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Sebastián J. Miller
Mauricio A. Vela

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Inter-American Development Bank
Department of Research and Chief Economist

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Abstract

Environmental taxes have been discussed as one of the main mechanisms to deal with environmental problems. Nonetheless, instruments of this type have rarely been implemented, and the adoption of new or higher environmental taxes has faced resistance in some countries. The purpose of this work is to identify one possible political answer to why adoption of environmental taxes varies. One explanation is that legislatures' ideological position affects the degree of usage of taxes generally and environmental taxes in particular. For example, right-wing parties tend to be less associated with environmental concerns and more associated with lower government intervention. This paper presents evidence that reflects this relationship, showing the positive association of more left-wing legislatures with higher levels of environmental taxation. A panel of data for 37 developed and developing countries over 16 years is used considering the percentage of total revenue from environmentally related taxes, the ratio of this revenue to total energy use and tax levels in industry and household sectors. The results show that most of these impacts involve environmentally related taxes in the industry sector. Proportional representation electoral systems and high seat concentration by few parties appear to be necessary conditions for the negative relation of right-wing ideology with environmental taxes.

JEL classification: H23, P16, Q58.

Keywords: Environmental Tax; Environmental Policy; Ideology

1 Introduction

The definition of policy is clearly shaped by ideological positions and, within policies, environmental issues are also an important political matter. Many political studies have associated a left ideology with a more pro-environmental orientation. Nonetheless, much of the political economic literature has thus far emphasized political factors that may affect the level of environmental performance; that is, how institutional variables and the degree and form of democracy may affect the level of pollution emissions and other environmental indicators. Following the studies by Poloni-Staudinger (2008) and Fredriksson and Wollscheid (2007), this work will consider one particular environmental policy variable, environmental taxes.

Commitment to pro-environmental policymaking and the range of instruments that may be applied to address environmental problems differ greatly among countries. The economics literature, moreover, provides a large set of possible instruments. These are typically divided into two types: command-and-control and incentive-based instruments. The former are what are typically known as regulations or standards that impose strict restrictions on activity or use of inputs. The second types of instruments are incentive mechanisms, which include pollution charges or taxes and tradable emission permit systems (also known as cap-and-trade systems). Market-based instruments such as environmental taxes are mentioned by the literature as one of the most efficient mechanisms for the reduction of pollution, but their implementation and magnitude have varied greatly across countries. Likewise, exemptions to favor certain economic sectors vary depending across countries. Few cases of implementation of tradable permits, for instance, have occurred: the EU-ETS, which is the European Union's continent-wide policy to cap emissions of greenhouse gases, and the Acid Rain Program in the United States, are the main examples. This paper looks at environmentally related taxes (ERTs) and analyzes how tax levels and revenue from those taxes differ across countries. In particular, the paper seeks to explain whether ideology may lead some countries to impose higher environmental tax levels than others.

Among political parties, environmental awareness has been emphasized during the last 40 years by rising new left parties which have shown interest in a green agenda rather than merging with communist and socialist parties. These green parties, though, are not alone in paying attention to environmental concerns, as the seriousness of environmental problems has made them highly relevant in political discussions. Several countries have already undertaken tax reforms that introduced new environmental levies or increased old ones. Examples include Switzerland's heavy goods vehicle road use fee, introduced in 2001; Ireland's plastic bag tax; and the aviation fuel tax that was implemented in Norway in 1992 after a green tax reform. France's attempt to implement an industrial energy consumption tax in France failed due to industry concerns (OECD, 2006). The level of awareness of environmental problems appears to differ according to ideological positions. Likewise, how society and political parties give priority to, examine, and politically accept ERTs has a clear ideological inclination. Considering these issues, this paper uses a panel data set of 37 countries between 1994 and 2009 to examine whether the ideology of parties with seats in the legislature led some countries to have higher levels and revenues from environmentally related taxes than others.

2 Environmental Issues and the Left

Many studies have concluded that higher environmental performance is associated with more democratic countries. Scruggs (1998), for example, finds evidence of lower air and water pollution in countries with more political rights; similar results on other pollution variables is found by Li and Reuveny (2006). These findings are in part based on the prominence of elite rent seeking and under-provision of public goods in non-democratic countries. Conversely, democratic countries with high levels of civil liberties experience greater demand for environmental protection from special interest groups than nondemocratic countries do. Similarly, countries with more social democratic governments and a more corporatist social structure have also been found to exhibit lower levels of pollution (Neumayer, 2003).

Although this work analyzes only democratic countries, it will consider differences in ideological positions in those countries. Two main points are important in identifying why left government would prefer higher ERTs. The first is the growing salience of environmental concerns in post-industrialized societies. Second, left and right-wing legislatures tend to disagree over the ideal size of the government.

Several authors have discussed the relative decline of traditional economic left-right issues within the parties' platforms and how a new political culture has emerged in the last 30 to 40 years. This new political culture has affected the electoral struggles among political parties by highlighting the relevance of previously secondary issues such as the environment. For instance, List and Sturm (2006) finds for the United States that environmental policy is largely influenced by electoral incentives. Consequently, the prominence of environmental issues has been increased by the weakening of the class voting and the rise of issue voting (Clark, 2001). Green-Pedersen (2007) similarly shows how, in Western Europe, parties' political agendas reflect an issue competition in which parties emphasize particular issues to increase their relevance in elections. This has allowed certain parties to emphasize specific subjects such as the economy and immigration, among others, and in relation to this work, environmental issues.

The fact that parties are competing so that their issues of interest are enhanced in the political discussion does not preclude positional competition on these issues, as parties need to gain political advantage and differentiate themselves from other parties. Thus, it is important to classify parties' positions on an ideological spectrum.

Environmental issues do not always have electoral relevance, but, as Green-Pedersen (2007) shows, parties across the ideological spectrum have increasingly paid attention to environmental issues in recent decades. This has fomented the formation of green parties in some countries and the adoption of environmental issues in most parties' agendas. These new elements of discussion, policies to protect the environment and the need for sustainable development, are part of a new political culture that influences all parties. Consequently, it is essential to identify which types of parties have incorporated more pro-environmental positions into their platforms. Some authors have argued that left parties have appropriated the pro-environmental discourse (Jahn, 1998, see) and that environmental concerns tend to be also more aligned with left vote behavior (Achterberg, 2006). Furthermore, the environmental movements and the subsequent establishment of green parties were influenced triggered by the traditional left wing.

The new political culture, in which post-materialist issues may predominate and where traditional class voting has been weakening, has promoted the emergence of left-libertarian parties with a strong ecological orientation. These left-libertarian parties, in contrast with traditional

left parties, are less likely to oppose environmental policies for reasons related to jobs losses or detriments to the working class (Neumayer, 2003). While green and left-libertarian parties have normally made coalitions with left parties rather than with right parties, exceptions have occurred in countries such as Latvia, Slovakia, Finland and Belgium, where green parties made national coalitions with non-left parties. Likewise, in Mexico the Ecological Green party allied itself with the National Action Party (PAN) to win the presidential election of 2000 with Vicente Fox. In Western Europe, in the same way, green parties joined with left parties to offset the electoral strength of right parties during the 1980s and 1990s. (Rihoux and Rüdiger, 2006). The latter experience represents a more typical coalition for green parties, which have been grounded in the left of the ideological spectrum.

To sum up, not only have green parties been placed on the left of the ideological spectrum, but the environmental discourse has also been assumed more by left-wing parties than right-wing parties. In other words, left parties are more inclined to support pro-environmental policies. Neumayer (2004) examines the relationship between a party's position on a left-right scale and its position with respect to environmental issues using data from the Comparative Manifestos Project, finding that left-wing parties are more pro-environmentally responsive than right-wing parties. Correspondingly, individuals with left-wing orientation express greater concern for environmental issues. Dunlap et al. (2001) also finds strong partisan and ideological cleavages over the environmental issue in the United States. In particular, Republicans and conservatives are found to be less pro-environmental than Democrats.

Environmental issues are increasingly salient and have grown in political importance over the last thirty years, and strong partisan and ideological differences exist on those issues. Thus, it should be expected that revenues and tax rates from ERTs will be higher in countries with a higher percentage of left parties in their executive and legislative branches. This expectation is based on two observations. First, as discussed above, parties at the left of the ideological spectrum tend to prefer pro-environmental policies. Second, left-wing political parties have preferences inclined toward greater governmental intervention in the economy. In fact, numerous studies have found a significant relationship between parties' ideological position and the governments size and economic intervention (Schmidt, 2006, Allan and Scruggs, 2004, Blais et al., 1993, see). Hence, this work will consider the separation of ideology into two dimensions: the social policy position and the economic policy position.

3 Environmentally Related Taxes

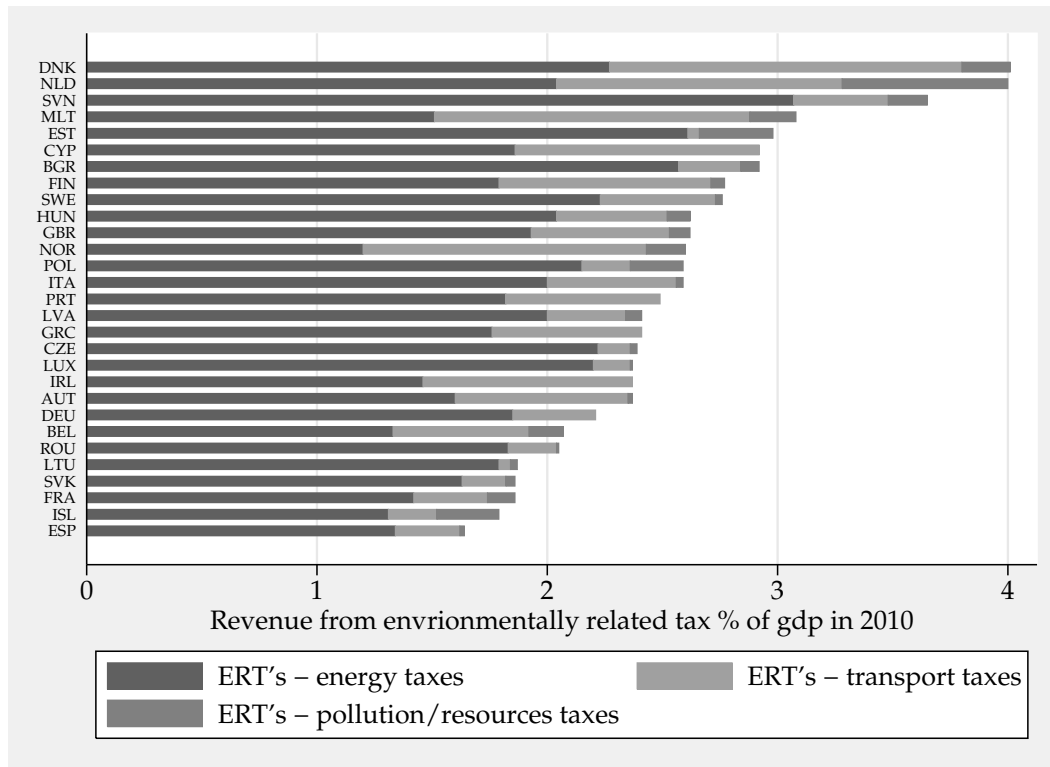
Environmentally related taxes are defined by the OECD as every payment to the general government levied on tax bases that have any environmental relevance¹. Taxes are unrequited in the sense that benefits provided by government to taxpayers are not in proportion to their payments. Therefore, this definition takes into account the effect on relevant price elasticity and also implies that not every ERT was implemented with a specific environmental goal but does have a final positive impact on the environment. The main feature of ERT is consequently that they incorporate the cost of pollution into final prices and thus create incentives for producers and consumers to change their

¹ Value added taxes (VAT) are excluded.

behavior toward less environmental damage. The ERT data analyzed in this paper were obtained from OECD, Eurostats and IEA².

Figure 1 shows ERT revenue as a percentage of GDP for the year 2010 for a sample of countries. This figure also reflects that most of the revenue from ERTs comes from energy taxes, which include taxes on leaded and unleaded gasoline, diesel, light fuel oil, electricity consumption, coal and natural gas. The second-largest category is transport taxes, which are taxes mainly on motor vehicles, road use, congestion and flights, and on other means of transport. Finally, pollution taxes are all those taxes levied on the emission of pollutants into air, ozone, and water³.

Figure 1. Revenue from Environmentally Related Taxes as Percentage of GDP in 2010



Source: OECD, Eurostats.

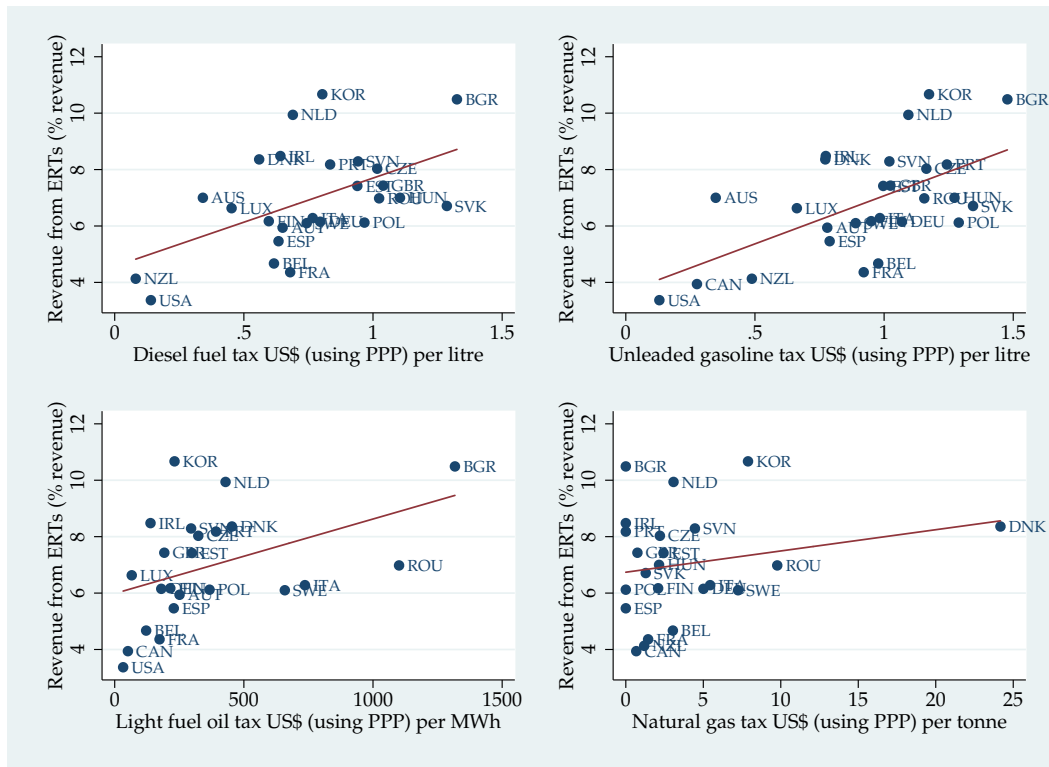
Higher revenue from ERTs does not necessarily imply higher ERT rates. Some countries could have low tax rates that change the behavior of consumer and producers so that those countries receive higher revenues from the use of the charged inputs. Nevertheless, this situation is not common, and countries with higher revenues from ERTs generally have higher tax rates (OECD, 2006). Figure 2 reflects this fact, showing the scatterplot of several taxes with revenue from ERT as a percentage of total revenue for the year 2009. The positive correlation is clearer for the tax rate on diesel fuel, unleaded gasoline and light fuel oil, but not as clear for natural gas. Table D.1

² Information about environmentally related taxes and some data description can be found at <http://www2.oecd.org/ecoinstd/queries/>

³ For additional information: http://epp.eurostat.ec.europa.eu/cache/ITY_SDDS/en/env_ac_taxind_esms.htm

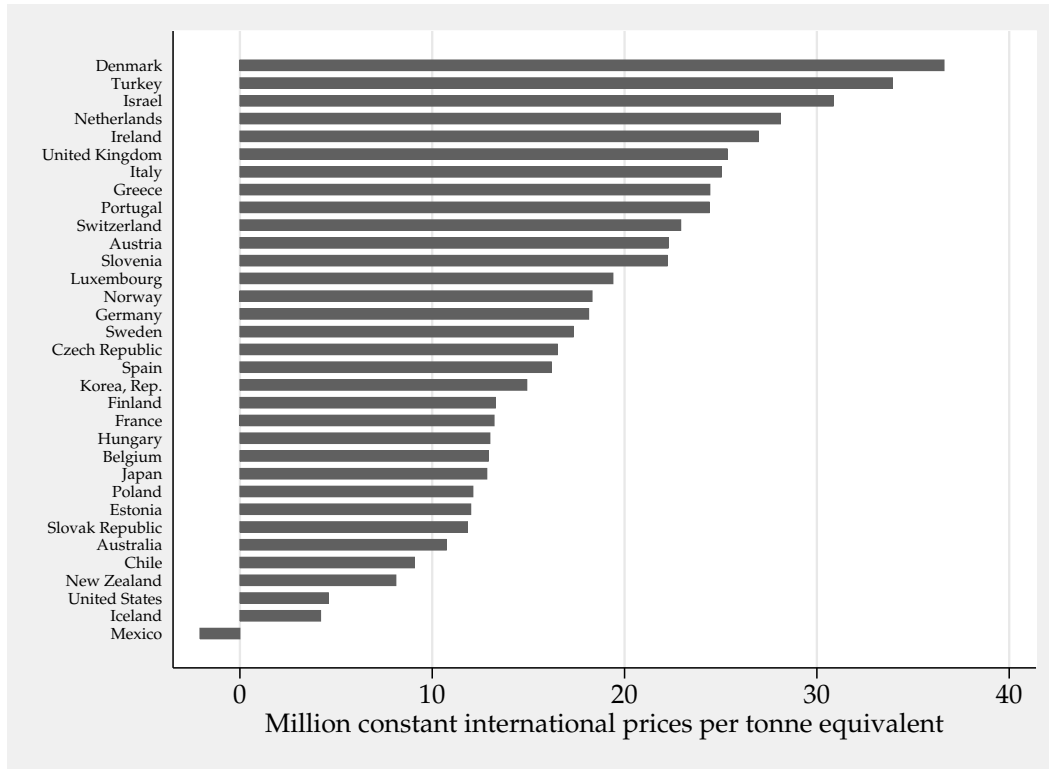
in the Appendix extends this analysis and estimates some regressions to show the significant and positive correlation of the variable of revenue from ERTs with different tax rates for several fuel energy variables. In this way, the variable of revenue from ERT could be used as a good indicator of a pro-environmental policy, but it is not sufficient. Another way to analyze ERTs is to consider the implicit tax rate, which consists of the ratio of total revenue from ERTs to final energy use. The final energy use variable excludes non-hydrocarbon energy, i.e., energy that does not produce carbon dioxide when generated. This variable is therefore measured in millions of 2005 constant US dollars (using Purchasing Power Parity PPP) per ton of oil equivalent from hydrocarbon energy. Like the revenue variable, this variable can take negative values implying a subsidy rather than a tax. Figure 3 shows the values for the implicit tax rate for the year 2010. Interestingly, these values do not change much with respect to Figure 1, so that the ranking of countries is almost the same. The information for revenue from ERTs was obtained from the OECD, while information on tax rates was gathered from the IEA.

Figure 2. Revenue from ERTs and Several Environmental Taxes in 2009



Note: Source: OECD, Eurostats, IEA. Regular unleaded gasoline for Australia, Canada, Japan and Korea; premium unleaded 95 gasoline for all other countries.

Figure 3. Implicit Tax Rate in 2010 (million US dollar per ton of oil equivalent)



Source: OECD, Eurostats, IEA.

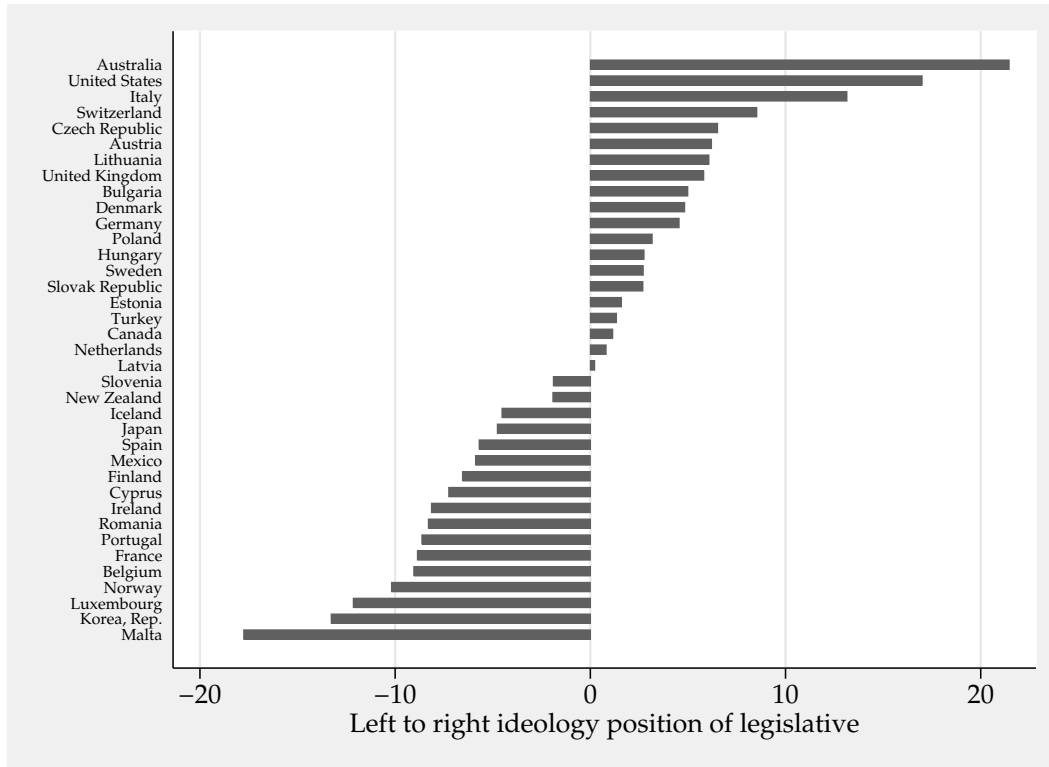
4 Political Variables

In this work we test whether the ideological position of the legislative branch has any relation with the environmental policy, in particular with ERTs. Data from the Comparative Manifestos Project (CMP) will be used to obtain the ideological position of parties. The CMP extracts policy positions from sentences of party manifestos for national elections. Data for 37 countries from elections involving years between 1994 and 2009 are included (see Appendix A). These data have been widely used and tested to provide a clear numerical time-varying approach to measure ideology. The right-left ideological spectrum is constructed according to Budge and Laver (1992), in which the percentage of the sentences on different pro-left economic, political and social categories is subtracted from the sum of other pro-right sentences (see Appendix C for more specific information). Once parties on each electoral period are classified in this ideological spectrum, a weighted mean according to the percentage of seats in that electoral year is constructed. In that way, an approximation of the ideological bias of the legislative branch can be obtained. The variable can take values from -100 to 100, where higher values would imply a more right-wing legislature.

Other substantive political components can be constructed using the same data. One variable of interest, as mentioned above, is to consider two dimensions of the ideological position: one on the economic policy component and another on the social policy component. These two indicators are constructed based on an analysis comparing expert surveys to the data from CMP by

Benoit and Laver (2007) (see Appendix C). Figure 4 shows the average ideological position of the legislature according to the partisan makeup of the parliament. A negative indicator implies that the policy sentences weighted mean is inclined toward a left position. Figure 5 plots the kernel density of the position of the legislature for all countries during the whole period.

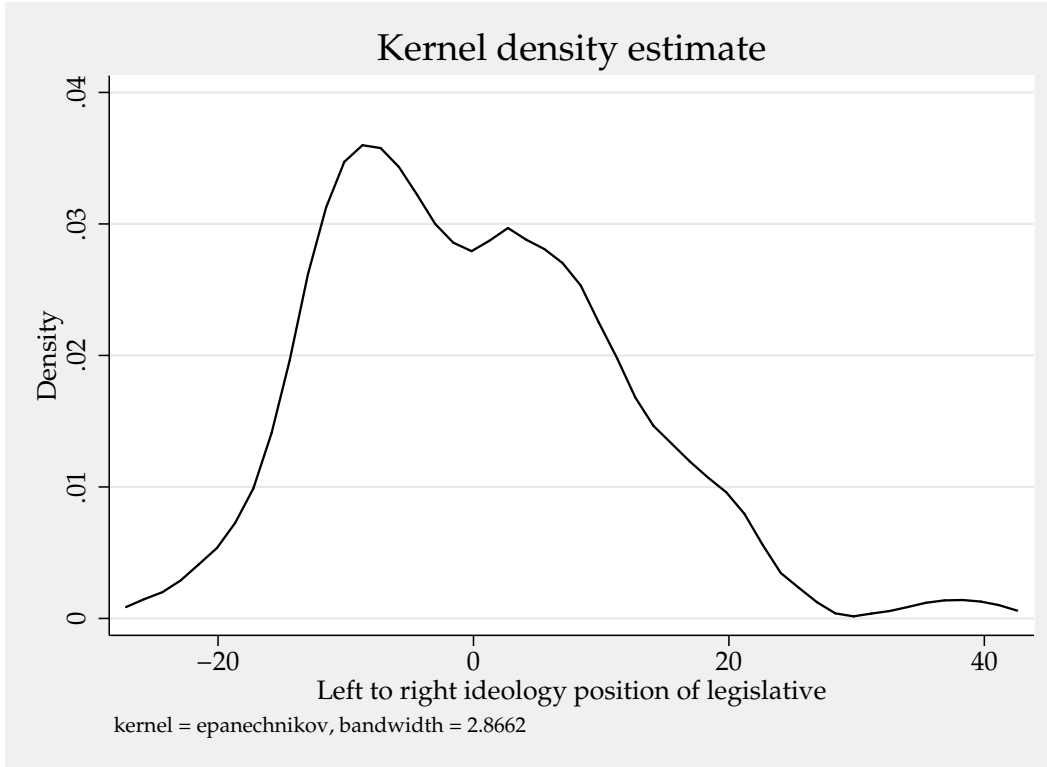
Figure 4. Ideological Position of the Legislature (average 1993-2010)



Note: Source: Comparative Manifestos Project. Not all countries have data until 2009; see Appendix A for information about years available.

Various other political variables have also been taken into account to explain the degree of environmental quality. Some of the most analyzed variables are: the type of democratic government (presidential versus parliamentary), the degree of corporatism, the type of electoral rules (majoritarian versus proportional representation), the level of corruption and veto players, the left-wing orientation of the legislature and cabinet, the degree of consensual politics, and the extent of decentralization (Gassebner et al., 2011, Lamla, 2009, Bernauer and Koubi, 2009, Neumayer, 2003, Scruggs, 2001, see). In order to analyze environmental policy, in this work the variables type of government, corporatism and electoral system will be included in some regressions with the purpose of checking the interaction with the variable of ideology.

Figure 5. Ideological Position of Legislature



Note: Source: Comparative Manifestos Project. Not all countries have data until 2009, see Appendix A for information on years.

5 Econometric Specification

Using a panel data set for 37 countries between the years 1994 and 2009, the following model will be estimated⁴:

$$Y_{it} = \alpha + \beta X_{it} + \gamma_1 Ideology_{it} + \lambda_t + \mu_i + \varepsilon_{it} \quad (1)$$

In this equation, Y_{it} denotes our environmental policy variables with ERTs in year t and country i . More specifically, the dependent variables are revenues from ERTs, the implicit tax rate, and different tax rates on different fuel energy variables. The taxes in consideration will be divided into two categories: one paid by households and the other paid by the industry sector. The former contain taxes on unleaded gasoline, diesel gasoline, regular leaded gasoline and light fuel oil. For the latter, taxes on high-sulfur fuel oil, natural gas, steam coal, cooking coal and electricity will be included.

The coefficient of interest is γ_1 , which captures the effect of the ideological position of the legislature on the environmental policy variable. In later estimations institutional variables will also be included as regressors. The institutional variables in consideration are the type of govern-

⁴ The number of countries and years may vary according to the data availability of the variables of interest.

ment, corporatist structure (corporatism vs. pluralism) and the electoral system (majoritarian vs. proportional representation). These are all dummy variables⁵ and will be also interacted with the ideology variable to analyze whether ideology might be stronger in a specific political institutional framework.

The vector X_{it} captures all control variables⁶. A variable that may impact the level of environmental commitment through ERTs is the level of development, and for a proxy of this variable, GDP per capita in PPP constant prices is used. As some fiscal instruments may be cyclical, a variable that captures income shocks is needed. This variable is included to capture possible cyclical effects that would affect certain sectors, in particular energy sectors, more or less than others. Therefore, the Hodrick-Prescott filter that measures cyclical deviation from GDP trend will be also included. As road sector diesel and gasoline fuel consumption per capita and the industrial intensity affect revenues from ERTs, industrial intensity is measured as industrial value over the level of GDP. These two variables are used as a proxy of the weight of polluting sectors in the economy. Another important variable to include is net imports of energy use, as countries that are net importers of energy might have an incentive or disincentive to charge for fuel oil consumption.

The percentage of electricity production from renewable sources and the stringency of regulation of auto emissions⁷ are used to capture possible substitutes for ERTs in environmental policy (Appendix B contains definitions of all variables and their sources). Time and country fixed effects are captured by the λ and μ coefficients, and ε represents the random error term. The model is estimated using the method of fixed effects. In Appendix D, when including the lagged of the dependent variable, the coefficients may be inconsistent using this method, as the lagged variable is endogenous to the fixed effects in the error. The alternative is to estimate the coefficients through an Arellano-Bond Dynamic Panel GMM⁸.

6 Results

6.1 Effect of Left-Right Ideology

The first estimations using the revenue from ERTs (percentage of total revenue) and the implicit tax rate as the dependent variables are presented in Table 1. It reports regressions including and excluding controls and using fixed and random effect estimations. The ideological scale variable is measured from left to right, so a higher value implies a legislature leaning towards a right position. The variable can take negative values, where -100 would imply that 100 percentage of every parties' sentences (among parties with seats in the legislative branch) was related to a left position in some of the relevant areas⁹. As shown in the table, our hypothesis is confirmed. When a legislature turns more to the right, revenues from ERTs are reduced keeping all other variables constant. In addition, the results are also robust for all estimations, and all coefficients of the ideological scale

⁵ The corporatism variable is a continuous variable but will be converted to a dummy variable.

⁶ The lagged dependent variable will be included in some specifications in Appendix D to control for inertia in fiscal instruments.

⁷ The data for automobile emission regulations was taken from Perkins and Neumayer (2012)

⁸ A two-step estimator is applied using the level equation and the first difference regression equation, where the first order difference variables and the lagged variables are employed as instrument variables for the level and first difference equation, respectively (Blundell and Bond, 1998) The dynamic GMM could also make it possible to correct possible endogeneity of our variables of interest.

⁹ See Appendix C for each of the categories included to measure the ideology scale.

are significant. The coefficient magnitudes of columns one to three are around -0.03. This means that an increase in one unit of the weighted mean of the ideological scale of the legislature would imply a reduction of around -0.03 percentage points of revenue from ERTs in an average country.

Columns 4 to 6 show the results for the implicit tax rate as dependent variable. The results in these columns are consistent with those of previous columns. An increase in the ideological scale toward the right is associated with lower ERTs, and a one-unit increase the weighted mean of the ideological position toward the right of the legislature implies a reduction of around 0.1 million dollars per ton of oil equivalent. Table D.2 in the Appendix includes as a regressor the lagged dependent variable to control for any inertia in the dependent variable. All coefficients in the table are significant including the GMM and Fixed effect estimations¹⁰.

Table D.3 in the Appendix shows other measures for the left ideology variables. These data were taken from an updated database by Swank (2002). They include the percentage of left and left-libertarian parties in cabinet portfolios, seats and votes, but the sample is reduced to 20 countries for years from 1994 to 2006. Left parties include communist; socialist, social democratic, and labor; and other various left-wing parties based on experts judgments. These estimations confirm our previous results: revenue as well as implicit tax rates from ERTs are higher under left-leaning governments measured by the percentage of left cabinet portfolios and seats. However, the coefficients are significant for only some of the specifications. This reflects the fact that the presence of left and left-libertarian parties is not a guarantee that pro-environmental policies will be adopted. Rihoux and Rüdig (2006) analyze green parties in Europe and explain how in a few cases these parties have been in a pivotal position that gave them enough power to impose their agenda on the national debate.

¹⁰ The AR test and Hansen test for the GMM accepts the hypothesis of no autocorrelation of the error terms and the hypothesis of overidentifying restrictions (whether the instruments appear exogenous).

Table 1. Fixed Effect Estimation for Revenues from ERTs (as percentage of total revenue) and for Implicit Tax Rate (million constant US dollar, using PPP, per ton of oil equivalent)

VARIABLES	(1) Revenue FE	(2) Revenue RE	(3) Revenue FE	(4) Imp_Tax FE	(5) Imp_Tax RE	(6) Imp_Tax FE
Ideology Scale	-0.0313* (0.0177)	-0.0359** (0.0174)	-0.0361** (0.0176)	-0.0961** (0.0427)	-0.102** (0.0477)	-0.102** (0.0480)
Observations	545	545	545	545	545	545
Number of country_id	37	37	37	37	37	37
Controls	No	Yes	Yes	No	Yes	Yes

Robust standard errors in parentheses

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

Note: All estimations include country and time fixed effects, and the controls included are the following: Energy imports, Diesel and gasoline consumption, Industrial intensity, Shock variable, GDP per capita, Emissions regulations, and percentage of electricity from renewable sources.

6.2 Results for Different Taxes

To continue the exploration of specific tax rates in relation to the ideological position of the legislative branch, Tables 2 and 3 report the regressions using different types of taxes paid by industries and households, respectively. In some cases the available information is scarce, and therefore the number of observations is reduced. On average there is information for about 25 countries for the whole period between 1994 and 2009. All these taxes are measured in 2005 US dollar constant prices (using PPP) per unit; VAT is included among those taxes. The units for high-sulfur fuel oil, steam coal and coking coal are tons; for light fuel oil, one thousand liters; for diesel, unleaded and leaded gasoline, liters; and for natural gas and electricity, MWh.

In Table 2 we find that in all cases the correlation of right ideology and tax rates is negative, and almost all results are significant. For example, an increase in one unit in the scale of ideology toward the right implies a reduction of about 0.03 dollars per MWh in the tax on natural gas for an average country. Thus, the ideological position of the legislature seems to affect the level of tax rates on different polluting inputs of the industry sector. For the estimations using household taxes on energy, the coefficient still confirms the hypothesis of lower taxes in countries with left-leaning legislatures. Nonetheless, none of the coefficients is significant.

Table 2. Fixed Effect Estimation for Different Industry Taxes (constant US dollars, using PPP, per unit)

VARIABLES	(1) High_Sulfur_Oil	(2) Natural_Gas	(3) Steam_Coal	(4) Coking_Coal	(5) Electricity
Ideology Scale	-1.013 (0.805)	-0.0330 (0.0196)	-0.270*** (0.0841)	-0.180** (0.0678)	-0.127** (0.0587)
Observations	252	300	169	144	364
Number of country_id	26	29	16	11	30
Controls	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses

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

Note: All estimations include country and time fixed effects and the following controls: Energy imports, Diesel and gasoline consumption, Industrial intensity, Shock, GDP per capita, Emissions regulations, and percentage of electricity from renewable sources . Units: sulfur fuel oil, steam coal and coking coal in tons; light fuel oil in thousand liters; diesel, unleaded and leaded gasoline in liters; natural gas and electricity in MWh.

Table 3. Fixed Effect Estimation for Different Household Taxes (constant US dollars, using PPP, per unit)

VARIABLES	(1) Light_Fuel_Oil	(2) Diesel	(3) Premium_Leaded	(4) Unleaded_Gasoline
Ideology Scale	-3.413 (2.458)	-0.00108 (0.00199)	-0.00502 (0.00296)	-0.000568 (0.00255)
Observations	359	419	158	440
Number of country_id	32	34	21	35
Controls	Yes	Yes	Yes	Yes

Robust standard errors in parentheses

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

Note: All estimations include country and time fixed effects and the following controls: Energy imports, Diesel and gasoline consumption, Industrial intensity, Shock, GDP per capita, Emissions regulations, and percentage of electricity from renewable sources . Units: sulfur fuel oil, steam coal and coking coal in tons; light fuel oil in thousand liters; diesel, unleaded and leaded gasoline in liters; natural gas and electricity in MWh.

Tables 4 and 5 repeat the estimations for the same type of taxes but excluding the VAT. This is done to determine whether ideology might be affecting the tax level only through the VAT

and not through excise levels. As the excise is part of the total tax (tax minus the VAT), lower coefficients should always be expected for the estimations using excises than for estimations with total taxes. Right ideology continues to show a negative correlation with tax levels. Again, the coefficients are significant only for taxes on the industry sector. Coefficients for estimations of coking coal and electricity in columns 4 and 5 of Table 4 are no longer significant, but their p values are close to the 0.1 threshold (p values equal to 0.14 and 0.12, respectively). One important result from almost all these estimations is a negative correlation between tax rates (with and without including VAT) and right-leaning legislatures.

Table 4. Fixed Effect Estimation for Different Industry Excise Taxes (constant US dollars, using PPP, per unit)

VARIABLES	(1) High_Sulfur_Oil	(2) Natural_Gas	(3) Steam_Coal	(4) Coking_Coal	(5) Electricity
Ideology Scale	-0.669 (0.451)	-0.0133* (0.00751)	-0.255*** (0.0727)	-0.0721 (0.0494)	-0.110 (0.0687)
Observations	223	284	155	134	327
Number of country_id	26	30	16	11	30
Controls	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses

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

Note: All estimations include country and time fixed effects and the following controls: Energy imports, Diesel and gasoline consumption, Industrial intensity, Shock, GDP per capita, Emissions regulations, and percentage of electricity from renewable sources. Units: sulfur fuel oil, steam coal and coking coal in tons; light fuel oil in thousand liters; diesel, unleaded and leaded gasoline in liters; natural gas and electricity in MWh.

Table 5. Fixed Effect Estimation for Different Household Excise Taxes (constant US dollars, using PPP, per unit)

VARIABLES	(1) Light_Fuel_Oil	(2) Diesel	(3) Premium_Leaded	(4) Unleaded_Gasoline
Ideology Scale	-2.914 (2.057)	-0.000445 (0.00134)	-0.00360 (0.00234)	0.000136 (0.00179)
Observations	349	403	158	424
Number of country_id	32	33	21	34
Controls	Yes	Yes	Yes	Yes

Robust standard errors in parentheses

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

Note: All estimations include country and time fixed effects and the following controls: Energy imports, Diesel and gasoline consumption, Industrial intensity, Shock, GDP per capita, Emissions regulations, and percentage of electricity from renewable sources. Units: sulfur fuel oil, steam coal and coking coal in tons; light fuel oil in thousand liters; diesel, unleaded and leaded gasoline in liters; natural gas and electricity in MWh.

6.3 Other Measures of Ideology

As explained above, the CMP data permit different classifications of ideology. It is also possible to disaggregate the ideology variable into two dimensions: the first refers to positions on economic policies and the second to a scale from left to right on social policy positions. In Table 6, the two explanatory variables are introduced as well as a variable to measure ideological polarization. This disaggregation is important in order to identify which dimension of ideology might have the greatest effect on ERT variables. Economic policy refers to ideological positions on market regulation, economic planning and the level of government intervention in the economy, while social policy positions range on a scale from left to right in areas such as morality, law and order and social harmony (see Appendix C). Both dimensions could affect parties environmental positions.

Table 6. Fixed Effect Estimation for Revenues from ERTs (as percentage of total revenue) and for Implicit Tax Rate (million constant US dollar using PPP per ton of oil equivalent)

VARIABLES	(1) Revenue	(2) Revenue	(3) Revenue	(4) Imp_Tax	(5) Imp_Tax	(6) Imp_Tax
L-R economy policy position	-1.641* (0.811)			-3.981* (2.357)		
L-R social policy position		-0.721 (0.917)			-3.241 (2.384)	
Polarization			-0.0437 (0.0285)			-0.134* (0.0763)
Observations	545	545	545	545	545	545
Number of country_id	37	37	37	37	37	37

Robust standard errors in parentheses

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

Note: All estimations include country and time fixed effects and the following controls: Energy imports, Diesel and gasoline consumption, Industrial intensity, Shock, GDP per capita, Emissions regulations, and percentage of electricity from renewable sources.

Columns one and three show the results for the economic policy dimension. The significance of the coefficients suggests that what matters most is ideological position on economic policy. The scale of social policy positions in columns two and four again reflects a negative correlation with ERTs, but the coefficients are not statistically significant. These results are the same when including either of the dependent variables, revenues from ERTs and implicit tax rate. A position closer to the right on economic policy ideology, or in other words a position less in favor of regulation and economic control by the government, is negatively correlated with the level of implicit tax rate from ERTs and with revenues from ERTs.

Results when including the variable of ideological polarization¹¹ suggest that a more polarized legislature is associated with lower revenues from ERTs as well with lower implicit tax rates. High ideological polarization is mentioned in the political literature with lower governability and higher electoral volatility (Mainwaring, 1995) and therefore, the introduction of new or higher environmental taxes may be more difficult for parties with those intentions.

In order to check whether the ideology scale may be affecting ERTs as part of a larger effect on all taxes, Table D.4 in the Appendix performs a regression estimation using as dependent variable total revenue as a percentage of GDP. The coefficients for the ideology scale variable are not statistically different from zero, and it consequently cannot be stated that left-leaning legislatures are a factor of influence on revenues from all taxes. This result helps us to conclude that, even if the economic policy ideology dimension predominates in the relationship with ERTs, left-wing

¹¹ See Appendix C for details on this variable

legislatures might prefer higher environmental taxes with an environmental-concern reason.

6.4 Interaction with Other Political Institutional Variables

The next exercise in this section is to include dummy variables for several political and institutional issues and interact them with our variables of interest:

$$Y_{it} = \alpha + \beta X_{it} + \gamma_1 Ideology_{it} + \gamma_2 INST_{it} + \gamma_3 INST_{it} \times Ideology_{it} + \lambda_t + \mu_i + \varepsilon_{it} \quad (2)$$

The variables to be included are presidential form of government, majoritarian electoral systems, and corporatism. All these are dummy variables indicating whether the country has that type of institutional system or rule. The third variable is a continuous variable based on Siaroff (1999), but it was converted to a dummy variable where countries above the median are classified as corporatist societies¹². The other variables reflect certain political conditions of the moment: first, if there is an election in that year, and second if the concentration of seats in the legislature was very high. To measure the concentration of seats the normalized Herfindahl index is used. This last variable was transformed to a dummy variable using the same procedure as with the corporatism variable. Each column of Tables 7 and 8 is an estimation using a different institutional or political variable indicated in the lower part of the table.

Table 7. Estimation for Revenue from ERTs as Percentage of Total Revenue

VARIABLES	(1)	(2)	(3)	(4)	(5)
Ideology Scale	-0.0366* (0.0192)	-0.0528** (0.0234)	-0.0455* (0.0269)	-0.0368* (0.0189)	0.0689* (0.0405)
Political/Institutional Variable	-2.798 (3.339)	0.0429 (0.949)	0.864 (1.000)	-0.0751 (0.0636)	1.327 (2.002)
Ideology Scale*(Pol./Inst. Variable)	0.00661 (0.0333)	0.0631** (0.0281)	0.0237 (0.0265)	0.00209 (0.00696)	-0.326** (0.144)
Observations	545	545	545	545	545
Number of country_id	37	37	37	37	37
Political/Institutional	Presidential	Majority	Corporatism	Election	Herfindahl

Robust standard errors in parentheses

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

Note: All estimations include time and country fixed effects and the following controls: Energy imports, Diesel and gasoline consumption, Industrial intensity, Shock, GDP per capita, Emissions regulations, and percentage of electricity from renewable sources.

¹² For all estimations with time-invariant variables, an estimation with random effects and including country dummies was used.

Table 8. Estimation for Implicit Tax Rate (million 2005 constant US dollar, using PPP, per ton of oil equivalent)

VARIABLES	(1)	(2)	(3)	(4)	(5)
Ideology Scale	-0.0955*	-0.150**	-0.130*	-0.110**	0.223*
	(0.0527)	(0.0630)	(0.0736)	(0.0511)	(0.125)
Political/Institutional Variable	-12.64	3.056**	19.94***	-0.315**	3.955
	(9.561)	(1.246)	(2.978)	(0.160)	(4.744)
Ideology Scale*(Pol./Inst. Variable)	-0.105	0.169*	0.0702	0.0272	-1.010**
	(0.118)	(0.0876)	(0.0749)	(0.0207)	(0.432)
Observations	545	545	545	545	545
Number of country_id	37	37	37	37	37
Political/Institutional	Presidential	Majority	Corporatism	Election	Herfindahl

Robust standard errors in parentheses

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

Note: All estimations include time and country fixed effects and the following controls: Energy imports, Diesel and gasoline consumption, Industrial intensity, Shock, GDP per capita, Emissions regulations, and percentage of electricity from renewable sources.

Lower environmental tax levels could be expected with a presidential form of government, as legislative cohesion in parliamentary systems generates a stable majority favoring higher taxes and higher spending at the expense of minority groups (Persson et al., 2000). In presidential systems, the absence of a residual claimant generates resistance to higher taxes and more benefits to minority groups. An opposite argument contends that presidents are institutionally enabled to provide collective goods and are elected at a national level (Eaton, 2000). This can result in greater pressure on the executive for a public good such as environmental quality, which can consequently be reflected in more instruments to improve it. The coefficients from column one, in both Tables 7 and 8, are negative. As a result, presidential governments have 2.7 percentage point lower revenues from ERTs and lower implicit tax rates. However, neither the coefficients alone nor the interacted term coefficients with the ideology scale variable are statistically significant.

The estimations from column two in both tables suggest that majoritarian electoral systems are positively correlated with revenues and implicit tax rates from ERTs. The explanation might be given by differences in accountability and representation between electoral systems. While a majoritarian system implies more local accountability, some studies suggest that proportional representation rules generate an incentive for parties to look for support among larger groups in the population but also allow smaller parties to gain political representation (Persson and Tabellini, 2005). This generates more veto players and the extraction of higher side payments for supporting certain taxes. With regard to the interacted term, the positive coefficients for these interacted variables show that, in countries with majoritarian electoral systems, the effect of ideology on ERTs is almost reversed to zero. This means that, in a country with a majoritarian electoral rule,

having a right-wing or left-wing legislature does not greatly affect the levels of revenues or implicit tax rate from ERTs. But the effect does occur in countries with proportional representation rules.

Another interesting result from Table 8 indicates that the implicit tax rate is higher in corporatist societies. Although the debate about the effect of corporatism on environmental indicators indicates effects in both directions, the results from this table would be in the line with the arguments of Crepaz (1995), who finds that a more corporatist structure of society will favor demands for higher environmental protection. The reason is that corporatism has well-defined interest representation of small groups that are constantly consulted by policymakers. According to the author, this generates means of internalizing environmental externalities. The table additionally shows the coefficient of election is negative, suggesting that implicit tax rates would be lower in election years. This may comport with political business cycle theories in which politicians manipulate fiscal instruments during election years.

A very interesting result from both tables is the coefficient of the interacted variables of ideology scale with the Herfindahl index dummy. A dummy equal to one indicates that a country's legislature has a high concentration of seats among a small number of parties. The sign of these coefficients in column five of each table would be expected to be negative, as concentration of seats would increase the effect of ideological positions on ERTs. This expectation is based on the intuition that parties with a high concentration of seats would encounter fewer political obstacles to pursuing their interests. The coefficients of the ideological scale variable alone indicate that more right-wing legislatures have higher revenues and a higher implicit tax rate of ERTs. Nevertheless, when the country has seats highly concentrated among a small number of parties the effect is totally reversed. This means that more left-wing legislatures do have a positive correlation with ERTs, but only when these left-leaning parties are a clear majority in the legislature.

7 Conclusions

In this work, we have shown how right ideological positions of the legislature are negatively correlated with levels of and revenues from environmentally related taxes. For most of the estimations, the results confirm that right legislatures tend to have lower tax rates and therefore lower revenues from ERTs. These outcomes are robust to the types of methodologies applied and types of taxes considered. We also find that, for the ERTs considered, only the estimates for industry sector taxes seem to be significantly different from zero.

Results from disaggregating the ideology scale into economic policy positions and social policy positions suggest that the former seem to matter more. This may imply that environmental taxes are introduced not only as a result of parties' environmental position but also as a reflection of their ideological position on government intervention in the market. Countries with legislatures composed mainly of parties that favor most government regulations on the market, welfare state expansion and economic planning tend to be the ones that have made greater efforts to implement market-based instruments that deal with environmental problems. Our results also indicate that electoral rules and the level of concentration of seats among parties might influence the effect of ideology on environmental taxes. The positive association of left ideology in legislatures with the level of environmental taxes occurs primarily under countries with proportional representation rules and in countries with high concentrations of seats among a small number of parties.

Even though the benefits of introducing environmental taxes to solve environmental problems are widely promulgated and discussed in the literature, there is little political consensus on

introducing such taxes. In this work it was shown that ideology can be one of the main reasons for the disparity of environmental policies among countries. In order to more thoroughly understand disparities in ERTs among countries, additional studies will need to be undertaken that collect information on green tax reforms and reforms related to modifying fuel taxes, while considering the political circumstances of each specific case.

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A Countries

Appendix Table A.1. Countries

country	Mean			Min	Max
	ERTs % Revenue	Implicit Tax Rate	Ideology Scale	Min. year	Max. year
Australia	7.9%	12.3	21.5	1994	2009
Austria	5.8%	23.8	6.2	1994	2009
Belgium	5.1%	15.5	-9.0	1994	2009
Bulgaria	8.3%	12.2	5.0	1995	2009
Canada	4.1%	7.2	1.1	1994	2009
Cyprus	10.0%	23.9	-7.3	1996	2006
Czech Republic	7.6%	13.8	6.5	1994	2009
Denmark	9.4%	40.7	4.8	1994	2009
Estonia	5.8%	6.8	1.6	1995	2009
Finland	6.8%	16.3	-6.6	1994	2009
France	4.8%	25.8	-8.9	1994	2009
Germany	6.6%	20.2	4.6	1994	2009
Hungary	7.6%	19.7	2.8	1994	2009
Iceland	7.6%	29.3	-4.5	1994	2009
Ireland	8.2%	26.1	-8.1	2000	2009
Italy	7.6%	30.4	13.1	1994	2009
Japan	6.5%	15.2	-4.8	1994	2005
Korea, Rep.	11.6%	15.8	-13.3	1994	2009
Latvia	7.6%	13.2	0.2	1995	2006
Lithuania	7.8%	16.3	6.1	1995	2008
Luxembourg	7.5%	21.0	-12.1	1994	2009
Malta	12.8%	36.7	-17.8	1996	2003
Mexico	9.2%	12.1	-5.9	1994	2003
Netherlands	9.4%	26.4	0.8	1994	2009
New Zealand	4.6%	11.6	-1.9	1994	2009
Norway	7.6%	40.8	-10.2	1994	2005
Poland	5.5%	9.6	3.2	1994	2009
Portugal	9.8%	28.2	-8.6	1994	2009
Romania	8.4%	12.0	-8.3	1995	2009
Slovak Republic	6.5%	12.8	2.7	1994	2009
Slovenia	8.6%	26.1	-1.9	1995	2009
Spain	6.1%	20.6	-5.7	1994	2009
Sweden	5.8%	28.4	2.7	1994	2009
Switzerland	7.1%	32.8	8.5	1994	2007
Turkey	11.7%	24.6	1.3	1994	2007
United Kingdom	7.8%	24.3	5.8	1994	2009
United States	3.5%	5.4	17.0	1994	2009
Total	7.4%	20.2	-0.0	1994	2009

Source: OECD, Eurostats, IEA, Comparative Manifestos Project.

B Variables

Appendix Table B.1. List of Variables

Variable	Mean	SD	Min	Max	Source
Revenues from ERTs as perc. of total revenue	7.4	2.3	3	16.6	OECD, Eurostats
Implicit tax rate from ERTs (million 2005 US constant dollar using PPP per ton of oil eq.)	20.2	9.5	1.9	47.6	OECD, Eurostats, IEA
Industry tax on High sulphur fuel oil (2005 constant US dollar using PPP per ton)	32.6	56.3	0	416.6	IEA
Industry tax on Natural gas (2005 constant US dollar using PPP per MWh)	1.3	2.4	0	24.2	IEA
Industry tax on Steam Coal (2005 constant US dollar using PPP per ton)	8.1	16.1	0	59.1	IEA
Industry tax on Coking Coal (2005 constant US dollar using PPP per ton)	7.4	14.8	0	55.8	IEA
Industry tax on Electricity (2005 constant US dollar using PPP per MWh)	5.6	9.6	0	54.3	IEA
Household tax on Light fuel oil (2005 constant US dollar using PPP per 1000 litres)	248.1	248.7	9.9	1448.5	IEA, OLADE
Household tax on Automotive diesel (2005 constant US dollar using PPP per litre)	.6	.3	0	1.5	IEA
Household tax on Premium leaded gasoline (2005 constant US dollar using PPP per litre)	.8	.3	.3	2.1	IEA
Household tax on Unleaded gasoline (2005 constant US dollar using PPP per litre)	.7	.3	.1	2.1	IEA
Ideology Scale (Left-to Right)	-0.02	11.2	-24.3	39.7	Manifesto Research Group
Left-Right economy policy position	-.4	.2	-.9	.6	Manifesto Research Group
Liberal-Conservative social policy position	.5	.2	-.3	1	Manifesto Research Group
Left party cabinet portfolios (%)	36.2	38.8	0	100	updated Swank (2002)
Left governing party seats (%)	20.5	20.7	0	63	updated Swank (2002)
Left party votes (%)	37	14.2	0	62	updated Swank (2002)
Executive left orientation with respect to economic policy==1	.4	.5	0	1	DPI WB (Keefer 2010)
GDP per capita, PPP (const 2005 int.)	25132.5	11390.9	6182	74113.9	WDI World Bank
Ln GDP cyclical component from Hodrick-Prescott filter	0	0	-.2	.1	WDI World Bank
Net energy imports (% of energy use)	22.8	124.9	-842.3	100	WDI World Bank
Road sector diesel and gasoline fuel consumption per capita (kg oil eq)	689.6	609.2	98	4755.4	WDI World Bank
Industrial Intensity	.3	.1	.1	.9	WDI World Bank
Electricity production from renewable sources (% of total)	3.4	5.1	0	29.9	IEA
Research and development expenditure (per. of GDP)	1.5	.9	.2	4.1	WDI World Bank
Automobile emissions standars	2.4	1.5	0	5	Perkins et al (2012)
Presidentialism ==1	.2	.4	0	1	DPI WB (Keefer 2010)
Electoral Rule House	.3	.5	0	1	DPI WB (Keefer 2010)
Closed List==1	.6	.5	0	1	DPI WB (Keefer 2010)
Corporatism scale according to Siaroff (1999)	3.2	1	1.8	4.6	Siaroff (1999)
Legislative election ==1	.3	.5	0	1	DPI WB (Keefer 2010)
Normalized herfindahl index	.1	.1	0	.4	constructed from Comparative Political Data Set

C Ideology Variable

The ideology scale variable is constructed by the Comparative Manifestos Project (CMP), which codes party manifestos in different categories for countries in several election years. The left to right scale, based on Budge and Laver (1992), is measured as the percentages of right-associated sentences (text) mentions minus the left-associated sentences (text) mentions. The scale therefore, ranges from -100 to 100. The sentences or text associated with anti-imperialism, military (negative), peace, internationalism (positive), democracy, market regulation, economic planning, protectionism (positive), controlled economy, nationalization, welfare state expansion, education expansion and labor groups (positive) are classified as left. On the other hand, right is classified in the categories of military (positive), freedom and human rights, constitutionalism (positive), political authority, free enterprise, incentives, protectionism (negative), economic orthodoxy, welfare state limitation, national way of life (positive), traditional morality (positive), law and order, and social harmony.

$$\text{Ideology Party Score (IPS)} = \textit{proportion}(\textit{right} - \textit{left}) * 100 \quad (3)$$

Using the same procedure, the economic policy ratio scale based on Benoit and Laver (2007) is constructed, using for left categories: market regulation, economic planning, protectionism (positive), controlled economy, welfare expansion, education expansion and labor groups (positive); and for right: the categories of free enterprise, incentives, protectionism (negative), economic orthodoxy and welfare state limitation. The remaining categories are used only to construct the social policy scale ratio. Having the ideology score for each party, the weighted average is calculated for each country legislature according to the percentage of seats of each party.

$$\text{Ideology Legislature Score (ILS)} = \sum_{i=1}^N s_i \times (IPS_i) \quad (4)$$

where N is the total number of parties with seats in the country legislature and s_i is the party total number of seats over the total seats in the legislature.

The ideological polarization index can be obtained by calculating the weighted standard deviation of the ideology party score according to:

$$\text{Ideological polarization} = \sqrt{\frac{N}{N-1} \sum_{i=1}^N s_i \times (IPS_i - ILS)^2} \quad (5)$$

D Appendix Tables

Appendix Table D.1. Regressions Using Revenue from ERTs (as percentage of total revenue) against Energy Taxes (constant US dollars, using PPP, per unit)

ERT variable	<i>Revenue from ERTs</i>	
	Coefficient	Std. Error
Light Fuel Oil	0.01	0.001***
Diesel	6.98	0.506***
Premium Leaded	6.75	0.486***
Unleaded Gasoline	7.18	0.419***
High Sulfur Oil	0.03	0.003***
Natural Gas	0.59	0.081***
Steam Coal	0.01	0.011
Coking Coal	0.11	0.02***
Electricity	0.04	0.017**

Robust standard errors in parentheses

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

Note: All estimations include time and country fixed effects. Units: sulfur fuel oil, steam coal and coking coal in tons; light fuel oil in thousand liters; diesel, unleaded and leaded gasoline in liters; natural gas and electricity in MWh.

Appendix Table D.2. Estimation Including Lagged Dependent Variable

VARIABLES	(1) Revenue FE	(2) Revenue GMM	(3) Imp_Tax FE	(4) Imp_Tax GMM
Ideology Scale	-0.0142* (0.00831)	-0.0182 (0.0134)	-0.0289 (0.0188)	-0.0619* (0.0341)
Observations	512	512	510	510
Number of country_id	37	37	37	37
AR(2)		0.266		0.0826
Hansen Test		0.766		0.471

Robust standard errors in parentheses

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

Note: All estimations include country and time fixed effects and following controls: Lagged dependent variable, Energy imports, Diesel and gasoline consumption, Industrial intensity, Shock variable, GDP per capita, Emissions regulations, and percentage of electricity from renewable sources.

Appendix Table D.3. Estimation Using Other Left Measures from Experts

VARIABLES	(1) Revenue	(2) Revenue	(3) Imp_Tax	(4) Imp_Tax
Left cabinet portfolios (%)	0.000859 (0.00158)		0.0103* (0.00594)	
Left seats (%)		0.0392 (0.336)		1.514 (1.295)
Observations	254	254	254	254
Number of country_id	20	20	20	20
Controls	Yes	Yes	Yes	Yes

Robust standard errors in parentheses

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

Note: All estimations include country and time fixed effects and the following controls: Energy imports, Diesel and gasoline consumption, Industrial intensity, Shock, GDP per capita, Emissions regulations, and percentage of electricity from renewable sources.

Appendix Table D.4. Estimation for Total Revenues as Percentage of GDP

VARIABLES	(1) Total Revenue FE	(2) Total Revenue RE	(3) Total Revenue FE
Ideology Scale	-0.0184 (0.0191)	-0.0193 (0.0197)	-0.0212 (0.0194)
Observations	545	545	545
Number of country_id	37	37	37
Controls	No	Yes	Yes

Robust standard errors in parentheses

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

Note: All estimations include country and time fixed effects and the following controls: Energy imports, Energy use per 1,000 GDP (constant 2005 PPP), Industrial intensity, Shock, GDP per capita.