to when the error terms instead are unequally distributed (Teorell and Svensson, 2012: 209). For example, the error term may vary depending on a country's size. This could cause invalidate statistical tests of significance, since the model assumes that the error terms are uncorrelated and constant. Contemporaneous correlation of error terms across units suggests that something affects all units simultaneously (Oxford Reference, 2015), for instance, an economic crisis that affect all countries at the same time. In order to avoid contemporaneous correlation as well as heteroscedasticity, robust standard errors are used in both models (Williams, 2015: 1-5).

One of the more pressing issues with pooled data is structural. In this study, it can be expected that each country's level of carbon emissions prior 2006 has been affected by various factors. Consequently, the level of such will likely differ across the countries systematically. If this is not adjusted for, the coefficients will be biased and the result will not be accurate. This is solved by the use of random effects, which is efficient since in includes the unit variance in the error term and subsequently makes the appropriate assumptions (Schimdheiny, 2015, p. 2-11) Also, in the autoregressive model, the factors that might have affected the level prior 2006 will be captured in the model, since the model assumes that the current value depends on the previous value.

Finally, when including several variables in a multiple regression there is always a risk of multicollinearity. This occurs when the variables within the model are highly correlated. Even though multicollinearity does not reduce the whole models reliability completely, it may lead us to draw misleading conclusions about each variables effect on the dependent variable, such as gender equality's effect on carbon emissions. There is not much to be done in order to control or adjust for multicollinearity, apart from excluding or finding instrument variables as substitutes for the original variables of choice (Maruyama, 1998: 60-66). A useful tool, on the other hand, is a correlation matrix with which it can be determined which variables are highly correlated with each other and then adjustments can be made accordingly. As illustrated in the correlation matrix in appendix 5.1.1, relatively low correlation between all variables are observed, with the exception from government effectiveness and GDP per capita (r=0.7445). However, since it is claimed that the issues of multicollinearity occur first when the variables are very highly correlated (r=0.9 or above) this is not a problem in our models (Pallant, 2010: 151).

3.3 *Data*

3.3.1 Dependent variable

As showed in table 1, the dependent variable of this study is each countries level of carbon dioxide emission per capita. There is a debate regarding how one should measure the level of carbon emissions, since different measurements generate different allocation of responsibility. The traditional method is to consider the amount of emission stemming from domestic production and use (Kander et al, 2015: 431). This operationalization has been used by previous studies when investigating the connection between different aspects of equality and the state level of carbon emissions (Ergas and York, 2012: 969-970; Ravallion et al, 2000:658). The disadvantage of such measurement is that it fails to recognise the emissions embodied in the goods and services consumed, which are produced elsewhere. Since previous research have illustrated how production-based measures seriously understates countries role in the output of carbon emissions (Peters et al, 2011: 8903-8904), this may cause us to draw misleading conclusions regarding the connection between the country level carbon emissions and its relationship to gender- and income inequality. Especially considering how "unchecked consumption" often is referred to as one of the main causes of global warming (Soper, 2009: 92).

The production-measure of carbon emission has also been considered to promote "carbon leakage". This phenomenon refers to when carbon-intensive production is shifted from developed countries to developing countries (Kander et al, 2015: 431). According to the OECD, 75 % of the carbon emission embodied in goods and services in some countries are emitted elsewhere. In other countries, this number might be less than 10 % (OECD, 2015a). Therefore, it can be argued that a consumption based measure of carbon emission is to prefer and is therefor used in this study. In the run up for COP21 in Paris in 2015, the OECD presented a consumption-based measure of carbon dioxide by final demand. The measure considers production based emissions, residential- and private road emissions (Wiebe and Yamano, 2015: 3), and uses tables illustrating input and output flows to more specifically calculate each countries final contribution to the emission of carbon. However, it should be noted that consumption-based measures have been criticised since they fail to take carbon efficiency in exports into account. Consequently, countries do not gain credit for cleaning up their export industry (Kander et al, 2015: 431-432). Also, another issue is that they exclude international transport emission from country totals (Wiebe and Yamano, 2015: 7). However, the availability of data which recognises such aspects is limited, and the consumption-based measure of carbon emissions by final demand is therefor considered the best available for the purpose of this study.

Table 1

Variables	***Description***
Dependent variable	
Carbon emission per capita	Production- and consumption based measure of carbon dioxide emissions per capita[a]
Independent variables	
Global Gender Gap index	Score between 0-1 representing the percentage of equality between women and men that has been closed within economic, political, educational and health related areas[b]
Gini coefficient	Score between 0-1 where 0 correspond to complete equal income distribution and 1 total unequal income distribution[c]
Control variables	
Military expenditure	Military expenditure as a % of GDP[d]
Government effectiveness	Score running from -2.5 to 2.5 where higher values represents better outcomes. The index reflects perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies.[e]
Agriculture	Value added from agriculture as a % of GDP[f]
Industry	Value added from industrial activity as a % of GDP[f]
Foreign Direct Investment	Net inflow of FDI as a % of GDP[f]
GDP per capita	Gross domestic product per capita expressed in current US$[f]
Export	Export of goods and services as a % of GDP[f]
Urbanization	Population living in urban areas as a % of total[f]

Sources: [a] OECD, [b] Data is collected from the Global Gender Gap Report of 2014, [c]For 2006-2010 data is collected from the SWIID (Standardized World Income Inequality database) and for 2011 data is collected from OECD. [d]Data is gathered from SIPRIS (Stockholm International Peace Research Institute) database over national military expenditures [e]The index is developed by the World Bank and is based on the summarized views on quality of governance provided by numerous enterprises, citizens, and expert surveys. [f]Data is collected from the World Banks database of World Development Indicators.

3.3.2 Independent variables

Our independent variables are income equality and gender equality. Income equality will be measured by the Gini coefficient as it is the most common to use in studies and research focusing on the distribution of individual income (The World Bank: A). The variable measures equality in disposable income post taxes and transfers, since the selected countries might have different redistributive polices which can affect the final distribution of income differently (SWIID, 2014). Thus, the redistribution of wealth often generates lower inequality (Ostry et al, 2014:26), and since the study does not attempt to analyse income per se but rather the effects of higher equality, this measurement is better suited for the model. Regarding measures of gender equality, there is no existing consensus on what measurement that is preferable. Previous studies often use female representation in governmental bodies as a proxy for the overall gender equality within the state, when investigating gender equality in relation to environmental degradation (Noorgard and York, 2005: 511; Ergas and York, 2012: 969-971). Ergas and York (2012) argue that other measures are too problematic. Either in terms of accuracy as measures of gender inequality, or due to the possible imposition of Western cultural assumptions about gendered behaviour expectations (Noorgard and York, 2012: 511). However, McKinney and Fulkerson (2015) emphasize how future research should focus on examining a broader facet of women's status than political representation. Thus, it is of interest to investigate whether the association between female status and lower carbon emissions hold across multiple dimensions (McKinney and Fulkerson, 2015: 311). Accordingly, this study aims to investigate the association between the variables by using a broader indicator of gender equality. The theoretical framework emphasizes the existence of "gender gaps" in environmental attitudes and behaviour between men and women, as well as suggesting that the balance of power between men and women in various institutions, expressions and structures represents the imbalance of power in society. Thus, environmental degradation and the inequality between men and women originate from the same structural oppression. It is important to note that the theory does not identify the causal mechanisms behind the association between gender equality and environmental degradation in specific. In this study, the Global Gender Gap (GGG) will be used to measure gender equality since it effectually evaluates states "gender gaps" in economic participation and opportunity, educational attainment, health and survival, and political empowerment. The measure considers income, labour force, the share of females in leading positions (such as managers, legislators, senior officials), access to basic and higher education, life expectancy, representation in parliament, female representation at ministerial level and the number of years with a female head of state (Global Gender Gap Report, 2014). The aim with this measurement is to capture the relationship between men and women in society, which according to the theoretical framework is analogous to that between men and nature. Subsequently, it its expected that countries with a smaller "gap" (i.e. higher gender equality) will have lower levels of carbon emissions. One of the advantages with GGG is that it focuses on the "gap" between men and women in each country and therefore do not favour countries with, for example, higher economic development. Thus, instead of including the share of women who are highly educated, it compares the share of women with higher education in relation to men's.

Still, it is important to acknowledge the shortcomings of such a measure. Some feminist theorists have noted that, in regards to consumption, gender equality measures that focus on the empowerment of women can be problematic. Thus, empowerment of women in a patriarchal society might only reflect women's adaption to the male norm and the consumerist model of the "good life" (Soper, 2009: 92-96). This contradicts the argument that countries performance in the GGG can be used to measure the overall gender equality in society, since it may only illustrate how well women have adapted to the patriarchal norms. Such arguments should be taken into consideration when interpreting the results, especially since the chosen measure of carbon dioxide includes emissions embodied in consumption. However, since the theoretical framework emphasises the importance of women's status and influence in society, measures that do not focus on women's empowerment are not suited for the aim of this study. Since such aspects of gender equality is effectively captured in the GGG, and other measures either fail to acknowledge the importance of such or do not exist for the chosen years, this is the most appropriate measure for the aim of this study.

3.3.3 Control variables

In order to gain a more accurate estimate of the relationship between carbon emissions and income and gender inequality, control variables that may be related to these and therefore affect the result, are included in the model. In order to distinguish gender inequality and income inequality from overall *institutional factors*, we include a measure of government effectiveness. This is an important control variable, considering that previous studies have suggested that undemocratic decision making and elite-controlled organizations, institutions and networks play an important role in environmental degradation (Downey and Strife, 2010: 155). It has also been argued that democracy, from an institutional point of view, may mitigate environmental harm (McKinney, 2014: 200). Even though the measure does not aim to capture democracy per se, it is well suited for this study's selection of countries since the majority of these are categorised as democracies.[2] Also, government effectiveness captures other institutional factors which otherwise may be absorbed by our independent variables, causing an overestimation of the relationship between those and the level of carbon emission.

Previous research has pointed out that there is a positive association between *economic development, modernization and the level of environmental degradation* (York et al, 2003: 279). Since it has been suggested that at least gender equality may be connected to the level of development (York and Noorgard, 2005: 511), it is important to control for the possible effects of such factors. The economic variables included in the model are GDP per capita, foreign direct investment, and the percentage of GDP added from both export, industrial and agricultural activity. There are numerous empirical studies arguing that GDP per capita is associated with environmental degradation, including carbon emissions (Jorgenson, 2007: 150; York, 2008: 370; Jorgenson, 2009: 641). For example, some research has used the environmental Kuznets curve (EKC) to illustrate a concave relationship between per capita income and environment degradation. It is expected that environmental degradation will worsen as per capita income increases, but also

[2] The measure ”POLITY2” developed by the Polity IV Project was at first included in the model. The index measures political regime and ranges from -10 to +10, indicating where a country is situated on the spectrum between a fully institutionalized autocracy and a fully institutionalized democracy. Since a majority of the countries scored +10, the data lacked variation. It was therefore excluded since the models assumes that the regressors have non-zero variance (Schmidheiny, 2015: 2-4).

decrease when per capita income rises above a certain level. Thus, higher income increases individual's ability and willingness to pay for avoiding environmental degradation (Boyce, 1994: 174). Empirical support for this claim has been found when investigating the relationship between GDP per capita and the ecological footprint of states (Al-Mulali et al, 2015: 321). However, others argue that carbon emissions will continuously rise as income level increases (Baek and Gweisah, 2013: 1437), although to a lesser degree when income has been raised over a certain level (Ravallion et al, 2000: 652.). These studies provide us with reason to believe that GDP per capita may explain some of the variation in the level of carbon emissions between countries. However, it is important to note that GDP per capita does not give us information about the characteristics of each country's economic structure. Therefore, the percentage of GDP originating from the output of industrial activity and agriculture is also included.

World-system theorists have argued that a country's position in the world system impacts its level of environmental degradation, and that this is crucial in understanding the origin of environmental problems such as global warming (Roberts et al, 2003: 300-301). Broadly speaking, world-system theory aims to explain the emergence and the relationship of what is typically known as the first, second and third world (Hall, 1996: 442). The theory emphasises the importance of understanding each countries position in the world-system to explain internal political problems (Wallersten, 1979:16). A variable often used by world-system theorists to reflect countries position in the world-system is the share of GDP that originates from foreign direct investments. That is the phenomenon when a resident in one economy has a significant degree of influence on the management of a company/enterprise resident in another economy (The World Bank, 2015a). It is argued that less developed countries may experience increased levels of environmental degradation due to a high amount of foreign investment. This is often used to finance polluting and ecological inefficient manufacturing processes and facilities (Jorgenson, 2007: 139). Even though it may be considered that such arguments are less relevant for the sample used in this study, there are other studies that suggest that these findings may still be applicable to the Annex B countries. A study analysing the relationship between female representation in parliament and state environmentalism including a majority of developed countries, found that foreign direct investment had a significant negative association with state environmentalism (Noorgard and York, 2005: 513).

World-system theorists further argue that states which lack a strong internal market and good infrastructure will have to compensate through competing on the global market with cheap labour, polluting industries and cheap material prices. This results in "polluting regimes", most likely among semi-peripheral or peripheral countries, where industries can avoid the cost of adapting to environmental regulations that is more likely to exist within core-countries, causing higher national carbon emissions among less developed nations (Roberts et al: 298-302). Even though our chosen population consists of developed countries, these may still vary in their dependency on export which may be causing a variation in carbon emissions. Therefore, the percentage of GDP that originates from exports is still included in the model. Previous studies have shown similar results, where a higher percentage of GDP from export is associated with higher domestic levels of carbon emission (Roberts et al, 2003: 299).

An additional variable that is often used as an indicator of modernization, when investigating environmental issues, is *urbanization*. Previous research has argued that some environmental issues follow an environmental Kuznets curve (EKC) relative to urbanization. This implies that increasing urbanization at first cause greater emissions, although since urbanization may contribute to the rational evaluation of the costs of environmental degradation, the emissions will eventually start to decline (Ehrhardt-Martinez, 1998: 580-584). However, other empirical studies argue the opposite, illustrating that urbanization is connected to higher levels of carbon emissions (York, 2008, p..375-380). Even though the empirical claims contradict each other, both indicate that the variable may influence the state level of carbon emissions.

The final control variable is military expenditure. Previous research has connected military spending and/or military activity to a number of environmental problems. For example, military growth in the context of expenditures per soldier has been linked to higher per capita ecological footprints of nations (Jorgenson and Clark, 2009: 641-642). Other studies highlights both the environmental damage and dangers associated with military activity (Hooks and Smith, 2004: 572). In particular, a study investigating the connection between gender equality and carbon emissions stemming from domestic use, found that military expenditure had a significant effect on the level of emissions. Even though this relationship was established within a different sample of countries, it can be suspected that the percentage of GDP dedicated to military spending also vary within this study's selection of countries (Ergas and York, 2012: 973). Thus, it is important to include the variable since it might, in some extent, contribute to the explanation of the variation in carbon emissions.

3.4 *Data related issues*

Issues related to the selection of data are important to consider since the data determines the statistical result. Even though the study includes a limited number of countries, lack of reliable and valid data has to some extent been an issue that needs to be taken into consideration. When data for a certain year has not been available, the assumption that the value follows the trend of the existing data has been made. In particular, the percentage of GDP that originates from Canadian industry and agriculture in 2011, the Gini coefficient for Japan in 2010 and finally the military expenditure for Island in 2006 and 2007 have been estimated through averages. Regarding the Gini coefficient, there has been a general lack of data originating from the same database. For the years 2006 to 2010 the SWIID (The Standardized World Income Inequality Database) has been used, but since data is not available for years post 2010, data from OECD covering 2011 has also been included. Both datasets measure the Gini coefficient post taxes and transfers, which should reduce the risk of invalid results. Additionally, the SWIID offers the most comprehensive and comparable measure of the GINI coefficient (Stolt, 2009: 231-234). Regarding the Gini coefficient post taxes and transfers for Denmark in 2011, the coefficient has been gathered from Denmark's national database, since data was not available at OCED:s databank. However, this should not affect the validity of the result considering that the estimate of the Gini coefficient is based on countries national statistics (OECD, 2015: B). Regarding issues related to the reliability and validity of the data, the same databases for each variable has been used to the greatest extent possible, except for when other sources have been better suited for the aim of this study (see table 1). Also, by using a sample of developed countries, the risk of deceptive data is minor.

4 Results

4.1 *Ordinary least squares regression model*

The results from model 1, the OLS regression, is illustrated in Table 2. The model shows the relationship between the explanatory variables (independent- and control variables) and the level of carbon emission in countries. It should be noted that the coefficient for both GGG and Gini may seem incorrect. However, as illustrated in Table 2, these variables are measured on a scale between 0 to 1, while all other variables are measured on a scale of 1 to 100. This causes the coefficients to seem unreasonably high in relation to the others, but is just a matter of interpreting the results correctly. According to our result, the model explains 53.8% of the variation in carbon emissions within countries and 40.63% of the variation in carbon emissions between countries (R-squared values). GDP per capita, industry output and foreign direct investment are significant on a 1 % percent level. The coefficient for GDP per capita is 0.00007, the coefficient for industry is 0.2226 and the coefficient for foreign direct investment is 0.0033. Thus, indicating that a one-unit increase in these variables also increases a country's carbon emission per capita. The Government effectiveness is significant on 5 % level and the coefficient is 1.3873, also indicating that an increase in the variable is associated with higher emissions. Agriculture, on the other hand, is significant on a 10% level with the coefficient 0.1877, illustrating that higher agricultural output is associated with lower levels of carbon emissions per capita. The independent variable, GGG, is

Table 2 – Result OLS regression

Variables	*Coefficient*	$P > \|z\|$
Global Gender Gap	-26.20049	0.000***
Gini coefficient	2.3268	0.537
Military expenditure	0.3652308	0.442
Government effectiveness	0.629625	0.028**
Agriculture	-0.1877431	0.106*
Industry	0.2226008	0.000***
Foreign direct investment	0.0033583	0.000***
GDP per capita	0.0000786	0.000***
Export	-0.0273832	0.212
Urbanization	0.0380576	0.341

*p<0,1 Coefficient is significant on a 10 % - level
**p<0,05 Coefficient is significant on a 5 % - level
***p<0,01 Coefficient is significant on a 1 % - level

significant on 1 % level. The coefficient indicates that a one-unit increase in the GGG decreases carbon emissions by -0.2602 units. The Gini coefficient is 0.0232, indicating that a one-unit increase in this variable (higher inequality) would increase the emissions. However, the variable is non-significant and therefore we cannot prove that income inequality affects the level of carbon emissions.

4.2 *Autoregressive model*

The results from the autoregressive model (model 2), is illustrated in Table 3. The model includes all variables used in model 1, and one additional variable that represents a lagged version of the dependent variable carbon emissions per capita. This model explains 45.69 % of the variation within countries and 99.48 % of the variation between countries (R-squared values). However, in an autoregressive model, a greater R-squared value is to expect since it includes the lagged version of the dependent variable. The coefficient of the lagged dependent variable is 0.9033 and is significant on the 1 % level. The independent variable, GGG, is significant on a 5 % level with a coefficient of -5.26033, while the Gini coefficient is significant on a 10 % level with a coefficient of 3.9440. Thus, indicating that both higher gender and income equality decreases carbon emissions per capita. On a 1 % level, both industry output and foreign direct investment are associated with higher emissions. The coefficient for industry is 0.0461 and the coefficient for foreign direct investment is 0.0074. Lastly, government effectiveness is significant on a 5 % level with a coefficient of 0.4814.

Table 3 – Result AR(1) regression

Variables	*Coefficient*	*P > /z/*
Global Gender Gap	-5.26033	0.018**
Gini coefficient	3.944084	0.080*
Military expenditure	0.1683897	0.130
Government effectiveness	0.4814222	0.048**
Agriculture	-0.0191597	0.739
Industry	0.046109	0.001***
Foreign direct investment	0.0074321	0.000***
GDP per capita	7.30e-06	0.189
Export	-0.0011224	0.712
Urbanization	0.0021543	0.786
Lagged dependent variable (CO2 emission per capita)	0.9033395	0.000***

*p<0,1 Coefficient is significant on a 10 % - level
**p<0,05 Coefficient is significant on a 5 % - level
***p<0,01 Coefficient is significant on a 1 % - level

5 Discussion

Some of the results in this study simply confirm previous research. The regressions illustrate how economic variables such as GDP per capita, foreign direct investment and industry output are positively associated with higher levels of emissions. Thus, confirming that there is a positive relationship between economic development, modernization and the level of environmental degradation – even in regards to emission of carbon dioxide. Conversely, greater agricultural output, which may reflect lower level of modernisation, is associated with lower levels of emissions.

On the other hand, we do not observe any significant relationships between military expenditure, export, urban population and the level of carbon emission per capita. Since this study uses a measure of carbon emission by final demand, it is not surprising that the level of export is non-significant. The variable was included since previous researchers argue that a high dependency on exports is associated with a more polluting industrial sector, although it seems like this argument cannot be applied to this study's sample of countries. It might seem surprising that urbanisation was not significant, but it should be noted that such a factor might be connected to GDP per capita in various ways since both variables are used as indicators of modernisation and development. Thus, this possible relationship might affect the significance as they depend on each other.

In the introduction, the possible interrelationship between gender equality and income equality was lifted as an argument to why the variables were interesting to investigate in the same study. As the correlation matrix shows, the GGG and the Gini coefficient is correlated by -18.97 %. In other words, even though higher gender equality is associated with lower income inequality, the degree of correlation is not especially high. This might seem surprising considering how previous studies have argued that lower income inequality foster gender equality. However, this might have to do with this study's sample of countries and the chosen measure of gender equality. Since the countries to a great extent share similar features, the correlation might be weaker and other factors more decisive. This might also be the reason why the effect of income inequality on carbon emissions is only evident in the 2nd model on a 10 % level. Regarding this study's measure of gender equality, GGG, it has been criticized for being too "elitist" since it focuses mainly on empowerment and not as much on gender equality anywhere else. As a result, this might cause the relationship between gender equality and income equality in this study to be weakened further.

The fact that the results do not establish a significant relationship between income inequality and the level of emissions in both models implies that we cannot with certainty argue that income equality has a negative effect on the level of emissions within industrialised countries. Although, it is interesting that income inequality is significant on a 10 % level in the autoregressive model. This indicates that the variable is better at explaining every year changes in emissions, than explaining the whole time periods levels of carbon emission where previous levels are disregarded (OLS regression). Still, even though lower income inequality is associated with negative changes of carbon emissions between 2006 and 2012, the relationship is only significant on a 10 % level.

Considering how the theoretical framework argues that greater income inequality increases status competition and therefore causes individuals to emit more, one could suspect that the relationship between lower income inequality and lower carbon emissions might be more prone on a household level. Also, since this study includes countries which are connected to each other due to factors such as globalisation, for example via economic markets, the focus on individualism and consumption might exist to a similar extent in all countries despite different levels of income equality. The theoretical framework moreover argues that income inequality fosters power inequality, which creates the opportunity for rich individuals to impose environmental risks on poorer individuals, causing environmental degradation to be worse within unequal societies. Such explanations might not be applicable in this study though, since the dangers associated with carbon emissions do not affect the individuals in the chosen countries to a great extent, but mainly poorer individuals in the Global South. However, these are questions that cannot be answered in this study. What can be determined is that there is no sign of a statistic trade-off between lower carbon emissions and lower income inequality, which a previous study suggests. Thus, even though our results do not establish a *significant* negative relationship between higher income equality and lower carbon emissions, the coefficient is still possibly indicating that a negative relationship may occur. This, to some extent, confirms parts of the previous research presented which argues that carbon emissions may decline for high average incomes considering that the majority of the countries in this study's sample can be classified as high income.

This study's key finding is that there is a significant negative relationship relationship between the Global Gender Gap index and industrialised countries levels of carbon emission per capita. Thus, a smaller "gender gap" between men and women in society is associated with lower levels of emissions. Even if previous studies have established a relationship between domestic carbon emissions per capita and women's overall status, no previous studies have yet established a significant relationship between industrialised countries levels of carbon emission by final demand (where consumption is included) and gender equality in terms of female empowerment. It is important to note that the relationship is significant in both models, thus greater gender equality is both associated with lower levels of carbon emissions when previous levels are disregarded (OLS model), as well as with negative changes in emissions (AR(1) model). In other words, even if previous year's levels are taken into account, greater gender equality is still connected to lower levels of emissions. This contradicts the argument that empowerment of women might only reflect women's adaption to the male norm and therefore should not have any positive effect on environmental issues. It is also interesting that observed higher levels of gender equality are associated with lower emissions while a higher level of government effectiveness is not. This strengthens the results further, since it indicates that institutional factors that might be associated with the level of democracy do not have a negative effect on the level of emissions in industrialised countries, while gender equality has. This implies that improving the effectiveness or credibility of the government is not enough if one wishes to mitigate global warming, rather it may be eligible to boost female empowerment. Although, the association between government effectiveness and higher levels of carbon emission is not that surprising, as it can be suspected that the variable is connected to countries level of modernisation, considering how it is positively correlated with GDP per capita by 74.45 % (see Appendix 7.1.1).

These results lead us to raise the question: what underlying mechanisms are causing greater gender equality to be connected to lower levels of carbon emissions? Even though this study fails to illustrate any causal mechanisms by investigating cross-national data on a macro level, the theoretical framework provides possible explanations to this phenomenon. One explanation is the existence of a "gender gap" in environmental issues and behaviour between men and women. Even if the causal mechanisms behind such a "gap" is debated, it is likely that if women are more sensitive to environmental dangers, greater female inclusion and influence in society will lead to greater focus on environmental issues, including carbon emissions. Another possible explanation is the linkage between gender inequality and man's domination over nature. If the "gender gap" in society is smaller, it indicates that the distribution of power between the sexes is more equal. Since the theory argues that the balance of power in society influences the balance of power in political and societal institutions, this might cause environmental responsiveness to be more prone in societies with greater gender equality. Especially since such institutions is considered to be important in the construction of values, norms and injustices. Thus, if gender equality is greater, the devaluing of both women and nature will be less likely to occur. This might foster greater awareness of the dangers associated with high levels of carbon emissions, making countries more prone to limit their carbon emissions. It is clear that further research is needed in order to uncover the driving forces behind the relationship between greater gender equality and lower carbon emissions in industrialised countries. This study's result confirms previous research which emphasises the need for improving our understanding of how gender equality relates to environmental issues. However, it also contributes by adding that it is not only female status or representation that can be connected to lower carbon emissions, but also aspects of female empowerment.

6 Conclusion

The aim of this study is to investigate whether industrialised countries levels of carbon emissions can be explained by their domestic level of gender and income equality. Accordingly, the hypotheses state that there is a negative relationship between the countries level of carbon emissions per capita and their domestic level of income- and gender equality. Investigating which factors affect the level of emissions is important since it increases our understanding of which tools can be used to limit it. Since the industrialised countries in this study are among the greatest emitters in the world, it is highly relevant to investigate which social, economical and political factors cause variation in the level of carbon emissions. According to the results, we can accept hypothesis 1, namely that greater gender equality lessens emissions. The measure of gender equality is significant both on a 1 % level and a 5 % level, while the measure of income equality is rejected on 5% level but significant on a 10 % level. Even though this study cannot confirm the second hypothesis, the results still point towards an opportunity that income equality may be effecting the level of carbon emissions negatively. Thus, even if the relationship cannot be fully established in this study with its chosen variables and models, investigating the possibility for such in future research may still be relevant. Nonetheless, the result of this study indicate that promoting gender equality can benefit measures to reduce the emission of carbon in industrialised countries. It also confirms previous studies which have linked female representation and status to lower levels of carbon emission stemming from production and greater state environmentalism. However, there is a need for further research investigating the casual mechanisms behind these relationships in more detail. Although, despite the need for further research, the results clearly illustrate the existence of a pattern where countries with higher gender equality, all else equal, are responsible for less carbon dioxide emissions.

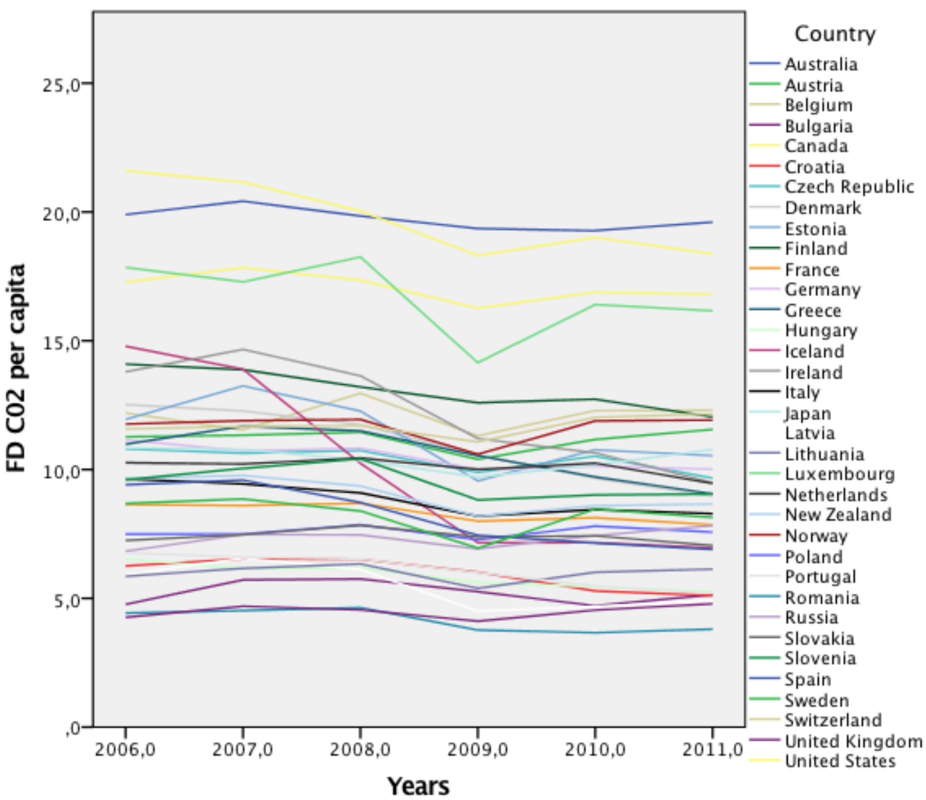
7 Appendix

7.1 *Figures*

7.1.1 Correlation-matrix

	GDPcap	GGG	Gini	Indust~P	MEGDP	FDIGDP	Export~P	UrbanP~p	Agricu~P	FDC02p~a	Govern~s
GDPcap	1.0000										
GGG	0.4596	1.0000									
Gini	-0.3329	-0.1897	1.0000								
IndustryGDP	-0.2262	0.0056	-0.3003	1.0000							
MEGDP	-0.2945	-0.2381	0.5301	-0.0648	1.0000						
FDIGDP	0.2299	-0.0107	-0.0787	-0.1859	-0.1237	1.0000					
ExportGDP	0.3512	-0.0505	-0.3790	-0.1202	-0.4745	0.4154	1.0000				
UrbanPopul~p	0.5557	0.4176	-0.0139	-0.3687	-0.0840	0.1248	-0.0063	1.0000			
Agricultur~P	-0.6000	-0.0397	0.2146	0.2197	0.0249	-0.1054	-0.1911	-0.2701	1.0000		
FDC02perca~a	0.6028	0.1235	-0.1349	-0.1163	0.0355	0.1298	0.1170	0.4643	-0.4722	1.0000	
Government~s	0.7445	0.5780	-0.4422	-0.2221	-0.3418	0.0650	0.1147	0.5991	-0.5761	0.5666	1.0000

7.1.2 Diagram



7.2 *Descriptive statistics*

Variable	Obs	Mean	Std. Dev.	Min	Max
GDPcap	210	36887.79	22687.5	4370.639	113731.7
GGG	210	.7232519	.0461291	.6434	.853
Gini	210	.3044653	.0435045	.2219218	.4523852
IndustryGDP	210	27.6221	6.334482	12.86556	44.80323
MEGDP	210	1.579753	.8141215	.1388548	4.665606
FDIGDP	210	8.631832	31.84879	-57.42675	430.6151
ExportGDP	210	49.19106	30.29313	10.65482	191.225
UrbanPopul~p	210	74.44014	11.78459	49.948	97.687
Agricultur~P	210	2.677926	1.800362	.2799001	8.795286
FDC02perca~a	210	9.921229	3.964061	3.665	21.595
Government~s	210	1.214459	.6749731	-.4538209	2.356591

7.3 *Regressions*

7.3.1 OLS regression

```
Random-effects GLS regression                   Number of obs      =       210
Group variable: Country1                        Number of groups   =        35

R-sq:  within  = 0.5380                         Obs per group: min =         6
       between = 0.4063                                        avg =       6.0
       overall = 0.4132                                        max =         6

                                                Wald chi2(10)      =     81.76
corr(u_i, X)   = 0 (assumed)                    Prob > chi2        =    0.0000

                                (Std. Err. adjusted for 35 clusters in Country1)
```

FDC02percapita	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
GGG	-26.20049	7.27962	-3.60	0.000	-40.46828	-11.93269
Gini	2.3268	3.77173	0.62	0.537	-5.065655	9.719256
GDPcap	.0000786	.0000183	4.29	0.000	.0000427	.0001144
IndustryGDP	.2226008	.0533184	4.17	0.000	.1180985	.327103
MEGDP	.2809467	.3652308	0.77	0.442	-.4348924	.9967859
FDIGDP	.0033583	.0009625	3.49	0.000	.0014719	.0052448
ExportGDP	-.0273832	.0219172	-1.25	0.212	-.0703402	.0155738
UrbanPopulationofpop	.0380576	.0399831	0.95	0.341	-.0403079	.116423
AgricultureGDP	-.1877431	.1161736	-1.62	0.106	-.4154392	.0399531
Governmenteffectiveness	1.387385	.6296925	2.20	0.028	.1532106	2.62156
_cons	15.97484	6.137269	2.60	0.009	3.946017	28.00367
sigma_u	2.9269979					
sigma_e	.66508789					
rho	.95090359	(fraction of variance due to u_i)				

7.3.2 AR(1) regression

```
RE GLS regression with AR(1) disturbances       Number of obs      =       175
Group variable: Country1                        Number of groups   =        35

R-sq:  within  = 0.4569                         Obs per group: min =         5
       between = 0.9948                                        avg =       5.0
       overall = 0.9644                                        max =         5

                                                Wald chi2(12)      =   3534.51
corr(u_i, Xb)      = 0 (assumed)                Prob > chi2        =    0.0000
```

FDC02percapita	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
FDC02percapita						
L1.	.9033395	.0244444	36.95	0.000	.8554294	.9512495
GGG	-5.26033	2.230859	-2.36	0.018	-9.632734	-.8879254
Gini	3.944084	2.254706	1.75	0.080	-.4750578	8.363226
GDPcap	7.30e-06	5.56e-06	1.31	0.189	-3.60e-06	.0000182
IndustryGDP	.046109	.0132933	3.47	0.001	.0200546	.0721633
MEGDP	.1683897	.1112775	1.51	0.130	-.0497103	.3864896
FDIGDP	.0074321	.0018812	3.95	0.000	.003745	.0111193
ExportGDP	.0011224	.0030432	0.37	0.712	-.0048421	.007087
UrbanPopulationofpop	.0021543	.0079486	0.27	0.786	-.0134246	.0177333
AgricultureGDP	.0191597	.0574414	0.33	0.739	-.0934234	.1317428
Governmenteffectiveness	.4814222	.2434747	1.98	0.048	.0042207	.9586238
_cons	.6582129	1.605632	0.41	0.682	-2.488768	3.805194
rho_ar	.11398213	(estimated autocorrelation coefficient)				
sigma_u	0					
sigma_e	.78519946					
rho_fov	0	(fraction of variance due to u_i)				
theta	0					

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