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Major Research Paper

**CAN THE ENVIRONMENTAL KUZNETS CURVE EXPLAIN THE
DIVIDE IN EUROPE IN TERMS OF CLIMATE CHANGE
CONSCIOUSNESS?**

(MAJOR RESEARCH PAPER – API 6999)

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Abstract

There is a divide in terms of environmental policies between the countries in the North and West of Europe versus those in the South and East. At the same time, these two regions are divided in terms of their economic development. While the Northern and Western European countries are, on average, more advanced and have higher levels of income per capita, the Southern and Eastern European countries are often observed to be relatively less developed with lower average income. I use the hypothesis of the Environmental Kuznets Curve (EKC) to explain this divide, however, instead of testing the degree or level of pollution, I investigate the impact of environmental consciousness on the level of emission tax rates set by the government.

Data for environmental consciousness is obtained from the Eurobarometer Polls conducted by the European Commission, whereas the 'Implicit Tax Rate', which is a composite index of different forms of tax relating to environmental quality, is obtained from the Eurostat database. I use data from 31 countries across Europe for the time-period between 2007 and 2018. A reduced-form regression of the EKC hypothesis confirms a positive relationship between income per capita and emission tax rates. I find that if GDP per capita increases by 1%, then the emission tax rates increases by 2.9%. This implies that the emission tax rate is significantly responsive to an increase in the average income of a country. The second-order term of the GDP per capita is negative, which complies with the established concavity of the EKC literature. Further, I also find that the effect of the Rule of Law is positive and significant, thus, serving as the determinant of how effectively consumer's environmental consciousness effects government's policy decisions. The

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effect of Rule of Law on emission taxes is higher in the North and Western countries and smaller in the South and Eastern countries.

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1. Introduction

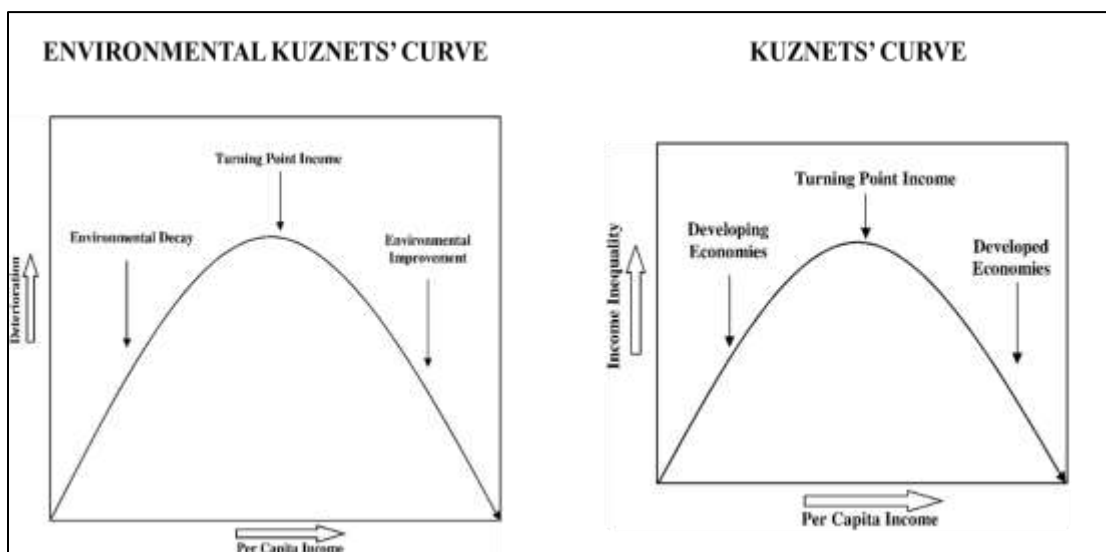
It is observed that in Europe, climate change consciousness is relatively higher than in the rest of the world. About 90% of Europeans believe that climate change is happening, and there are similar ranges present for agreeing that climate change is caused by human activity (Poortinga et al., 2018). However, looking back into some recent history reveals that Eastern European countries are slightly less likely to believe in climate change, or the dangers of it, with only 24% considering it to be fairly serious and over 10% claiming it is not a serious problem at all (Eurobarometer Survey, European Commission, 2009). The Eurobarometer poll reports that the same statistics for the current 28 countries in the European Union (EU28) averages only 23%, even though it is higher in North-Western Europe. Thus, the major share of the population who believes in climate change and the dangers of it, is mostly from the countries in the North-Western Europe. More recently, in the 2019 European Green Deal, industry and jobs were considered over and above environmental concerns by the Eastern European countries. These regions remain energy-intensive and protective of its traditional industries. The European Council on Foreign Relations (ECFR) reports longer-term trends between 2011 and 2019, which presents that there has been an increase in the population considering climate change as a threat, but most of this increase was attributable to the North and Western European countries (Lessinski, 2019). The reports revealed that half of the Swedish population considers climate change a serious issue threatening lives, whereas only 10% of Bulgarians agreed with this claim (Eurobarometer Survey, European Commission, 2019). Delving further into details, the report claims that the population considering climate change as a threat

increased from 30% to 50% in Sweden. Contrarily, there have been only small changes, or even decreases, in countries that feel less concerned. For example, Bulgaria witnessed a decline from 15% to 10%.

This leads us to question why is there such a divide in terms of environmental consciousness and environmental policies between countries and regions in Europe. South and Eastern European countries are, on average, relatively less developed and relatively poorer than the advanced North and Western countries. The discussion above also reveals that the countries in the South and East are less concerned about the environment or the effects of climate change. This relationship between economic development and environmental consciousness could be connected to the idea of the Environmental Kuznets Curve (EKC). The EKC hypothesizes that higher income per capita relates to higher environmental quality. This specific relationship between income per capita and environmental degradation is an inverted U-shape curve, which is named after the economist – Simon Kuznets. Kuznets (1955) hypothesized that there is a U-shaped relationship between income per capita and economic inequality. The paper was focused on the perspective of economic development. It sought to capture the difference between per capita income (which is essentially the average income of the country) and the income inequality. Although per capita income is usually an accepted indicator to measure inequality, Kuznets (1955) reveals inequality might be varying at various levels of per capita income. According to the hypothesis, income inequality initially increases as the per capita income increases, and then begins to fall after a certain level of income per capita is reached.

The EKC implements the idea of Kuznets' Curve in the context of environmental quality. Thus, as the population's average income increases, pollution, being an inferior good, is substituted for better environmental standards. In Economics, there is a categorization of goods based on the change in consumption in response to the change in income. Based on this categorization, a good may be termed as 'normal' or 'inferior'. A good is called 'normal' if the consumption increases with the increase in income and vice-versa. A good is termed as 'inferior' when there is an increase in income and yet the consumer decides to consume less of the good. Conversely, if the income level decreases, then the consumer decides to purchase more of the inferior good. Applying this categorization in the context of this research, pollution being an inferior good (due to the health hazard it poses) is substituted for better environmental quality when the per capita income of the country increases. Figure 1 illustrates this idea of the Kuznets' Curve and the Environmental Kuznets Curve (EKC) together to present a relatable picture.

Figure 1: The Kuznets' Curve and the Environmental Kuznets' Curve



Source: Yandle et al., (2002)

This notion of causality from the income level of the country to environmental consciousness is highly criticized. For instance, Stern (2004) argues that developing countries do not neglect environmental issues, adopting developed country standards within a short time lag and perform better than some wealthy countries. Further, the author also claims that EKC may not hold in many circumstances. That leaves us with another question: are government policies on mitigating climate change a function of people's beliefs vis-à-vis climate change or are people's beliefs a function of policies?

There is a large section of the political economy literature which resonates with the idea that beliefs or consumer consciousness drive policies. There could again be certain exceptions in terms of policies against addiction or harmful social norms (tax on smoking, addictive substances, and other harmful habits). However, when the government imposes a policy like a tax (and, in this case, an emissions tax), it risks the potential reaction of the people in terms of the voter base (Vermeir & Heyndels (2006); Ashworth, Geys and Heyndels (2005); Revelli (2001); Bosch and Olle (2007)). For example, Vermeir and Heyndels (2006) develop political agency models in which voters compare tax policy with neighboring jurisdictions to cast their votes. The key notion of the causality is that if voters are environmentally conscious, then the implication of a relatively higher level of environment-related tax would be less for the incumbent government. In other words, those who are ill-informed about the consequences of climate change or other environmental issues will have a low willingness to accept a more stringent tax regime. Thus, a higher penalty on emissions, such as a higher emission tax rate, would imply that the government

and the public, in general, have taken a stronger step to deal with the impacts of climate change. This trigger is induced by the higher willingness to pay for higher environmental quality, thus, falling in line with the idea of the EKC. Therefore, the research question boils down to: are the different levels of emission taxes in European countries explained by higher environmental consciousness of the public?

I use the structure of the EKC hypothesis to answer this question. However, instead of testing the degree or level of pollution, I test the level of emission tax rates set by the government. Following the EKC hypothesis, if the income per capita of the country increases, there would be an increase in the willingness to tax emissions to ensure better environmental quality. The results help us present a more robust explanation for “the divide” between the European countries and to develop policy recommendations in order to address it. With the increase in income, people become more conscious about the environment and this leads to a higher level of emission taxes until the “turning point” in the EKC is achieved. The idea of the ‘turning point’ is discussed in detail in the next section.

Ordinary Least Square (OLS) regression on the reduced-form model of the EKC shows that the effect of income per capita on emission tax is increasing and concave. The effect of income per capita is stronger in the countries in North and West (NW) than those in South and East (SE), therefore explaining the divide in the European countries via the EKC hypothesis. I find that the ‘environmental consciousness’ parameter is positively correlated with the income per capita, which hints towards the idea that higher-income countries have, on average, a higher level of consciousness in terms of environment and

climate change. The OLS results also indicate that the ‘environmental consciousness’ parameter leads to a consistent increment in emission tax rates. However, it is observed that the coefficient of environmental consciousness is insignificant when the model includes only the SE countries in the analysis. This can be attributed to not only the lack of importance of environmental consciousness in the SE countries but also to the low index of Rule of Law, which can play an essential role in ensuring that the consumer’s preferences are reflected in the policies passed by the government. The effect of Rule of Law is observed to have a higher impact on emission taxes in NW countries.

The rest of the paper is structured as follows: section 2 discusses the related literature in this field, such as the papers which approach the Environmental Kuznets Curve hypothesis using similar models, and finally it attempts to delineate the contribution of this paper in the related field. Section 3 is dedicated to the explanation of the models used and the analysis of results. Section 4 concludes the analysis of the results and provides policy perspectives and a way forward to this paper.

2. Literature Review

The EKC literature is extensive, albeit not without criticism and counter debates. Studies like Stern (2004) criticize the EKC in terms of weak econometric support, whereas some studies present extensive robustness checks (Constantini & Martini, 2006) in support of the idea. There exists a consensus on the hypothesis that higher income leads to better environmental quality; however, the techniques to support the hypothesis have been debated. This section attempts to underpin the related literature and evaluate the techniques and findings of relevant papers. The section has been divided into segments, in order to highlight the significant aspects of the current research. The attempt is to place the paper in the existing research conducted in the related fields in order to bring forward its novelty and contribution. The literature attempts to cover most of the relevant works in the field.

2.1 Environmental Kuznets Curve – Theory

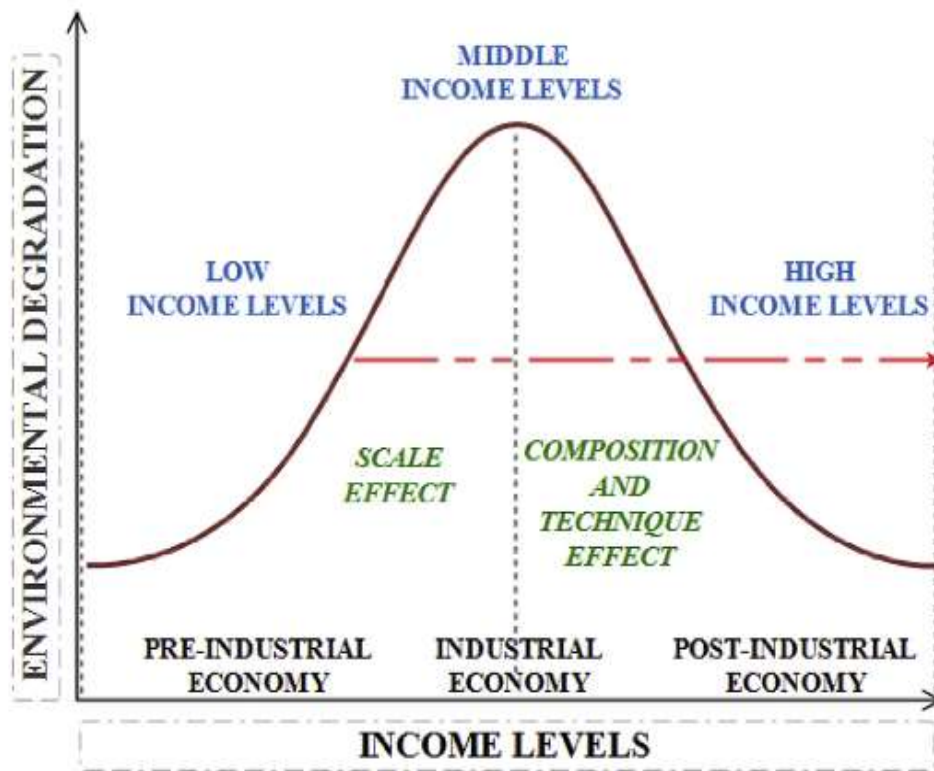
The Environment Kuznets Curve (EKC) merely mimics the Kuznets Curve model in the environmental context. Instead of income inequality, the EKC model introduces pollution levels to be dependent on the income per capita, following the same inverted U-shaped structure. Increasing income and higher standards of living lead to the demand for better environment quality (Beckerman, 1992). Consequently, economic growth turns out to be the precursor to environmental improvement (Bhagwati, 1993). EKC's theoretical explanation revolves around the idea that pollution is deemed to be a normal good until a certain level of income is reached. Therefore, there exists a 'tipping point' on the level of income per capita beyond which pollution becomes an inferior good (Grossman & Krueger,

1991). Technically, this transition of the good from being ‘normal’ to ‘inferior’ occurs when there is an increase in income. The higher quality goods which were erstwhile unaffordable becomes feasible given the increase in budget and those lower quality goods which were considered ‘normal’ at a lower level of income, does not provide as much utility as before. In the context of the environment, the environmental quality gains preponderance against higher production from polluting industries. This change takes place at the ‘tipping point’, as the necessities of the society are met given the increase in per capita income. This notion follows from the development economics literature, which argues that less developed countries that have not been able to cater to the basic needs – of food, shelter, and health – care less about the quality of environment than developed countries, whose focus is inclined towards the ‘quality’ of those necessities and other amenities (Alstine, & Neumayer, 2010). This explains the initial upward-sloping portion of the curve. Thereafter, as the economy progresses, income per capita increases and, in parallel, the economy transitions to focus more on service-based output. This transition favors the decline in pollution at the aggregate level as the growth of higher-polluting sectors decline. The per capita income level rises and demand for a higher quality of environment increases (Jänicke et al., 1997).

Grossman and Krueger (1991) explain the EKC based on scale, composition, and technique effect. Figure 2 presents a graphical description of this categorization. The scale effect is the increase in the level of environmental pollutants as a result of the increase in economic development in the less developed, pre-industrial economies. Economic development in the pre-industrial economies is usually fostered by the increase in

production in the industries which are highly polluting in most cases (Grossman and Krueger, 1991). The demand for energy to fuel these industries are obtained through the use of fossil fuels like coal, natural gas, and oil, thus increasing the level of pollution and other environmental hazards (Sarkodie & Strezov, 2018). The composition effect is applicable at a stage with higher income per capita than the level at which the scale effect is dominant. The composition effect can be observed in middle income, developing countries. These countries are observed to have weak environmental regulations and policies to safeguard environmental deterioration. The argument for having weak regulations is to support domestic industries perform competitively in the international market. The technique effect marks the phase where there is a regime shift towards transforming the production capacity towards cleaner technology. The cost of environmental degradation in this phase is higher than the benefits of additional income per capita generated. This shift is marked by the increase in environmental and health awareness (Sarkodie & Strezov, 2018). According to Grossman and Krueger (1991) the developed countries adopt higher environment standards as an expression of their high per capita income and high standard of living.

Figure 2: Schematics of the EKC



Source: Sarkodie & Strezov (2018)

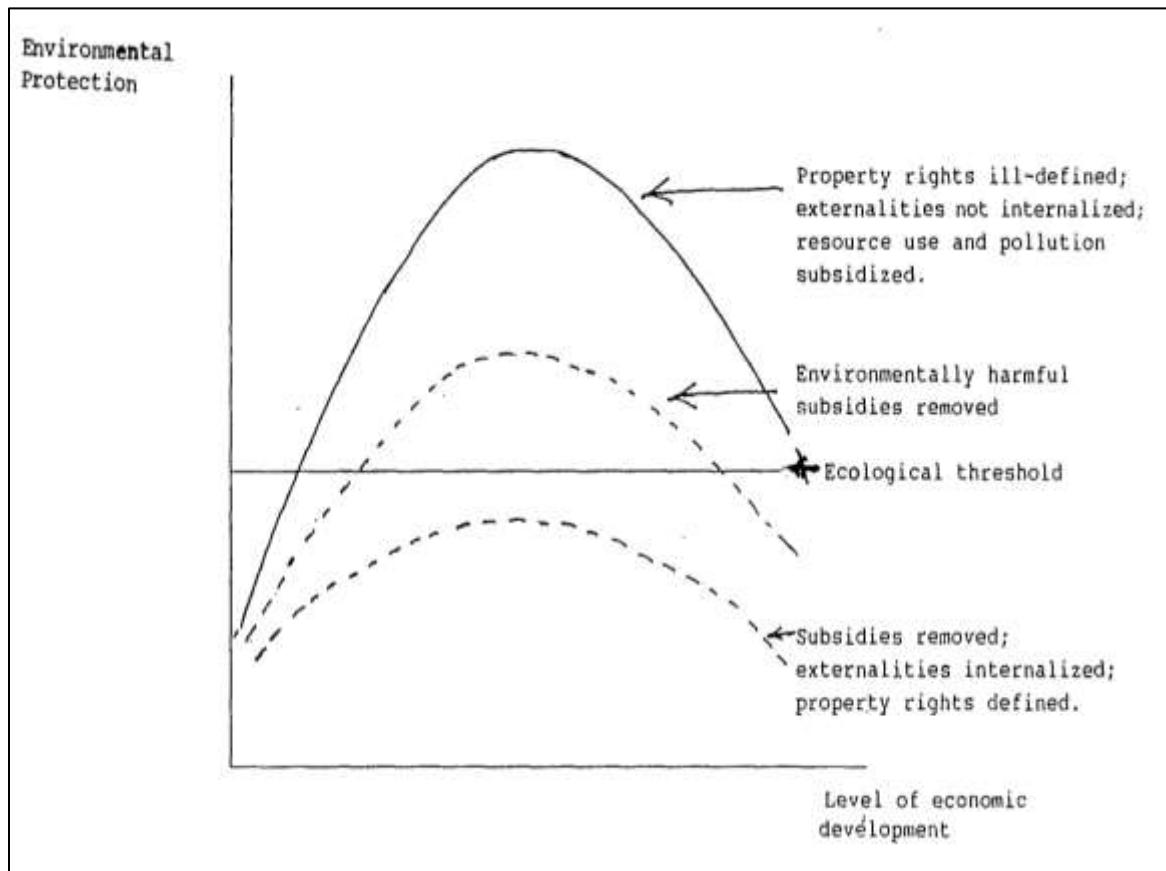
2.2 Environmental Kuznets Curve – Empirical Evidence

Since the early 1990s, there has been a large section of the economics literature that has been dedicated to analyzing the EKC's shape (Shafik & Bandyopadhyay, 1992); Panayotou, 1993); Selden & Song, 1994); Grossman & Krueger, 1995); Holtz-Eakin & Selden, 1995); De Bruyn et al., 1998); Borghesi, 2000). The present paper is motivated by the reduced-form application of the EKC hypothesis in the aforementioned studies. Shafik & Bandyopadhyay (1992) contribute to the literature by analyzing the impact of economic growth on environment quality at different levels of income. The studies establish that the

EKC does not have a smooth inverted U-shape curve and the nature of the effect of income per capita or economic growth differs at different levels of income (Shafik & Bandyopadhyay, 1992). The latter is supported by Panayotou (1993), who claims that the hypothesized inverted U-shape of the EKC may not be as smooth as hypothesized: environmental quality takes a sharp dip before it smoothens out closer to the turning point. This further motivates the usage of a non-linear relationship in the model beyond the expected role of the hypothesized inverted U-shape.

Panayotou (1993) justifies the erratic nature by the structural changes that occur in the economy as the EKC approaches the turning point. However, the shape of the curve might not be the same in different economies. The level of the turning point or the nature/shape of the EKC depends upon the institutional setup and other inherent country-specific factors (Panayotou, 1993). The paper discusses the steepness of the EKC before the turning point. Specifically, Panayotou (1993) refers to policy distortions in the economy like protectionist policies, the role of political lobbying, subsidies, and other distortionary interventions. The paper also recommends the role of internalization of environmental cost as one of the key factors in the flattening of the EKC.

Figure 3: Scenarios with Policy Impacts on Flattening the EKC



Source: Panayotou (1993)

I integrate these findings in my model by introducing institutional factors like the Rule of Law. A country's industrial structure could play a significant role in the determination of the shape of the EKC. I also add country fixed effects to account for inherent regional and political characteristics. A later segment in the literature review is dedicated to the importance of institutions, and specifically the literature on Rule of Law in the context of the EKC. Grossman & Krueger (1995) attempt to capture the shape of the EKC using a reduced-form model. They study how the income per capita explains different

forms of pollution – like air pollution in urban areas and oxygen regime, fecal, and heavy metal contamination in rivers. Although they do not find any significant evidence in support of the expected deterioration of the environmental quality, the authors show some evidence of a ‘turning point’, which appears for a country at a level of per capita income of \$8,000. Similarly, Selden & Song (1994) extended the study to a larger set of data using a cross-national panel data. The data focused on emissions of some important air pollutants and confirmed an inverted U-shaped relation of the pollutant emissions with economic growth. The paper predicts that the rate of decrease in emissions is low compared to economic growth and the hypothesized negative relation, or the turning point, are possible only in the long run. Holtz-Eakin & Selden (1995) test the EKC hypothesis using global panel data. They focus on the relationship between carbon dioxide emissions and per capita income. They define Marginal Propensity to Emit (MPE) as the amount of carbon dioxide emitted as income increases. There is evidence of an increasing MPE but at a decreasing rate over time (Holtz-Eakin & Selden, 1995). Their study estimates that global carbon dioxide emissions will be increasing over time rather than decreasing because the population and industrial growth of the developing and less-developing economies will have a larger impact on the emissions than the reduction in developed countries. These findings are also supported by De Bruyn et al. (1998), who are using data from different time intervals between 1960 and 1993 for several countries. That different measurement techniques leading to different results is extensively represented in Borghesi (2006), who emphasizes the role of income inequality as being the driver of the improvement in environmental quality by using the Gini coefficient of countries along with a non-linear function for GDP.

2.3 Role of Institutions

The improvement in environment quality significantly relies in good governance and policies (Panayotou, 1997). The majority of the empirical work in the quest for evidence of the EKC hypothesis has been criticized because of existing endogeneity problems. Castiglione et al. (2014) claim that excessive focus on the shape of the curve over and above the underlying factors that define the relationship leads to these endogeneity concerns. An important factor contributing to this problem is the role of institutions. One of the reasons that we do not observe the role of institutions in these empirical studies of the late 20th century could be, possibly, due to the lack of reliable and sufficient data accounting for the role of institutions. There have been several studies that point out the importance of the role of institutions in the shape of the EKC (Jalal, 1993; Dasgupta et al., 1995; De Bruyn, 1997; Panayotou, 1997; Borghesi, 2006; Cole, 2007; Dutt, 2009). Most of these papers support the idea that social and institutional construct and the nature of policy developments critically determine the shape of the EKC. As pointed out in Jalal (1993), this process depends on how society manages its resources (natural and human) and how the government is responsible to channel this activity. The government bearing the responsibility of framing the regulations and the essence of the same in the context of EKC hypothesis is highlighted in Dasgupta et al. (1995).

Evidence of certain features of the EKC being better explained by the role of institutions rather than the structural changes in the economy is emphasized in De Bruyn (1997). The study adds to the findings of Panayotou (1993), who claims structural changes in the economy explain the sharp change in the EKC before the ‘turning point’. De Bruyn

(1997) demonstrates that the role of the government in designing and implementing environmental policy have a significant role in explaining the portion of the EKC after the ‘turning point’, when the curve is hypothesized to be sloping downwards. Borghesi (2006) not only includes income inequality (indicating towards the role of the government is providing equitable resources to the population) but also adds a ‘democracy’ index, which captures liberty and economic freedom¹ during the 1980s. The study also emphasizes on the use of a fixed effects model, owing to the heterogeneous nature of countries. This propagates the idea of how different nations with different capacities and qualities of institutions could lead to different impacts on shaping the EKC. Thus, capturing country specific variations requires a fixed effect model to counter this issue.

There also exists a stream of literature that investigates specific features of institutional strength of a nation or the government’s role at large. Considering human development indices and sustainability parameters, Constantini and Martini (2006) find that the ‘turning point’ occurs at lower levels of income per capita. Some studies have also investigated the role of corruption in emissions and found a negative relationship in developing and less developed countries (Cole, 2007). Education and access to information have been shown to have significant effects (Deacon & Norman, 2006), which throws light on the possible multicollinearity effects of using income per capita and the strength of the institutions in the same analysis as there is a strong correlation between them. This implies that I cannot use income per capita and the Rule of Law in the same regression as it would lead to multicollinearity issues and the results obtain would be biased. All these studies

¹ See Gastil (2000)

demonstrate the significance of the quality of institutions in estimating the EKC. One of the popular forms of government intervention to regulate environmental issues is the implementation of taxes.

2.3.1 Environmental Tax

Government intervention in the form of taxes directed to activities that hurt the economy is extensively discussed in public economics literature. Our focus in this paper is on environmental taxes. The literature in this field establishes that there are both economic and environmental benefits to implementing an environmental tax (Bovenberg & de Mooij, 1996; Bosquet, 2000; Scrimgeour et al., 2005; Castiglione et al., 2014). These studies not only emphasize the role of institutions in our direction of interest, but also cater to a specific policy tool to evaluate governments' responsiveness.

Bovenberg & de Mooij (1996) resort to a macroeconomic model (Endogenous Growth Theory) to investigate the impact of environmental taxes on pollution and social welfare. The authors establish that there are two channels of impact owing to the implementation of an environmental tax on pollution generation rather than on the production. There are 'double dividends'. The first effect is in reducing pollution-based production. The second impact results in generating clean technology investments due to the change in the nature of taxation from – production to pollution focus. The 'double dividend' in the context of environmental policy is defined as the situation where a policy improves the condition of the environment without hurting the economy (Bovenberg & de Mooij, 1996). An extensive empirical assessment is carried out in Bosquet (2000), who shows various impediments to the realization of the 'double-dividend', including wage-

rigidities, inflation and declining investments. Scrimgeour et al. (2005) conduct a similar study focusing on evaluating the ‘double dividend’ of taxes. Although specific to New Zealand, their paper uses a Computable General Equilibrium (CGE) model and focuses on the energy sector to show that there could be possible improvements and relative capital gains if a more specific tax, such as a carbon tax (as it is in many European countries), is implemented instead of a general energy tax. Castiglione et al. (2014) investigate how the change of environmental taxation is a function of the growth rate of GDP and the Rule of Law. I consider this study as one of the key papers in my analysis.

2.3.2 Rule of Law and Emission Taxes

Castiglione et al. (2014) provide evidence of a positive relationship between the Rule of Law and improvements in environmental quality. This implies that countries with a higher index (i.e. higher quality) of rule of law have the ‘turning point’ occurring at a lower level of income per capita than those countries where the Rule of Law Index is low. The relevant studies in this field have identified that more rigorous implementation of law leads to a decrease in the income level where the turning point occurs. Issues linking corruption with the turning point in the EKC have been carried out by some authors who claim that corruption has had a negative impact in the improvement of environmental quality (Cole, 2007; López and Mitra, 2000; and Leitão, 2010). Interestingly, Torras and Boyce (1998) argue that a more equitable distribution of power in the country and the presence of a democratic political system can reduce the effect of income in the EKC for the developing countries. On a similar note, Bhattarai and Hammig (2001) argue that institutional characteristics like civil rights and a more liberal political atmosphere impact

deforestation. Stronger implementation of civil/political rights also leads to improvement in environmental quality, *ceteris paribus* (Culas, 2007). These studies demonstrate how the Rule of Law leads to improvements in policies over different aspects of environmental concern.

The study by Castiglione et al. (2014) is important for the present paper because it is the only study (to my knowledge) that connects the role of institutions to environmental tax, with the underlying notion of the EKC. The authors' focus is on Europe and the benchmark model is dedicated to identifying the linkage between income per capita, emission taxes and the rule of law. The study follows the findings and analysis of Yandle et al. (2002), who emphasize the role of the institutional framework at every point on the EKC. Castiglione et al. (2014) present two hypotheses. They demonstrate that per capita income and environmental tax have an inverted U-shape like the EKC. Then, the study proceeds to verify the influence of Rule of Law in the model proposed. The authors find that Rule of Law accelerates the improvement in environmental quality. Castiglione et al. (2014) name the relationship between environmental tax and income per capita as the 'Environmental Tax Kuznets Curve (EKTC). This is a critical element of my paper's analysis.

2.3 Environmental Consciousness

In the present paper, I also attempt to analyze the causality between emission taxes raised by the government and citizens' environmental consciousness. The objective is to establish that it is consumer consciousness that drives government policy, and not the government policy that triggers consumer consciousness. Intuitively, higher tax rates pose

a higher risk for the incumbent government without consumer support: ‘voters vote for the politicians or party from whom they expect the highest utility gain’ (Vermeir & Heyndels, 2006). Effectively, governments face the inherent risk of increasing taxes and losing voters. If voters are pro-environment, then they will be supportive of a higher tax on emissions; and higher penalty on emissions implies that the government and public have taken a stronger step to deal with the impacts of climate change.

2.3.1 Direction of Causality: Environmental Consciousness to Government Policy

In order to understand this causality (that tax policy is driven by consumer consciousness), I examine a few relevant papers. Vermeir & Heyndels (2006) argue that there is an electoral impact of tax rates, and incumbent parties are punished for higher taxes: i.e., higher income tax rates have a negative impact on voting. Voters judge incumbents by comparing their policy with the policies adopted by neighboring jurisdictions. This resonates with the key idea of the present paper. The authors argue that it is risky for the government to increase taxes, because voters will evaluate how large the tax is. For the government to increase emissions tax, it needs the confidence of voters. Further, Ashworth, Geys and Heyndels (2005) reaffirm that setting new taxes has potential political costs. The paper explores the setting of environmental taxes at the municipal levels. It argues that adoptions of a ‘green tax’ are less likely to happen during the election period; however, they are more likely to occur if neighboring municipalities already have a higher tax. The study classifies that tax innovation involves economic, administrative and political risks. Therefore, the possibility of a citizen voting for a party depends positively

on the public services provided and negatively on the income loss of the individual due to taxation.

Relative voting is also demonstrated in Revelli (2001), where the author uses the 'yardstick' model. The author argues that voters analyze their own government's quality with respect to the neighboring jurisdictions and one of the key factors in the analysis is to compare the quality of governance given the tax rates applied. More importantly, Revelli (2001) indicates the possible endogeneity of setting taxes. The voters' consciousness plays an important role in determining the extent of tax increase that the incumbent can afford, depending upon its performance. Bosch and Solé-Ollé (2007) do a similar study using the 'yardstick competition' hypothesis on Spanish municipal corporations' property tax rates. The paper drives the essence of consumers' or voters' consciousness in the sense that voters tend to vote in support of tax increments directed to ensure performance improvement of public services.

These papers address the cost of tax increments at different levels – such as municipal, provincial and national elections and they make a good combination to support the claim that if taxes are raised, then there is less chance of the government winning unless otherwise supported by the voters' consciousness. I incorporate this idea and the data collected on consumer confidence to see the latter's effect on the emission tax rates in European countries, with the strong underlying notion of the EKC. As far as my review of literature is concerned, there is no other theoretical or empirical work that caters to this causality. This is possibly because it is hard to obtain data on environmental consciousness. I use the European Commission's Eurobarometer survey to obtain data on the

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environmental consciousness level. I analyze consumer consciousness on the environment and climate change to see if governments have been able to implement a stronger or pro-environmental regime by increasing the emission tax rates. This causality directly relates to the notion of EKC. Past the turning point, as the population is having higher income per capita, they become more pro-environment; therefore, they should be more supportive of the government raising emission taxes than in poorer countries. Consumer consciousness should dictate and help position the model accurately in relation to the emissions tax, which also depends on per capita income, Rule of Law, the density of population and the nature of industrialization.

3. Data, Methodology and Analysis

3.1 Data and Summary Statistics

The data for this paper is obtained from the Eurostat database, Eurobarometer Polls conducted by the European Commission and the World Bank Development Indicators (WDI). It includes 31 European countries (with available data on Implicit Emission Taxes) for the time-period between 2007 and 2018.² All the countries included in the analysis are members of the European Union apart from Norway, Iceland and the United Kingdom. However, the analysis takes into account data until 2018 where the United Kingdom had not officially implemented the Brexit. This similarity in the countries of being a part of the European Union allows for a similar regulatory environment which helps to do away with the heterogeneous nature of policies to some extent.

The dependent variable in our analysis is the emission tax rate. The data is obtained from Eurostat database as the 'Implicit Tax Rate'. This implicit tax rate on energy (Euro per ton of oil equivalent) is defined as the ratio between energy tax revenues and final energy consumption calculated for a calendar year. Energy tax revenues are measured in euros (deflated) and the final energy consumption as TOE (tons of oil equivalent).³ This makes the variable comprehensive in the sense that it includes the mix of all forms of environmental taxes and does not focus on any specific sector. This goes well with the analysis as the other variables in hand are mostly annual macroeconomic variables. The

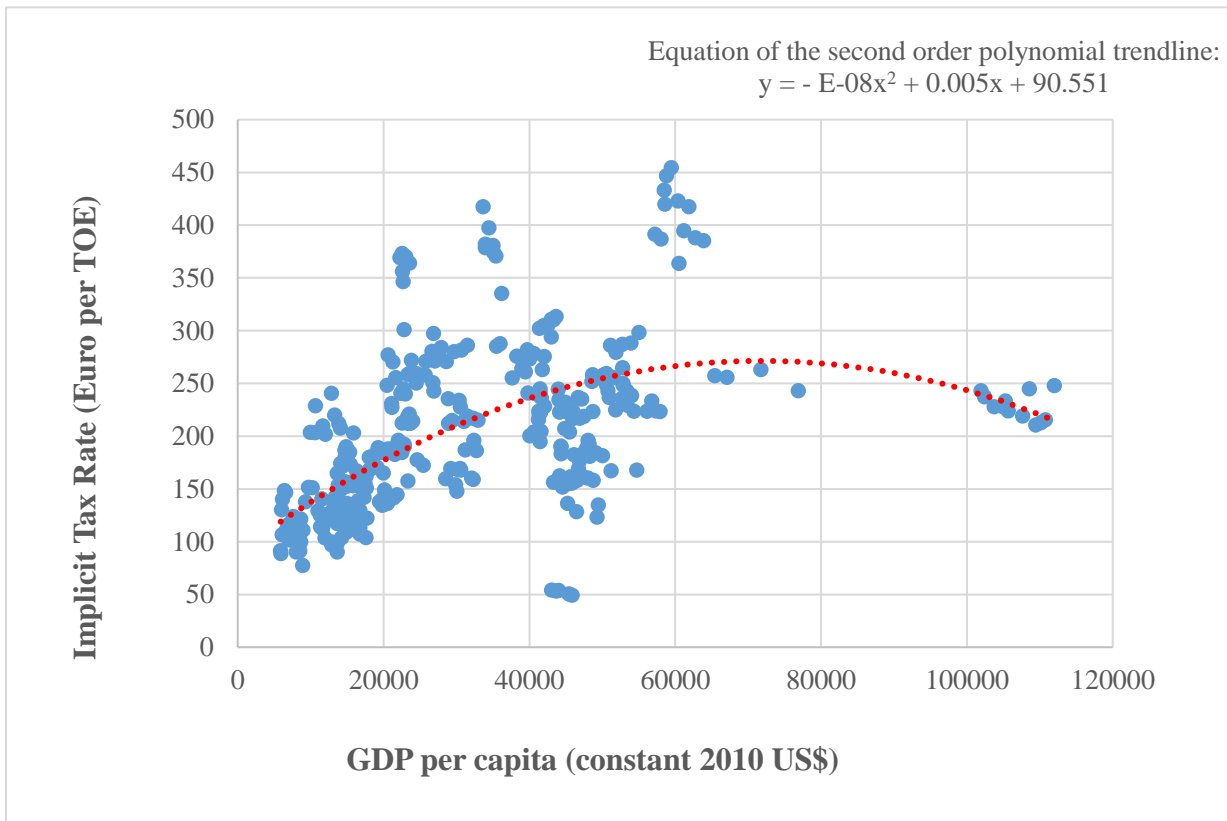
² See Appendix for the list of countries

³ See <https://ec.europa.eu/eurostat/en/web/products-datasets/-/TEN00120> and <https://ec.europa.eu/eurostat/statistics-explained/pdfscache/53713.pdf>

data set excludes countries like Switzerland, which has its own Emissions Trading System (ETS). Further, it also makes sense to exclude Switzerland from the analysis because it is not a part of the European Union or the European Economic Association (EEA).

One of the key explanatory variables is income per capita, which is represented by the real gross domestic product (GDP) per capita. This is obtained from the WDI data repository. The relationship of income per capita with emission tax rates directly reflects upon the definition of EKC. The non-linearity assumed in the model is taken from the standard EKC regression model developed from Grossman & Krueger (1991), where the non-linearity is taken up to the second order. The EKC hypothesis claims that the curve is initially increasing at a decreasing rate and then, after reaching the turning point, decreases at a slower rate. Thus, we can expect that the EKC would trace out a concave shape. Figure 4 illustrates the relationship from the raw data. A second order polynomial trend line tries to explain the relationship. The concavity of the relationship is biased due to outlier countries like Luxembourg, where income per capita is very high and emission-related tax rates are relatively low as there are few heavy polluting industries.

Figure 4: Relationship between Implicit Tax Rate and GDP per Capita

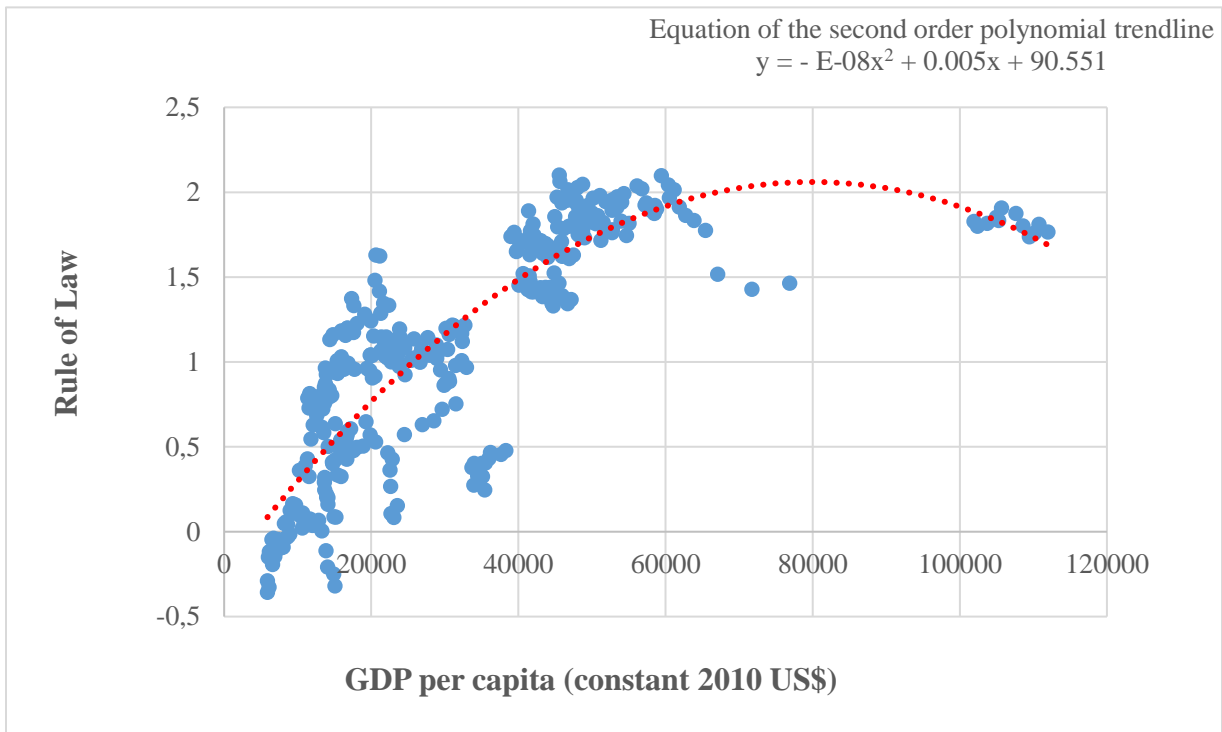


The control variables include the extent of urbanization, population density and the amount of fossil fuel used in the economy. All these variables are obtained from the World Bank's WDI data repository. Urbanization is measured as the percentage of urban to total population. The idea follows from Dogan & Turkekul (2016), who argue that the level of urbanization has had a positive impact on the increase in the level of CO2 emissions. Therefore, this could influence the government of climate-conscious states to increase taxes. Population density is defined as the number of people per square kilometer of land area. The higher the population density is in a region, the more difficult it is to maintain environmental quality. Fossil fuel energy consumption is measured in kilograms of oil

equivalent per capita. Higher fossil fuel energy consumption could be directly related to higher emissions.

The Rule of Law estimate is derived from World Bank's WDI data repository and it captures perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the "quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence" (Kaufmann et al., 2010). The index gives the country's score on the aggregate indicator, in units of standard normal distribution, ranging from approximately -2.5 to 2.5. The range of the index indicates that the 'Rule of Law' is increasing from negative to positive with zero being the mean of the distribution. Figure 5 illustrates the relationship between the Rule of Law and Income per capita. Again, there seems to be a concave relationship, but the lack of data for countries with per capita income levels between \$70,000 and \$100,000 could mean that the concavity is a biased result. In fact, there are very few countries in that income level making information scarce at that level.

Figure 5: Relationship between Rule of Law and GDP per Capita



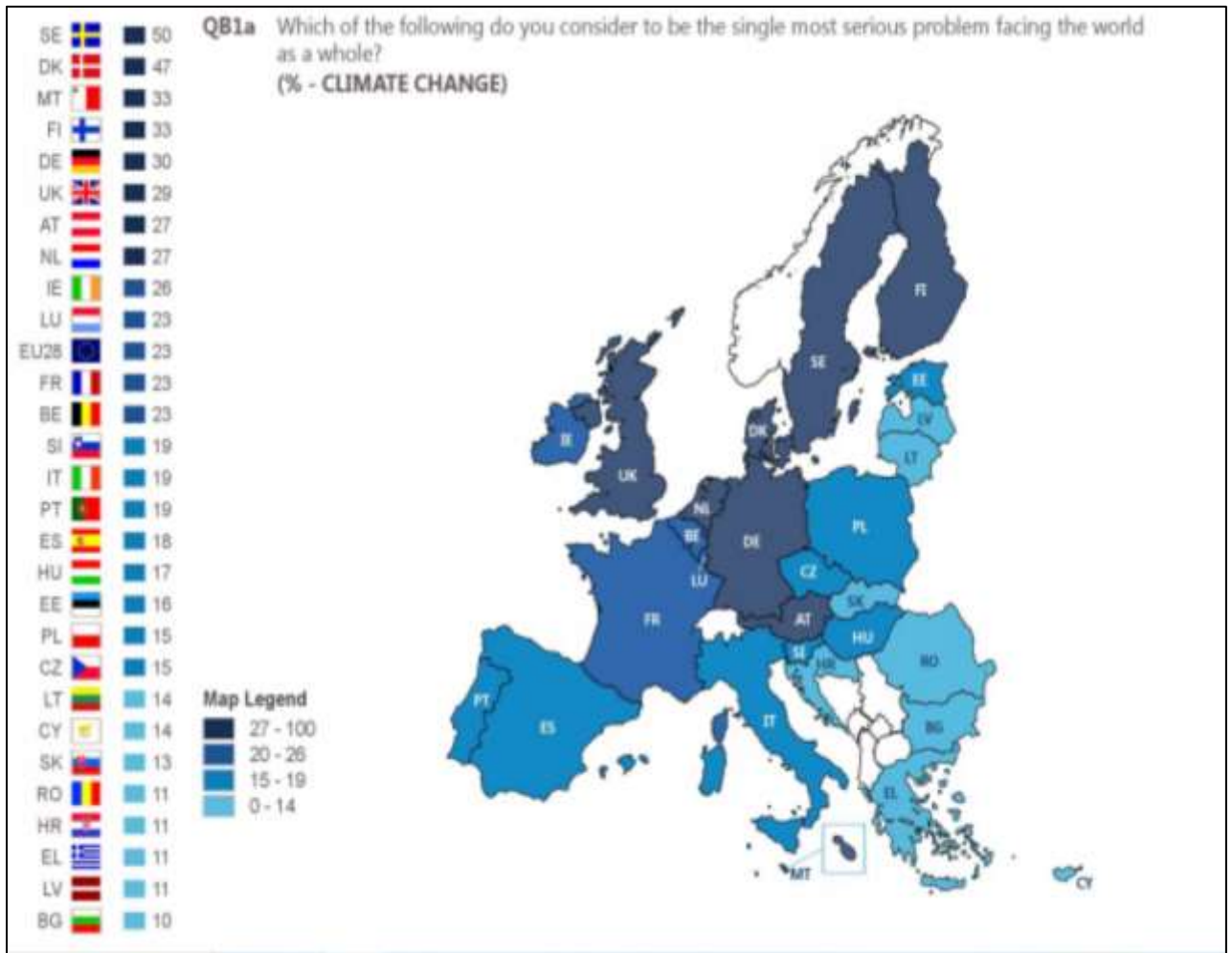
One of the main objectives of this paper is to demonstrate that it is consumer consciousness that drives government policy and not the other way around: i.e., democratic governments are responsive to voters' concerns. This is incorporated in the model with the use of environmental consciousness as an explanatory variable in the regression. I derive the data for consumers' environmental consciousness from Eurobarometer polls conducted twice every year. I have included data from 2007 to 2018 in this study. Since all other variables were measured annually, I took the poll results from the later part of every year. Residents of different European countries were asked to list issues that they consider as a threat to them and their country. Specifically, the question reads as – “What do you think are the two most important issues facing the EU at the moment?” (European Commission, 2018). There were given several options to choose – ranging from issues related to

immigration, health and social security, taxation, inflation and climate change. Figure 6 presents the data on “environment and climate change concerns”, indicating the percentage of people who voted climate change as a threat in the Eurobarometer poll (European Commission, 2018).⁴ Effectively, this variable would help rank countries in terms of their climate consciousness.

Higher consciousness would make it easier for governments to implement or increase the emission tax rates. I have also included the opinion poll on ‘health and social security’ and ‘taxation’ to see the impact on the emission rates. A population having higher concerns about ‘health and social security’ should be naturally more inclined towards supporting the government in the implementation of policies in order to improve environmental quality. However, those concerned about ‘taxation’ seem to have less confidence on the government and might go against the government’s decision of increasing the environmental taxes.

⁴ See <https://ec.europa.eu/commfrontoffice/publicopinion/index.cfm/Chart/getChart/chartType/gridChart/themeKy/31/groupKy/188/savFile/911>

Figure 6: Eurobarometer Survey on Climate Change Consciousness



(Source: Special Eurobarometer Survey Report – Climate Change, 2019)

I introduce the North and Western Europe Dummy (NW_ Dummy) to better establish the idea of the divide in Europe in terms of climate change consciousness and efforts taken thereof. The dummy indicates whether the country is in North and Western Europe (taking the value of one if it is and zero if it is not) (See Appendix). This dummy should help explain if there is an inherent divide in the effort of the governments to tackle

climate change in terms of emission taxes. Further, this dummy breaks down the analysis to compare data between the two regions.

Table 1 illustrates the summary statistics, which are sorted by the NW and SE regions in Europe. The summary statistics consolidates the idea of the divide between the NW and the SE countries in Europe. Not only does the statistics provide evidence in terms of the numbers, but also provides hints to the plausibility of applying the EKC hypothesis in this context. Table 1 shows that the average GDP per capita is about \$10,000 more in the NW countries and the implicit tax rate on emission is about 10 units more on average. This correlation provides preliminary indication towards the existence of the EKC hypothesis that higher income leads to higher environmental consciousness, consequently leading the government to impose higher taxes.

Overall, the division of the statistics into the NW and SE regions reflects more of a divide between the developed and developing nations. The characteristics of a developing nation like lower per capita GDP, high population density and higher fossil fuel use are differentiable in the summary statistics. Looking at the consciousness parameters, including 'health and social security' and 'taxation', one can observe that on average, the NW European countries are more concerned about the listed features as represented by the poll results. That the taxation concern is high in the NW countries could bear significance in the regression results.

Table 1: Summary Statistics – Sorted by NW and SE countries

South and East Europe					
	N	mean	Std. Dev.	min	max
Implicit Tax Rate	201	192.94	75.28	66.28	417.5
GDP Per Capita	204	29332.29	27483.86	5472.71	112000
Population Density	204	182.17	297.47	12.89	1511.03
Rule of Law Estimate	204	0.74	0.68	-0.49	2.03
Fossil Fuel Use (% of total Energy)	147	79.88	11.36	56.19	99.91
Energy Imports	147	19.64	156.3	-680.48	99.91
Opinion Poll_ Taxation	188	0.07	0.05	0.01	0.3
Opinion Poll_ Health & Security	188	0.13	0.1	0.01	0.48
Opinion Poll_ Climate Change	188	0.04	.045	0.0	0.28
North and West Europe					
Implicit Tax Rate	180	203.28	85.04	42.26	454.49
GDP Per Capita	180	39151.51	15511.66	11344.69	76880.81
Population Density	180	136.39	139.7	3.11	511.46
Rule of Law Estimate	180	1.5	0.4	0.72	2.1
Fossil Fuel Use (% of total Energy)	133	62.15	24.75	10.25	93.67
Energy Imports	133	45.1	29.87	-38.71	90.68
Opinion Poll_ Taxation	172	0.09	0.06	0.0	0.28
Opinion Poll_ Health & Security	172	0.13	0.14	0.02	0.73
Opinion Poll_ Climate Change	172	0.08	0.08	0.0	0.41

3.2 Methodology

I use the underlying concept of the EKC model to establish the relationship between environmental consciousness and government response in terms of increasing the emission tax rate. Thus, instead of testing the degree or level of pollution, I test the level of emission tax rates set by governments. The emission tax rate is represented by the ‘implicit tax rate’ obtained for each country. Following the EKC hypothesis, if the income per capita of the country increases, there should be an increase in the willingness to tax emissions to ensure better environmental quality. With the increase in income, people become more conscious about the environment and this leads to a higher level of emission taxes until the ‘turning point’ in the EKC is reached. Beyond the ‘turning point’, since the amount of pollution is already low, the environmental tax generated is lower (Castiglione et al., 2014). Thus, we can expect to see a concave relationship between income per capita and emission taxes.

The proposed regression in this paper tweaks the standard EKC regression model developed from Grossman & Krueger (1991). I run separate regressions to capture the effect of the key variables in the analysis. This model determining the emission taxes using income per capita and environmental consciousness is novel in the literature and, therefore, I break down the analysis into several regressions to develop a better understanding. I use five models to establish the relationship of emission taxes (implicit tax rate) and environmental consciousness; building off from the basic variant of the EKC. The idea is to delineate the effect of the inclusion of the key variables like income per capita and environmental consciousness to the control variables and highlight the changes from the basic model. The model for the analysis takes the following reduced form with the log of

the emission tax rate as the dependent variable and the main explanatory variables include income per capita and the environmental consciousness parameter. The control variables include urbanization, population density and fossil fuel energy consumption. The Rule of Law is introduced in a separate section as the inclusion of the variable would be highly correlated with the income per capita. Hence, section 3.4 is separately dedicated to the application of Rule of Law, which replaces income per capita as the key explanatory variable in the EKC model.

3.3 Model and Results

Model 1 represents the basic deviation from the EKC model without including the environmental consciousness parameter. Using the underlying notion of the EKC, when income per capita increases, there is an improvement in the environmental quality due to more stringent policies being designed. The policy under consideration in this exercise is the emission tax rate.

$$\begin{aligned} \ln_Emission\ Tax_{it} &= (\beta_{1it} * \ln_Income\ per\ Capita) + (\beta_{2it} \\ &\quad * \ln_Income\ per\ Capita_square) \\ &+ (\beta_{3it} * \ln_Urbanization) + (\beta_{4it} * \ln_Population\ Density) \\ &\quad + (\beta_{5it} * \ln_Energy_Consumption) + \epsilon_{it}, \end{aligned}$$

where 'i' represents country and 't' represents year.

Model 1 confirms an increasing and concave relationship between income per capita and emission tax rates. Table 2 lists the results of the models discussed. More

specifically, if the GDP per capita increases by 1% then the emission tax rate increases by 2.9%; having controlled for population density, urbanization and fossil fuel use. This implies that emission tax rates are highly responsive to increases in GDP per capita. Further, the second-order term of the GDP per capita is negative, which confirms with the EKC's concavity. In this basic model, I observe that population density and urban population do not have a significant effect. However, fossil fuel usage has a significant and positive effect on emission taxes. Since the definition of emission taxes already includes fossil fuel consumption as a denominator, a positive coefficient implies that the tax rates increase more than the amount of fossil fuel being used. Model 2 introduces environmental consciousness as an explanatory variable in the following form:⁵

$$\begin{aligned}
 \ln_Emission\ Tax_{it} &= (\beta_{1it} * \ln_Income\ per\ Capita) + (\beta_{2it} \\
 &\quad * \ln_Income\ per\ Capita_square) \\
 &+ (\beta_{3it} * \ln_Urbanization) + (\beta_{4it} * \ln_Population\ Density) \\
 &+ (\beta_{5it} * \ln_Energy_Consumption) + (\beta_{6it} * Environmental\ Consciousness) \\
 &\quad + \epsilon_{it}
 \end{aligned}$$

where 'i' represents country and 't' represents year.

The effect of environmental consciousness is not only positive and significant, but it also increases the impact of GDP per capita on the emission tax rate. If the percentage of people considering climate change and environmental concerns increase by 1 unit, then the

⁵ Interaction of the environmental consciousness and GDP per capita leads to some inconsistent results with small magnitudes. Thus, I do not report it in the analysis.

emission tax increases by 1.78%. Model 2 in the table also presents that the first-order term of the GDP per capita increases by 0.4% and the second-order term decreases by 0.02%. This indicates that the inclusion of the environmental consciousness parameter not only makes the EKC steeper, but also increases the curvature; thus, reaching the ‘turning point’ at lower level of income per capita than without the environmental consciousness parameter. This notion relates with the existing literature which claims that the EKC becomes steeper when stronger environmental policies are implemented. This can be explained by the key underlying idea of this study that – higher environmental consciousness is driving the implementation of stronger environmental policy. The other control variables remain unperturbed. It is important to note that the rule of law would play a major role in this channel of effect from environmental consciousness to government’s implementation of emission tax.

Model 3, in addition to Model 2, includes ‘health and social security’ and ‘taxation’ consciousness. The model takes the following form:

$$\begin{aligned}
 \ln_Emission\ Tax_{it} &= (\beta_{1it} * \ln_Income\ per\ Capita) + (\beta_{2it} * \ln_Income\ per\ Capita_square) \\
 &+ (\beta_{3it} * \ln_Urbanization) + (\beta_{4it} * \ln_Population\ Density) \\
 &+ (\beta_{5it} * \ln_Energy_Consumption) + (\beta_{6it} * Environmental\ Consciousness) \\
 &+ (\beta_{7it} * Health_Consumption) + (\beta_{8it} * Tax\ Consciousness) + \epsilon_{it},
 \end{aligned}$$

where ‘i’ represents country and ‘t’ represents year.

The results are confounding in the sense that the co-efficient on tax consciousness, although small, is positive. It implies that those who consider tax, in general, as a problem in their country would support the increment in emission tax rates. This could be attributed to the idea that those who are concerned by high taxes are the ones who seek to observe how well the government handles the taxpayers' money. In that case, those people could extend their support to the government if they believe that a tax dedicated to the improvement of environmental quality is acceptable. Model 3 also presents that higher health consciousness leads to a decline in emission taxes. This result could possibly be explained by health concerns in NW countries being lower due to higher coverage in national healthcare schemes.

As established in the summary statistics, the features of the NW and SE countries in Europe are quite different. For that purpose, Model 4 runs the same model as in Model 3 but only on NW countries whereas Model 5 includes only the SE countries. In Model 4, which includes only the NW countries, the coefficients on the income per capita have reversed while remaining statistically significant. This confirms our claim that the EKC holds. For the higher income countries, the increase in income leads to smaller and then negative increments in the emission tax rate, thus, mapping out the ETKC hypothesis. The central notion of the paper which states that the environmental consciousness drives the government to increase taxes is observed. Nonetheless, I need the inclusion of the rule of law to support this claim. The coefficient on the environmental consciousness increased along with the coefficient on taxation. Higher tax consciousness in the NW countries implies that people are unhappy that a large sum of their income goes into taxes. Reduction in any other form of taxes (probably non-environmental) becomes pertinent as income

increases to the level of the NW countries. If these advanced economies have already adopted clean technologies (some of the forerunners being Germany and the Nordic countries), then the industries from which the tax is being accrued is less. Moreover, there exists some polluting industries which the countries cannot transform easily into clean technology and, therefore, the tax on those few remaining industries are lower.

The coefficients being reversed in Model 5, where the SE countries are considered, is further strengthening the notion of the EKC behind the models. The SE countries, on average, may be deemed to be on the left-hand side of the tipping point in the EKC. Therefore, a unit increase in the population showing concerns about climate change and the environment pushes the government to further increase the emission tax. The coefficients of GDP per capita supports the claim. A 1% increase in the GDP per capita increases the emission tax rate by 3.07%. However, it is to be noted that the coefficient of the environmental consciousness parameter is insignificant in Model 5.

Table 2: OLS results on the Benchmark Model - Regression on Log of Emission Tax

	Model 1	Model 2	Model 3	Model 4	Model 5
_constant	-11.786*** (3.489)	-13.451*** (3.719)	-11.687*** (3.595)	34.660** (15.441)	-11.973*** (2.948)
ln_GDPPC	2.866*** (0.685)	3.243*** (0.732)	2.915*** (0.709)	-6.021** (3.035)	3.069*** (0.581)
ln_GDPPC_square	-0.122*** (0.034)	-0.144*** (0.036)	-0.128*** (0.035)	0.315** (0.150)	-0.142*** (0.029)
Urban Population (% of total population)	-0.003 (0.002)	-0.002 (0.002)	-0.001 (0.002)	-0.015*** (0.004)	0.006** (0.002)
Population Density	0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)	0.001** (0.000)	0.000 (0.000)
Fossil Fuel Use (% of energy consumption)	0.009*** (0.001)	0.009*** (0.001)	0.009*** (0.001)	0.005*** (0.002)	0.004* (0.002)
Environmental Consciousness		1.782*** (0.457)	2.474*** (0.459)	2.094*** (0.577)	0.214 (0.963)
Health Consciousness			-0.706*** (0.155)	-0.910*** (0.219)	-1.179*** (0.214)
Tax Consciousness			0.650** (0.329)	-1.939*** (0.602)	2.352*** (0.332)
Observation	279	261	261	128	133
R-squared	0.530	0.545	0.589	0.667	0.759
Standard errors are in parenthesis *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$					

3.4 Rule of Law

As discussed in the review of literature, endogeneity issues relating to the nature of institutions, political and legal systems have been criticized in several papers. Castiglione et al. (2014) claim that excessive focus on the shape of the curve over and above the underlying factors that define the relationship between income and climate change policy leads to endogeneity concerns. Most of these studies claim that increasing per capita income is not the direct reason for the improvement in environmental quality, but it takes place through the development of several other factors. The literature establishes the role of institutions as the linkage between the two variables. I follow Castiglione et al. (2014) and include 'Rule of Law' as an indicator of the role of institutions in the analysis. The key idea of this paper is that consumer consciousness drives government policies. Specifically, it is environmental consciousness of the consumers that drives the government to implement a stricter environmental regulation in the country. However, this implementation is possible due to presence of robust legal and institutional system. Such characteristics are represented by Rule of Law.

It should be noted that higher income per capita is highly correlated with Rule of Law, thus leading to the multicollinearity problem. This is the primary reason for having a separate analysis by dropping GDP per capita as the explanatory variable and including Rule of Law. Deacon and Norman (2006) already points out to the possible multicollinearity effects of using income per capita and strength of the institutions in the same analysis. Castiglione et al. (2014) also avoid using income per capita and rule of law as explanatory variables in the same regression. This implies that I cannot use Income per Capita and Rule of Law in the same regression as it would lead to multicollinearity issues.

In my data, the correlation coefficient between rule of law and GDP per capita is 0.76, which validates the findings on the correlation. The result is provided in Table 3 below.

Table 3: Correlation Matrix

	Environmental Consciousness	GDP per capita	Rule of Law
Environmental Consciousness	1.000		
GDP per capita	0.450	1.000	
Rule of Law	0.521	0.759	1.000

Using the above information, I run the same models replacing income per capita with the rule of law (see Table 4) such that the regression takes the following form:

$$\begin{aligned}
 \ln_Emission\ Tax_{it} = & (\beta_{1it} * Rule\ of\ Law) \\
 & + (\beta_{2it} * \ln_Urbanization) \\
 & + (\beta_{3it} * \ln_Population\ Density) \\
 & + (\beta_{4it} * \ln_Energy_Consumption) \\
 & + (\beta_{jit} * Consciousness_Parameters) + \epsilon_{it},
 \end{aligned}$$

where 'i' represents country and 't' represents year.

The impact of environmental consciousness and the other control does not alter significantly. The direction of the effect of the explanatory variables remains intact. This indicates that the model is robust to the inclusion of the role of institutions. However, the inclusion of 'Rule of Law' bears some interesting results. Stronger institutions lead to higher emission taxes being imposed. This finding is in line with our hypothesis. I estimate

that a one-unit increase in Rule of Law Index is associated with an increase in emission taxes by 33%. Including the consciousness parameters of the environment, health and taxation lowers the magnitude of the coefficient on Rule of Law but does not alter the level of significance. This confirms that there is positive and significant effect of environmental consciousness on the level of emission taxes. With Rule of Law as an explanatory variable, if there is one percent increase in the number of people voting in favor of environment and climate change risks, then the emission taxes are expected to increase 2.74%.

The effect of Rule of Law on emission tax rates is higher in the NW countries and smaller in the SE countries. The effect of a unit increase in the rule of law increases the emission tax rate by 51.1% in the NW countries and by 15.6% in the SE European countries. This implies that in the NW countries there are stronger regulations which enables environmental policies to be implemented (in this case, emission taxes) backed by the environmental consciousness of the consumers. In other words, the environmental consciousness of the consumers drives stringent policies to be implemented if the rule of law is strong. This implies that if a country has a strong institutional structure, then the environmental consciousness of the consumers are represented more in the government's policy than those countries where the rule of law is weak.

Table 4: OLS results of Regression of Rule of Law on Log of Emission Tax

	Model 1	Model 2	Model 3	Model 4	Model 5
_constant	3.893*** (0.185)	3.970*** (0.172)	4.024*** (0.169)	4.937*** (0.292)	4.248*** (0.198)
Rule of Law	0.336*** (0.039)	0.234*** (0.040)	0.269*** (0.038)	0.511*** (0.101)	0.156*** (0.039)
Urban Population (% of total population)	0.001 (0.002)	0.002 (0.002)	0.001 (0.002)	-0.010*** (0.003)	0.004* (0.002)
Population Density	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)
Fossil Fuel Use (% of energy consumption)	0.011*** (0.001)	0.011*** (0.001)	0.010*** (0.001)	0.007*** (0.002)	0.005* (0.003)
Environmental Consciousness		1.894*** (0.529)	2.741*** (0.505)	2.090*** (0.544)	0.726 (1.082)
Health Consciousness			-0.958*** (0.174)	-1.017*** (0.216)	-1.508*** (0.234)
Tax Consciousness			1.224*** (0.359)	-1.627*** (0.567)	3.362*** (0.361)
Obs.	279	261	261	128	133
R-squared	0.402	0.396	0.491	0.673	0.666

Standard errors are in parenthesis

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

3.5 Country Fixed Effects

Borghesi (2006) emphasizes on the use of fixed effects model due to the heterogeneous nature of countries. The study supports the idea of how different nations with different capacity and nature of institutions could lead to different impacts on shaping the EKC. This would lead to another form of endogeneity in the model emanating from the country-specific factors and thus, it biases the estimates. For example, Figure 4 and Figure 5 above yield a remarkable concave shape; however, that shape is in part due to outlier countries like Luxembourg. Focusing on the country-fixed effects helps us to establish if the EKC hypothesis is valid when looking at a country level.

The effect of the income per capita on the emission tax rate is robust to the implementation of country fixed effects and retains the same form, i.e., the increasing and concave relationship is maintained (see Table 5). The effect of the income per capita is two to three times as strong as in the pooled OLS. Applying the country fixed effects makes the coefficient of the environmental consciousness insignificant. However, this loss in significance in the analysis could be arising due to a certain bias in the model generated by the inclusion of the fixed-effects model. This bias can be attributed to the range of data in our analysis, which is for twelve years (2007-2018). Thus, if I apply country fixed effects, I am analyzing the data using only 12 data points for each country. This is technically small to capture a macroeconomic and structural shift in the policy regimes towards emission tax. As it is evident in the literature, the change in the consciousness level and implementation of the stronger environmental regime is a lengthy process. The change within the countries would, therefore, be insignificant to contribute to the emission tax

rates. Moreover, not only is the growth in income per capita slow in the richer countries, but also countries of the NW and SE will have different reactions to the change in the income per capita. Thus, a cross-sectional study provides a better analysis in this case.

Table 5: Fixed Effect Regression on Log of Emission Tax

	(Model 1)	(Model 2)	(Model 3)
_constant	-25.751** (10.533)	-20.495* (10.836)	-15.345 (10.298)
ln_ GDPPC	6.839*** (2.133)	5.801*** (2.200)	4.729** (2.094)
ln_ GDPPC_ square	-0.365*** (0.107)	-0.314*** (0.111)	-0.257** (0.106)
Urban Population (% of total population)	0.009 (0.011)	0.008 (0.011)	0.003 (0.010)
Health Consciousness			-0.027 (0.100)
Tax Consciousness			1.239*** (0.213)
Population Density	0.000 (0.001)	0.001 (0.001)	0.001 (0.001)
Fossil Fuel Use (% of energy consumption)	-0.019*** (0.002)	-0.020*** (0.002)	-0.019*** (0.002)
Environmental Consciousness		-0.309 (0.303)	-0.222 (0.284)
Obs.	279	261	261
R-squared	0.344	0.372	0.455
Standard errors are in parenthesis *** p<0.01, ** p<0.05, * p<0.1			

3. Conclusion

In Europe, there is a divide between countries in the North and Western part of the continent and those in the South and Eastern regions in terms of their level of consciousness concerning the environment and climate change. This paper is an attempt to explain this divide using the Environmental Kuznets Curve (EKC) hypothesis. The study extends beyond the direct application of the EKC to the inclusion of an ‘environmental consciousness’ variable to explain the EKC. Given the underlying notion of the EKC, the main finding of the paper is that environmental consciousness drives government policy regarding the environment and climate change. This direction of effect is supported by the strength of institutions, measured in terms of the Rule of Law.

One of the major findings in this paper is that environmental consciousness plays a significant role in determining the level of government initiative in deciding the level of effort and commitment towards improving the environmental quality. I demonstrate this idea by using the opinion poll of people from 31 European countries on climate change and environmental factors, and find that, on average, if 1% more people in the population start believing climate change and other environmental factors as a threat, then the emission taxes could increase by 2.5%. Although the magnitude is hard to decipher and put to context, the idea that environmental consciousness increases government initiative is the contribution of this study in the current literature. Thus, as a policy recommendation the European Union could focus on countries environmental consciousness and the structure of institutions within countries to enhance the state of environmental quality. When the

latter inherent qualities are improved, the government follows up with the policies to address environmental concerns more efficiently.

The idea supporting the inclusion of the Rule of Law is to capture some of the endogeneity problems arising due to the implicit factors which determined the shape of the EKC. An increase in income per capita leads to an increase in higher environmental consciousness, which in turn induces the government to implement higher environmental standards. However, the effect from consumer consciousness to government policy takes place through multiple channels discussed in the literature, such as the role of institutions. These leads to the endogeneity issues in which different countries have different slope of the EKC. I use the standard EKC model; however, instead of the emission level as the dependent variable, I use the level of emissions tax rate to determine the extent of government reaction through tax policy. The idea behind using this model is that consumer or voter consciousness drives government policy and not the other way around.

The model shows a positive and concave relationship of income per capita with the emission tax rates which complies with the literature. Beyond a certain level of taxation, it is harder to raise it further. The environmental consciousness parameter exhibits positive and significant impact on the emission tax rates. I extent the basic model to run the same over NW and SE countries separately and find significantly different coefficients of income per capita, in terms of magnitude and direction. This explains the divide in Europe in terms of the climate change and environmental consciousness levels.

The model is robust to the inclusion of the role of institutions incorporated through the addition of rule of law as an explanatory variable. The Rule of Law has positive and significant impact on the tax rate indicating an increase in emission tax rates with stronger

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Rule of Law. However, controlling for country fixed effects leads to the environmental consciousness parameter losing its significance. This can be attributed to a relatively shorter time-series in the data. For each country, the data spans over twelve years, that is, from 2007 to 2018. This period is short in terms of capturing the dynamics of the change in income per capita leading to the development of institutional capacity, and further initiating change in environmental consciousness amongst the population of that country.

4. References

Ashworth, J., Geys, B., & Heyndels, B. (2005). Government weakness and local public debt development in Flemish municipalities. *International Tax and Public Finance*, 12(4), 395-422.

Beckerman, W. (1992). Economic growth and the environment: Whose growth? Whose environment? *World Development*, 20(4), 481-496.

Bhagwati, J. (1993). The case for free trade. *Scientific American*, 269(5), 42-49.

Bhattarai, M., & Hammig, M. (2001). Institutions and the environmental Kuznets curve for deforestation: a crosscountry analysis for Latin America, Africa and Asia. *World Development*, 29(6), 995-1010.

Borghesi, S. (2006). Income inequality and the environmental Kuznets curve. *Environment, inequality and collective action*, 33.

Bosch, N., & Solé-Ollé, A. (2007). Yardstick competition and the political costs of raising taxes: An empirical analysis of Spanish municipalities. *International Tax and Public Finance*, 14(1), 71-92.

Bosquet, B. Environmental tax reform: Does it work? A survey of the empirical evidence. *Ecological Economics*. 2000, 34, 19–32.

Bovenberg, L.A.; de Mooij, R.A. Environmental tax reform and endogenous growth. *Journal of Public Economics*. 1997, 63, 207–237.

Castiglione, C., Infante, D., & Smirnova, J. (2014). Is there any evidence on the existence of an environmental taxation Kuznets curve? The case of European countries under their rule of law enforcement. *Sustainability*, 6(10), 7242-7262.

Cole, M. A. (2007). Corruption, income and the environment: an empirical analysis. *Ecological Economics*, 62(3-4), 637-647.

Costantini, V., & Martini, C. (2010). A modified environmental Kuznets curve for sustainable development assessment using panel data. *International Journal of Global Environmental Issues*, 10(1-2), 84-122.

Iulia Lupulescu
300031837
Major Research Paper

Culas, R. J. (2007). Deforestation and the environmental Kuznets curve: An institutional perspective. *Ecological Economics*, 61(2-3), 429-437.

De Bruyn, S. M., van den Bergh, J. C., & Opschoor, J. B. (1998). Economic growth and emissions: reconsidering the empirical basis of environmental Kuznets curves. *Ecological Economics*, 25(2), 161-175.

Deacon, R. T., & Norman, C. S. (2006). Does the environmental Kuznets curve describe how individual countries behave? *Land Economics*, 82(2), 291-315.

Dogan, E., & Turkekul, B. (2016). CO 2 emissions, real output, energy consumption, trade, urbanization and financial development: testing the EKC hypothesis for the USA. *Environmental Science and Pollution Research*, 23(2), 1203-1213.

Dutt, K. (2009). Governance, institutions and the environment-income relationship: a cross-country study. *Environment, Development and Sustainability*, 11(4), 705-723.

Eurobarometer, S. (2009). Europeans' attitudes towards climate change. *European Commission*, 29, 30.

Eurobarometer, S. (2019). Europeans' attitudes towards climate change. *European Commission*, 29, 30.

European Council on Foreign Relations, 2019. "Taking on climate change: The new east-west divide?", Retrieved from: https://www.ecfr.eu/article/commentary_taking_on_climate_change_the_new_east_west_divide

Gastil, R. D. (1990). The comparative survey of freedom: Experiences and suggestions. *Studies in Comparative International Development*, 25(1), 25-50.

Grossman, G. M., & Krueger, A. B. (1991). Environmental impacts of a North American free trade agreement (No. w3914). *National Bureau of Economic Research*.

Grossman, G. M., & Krueger, A. B. (1995). Economic growth and the environment. *The Quarterly Journal of Economics*, 110(2), 353-377.

Jalal, K. (1993). Sustainable development, environment and poverty nexus. *Asian Development Bank*.

Iulia Lupulescu
300031837
Major Research Paper

Jänicke, M., Binder, M., & Mönch, H. (1997). 'Dirty industries': patterns of change in industrial countries. *Environmental and Resource Economics*, 9(4), 467-491.

Kaufmann, Daniel, Aart Kraay and Massimo Mastruzzi (2010). "The Worldwide Governance Indicators: Methodology and Analytical Issues". World Bank Policy Research Working Paper No. 5430 (http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1682130).

Kuznets, S. (1955) "Economic growth and income inequality." *The American Economic Review* 45.1 (1955): 1-28.

Lee, T., Markowitz, E., Howe, P. *et al.* Predictors of public climate change awareness and risk perception around the world. *Nature Climate Change* 5, 1014–1020 (2015).

Leitão, A. (2010). Corruption and the environmental Kuznets curve: empirical evidence for sulfur. *Ecological Economics*, 69(11), 2191-2201.

Lopez, R., & Mitra, S. (2000). Corruption, pollution and the environmental Kuznets curve. *Journal of Environmental Economics and Management*, 40(2), 137-150.

Lessinski, L. (2019, October). Taking on climate change: The new east-west divide? In *The European Council on Foreign Relations*.

Panayotou, T. (1993). *Empirical tests and policy analysis of environmental degradation at different stages of economic development* (No. 992927783402676). International Labour Organization.

Panayotou, T. (1997). Demystifying the environmental Kuznets curve: turning a black box into a policy tool. *Environment and Development Economics*, 2(4), 465-484.

POLTICO, 2019. "Europe's East-West divide is back, this time over climate policy", Retrieved from: <https://www.politico.eu/article/climate-protest-europe-policy/>

Poortinga, W., Fisher, S., Bohm, G., Steg, L., Whitmarsh, L., & Ogunbode, C. (2018). European attitudes to climate change and energy. "European Social Survey". Topline results from Round 8 of the European Social Survey.

Revelli, Federico. (2001). "Spatial patterns in local taxation: Tax mimicking or error mimicking?" *Applied Economics* 33.9 (2001): 1101-1107.

Iulia Lupulescu
300031837
Major Research Paper

Scrimgeour, F., Oxley, L., & Fatai, K. (2005). Reducing carbon emissions? The relative effectiveness of different types of environmental tax: The case of New Zealand. *Environmental Modelling & Software*, 20(11), 1439-1448.

Sarkodie, S. A., & Strezov, V. (2018). Empirical study of the environmental Kuznets curve and environmental sustainability curve hypothesis for Australia, China, Ghana and USA. *Journal of cleaner production*, 201, 98-110.

Stern, D. I. (2004). The rise and fall of the environmental Kuznets curve. *World Development*, 32(8), 1419-1439.

Torras, M., & Boyce, J. K. (1998). Income, inequality, and pollution: a reassessment of the environmental Kuznets curve. *Ecological Economics*, 25(2), 147-160.

Van Alstine, J., & Neumayer, E. (2010). The Environmental Kuznets Curve. *Handbook on Trade and the Environment*, 2(7), 49-59.

Vermeir, J., & Heyndels, B. (2006). Tax policy and yardstick voting in Flemish municipal elections. *Applied Economics*, 38(19), 2285-2298.

Yandle, B., Vijayaraghavan, M., & Bhattarai, M. (2002). The environmental Kuznets Curve. *A Primer, PERC Research Study*, 02-01.

5. Appendix

List of Countries by Geographical Region defined by the United Nations Geographical Scheme for Europe

List of countries in North and Western Europe	List of countries in South and East Europe
Austria	Romania
France	Slovakia
Germany	Slovenia
Belgium	Italy
Netherlands	Greece
United Kingdom	Turkey
Ireland	Malta
Iceland	Croatia
Norway	Cyprus
Sweden	Bulgaria
Finland	Hungary
Denmark	Czech Republic
Latvia	Serbia
Estonia	Poland
Latvia	
Lithuania	
Luxembourg	

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