Master Thesis

What is the effect of left-wing party strength and wealth inequality on the environment?

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Date: 01-03-2020

Abstract

With the increasing problems related to a degrading environment, environmental protection becomes more and more important. However, the willingness to implement environmental protection differs per government. This study will try to answer the question if left-wing governments are beneficial for the environment and whether the effect differs in countries with low and high levels of wealth inequality. This paper will make use of panel data of 21 OECD countries for the period 1990-2015 in order to study the effect of left-wing party strength on the environment. A distinction is made between regular left parties and so-called green parties which have environmental welfare as one of their primary goals. Little evidence is found for the claim that left-wing party strength has a positive effect on the environment. Additionally, no evidence is found that green parties have a positive impact on the environment or that the effect of left-wing party strength depends on the level of wealth inequality within a country.

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1. Introduction

The degradation of the environment is becoming an increasing problem in recent years. If emissions are not aggressively reduced, by 2100 the world's population will be exposed to multiple climate hazards of the largest magnitude (Mora, et al., 2018). Therefore, it's important to know in what way environmental degradation and pollution can be reduced. The government has many policy instruments available to reduce pollution, however not every government is as willing to use these instruments. For example, left-wing parties could potentially be more willing to implement environmental protection than their right-wing opposition. Traditionally, left-wing parties are more likely to embrace government intervention. However, government intervention in order to reduce pollution is likely to be costly and hurt heavily polluting industrial sectors such as basic metals, chemicals and non-metallic mineral products. This would endanger the left-wing party objectives of full employment and increasing the materialist benefits to the working class (Neumayer, 2003). The willingness to implement environmental protection doesn't only depend on the inherent preferences of parties but also on the current state of society. In a society with greater inequality, government parties might want to address the inequality issue before implementing environmental protection. Recent studies such as Chancel & Piketty (2015) are starting to pay more attention to the relationship between inequality and the environment.

This paper will study the effect of left-wing party power and green party power on environmental performance and look at the difference in effect for high inequality countries and low inequality countries. These questions will be tested with a panel data set consisting of 21 countries for the period 1990-2015. Emission data of SO_x, NO_x, VOC, CO_2 and CO are used as proxies for environmental performance. A few studies have looked at the effect of government ideology on emissions such as Neumayer (2003) Wen et al. (2016) and Garmann (2014). However, no studies have been found that researched the interaction effect between government ideology and wealth inequality. The findings of the current study suggest that there is some negative relationship between left-wing party strength and emissions although the evidence is weak. Additionally, no evidence for an interaction effect between left-wing party strength and wealth inequality was found with the current data set.

The paper has the following structure. First the existing literature and the theoretical background about the effects of left-wing party power and wealth inequality on the environment and the potential interaction effects will be discussed. Section 3 will review the existing quantitative

studies on the relationship between left-wing party strength, wealth inequality and the environment. Section 4 will introduce the model specification and the data used, while section 5 shows the results and discusses their implications. Section 6 concludes the paper and section 7 will debate the limitations of this research.

2. Theoretical framework

2.1 The effect of left-wing party strength on the environment

In general left-wing parties are more willing to incorporate more pro-environment policy positions in their party program than their right-wing counterparts, although the difference is very small and varies over time (Carter, 2013). A possible explanation for this difference can be found in the emergence of green parties. These green parties have environmental welfare as one of their primary goals and are overall located on the left-side of the political spectrum. The higher willingness to incorporate pro-environment policy positions by left-wing parties can be explained by a greater sense of pressure to incorporate environmental protection since green parties have a greater potential to steal their votes than they do for right-wing parties (Rohrschneider, 1993). Although left-wing parties incorporate slightly more environmental protection than right-wing parties, it is not beyond doubt that higher left-wing party strength has a positive effect on the environment. A priori the effect of left-wing party strength on the environment remains ambiguous. Here I will discuss the different theories regarding the effect of left-wing party strength on the environment.

Traditionally left parties have more redistributive preferences than right parties which prefer private property with little government interference. Left-wing parties pursue equality through redistribution and government intervention where everybody gets relatively the same amount of resources. Right-wing parties pursue equality through little government intervention where everybody gets the same chances and the difference in income and wealth is a result from one's own actions (Knapp & Wright, 2006). These redistributive preferences of left-wing parties result in higher preference for government intervention. One argument that left-wing party strength would have a positive effect on the environment argues that since left-wing parties are already more inclined to use government intervention for redistributive purposes, they are more willing to implement environmental protection as well (Benton, 1997). This argument depends on the assumption that the willingness to implement government intervention in order to protect their voters translates well to the willingness to implement government intervention for the purpose of environmental protection. If the willingness to implement environmental protection is only present to protect their voters and not the environment this argument becomes obsolete.

When looking at state-society relations, it can be expected that ideology will strongly affect public support for pro-environmental policy implementations. It is likely that people who find themselves more on the left side of the political spectrum have less aversion to government intervention and will have a better attitude to pro environmental policies. Rightists generally prefer as little government intervention as necessary and will have less support for government intervention with the goal of environmental protection. In other words the public opinion should be reflected in the political parties, and when there is high left-wing party strength the public support for environmental protection will be high as well (Jagers, Harring, & Matti, 2018). The public support can play an important role in the ability and willingness for a government to implement environmental protection. The restructuring of the economy in order to combat climate change may also work in favor of left-wing parties since they will be able to regulate and control a larger part of the economy giving the government more influence (Buttel & Flinn, 1976). If the government desires more influence in the economy, implementing environmental protection would provide a useful tool to expand their sphere of influence.

However, there are multiple reasons why the left-wing parties would be averse to environmental protection. For starters, the primary goal of left-wing parties is a socially equal society. They place greater emphasis on the poorer portion of society and focus most of their government planning on this section. Generally, implementing environmental protection has a negative impact on the economy (Meyer, 1995). These measures can threaten jobs, which goes against the goal of full employment of the left-wing government. Especially the high polluting industries where a greater part of the lower income people work will be affected by environmental measures. So left-wing parties might have some aversion to environmental protection since it will negatively affect poorer people (Neumayer, 2003).

Counterintuitively, the goal of left-wing parties to protect the poorer people or 'working class' can also be an incentive to implement environmental protection. The poor people have fewer resources and might be more affected by the consequences of a degrading environment than the higher-class people. Wealthy people can use their resources in order to protect themselves from the damage caused by pollution, which the working class cannot afford. Take for example the emission of pollutants where the wealthy might have the resources to relocate themselves far away from the source of the pollution, while the working class cannot. In order to increase the social welfare, it might be beneficial to employ a certain level of environmental protection. This higher level of environmental protection will benefit especially the working class by reducing the problems associated with a polluted environment. The right-wing parties have a weaker preference for social equality so they will care relatively less about the negative effects for the working class than the left-wing parties. The

ideology of right-wing parties attaches greater value to the interests and benefits of the wealthy. This results in less environmental protection if it is harmful to the interests of the wealthy, such as the companies where they have some ownership in (Wen et al., 2016).

Lastly there is the point of electoral competition where political parties base their political agenda on strategic choices in order to gain the most votes (Merlo, 2018). This can lead to parties incorporating environmental protection in their program since a share of the voters value environmental welfare. If left-wing parties refuse to incorporate environmental demands in their agenda, it could result in losing voters to other competing parties instead. This is especially true in electoral systems where lots of smaller parties exist, such as in parliamentary systems. Left-wing parties often had to realign themselves concerning the environment so that other parties didn't 'steal' their voters. In electoral systems where they favor bigger parties such as the presidential system in the US, the parties don't incorporate environmental demand as fast. This suggests that there is a greater positive effect of left-wing parties on the environment in countries with an electoral system where they favor more smaller parties instead of a small amount of bigger parties (Dolezal, 2010).

2.2 The effect of wealth inequality on the environment

The effect of inequality on the environment remains ambiguous as well. Multiple channels exist through which inequality can influence the environment, both direct and indirect. Viewing the environment as a luxurious good in a household optimization problem you would expect that inequality, specifically income inequality, would lead to more environmental protection. If the environment is a luxurious good, richer people are more willing to sacrifice money in order to protect the environment. If the relation between income and environmental pressure is non-linear at the household level, redistributing income could lead to less environmental protection (Heerink, Mulatu, & Bulte, 2001). Reason being that after a certain income threshold consumers are more willing to sacrifice an amount of their income to protect the environment. Before redistribution a small portion of society would be willing to sacrifice some of their income. After redistributing income, it could lead to fewer consumers willing to sacrifice some of their income resulting in less environmental protection.

The study of Boyce (1994) about wealth inequality is of more importance to this paper. Boyce provides a new approach for why greater wealth inequality could lead to greater environmental degradation. The political economy argument assumes that wealth and power are correlated so that the wealthy people also hold great political power. If wealthier people prefer more pollution more wealth inequality would lead to greater environmental degradation, since the opinions of wealthy people are better represented in the government when wealthy people hold greater political power.

Greater wealth/power inequality causes structural changes that can increase degradation in the long-term. This can be done by altering market values, influencing other peoples' preferences and determine the technology path of society. Political power derived from concentrated wealth can be exercised without much individual effort as the wealthy often control organizations and companies or have the means to hire professionals and firms that can act for them in the pursuit of their interests (Winters & Page, 2009). Winters and Page (2009) argue that wealth is more translatable to political influence in that it is "A material form of power that is distinct from all other power resources, and which can be readily deployed for political purposes." Whether wealth inequality leads to more environmental degradation depends on whether wealthier people prefer more pollution, which is debatable. On the one hand wealthier people have more resources which they can invest in order to protect themselves from the harms of pollution, like previously discussed in Section 2.1. Additionally, wealthy people might (partially) own companies which would be disadvantaged by more environmental protection. On the other hand wealthy people might have a higher willingness to pay for a better environment since they have more money to spend.

Expanding on Boyce, Downey (2015) argued that elites actively work to create undemocratic institutions and elite-controlled organizations and networks as means to exert their power and achieve what are often environmentally destructive goals. He stated multiple ways through which inequality can increase environmental degradation such as concentrating decision-making power, shifting environmental costs to those who are less powerful and less affluent, inhibiting public pro-environmental behaviors, and enhancing the ability of elites to frame issues in their favor and divert attention from their activities.

The political economy approach is not the only channel through which inequality can affect the environment. In order to reduce pollution it is important for citizens to cooperate. Sufficient cooperation is often possible if individuals are adequately informed of the consequences of their actions. This however doesn't take into account the heterogeneity of their resources to mitigate climate change and the heterogeneity of the consequences of climate change. If there is a larger relative risk of global warming for poorer members, cooperation will fail. (Burton-Chellew, May, & West, 2013). Burton-Chellew, May & West (2013) take a game theory approach to the problem of global warming and find that when there is inequality in resources and wealthier people can protect themselves better from the harm of global warming cooperation will fail. This approach is very similar to the political economy argument of Boyce (1994) although Burton-Chellew et al. focus on the effects of social cohesion and cooperation, while Boyce focuses on the effects from inequalities in political power. So although both approaches rely on heterogeneity of risk from pollution there is an important distinction through which channel inequality affects the environment.

Lastly there is the effect inequality has on the desire to consume. The level of consumption people are content with strongly depends on the overall level of consumption. Consumers care about their social status measured by consumption. If other people have a higher level of consumption people become 'jealous' and have the urge to increase their own level of consumption so that they don't fall behind others (Alpizar, Carlsson, & Johansson-Stenman, 2005). The consumption levels of the wealthiest set a certain standard for what constitutes a good life. In society there is the urge of the poorer people to increase their consumption just to have a consumption level closer to the wealthy people. In a highly inequal society the poor would have a much stronger urge to increase their consumption since there is a greater gap between the poor and wealthy. In a more equal society this gap would be significantly smaller, since the standard set by the rich is considerably lower and there would be less desire for the poor to increase their consumption. This channel is more dependent on the level of income inequality and not on their wealth inequality, since a persons' consumption depends on their level of income and not on their initial level of wealth. However, there are certain examples where wealth inequality plays an important role. For example, the size and quality of one's home which is a portion of one's wealth. In the USA the economic elite often try to isolate themselves from the rest of society in gated communities. This physical separating between the wealthy and poor can also lead to longer commutes which increases pollution levels (Cushing, Morello-Frosch, Wander, & Pastor, 2015).

2.3 Interaction effect of left-wing party strength and wealth inequality

After discussing the effects of left-wing party power and inequality on the environment it's important to look at the interaction effect between them. As previously discussed the greater consequences of pollution for the poorer segment of society and left-wing parties having less aversion to government intervention are the main arguments for the hypothesis that left-wing party strength is beneficial for the environment. In a society with low inequality, the effect of the first argument might be weaker. The difference between the rich and the poor is smaller which means that the difference in risk because of pollution will be smaller as well. Rich people use their resources to protect themselves from the harms of a degrading environment. However, the difference in resources they can use to protect themselves is smaller as well which means that there is a smaller difference in risk. Since left-wing parties have a stronger focus on social equality and with it protecting the poor, they might have less inclination to impose environmental protection. With more inequality there is also a greater difference in risk for the poor and wealthy people. So in order to protect the less wealthy people a stronger will to protect the environment of left-wing parties in a more inequal society is expected, which would result in a stronger effect of left-wing party strength on emission in an inequal

society. However, left-wing parties might have a greater willingness to raise environmental protection, since they favor more government intervention in general. This willingness to intervene wouldn't depend on the level of inequality in society but would be more of an inherent trait of left-wing parties. What can change however is their ability to implement environmental protection. As previously explained, the argument of Boyce (1994) is a political economy approach which relies on the relationship between economic power and political power. When there is higher inequality the wealthy people can use their greater resources through organizations or companies to influence politics. In other words with greater wealth inequality the views of the wealthier people are better represented in the government. Under the assumption that wealthy people prefer less environmental protection, since it would be unbeneficial for the companies which they own or own a share in, wealth inequality would lead to a weaker positive effect of left-wing party strength on the environment.

The main opposing argument is that government intervention to protect the environment can negatively affect jobs especially for the poorer people. When looking at a society with low inequality this effect would be weaker. Since there is already high equality present in the country the negative effect of stronger environmental protection wouldn't be as detrimental to the poorer segment of society. In a highly inequal society the poor would already have a much larger disadvantage compared to the wealthy and the economic effects of environmental protection could have much more dire consequences. Governing parties have to cooperate together which means they might have to make concessions in order to govern, especially in countries with a parliamentary system where not one party is big enough to govern alone. Looking at the objective of social equality of left-wing parties this becomes more important in an inequal society. Left-wing parties would focus more on social equality and let their other party objectives go in an inequal society. If society has already a high level of equality left-wing parties could focus more on their secondary objectives like environmental protection. So the effect of left-wing party strength on the environment would be weaker in a highly inequal society.

3. Review of empirical studies

3.1 The effect of left-wing party strength on the environment

Although existing quantitative studies about the effect of left-wing party strength on the environment are scarce, there are a few papers who have studied the effect. One of the papers is Neumayer (2003), in which the effect of left-wing party strength and corporatism on the environment in 21 OECD countries for the period of 1980-1999 is studied. In this research five different kinds of air pollution per capita are used as a measurement for environment, including CO_2 which is the principal contributor to global warming of the greenhouse gases (Reilly, Jacoby, & Prinn, 2003). The left-wing

party strength variables contain the share of green or left-libertarian party legislative seats as a percentage of all legislative seats, the share of traditional left-wing party legislative seats and the share of cabinet portfolios belonging to left-wing parties. The data on party types are retrieved from the Comparative Parties Data Set of Swank (2002). Furthermore, Neumayer controlled for economic activity by adding the GDP per capita and vehicle use per 1000 capita. The share of fossil fuel of primary energy consumption and the share of GDP from manufacturing are added in the regression in order to control for the high output of emissions associated with them. The technique effect which controls for the difference in efficiency of energy use is measured by the ratio of GDP per unit of energy. Neumayer (2003) measured the effect of left-wing party strength with a fixed effects model and the effect of corporatism on the environment with a linear regression since there is little variation within countries over time for the corporatism variable. Since there are great differences between countries, it's better to use a fixed effects model than a random effects model in order to study the effect of left-wing party strength. Focusing on the fixed effects model, Neumayer (2003) found some statistically significant negative effects of left-wing party power on pollution. Especially for the green party variable a negative significant effect for all five types of pollution was found. In addition, a significant negative effect for the share of traditional left-wing parties for three types of pollution has been found. The share of cabinet portfolios proved of no significant effect. The control variables of GDP, vehicles, fossil energy share and efficiency show a significant effect for all emission types and manufacturing for only one emission.

Garmann (2014) researched the effect of government ideology and government fragmentation on the reduction of CO_2 emission in the period 1992-2008. Garmann (2014) used almost the same OECD countries as Neumayer (2003) since they have good data coverage. In contrast to Neumayer who uses per capita emissions, Garmann (2014) uses the growth rate CO_2 emissions per unit of GDP. This is done because CO_2 emissions may change along with the economic situation. This way Garmann tries to ensure that the effect stems from the climate policy of the government and not from the economic policy, since a reduction in production will be accompanied by reduced emissions. For government ideology he uses a scale from 1 to 5 where 1 indicates right-wing dominance, which means that more than two thirds of governing parties are of the right-wing. Vice versa this means that 5 is given if two thirds of governing parties are of the left-wing. Garmann (2014) finds a significant negative relationship between share of left-wing parties and the growth rate of emissions, indicating a positive relationship between left-wing party strength and the environment.

A more recent paper is written by Wen et al. (2016) where they studied the influence of government ideology on environmental performance. For this they used panel data of 85 countries for the years 2002-2012. In contrast to other papers where emissions are used as an indicator for

environmental quality, Wen et al. (2016) used the Environmental Performance Index (EPI), Environmental Health Index and the Ecosystem Vitality Index (EVI). The EPI index shows how well countries perform on important environmental issues comprised of 20 indicators and measure how close a country is to meeting internationally agreed-upon targets. For the government ideology they look at the proportion of legislative seats for different party ideologies, where they made a distinction between three different types: Left (1), Central (0) and Right (-1). Besides the control variables of Neumayer (2003), Wen et al. (2016) included a wide range of other control variables. For all three indexes they found a significant positive relationship with party ideology, indicating that the further left on the political spectrum a party is positioned, the better for the environment. Wen et al. (2016) found overall that left-wing governments prefer environmental quality to economic performance, while right-wing governments care more about economic growth than environmental issues. However, both sides tend to forego environmental issues if pressured for better economic performance. The latter insight that economic performance is valued above the environment could also imply that if there is greater inequality left-wing parties could forego environmental goals and instead focus on reducing inequality.

3.2 The effect of wealth inequality on the environment

Although the number of papers written about the effect of inequality on the environment is growing, currently there are few quantitative studies about the subject. One paper that did research the effect of wealth inequality is Knight et al. (2017), which studied the connection between domestic wealth inequality and consumption-based CO_2 emissions. For their tests consumption-based CO_2 emissions per capita was used where emissions from bunker fuels which are used for international transport were excluded. By excluding emission from bunker fuels, their emission measurement will only take consumption attributed emissions into account. For wealth inequality Knight et al. (2017) used the percentage of total wealth owned by the 10% wealthiest individuals. Data is retrieved from Shorrocks et al. (2014), which estimated the share of wealth owned by the top 10% for 46 countries in the period 2000-2014. The wealth estimations from Shorrocks et al. (2014) will be used as a measurement for wealth inequality in this paper as well. Knight et al. (2017) only used countries with good or satisfactory quality data since some of the measurements are incomplete. The regression includes control variables for GDP per capita and income inequality measured as the Gini coefficient of inequality for household disposable income.

The quantitative studies about the connection between wealth inequality and the environment are rare. A relatively higher number of papers are written about the effect of income inequality. Scruggs (1998) studied the effect of political and economic inequality on the environment

using data of the period 1979-1990. Economic inequality is seen as income inequality which is measured with the Gini coefficients. Scruggs (1998) used the Freedom ranking of Gastil (1989) as a measure for political inequality, which has a scale from 2 to 12. Scruggs (1998) performed two different tests, the first test with a wider range of different countries which has the advantage of more variation in income inequality and political equality. The downside is however that there are many unobserved differences as well, which can compromise the result. The second test is with a smaller group of 17 wealthy OECD countries. In the first test environmental quality is measured by four major pollutants which are separated in water and air pollution. No consistent evidence is found that more economic equality or political equality has a negative effect on pollution. In the second test environmental quality is measured by fertilizer used, municipal waste and three different types of emissions. In order to capture the environmental quality in one variable, the national scores were subtracted from the country with the highest level and then divided by the difference between the highest and lowest levels. This was done for each type of pollutant and results in a score between 0 and 100 for each pollutant and a score between 0 and 500 in total. This last variable was used as a measure for environmental quality. For the economic equality measurement an extra variable showing the 80/20 income ratio was added since there was more data available for these countries, while the Freedom ranking is left out of the equation. For the second test no proof has been found to support a positive effect of income equality on the environment.

Another paper that studied the effect of income inequality is written by Torras and Boyce (1998). In this study data from 1977-1991 was used of up to 58 countries depending on the pollution variable. Seven different pollution variables were used, which can be subdivided in 3 categories: water pollution, atmospheric pollution and access to safe water and sanitation facilities. Their main variable of interest, income inequality, is measured by the Gini ratios. Furthermore, control variables were added for the literacy rate, urbanization rate and power equality. In order to test whether the effect of inequality differs in high- and low-income countries a dummy variable was added. This dummy variable interacts with the inequality variables to estimate two separate coefficients for the inequality variables. The results for income inequality differ depending on the environmental variable. For some environmental variables and access to safe water, greater income inequality relates to more pollution in the low-income countries. However, when looking at the high-income countries this effect is not found. For other pollutants they obtained opposite results where greater income equality relates to more pollution in low-income countries. So in the end Torras and Boyce (1998) haven't found a clear relationship between income inequality and the environment.

Up until this point papers that found a positive relationship between equality and the environment have been discussed, however they disregard the effect of government policy making.

Magnani (2000) used data of the period 1980-1991 for 19 OECD countries to study the effect between income distribution and environmental protection policy. As a proxy for the environmental protection policy of countries Magnani (2000) used the per capita expenditure for environmental protection Research and Development (R&D). As a measurement for inequality the Gini coefficient was used. Magnani (2000) used the fixed effect, random effect and pooled cross section model to test his hypothesis. Although a negative relationship is found between inequality and environmental protection expenditure, it is only significant in one of the models used. Magnani (2000) did not find a strong relationship between income inequality and the environment. What is interesting is that not the effect of environmental policy and inequality on the environment itself is studied, but instead the effect of inequality on the policy making. The findings of Magnani (2000) only give a broad estimate of the relationship between income inequality and policy making since there are many other aspects of environmental protection besides per capita expenditure.

4. Estimation method and data

4.1 Dependent variables

This study will use the panel data approach in order to test the hypothesis that left-wing party strength has a negative impact on emission. Using panel data provides the advantage of more observations in contrast to cross-sectional methods. In addition, panel data can deal better with serial correlation problems found in time series data of a single country. In order to test the effect of left-wing party strength and wealth inequality on the environment a measurement for environmental welfare is needed. Looking at current environmental threats, global warming is one of the most debated threats. The cause of global warming are the emissions of greenhouse gases such as CO_2 (Mora et al., 2018). So using greenhouse gas emissions as a measurement for the environment would give a reliable view of environmental welfare. An advantage of using emissions is that emissions are well monitored for developed countries, which results in adequate data availability.

In total five different kinds of pollutants are used: VOC, NO_x, SO_x, CO and CO_2. Nitrogen oxides (NO_x) and Sulphur oxides (SO_x) are measured in quantities of NO_2 and SO_2 respectively. Furthermore, this paper will follow the example of existing literature and make use of non-methane volatile organic compounds or nmVOC, which will be abbreviated to VOC. VOC's direct effects as greenhouse gases are relatively insignificant compared to others. Instead VOC helps in creating photochemical oxidants such as ozone, which can be harmful to a person's health when inhaled. VOC's are emitted by a variety of sources, but the industrial processes and use of products accounts for 50% of the VOC emissions (European Environment Agency, 2017). Nitrogen dioxide (NO_2) has both direct effects on human health and the environment. Human exposure to NO_2 over periods of time can lead to respiratory

diseases such as asthma. Higher concentrations of NO_2 in the environment can lead to acid rain, smog and nutrient pollution in coastal waters. Almost half (46%) of the nitrogen oxides are emitted by the transportation sector, both by on-road vehicles as well as non-road vehicles such as boats or construction vehicles. The second largest contribution to nitrogen oxide emissions is the production and distribution of energy (19%) (European Environment Agency, 2017). Similar to NO_2, sulfur dioxide (SO_2) contributes to acid rain and has a negative impact on the respiratory system as well. The production and distribution of energy is by far the largest contributor to sulfur oxide emissions and accounts for over half of the total emissions (59%) (European Environment Agency, 2017). Carbon monoxide (CO) mainly has an impact on human health and little effect on the environment. It reduces the amount of oxygen that can be absorbed by the human body, which is especially harmful to people who already have some form of heart disease. The largest part of CO emissions stems from the commercial, institutional and households sector (47%) (European Environment Agency, 2017). Finally, of all the greenhouse gases carbon dioxide (CO_2) has the largest contribution to global warming. By far the largest contributor to carbon dioxide emissions is the burning of fossil fuels, similar to the other emission types (European Environment Agency, 2017).

In order to combat climate change multiple policy instruments are available. These instruments can be broadly categorized into two groups. The first group are the so called command-and-control instruments, which regulate the activities of citizens and companies. The second group is through market-based policies, which have become more popular in recent years. With these market-based policies polluters will face direct cost incentives when they want to increase their pollution (Stavins, 1997). The production and distribution of energy contributes a large part of the emissions for multiple types of pollutants. Although governments are trying to reduce their reliance on fossil fuel by shifting to other sources of energy, the majority of energy used stems from combustion of fossil fuel. The share of fossil fuel is also taken as a control variable in the regression, so the change in emission due to less use of fossil energy will not be accounted to environmental protection of left-wing parties in the regression but to the control variable 'Fossil'. Of course other ways to transition to a less pollutant way of energy exist but shifting away from the use of fossil fuel remains an important way to reduce emissions. Since the shift away from fossil fuel will be attributed to the control variables instead of left-wing party strength the expectation is that for the pollutants where the production and distribution of energy plays an important role like CO_2 and SO_2, the effect of left-wing party strength will be smaller.

The second source of emission that is unlikely to be greatly influenced by the left-wing party power variables is the transport source. The use of motor vehicles in the EU remains on the rise between the years 2000 and 2017 (European Environment Agency, 2019). Although the use of motor

vehicles still grows, the focus of environmental protection is on improving the age and environmental performance of the motor vehicle fleet. An example of this is the promotion of electric cars and higher taxes on older more polluting cars. However, the expectations are still that the use of motor vehicles will continue to rise despite environmental protection. Industrial processes and building materials can be potentially more heavily regulated than transport by setting certain standards for the allowed amounts of emission per output. The expectations are that the effect of left-wing party power is smaller on the emissions which are largely produced by transport such as NO_2.

For this study panel data of 21 OECD countries for the period of 1990-2015 is used. The following countries are included: Austria, Australia, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, the United Kingdom and the United States. Data of CO, VOC, SO_2 and NO_2 for all 21 OECD countries is retrieved from OECD (2019). OECD (2019) retrieved the data for most of the countries from the European Monitoring and Evaluation Programme (EMEP). EMEP is the cooperative programme for monitoring and evaluation of the long-range transmission of air pollutants in Europe. EMEP is a policy driven programme under the Convention on Long-range Transboundary Air Pollution (CLRTAP), with the goal of international cooperation in order to solve air pollution problems. In order to compare the pollution levels of the different countries with each other, it is necessary to normalize them. This is done by dividing the total emissions by the population in order to obtain the per capita emissions for each type of emission. By using emission per capita as the dependent variable the difference in population size is taken into account.

4.2 Control variables

In this study four variables of interest and five control variables are used. The variables of interest are three variables representing left-wing party strength and one variable representing wealth inequality. The control variables consist of: GDP per capita, share of manufacturing of total GDP, share of fossil fuel of total fuel, ratio of GDP per unit of energy used and the urbanization rate. GDP per capita is defined as Output-side real GDP in chained Purchasing Power Parity (PPP) in 2011 US$ retrieved from the Penn World Tables (Feenstra, Inklaar, & Timmer, 2015). Share of fossil fuel of total primary energy consumption data is retrieved from BP (2019). The data of GDP per unit of energy used in constant 2011 PPP $ and urbanization rate is retrieved from World Bank (2019). Data on manufacturing share of total GDP is retrieved from Euromonitor (2019). Data on manufacturing share for Ireland and Spain was incomplete and has been corrected by method of extrapolation. The available years followed a slight decline in manufacturing share for both countries which continued after the extrapolation. The test is executed with and without those years in order to check for biases.

The differences were very small, which provided confidence to use the extrapolated manufacturing data. The next part will explain the reasons for selecting each control variable.

(1) GDP per capita (GDP): The relationship between GDP and the environment is a heavily debated topic with many papers written about the subject. One of the theories that describes the relationship between economic development and the environment is the Environmental Kuznets Curve (EKC). The EKC theory hypothesizes an inverted U-shaped relationship between per capita income and pollutants. Meaning that economic growth will lead to environmental degradation up until a certain point, where afterwards economic growth will have a positive effect on the environment. Reason being that countries with more financial resources can afford greater investment in environmental protection (Dinda, 2004). The setup used in this paper makes it unlikely that the effect of GDP per capita will follow the EKC. This is because in the EKC two of the main reasons for the existence of a turning point are the efficiency and composition of industries in a country. The increase of economic development often goes hand in hand with technological innovation, which can positively influence the energy efficiency in a country (Stern, 2004). This is one of the important hypothesized reasons for why at some point economic growth could lead to less pollution. The second reason is that as a countries' economic development increases they will change their output mix. More developed countries will move away from the heavy industrial sectors to service sectors (Stern, 2004). The higher efficiency is taken into account by the efficiency variable and the economic composition is taken into account by the manufacturing variable, which will both be explained below. So in this study GDP per capita is expected to have a strictly positive relationship with pollution.

(2) Share of manufacturing of total GDP (Manufacturing): The composition of the economy can have an impact on pollution especially if some industries are likely to be accompanied with greater pollution. Manufacturing industry is a sector which has a close relation with pollution, especially the effect of manufacturing on VOC is likely to be substantial. In order to control for the effects of manufacturing this variable is added.

(3) Share of fossil fuel of total primary energy consumption (Fossil): The use of fossil fuel has a direct effect on pollution since greenhouse gases are emitted during the process of burning fossil fuels. Although CO_2 makes up the majority of the greenhouse gases emitted during the combustion of fossil fuel, other gases are emitted as well. Compared to other forms of generating energy combustion of fossil fuel emits far more, which makes it an important variable to control for.

(4) Ratio of GDP per unit of energy (Efficiency): Advanced technique will have a positive effect on the efficiency in a country. In order to capture the difference in technology and technique used in a country and over time this variable is added. The effect of increasing energy efficiency on pollution can remain ambiguous. On the one hand higher efficiency means that less pollution is generated per unit of energy. On the other hand higher efficiency means lower cost of energy consumption. This can encourage people to increase their energy consumption resulting in higher pollution. The expectations are that the lower pollution associated with generating energy will dominate the greater demand for energy consumption and a negative relationship between efficiency and pollution exists.

(5) Urbanization rate (Urban): The effect of urbanization rate on pollution is ambiguous as well. There are multiple theories how urbanization can affect emissions. According to the compact city theory economics of scale can be exploited for urban public infrastructure in high urban density cities, thus reducing the reliance on peoples own transportation and reducing pollution. However, higher urban density can lead to more air pollution and traffic congestion, which can mitigate the positive effects of the economics of scale (Poumanyvong & Kaneko, 2010). Secondly the theory of ecological modernization suggests that urbanization is associated with modernization. An increase from low to intermediate levels of urbanization can lead to higher emissions, however at some point further modernization can lead to society realizing that environmental sustainability is important and focus more on environmental protection (Poumanyvong & Kaneko, 2010). Urbanization is also one of the reasons for the emergence of environmental action groups to influence politics in order to battle urban pollution (Farzin & Bond, 2006). So the relationship between urbanization rate and pollution can be positive or negative depending on which effects are stronger.

With this research setup it is important to note exactly what effect is being studied. Because control variables were used the found effects of left-wing party strength on the environment would be through other channels than the control variables included in the regression. Since every effect of left-wing party strength on emissions through any of these control variables will be attributed to that control variable and not to the variables representing left-wing party strength. So any effect of left-wing party strength that is measured will be through other channels than those which are controlled for. Since the effects of government policy through any of these channels are not taken into the account when looking at the effect of left-wing party strength, it is likely that the actual effect will be greater than the possible effect that will be found. Since government policy can potentially influence all aspects of society it is impossible to use only control variables that are not influenced by government policy. So if all control variables government policy can influence are left out, a simple

regression with only an independent variable emission and a dependent variable left-wing party strength without control variables would be left. In order to find the policy impact and isolate the effect from the most important exogenous variations, a small amount of selected control variables are used. The control variables used in this study are likely to be affected by exogenous factors so it's important to include them.

4.3 Variables of interest

In order to capture left-wing party strength, a measurement is needed to determine which parties belong to the left-wing. This paper uses the Comparative Political Parties Dataset of Swank (2018). The Comparative Political Parties Dataset provides an objective overview of the percentage of left-wing party power in a country every year. This paper will use three different variables of the national parliament presented in Swank (2018): The percentage of left party cabinet portfolios compared to all cabinet portfolios, left party legislative seats as a percent of all legislative seats and lastly the percentage of lower chamber seats owned by left-libertarian or green parties. The percentage of left party cabinet portfolios and percent of left party legislative seats show the effect of left-wing party power in general. The cabinet is a relatively small group of high-ranked officials with different specializations. These members hold considerable influence in the policy making with either an advisory task or a decision making task depending on the government system. Since the members of a cabinet each have a large responsibility, a change in the percentage of left-wing portfolios can have a great impact on policy making. The percentage of left party legislative seats is a straightforward variable which measures the power of the left-wing in the total legislature and takes into account all left-wing parties including the green and left-libertarian parties. As it takes the entire legislative system into account it is an excellent variable to test the effect of left-wing party power on the environment.

In the political party dataset of Swank (2018) left-libertarian and green parties are lumped together in one variable representing left-libertarian party strength. Kitschelt (1988) observed the rising green parties as members of the left-libertarian front sharing many of the same values as other left-libertarian parties. Given that green parties still embrace a left-libertarian agenda on various issues it can be justified that left-libertarian and green parties are put together in one variable (Carter, 2013). Furthermore, Swank (2018) also presents an overview of the major left-libertarian parties of each country presented in **Appendix A,** which is primarily dominated by green or ecological parties. This shows that left-libertarian party power can be used to represent green party power in the model.

The percentage of left-libertarian or green parties of the lower chamber seats is added in order to specifically look at the effect of so-called "green" parties, henceforth indicated as green parties.

These parties positioned themselves as parties with protection of the environment as one of their primary goals. The lower chamber generally has more influence than the upper chamber, especially in parliamentary systems where the upper house usually has more of a revising task. Although the percentage of cabinet portfolios in national government held by left libertarian parties is available, this variable isn't used. Since left-libertarian parties still form a minority in most governments it is unlikely that there are many observations where left-libertarian parties hold a large share of cabinet portfolios, which would result in little data variation. So in order to test the effect of green parties on the environment, the percentage of green parties in lower chamber can be used. The setup of three different variables representing left-wing party strength and green party strength allows to test the effect of all left-wing parties in general and more specifically the effect of green parties on the environment.

As previously discussed this paper will study the effect of inequality as well. First a distinction is made between countries with high levels of wealth inequality and low levels of wealth inequality. By comparing the different coefficients of the left-wing party strength variables a difference in effect can be found between high or low inequality countries. The distinction between high and low inequality countries is based on wealth inequality data of the period 2000-2014. A widespread used indicator for inequality is the equality of income and specifically the Gini coefficient of income. The reason wealth inequality is used instead of income inequality as a measurement lies in the way both inequalities theoretically affect the environment. The theoretical effect of income inequality on the environment is that inequality can affect consumption patterns of people resulting in higher consumption and more pollution. Although this is an interesting approach on itself, little interaction effect with left-wing party power can be expected. In comparison, the theoretical effect of wealth inequality on the environment relies on the correlation between wealth inequality and political inequality. Wealthier people can influence politics to push their own demands about environmental protection policy. If that really is the main channel through which wealth inequality affects the environment, a significant difference in coefficients for low and high inequality countries would be expected.

The data on wealth inequality is retrieved from Shorrocks et al. (2014), which estimated the share of wealth owned by the top 10% for 46 countries in the period 2000-2014. By setting the cutoff point at 10 countries with the smallest share owned by the richest 10% in 2014 the following group of Low inequality countries is created: Belgium, Japan, Australia, Italy, France, United Kingdom, Finland, Netherlands, Spain, Greece. The high inequality countries consist of Canada, New Zealand, Portugal, Ireland, Germany, Austria, Norway, Denmark, Sweden, Switzerland and the United States. Although the countries are arranged by wealth inequality in 2014, the groups would consist of the same

members if arranged by data for the years 2000 and 2007. Based on the little variation of wealth inequality in those 14 years we can assume that the 10 years prior would result in relatively the same groups. An overview of wealth inequality for the wealth share of the top decile for the years 2000, 2007 and 2014 can be found in **Appendix B.**

4.4 Estimation specification

The following estimation specification will be used for both country groups:

$$\begin{aligned} ln(emission_{it}) = {} & \beta_1 \ln(GDP_{it}) + \beta_2 \ln(Manufacturing_{it}) + \beta_3 \ln(Fossil_{it}) \\ & + \beta_4 \ln(Efficiency_{it}) + \beta_5 \ln(Urban_{it}) + \beta_6 Leftseat_{it} + \beta_7 Greenseat_{it} \\ & + \beta_8 Leftcabinet_{it} + \gamma_t + \alpha_i + u_{it} \end{aligned}$$

The i subscript indicates the country and the t subscript indicates the year. In order to take into account year specific trends across countries, T-1 year specific dummy variables were added which are captured in the γ variables. α captures country specific effects and u_{it} captures the error term. All control variables were logged since there was skewedness in distribution. Since countries have many different characteristics which are relatively stable over time, a fixed effects model is used in case of correlation between these characteristics and explanatory variables. By eliminating the fixed effects from the model any potential bias because of correlation between countries and explanatory variables is eliminated. Furthermore, the variables have enough within country variation needed to use a fixed effects model.

5. Results

Tables 1-5 present the estimation results for the sample of five air pollutants for high and low inequality countries. Regression Low shows the results for low inequality countries and regression High shows the results for the high inequality countries. Since the observations are grouped in 21 countries the regression made use of clustered standard errors.

Table 1 Carbon dioxide results for low and high inequality countries

	Low	High
Leftcabinet	-0.000	-0.000
	(0.00)	(0.00)
Leftseats	0.001	0.002
	(0.00)	(0.00)
Green	0.005	0.000
	(0.00)	(0.00)
GDP	0.465***	0.329*
	(0.12)	(0.17)
Manufacturing	-0.260***	0.183
	(0.06)	(0.13)
Fossil	1.049***	1.161***
	(0.27)	(0.29)
Efficiency	-0.683***	-0.471**
	(0.08)	(0.20)
Urban	-0.105	1.056**
	(0.30)	(0.41)
R2within	0.711	0.687
R2between	0.882	0.494
R2overall	0.860	0.505
Observations	260	286

* p<0.10, ** p<0.05, *** p<0.01

Table 1 presents the results for carbon dioxide emissions for low and high inequality countries**.** Starting with the results for low inequality countries, regression Low suggests statistically significant effects for all control variables except the urbanization rate (Urban) on the CO_2 emission per capita. More specifically, a statistically positive effect of economic output per capita (GDP) and the primary energy consumption share gained from fossil fuel (Fossil) are found. Both effects are in line with the expectations that economic growth will result in more pollution and that use of fossil energy has a direct impact on the emission of CO_2. A negative effect is found for GDP per unit of energy used (Efficiency) and the manufacturing share of total GDP (Manufacturing). It is within expectations that greater efficiency could lead to lower emissions, however the negative effect of manufacturing share

on CO_2 emissions is contrary to expectation. Regression Low suggests no statistically significant effect of left-wing party power on CO_2 emission per capita for low inequality countries. The same is the case for regression High which represents high inequality countries. Although the dependent variables show no difference between low and high inequality countries, there are differences for the control variables. Regression High suggests a positive relationship between urbanization rate and the emission of CO_2, while there is no significant effect for manufacturing.

Table 2 Carbon monoxide results for low and high inequality countries

	Low	High
leftcabinet	-0.000	0.001
	(0.00)	(0.00)
Lefts	-0.001	-0.007**
	(0.00)	(0.00)
Llseat	0.001	0.004
	(0.01)	(0.01)
GDP	0.220	0.074
	(0.53)	(0.13)
Manufacturing	0.209	-0.471
	(0.25)	(0.36)
Fossil	0.429	0.995*
	(0.80)	(0.47)
lnefficiency	-0.586	-0.583***
	(0.65)	(0.14)
Urban	2.149**	-0.920
	(0.79)	(1.14)
R2within	0.929	0.911
R2between	0.135	0.251
R2overall	0.060	0.407
Observations	260	286

* p<0.10, ** p<0.05, *** p<0.01

Table 2 presents the results for carbon monoxide emissions, where regression Low presents the results for low inequality countries and regression High for high inequality countries. For low inequality countries there is a positive significant effect found for urbanization rate, all other variables suggest no significant relationship. Regression High is the first regression to suggest a significant negative relationship between left-wing party power and emissions. This is in line with the theoretical expectations and findings of previous literature like Neumayer (2003) and Wen et al. (2016). Furthermore, a significant negative relationship between efficiency and emissions is found and a positive relationship between the use of fossil fuel and emission significant at the 10% level.

Table 3 Sulphur dioxide results for low and high inequality countries

	Low	High
leftcabinet	-0.000	-0.000
	(0.00)	(0.00)
Lefts	-0.006	-0.003
	(0.01)	(0.01)
Llseat	0.028	-0.010
	(0.03)	(0.01)
GDP	0.336	0.075
	(1.37)	(0.27)
Manufacturing	-0.846	-0.870
	(0.57)	(0.60)
Fossil	3.791*	3.343**
	(1.98)	(1.37)
lnefficiency	-1.023	-1.702***
	(1.44)	(0.35)
Urban	-1.355	-3.773*
	(3.08)	(1.87)
R2within	0.810	0.856
R2between	0.207	0.679
R2overall	0.391	0.698
Observations	260	286

* p<0.10, ** p<0.05, *** p<0.01

Looking at the emission of Sulphur dioxide for low inequality countries in Table 3, a positive effect is found between the use of fossil energy and emission significant at the 10% level. For high inequality countries the same significant relationship is found for the use of fossil energy. Additionally, a significant negative effect of efficiency and negative effect of urbanization rate is found. The effects of fossil energy and efficiency are again in the expected direction. The effect of urbanization is the opposite of the findings for carbon dioxide in low inequality countries, although it is only significant at the 10% level. No significant effects for any of the variables of interest are found.

Table 4 Nitrogen dioxide results for low and high inequality countries

	Low	High
leftcabinet	0.000	-0.000
	(0.00)	(0.00)
Lefts	-0.004**	-0.001
	(0.00)	(0.00)
Llseat	0.014	0.000
	(0.01)	(0.00)
GDP	0.341	0.322*
	(0.43)	(0.15)
Manufacturing	-0.267	-0.201
	(0.18)	(0.30)
Fossil	1.387**	1.304**
	(0.55)	(0.49)
lnefficiency	-0.958	-0.771***
	(0.58)	(0.17)
Urban	-1.355	-0.834
	(1.13)	(0.95)
R2within	0.852	0.863
R2between	0.527	0.324
R2overall	0.605	0.407
Observations	260	286

* p<0.10, ** p<0.05, *** p<0.01

Table 4 shows the results of the regressions for nitrogen dioxide. The results suggest a significant negative effect of the percentage of left-wing legislative seats on emissions in low inequality countries. Besides this negative effect, regression Low suggests the usual positive effect for the use of fossil energy on emissions. For high inequality countries no significant relationship between left-wing party strength and emissions is found. The expected effects for the use of fossil energy, efficiency and GDP are found again although the positive effect of GDP on emission is only significant at the 10% level.

Table 5 Volatile organic compound results for low and high inequality countries

	Low	High
leftcabinet	0.000	0.000
	(0.00)	(0.00)
Lefts	-0.003	-0.003
	(0.00)	(0.00)
Llseat	-0.001	0.010
	(0.01)	(0.01)
GDP	0.847**	-0.391*
	(0.33)	(0.21)
Manufacturing	0.033	-0.327
	(0.26)	(0.36)
Fossil	0.835	0.998*
	(0.59)	(0.45)
lnefficiency	-1.246***	0.725**
	(0.36)	(0.31)
Urban	-0.743	1.870
	(0.91)	(1.23)
R2within	0.911	0.843
R2between	0.304	0.127
R2overall	0.514	0.001
Observations	260	286

* p<0.10, ** p<0.05, *** p<0.01

Table 5 presents the results for Volatile Organic Compound (VOC). The results for low inequality countries show a positive effect of GDP on emission and a negative effect of efficiency. Regression High shows some irregular effects contrary to the expectations. First is a regular positive effect of fossil energy usage on emission significant at the 10% level. However, a negative effect of GDP on emissions significant at the 10% level is also found. Secondly, a positive effect of efficiency on emissions significant at the 5% level is found. The effect of efficiency on emissions is the only one across all 10 regressions that bears a positive sign, contrary to expectation. Again no significant results were found for the effect of left-wing party strength on the environment.

6. Robustness check

It is important to check the degree of robustness for the results shown in the sections above. One important omission in the regressions used in this paper is that they do not consider the effect of policy making of previous years. Since policy making is a time intensive process and the implementation of policies can take a longer period there is a potential impact of government ideology of previous years on emission. In order to check whether a time-lag exist between policy making and the impact on emissions the variables representing left-wing party power were lagged by one year. The results remained relatively similar and there were no changes in significance except for the effect of left-wing portfolios in cabinet on CO_2 in low income countries. After lagging all variables of interest by one year, a negative relationship was found for left-cabinet significant at the 10% level.

What would happen if the three variables of interest are tested separately instead of in a single regression? The only noteworthy changes are to the effect of left party legislative seats as a percentage of all legislative seats. The significant negative effect of left legislative seats on NO_2 in low inequality countries remains the same. Taking 10% as benchmark for significance the negative effect of left legislative seats on VOC emissions in low inequality countries becomes significant if entered in isolation from the other variables of interest. The second change is that the effect of left legislative seats on CO in high inequality countries now becomes significant only at the 10% level instead of the previous 5%. Lastly a negative effect of left legislative seats on SO_2 in low inequality countries is found significant at the 10% level. The variables left cabinet and green party remained insignificant in all tests.

Up until now a distinction was made between low and high inequality countries. What would happen if countries are not split into two groups but the regression uses all countries? If the distinction between high and low income inequality countries is ignored and all countries are put in one regression the results become mostly insignificant. Only the left party legislative seats for NO_2 becomes significant at the 10% level. This isn't a great change compared to before since little effect of left party power was found in the original regressions as well.

Robustness can also be checked by estimating reduced models. Since these variables have the smallest level of significance it is interesting to find out what the effect is of leaving out manufacturing share of GDP and urbanization rate. Manufacturing share tested significant in only 1 out of 10 regressions, specifically for CO_2 in low inequality countries. Urbanization rate tested significantly in 3 out of 10 regressions and had varying signs for the coefficient. Once these control variables are taken out of the regressions the results remain relatively the same. In the reduced model left legislative seats retain their significance for NO_2 in low inequality countries and CO in high inequality countries. So the results in the reduced model resemble the results of the original model very closely.

Another possible reduced model is based on the likeliness that the control variables are affected by government policy. Government policy can have a large effect on the usage of fossil fuel and the energy efficiency in a country, by giving out subsidies for example. The environmental and energy study institute estimates that the US gives at least 20 billion dollar annually as direct subsidies to the fossil fuel industry and the European Union 55 billion euros annually. Likewise, government subsidies can help improve energy efficiency in a country. The results vary little after performing a reduced model without the efficiency and fossil variables. Similar to the other reduced model, left legislative seats retain their significance for NO_2 in low inequality countries. However, the effect of left legislative seats on CO in high inequality countries is only significant at the 10% level instead of the former 5% level.

7. Conclusion

In general, the regressions found confirmation of the expected effects for some of the control variables. First of all, the higher economic output captured in the GDP per capita is associated with higher level of emissions. The effects of Manufacturing share are of the expected sign although it only tested significant at the 5% level in one regression. The expected positive relationship between use of fossil fuel and emissions is found as well in multiple regressions. Some proof is found that efficiency has a negative impact on emissions which is in accordance with expectations. The effect of urbanization rate is found to be ambiguous for which both a positive and negative relationship is found depending on the regression. The exact reason for the inconsistent sign of the coefficient is not clear. One of the possible reasons lies in the different characteristics of the types of emissions. It is possible that some type of emissions will increase when the urbanization rate is higher and other types will decrease. Another possible reason is the difference in high and low inequality countries. Unfortunately, the exact reason cannot be clearly found since there is no consistent difference between low and high inequality countries and too few significant effects were found in order to make a clear comparison.

The expectations were that the three main variables of interest representing left-wing party strength have a positive impact on the environment and therefore a negative effect on the emissions of greenhouse gases. Little evidence was found to back up this claim. The effect of left-wing party strength in cabinet and green party strength in lower chamber test insignificant for all regressions. Percentage of left party legislative seats is the most comprehensive indicator of left-wing party strength used in this study. Looking at left legislative seats all coefficient signs except for CO_2 are negative, including the two cases where left party legislative seats is significant. This does provide some support for the claim that left-wing party power has a negative effect on emissions, although

relatively weak. The variable green party strength looks at the environmental green parties which have a specific focus on environmental welfare. This variable doesn't take all left-wing parties into account and is added in order to measure the effect of specifically these green parties. Left cabinet portfolios as a percentage of all cabinet portfolios looks at a select group of influential people. Although each of these people play an important role in the government this variable doesn't take other aspects of the government into account. Compared to these two variables left party legislative seats is a better measurement for the left-wing party power since it takes into account all legislative seats. Even though the found effect of left legislative power is weak and significant in only a few of the regressions, it does support the hypothesis that left-wing party power has a positive effect on the environment.

Green party power should arguably have the strongest effect on the environment, since one of their primary goals is the protection of the environment. Although green parties make up a minority of the government, they can help pressure other parties into protecting the environment. In this paper however, no significant effect is found for green party power. Additionally, the sign of the coefficient for green party strength varies between the regressions. So no evidence for the claim that green party power is beneficial for the environment is found. A possible reason could be that along with the emergence of green parties, other parties will try to distinguish themselves by moving away from the environmentally friendly point of view. By branding themselves as parties that don't prioritize the environment but instead focus on economic development they can capture other groups of voters. If the emergence of stronger green parties results in other political parties preferring less environmental protection than originally, greater green party strength could lead to less environmental protection. Although this is speculation, it could explain why greater green party strength has ambiguous consequences in the results. Lastly there is no evidence found that left cabinet power has a positive effect on the environment. Like green party power no significant effect is found for left cabinet portfolio as a percentage of all portfolio. The coefficient signs for left cabinet also vary between the different types of regressions. The expectations were that left cabinet would have roughly the same effect as left legislative seats, however no evidence was found to support this hypothesis. A possible reason for this could be that left-wing party power works differently depending on which aspect you look at as Neumayer (2003) suggests.

In his paper Neumayer found consisting evidence that green party power has a negative effect on emissions, where he performed tests with similar data as this paper although from an earlier time period. A possible explanation for the difference in found effects is that the definition of left-libertarian parties changed over time. Following the example of Neumayer (2003) this paper made use of the green and left-libertarian parties, having similar goals for environmental protection by using the percentage of left-libertarian parties for green party power. If the goals of left-libertarian parties

changed over the years, putting less emphasis on environmental protection, a smaller or no effect of left-libertarian parties on the environment will be found. Another possible explanation is that Neumayer (2003) included a variable measuring the number of vehicles per 1000 capita. The exclusion of this variable due to data unavailability could lead to a difference in found effects, although it is unlikely this alone could lead to such a large difference in found effects. In the end, based on the results of this paper no significant effects can be found for left-libertarian parties and further research is needed on the different aspects of left-wing party power.

The second objective of this paper was to study the different effects of left-wing party strength between high and low inequality countries. The significant effects found for left-wing party strength are the effects of left party legislative seats. Solely looking at these two significant effects we see negative effects for nitrogen dioxide in low inequality countries and a negative effect for carbon monoxide in high inequality countries. The exact effect found is as follows: In high inequality countries a 1%-point increase in the left party legislative seats as a percent of all legislative seats would result in reduction of about 0.7% in per capita emission of carbon monoxide. Likewise, in low inequality countries a 1%-point increase in the left party legislative seats as a percent of all legislative seats would result in a decrease of about 0.4% in per capita emission of nitrogen dioxide. An important note is that the real effect is likely to be stronger than the effect found here. This is because the control variables take into account a few of the channels through which government policy can impact emission. Based solely on these two results it's not possible to draw a conclusion about the differences in high and low inequality countries. This is because there were too few significant results and the only significant results are for two different types of emissions.

8. Limitations and future research

An important note for future research is that this paper could only use 21 countries because political data was lacking for other countries. For future research it would be helpful to use a larger dataset of similar well developed countries to test whether a difference exists in the effect of left-wing party strength for high and low inequality countries. The second important limitation lies in the measurement of the emissions. Most of the emission measurement relies on measurement stations in countries which measure the amount of pollution in the air. Although the locations of these stations are carefully chosen in order assure the quality of the measurements, measurement complications can arise due to emissions not staying within one country. Emissions originating from one country can get carried across borders which could compromise the accurate measurement of emission per country.

Furthermore, this study presumes that green parties are identical to left-libertarian parties. This is done because left-libertarian generally have a stronger drive for environmental protection than other parties. However, if there is a substantial difference between the goals of left-libertarian and green parties the performed tests will not accurately measure the effect of green party power.

Lastly there is the caveat that left-wing party power can have an effect on the environment through one of the control variables used in the model, as discussed in section 4.2. These variables are added in order to control for exogenous variations. However, changes in emission due to government policy will be attributed to these control variables instead of the variables of interest. This would result in a weaker effect of left-wing party power, since the effects would be attributed to the control variables instead of left-wing party power. This problem has been partially addressed by estimating a reduced model in the robustness analysis although it still remains a shortcoming for testing the effect of government policy.

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Appendix A

Country	Major left-libertarian parties
Australia	Greens
Austria	United Greens, Green Alternative
Belgium	Ecologists/Ecolo, Groen, Live Differently (Agalev)
Canada	Green Party
Denmark	Socialist People's Party, Green Party, Red-Green Unity List, The Alternative
Finland	Green League, Ecology Party
France	Greens, Ecologists
Germany	Greens (Alliance 90/Greens), Ecologists, Pirate Party
Greece	Green Lists, Ecologists Alternative
Ireland	Greens
Italy	Greens, Radical Party
Japan	Ecology Party
Netherlands	Green Progressive Accord/Green Left, The Greens, Party for the Animals
New Zealand	Values Party/Green Party
Norway	Socialist People's/Left Party, Greens, People's List for Environment and Solidarity
Portugal	Greens
Spain	Green List (LV), Ecologic Greens (LVE)
Sweden	Greens
Switzerland	Progressives, Greens, Alternative Greens
United Kingdom	Ecology/Green Party
United States	Green Party

Table 6 Major left-libertarian parties of each country

Appendix B

	Share of top decile (%)			Change in share of top decile		
Country	**2000**	**2007**	**2014**	**2000-2007**	**2007-2014**	**2000-2014**
Belgium	47.5	47.1	47.2	flat	flat	flat
Japan	51.0	49.4	48.5	fall	slight fall	slight fall
Australia	51.1	50.7	51.1	flat	flat	flat
Italy	52.6	47.9	51.5	rapid fall	rapid rise	flat
France	56.4	51.1	53.1	rapid fall	rise	fall
United Kingdom	51.5	52.0	54.1	flat	rise	rise
Finland	55.0	54.5	54.5	flat	flat	flat
Netherlands	55.2	53.6	54.8	fall	slight rise	flat
Spain	54.1	52.0	55.6	fall	rapid rise	slight rise
Greece	54.8	48.6	56.1	rapid fall	rapid rise	flat
Canada	61.5	58.0	57.0	fall	slight fall	fall
New Zealand	62.3	61.2	57.0	slight fall	rapid fall	fall
Portugal	57.8	56.0	58.3	fall	rise	flat
Ireland	58.2	57.8	58.5	flat	slight rise	flat
Germany	63.9	61.7	61.7	fall	flat	slight fall
Austria	63.0	63.0	63.8	flat	slight rise	flat
Norway	67.0	66.5	65.8	flat	slight fall	flat
Denmark	68.9	62.6	67.5	rapid fall	rapid rise	slight fall
Sweden	69.7	68.6	68.6	slight fall	flat	flat
Switzerland	73.4	72.0	71.9	slight fall	flat	slight fall
United States	74.6	74.8	74.6	flat	flat	flat

Table 7 Overview of estimated wealth inequality from Shorrocks et al. (2014)