An Interest Groups and Partisan Politics Model for Renewable Energies

Xun Cao
Department of Political Science
Penn State University
University Park, PA, USA

First Draft: September, 2012

Abstract: Renewable electricity development has taken different paths across countries. With few exceptions, the recent literature has focused on different policy frameworks for renewable energy development, for example, the differences between feed-in tariffs (FIT) and renewable portfolio standards (RPS). This study brings politics back in to the study of renewable energies. Feed-in tariffs, renewable portfolio standards, and many other renewable energy policies are ultimately forms of state support to an industry that still is largely uncompetitive compared to conventional energies. We assume a country's renewable energy production is a positive function of the size of its state support. Two factors are important determinants for the size of the state support: 1) the weight that a government places on subsidizing industries against other objectives, and 2) the relative strength of the green sector (vs. the brown sector). We posit that partisanship matters for government's preferences towards industry-support with right parties associated with higher level of state support to industries. Moreover, when the government "trades" state industry aid for financial and other support from interest groups, the stronger sector is more likely to reap a larger share of the state aid. Therefore, government partisanship and relative strength of the green (brown) sector affect renewable energy production in an interactive way. We model geographical and temporal variation in non-hydro renewable electricity generation using panel data on the OECD member states from 1980 to 2004. The empirical findings support the theory.

Introduction

In this paper, we present a model based on interest group and partisan politics to explain the size of renewable energy sector in the OECD countries. The intuition of the model is indeed similar to models on interest group politics and trade policy (Grossman & Helpman 1994), and more recently on environmental policies (Aidt 1998, Damania 2001) as well as energy policies and intensities (Fredriksson, Vollebergh & Dijkgraaf 2004). A country's renewable energy production, given it is not as competitive as conventional fossil fuels (environmental externalities not included in the price though), is assumed to be a positive function of the size of the state support that it receives. Two factors are important for the size of the state support to renewable energy production: first, the weight that a government places on subsidizing industries (both the green and the brown types) against other objectives such as protecting the labor or maximizing aggregate social welfare; second, the strength of the green sector (relative to the brown sector).

We posit that partisanship matters for the weight that the government places on industry-support, with right parties associated with higher level of state support to industries in general. Moreover, when dividing the total state industry support between the green and brown sectors, the relative strength of two sectors matters. While caring about general social welfare, government also "trades" state industry aid for financial and other support from interest groups, with the stronger sector (one that is able to offer more contributions) more likely to reap a larger share of the state aid. Therefore, government partisanship and relative strength of the green sector affect renewable energy production in an interactive way: a right-party government plus a strong green (weak brown) sector is the best scenario for the development of renewable energies, because the former is often associated with higher levels of total state support to industries and the latter a larger share of the given total state support for the green sector. A less right-leaning government is associated with lower level of state-industry support; a weaker green sector (stronger brown sector) implies a smaller share of the total state-industry support for renewable sectors. In other words, a left-ward shift in government partisanship and/or a weakening of the green sector results in lower state support to the green sector and therefore decreased renewable energy production.

The rest of the paper is organized as follows: the next section discusses the theoretical model of the paper. The following two empirical sections present data and empirical findings. We conclude and discuss issues related to future research at the end.

An Interest Groups and Partisan Politics Model for Renewable Energies

For simplicity, we focus on the two sectors in the economy that compete for energy-related state support: one green sector and one brown sector. The green sector might include firms that invest in green technologies and produce renewable energies. They benefit from and therefore prefer government support for green technologies and renewable energies. The brown sector might include those directly involved in the production and distribution of conventional energies (for example, oil and natural gas and utility companies) and industries that are energy-intensive (for example, basic metals and paper and paper products). Companies producing and distributing conventional fossil fuel energy often compete directly with renewable energies for market shares and state support. For energy-intensive sectors, given the fact that renewable energies are on average more expensive than fossil fuels despite years of technological innovations, the preference is similar to those energy companies. They prefer the government not to subsidize the green sector, partly because more renewable energies as input of production imply higher production costs. They prefer government subsidies going to their own sector and/or to fossil fuels (which reduces conventional energy prices therefore their production costs).

We focus on the OECD countries, therefore, it is safe to assume democratic politics in which political parties trade policies for support from key interest groups. We use a very simple model setup where there are only two key interest groups that compete for government support. Voters (or consumers) are also important in democratic politics. However, we think it is reasonable to only focus on the green and brown sectors, at least as a first step to link interest groups and partisan politics to renewable energies. There are many research on interest group politics that point out how organization and action are often far more influential than public opinion in democratic politics. We suspect this asymmetry in influence between organized interest groups and the public is even more salient for the case of renewable energies given the complex nature of energy policies and politics.

Similar to previous research in international trade and environmental and energy policies (Grossman & Helpman 1994, Aidt 1998, Damania 2001, Fredriksson, Vollebergh & Dijkgraaf 2004), we assume government cares about aggregate social welfare and "bribes" from interest groups as means to survive in office: winning the next election in a democratic context. The bribes that government takes from interest groups could include direct financial contributions, information, expertise, votes, and organization infrastructures to mobilize general voters. In return, government distribute rents to interest groups in accordance to the amount of their contribution. In the context of energy production, such rents might include different types of energy-related state support, for instance, subsidies and tax exemptions for energy production and consumption. The nature of government matters because different governments put different weights on taking bribes from and therefore being subject to the influence of organized interest groups. The higher the weight associated with interest group contributions, the more bribes taken by the government, the higher the level of rents distributed by the state in exchange. Theoretically, in an extreme scenario, the government might put zero weight on interest group contributions and completely focuses on maximizing aggregate social welfare. But we think this is unlikely in real world politics.

Organized interest groups in our model are the green and brown sectors; they are ultimately industrial interest groups. In our model, we posit that a government tendency to taking bribes from industrial interest groups is a function of its partisanship, more specifically the left-right dimension of partisan gravity. We argue theoretically that right-leaning governments put higher weights on taking bribes from industrial interest groups. We also demonstrate empirically (in an appendix) that right-leaning governments are associated with higher levels of total state support given to industries.

There are indeed other dimensions regarding the partisan nature of the government. For instance, the environmental emphasis of the government might appear to be more important for environmental and energy policies (Ward & Cao 2012).[1] But recent research suggests that the left-right dimension still is the "super-dimension" for partisan politics, even though its overall salience has been in decline in some Western democracies.[2] On the theoretical ground, the left-right dimension matters because it affects the tendency for the

[1]In the empirical analysis, we control for the the environmental emphasis of the government and find that this environmental dimension of the government does not affect renewable electricity production.

[2]For instance, Hellwig (2008) shows that for many voters, left and right remain an important means for comprehending many issues encountered during a campaign. However, his research emphasizes that both deindustrialization and globalization reduce the salience of the left-right dimension of political contestation. Also note that other important dimensions have been proposed, for example, post-materialist-materialist (Inglehart 1995), libertarian-authoritarian (Flanagan & Lee 2003), and green/alternative/libertarian-traditional/authoritarian/nationalism (Hooghe, Marks & Wilson 2002).

government to provide "aid" to domestic industries, both the green and brown sectors, in exchange for electoral support. State aid to the industries often takes various forms of industrial subsidies. Recent research on state aid and subsidies, often based on the OECD cases, has discovered that right government is indeed associated with higher level of subsidies (Neven 1994, Cao, Prakash & Ward 2007, Zahariadis 2010).[3] Zahariadis (2010) draws insight from Cao, Prakash, and Ward (2007) in explaining right parties' preferences towards subsidizing industries. First, industrial subsidies involve more political payoffs to right-wing parties, because subsidies are direct and visible help to their core business owner and shareholder constituents. Conversely, the left may find that welfare measures are preferable instruments under the same conditions because workers, as core supporters of the left, prefer direct unemployment benefits.[4] Second, parties of the right engage in vote buying and subsidies with fewer adverse consequences, largely because they enjoy the image of fiscal responsibility while left-parties need to make real efforts to cut state support in order to appeal to the general voters that they are serious about fiscal discipline.

Our model posits that left-right partisan gravity of the government affects the total level of subsidies with right-party government being associated with higher level of state support to industries. However, we want to emphasize that right parties on average are more responsive to industrial pressures not because of certain traditions and ideologies. They do so because it generates the highest benefits by pleasing their key constituencies, and incurs the lowest costs thanks to their traditional image of fiscal responsibility. Therefore, assuming a re-election seeking government, it is logical for right-leaning governments to put more weight on subsidizing industrial organized interests in exchange for their electoral support.

We are aware that there are many who argue for the opposite relationship between government's partisanship and its tendency to offer state support. Indeed, there is a tradition in the partisan politics literature to associate left-leaning parties with more government intervention in the economy, though often in the form of various types of social welfare provisions and trade protectionism (Hibbs 1977, Garrett 1998, Milner & Judkins 2004). State support to industries, even though much less studied, is often argued to be no exception to this traditional partisan politics argument (Blais 1986, McGillivray 2004). In this paper, in addition to our previous theoretical discussion and supporting empirical findings from more recent and comprehensive research (Neven 1994, Clark 2003, Cao, Prakash & Ward 2007, Zahariadis 2010), we conduct a brief data analysis using the most updated data on state aid. We find that right-party governments are associated with more sectoral state aid, that is, the type of rents given to specific sectors and firms, in 18 EU countries, 1992-2004.[5]

In our model, a government's weight on taking bribes from industrial organized interests varies by the left-right dimension of partisanship. However, the government itself has no preference (e.g., as a function of ideology) toward either the green or brown sector. The government simply maximizes the chances of re-election by distributing state aid/subsidies to interest groups that can provide the most electoral support. In other words, the government weighs the political support that it can receive when it decides how much subsidies to give to

[3]Using European data from the 1980s, Neven (1994) finds that governments dominated by right-wing parties are more likely to subsidize industry than left-wing governments. Clark (2003) concludes that when trade exposure is low and capital mobility high or when both are set at low levels, left-labor power has a negative effect on subsidies. Most recently, findings from Zahariadis (2010) reinforce right parties' association with more state support to industries.

[4]Industrial subsidies benefit firms, but they do not necessarily eliminate the possibility of layoffs.

[5]See Appendix A for more details.

each sector. In this simple two sector setup, government trades state subsidies for electoral support such as votes that each sector can contribute in future elections, direct financial contribution, and organizational apparatus to mobilize general voters. We assume that electoral support is a function of the political strength of each sector.

Indeed, the studies of government-interest groups interactions abound in political science. Students of American politics have studied the ways by which interest groups and lobbyists influence public policies (Lowery & Brasher 2004). The exchange theory of lobbying assumes that interest group agents and legislators engage in mutually beneficial trade, typically campaign contributions for votes (Austen-Smith 1996). Lobbying is also conceptualized as a mechanism of persuasion in which lobbyists provides valuable and yet costly information in exchange for support for their favorite policies (Wright 1996).[6] In West European context, interest groups, labor unions in particular, have also been studied for a long time (Korpi 1989). The interest group's ability to mobilize, union density and level of centralization in the case of labor, has been shown to greatly affect the chances of swaying public policies in its favor (Castles 1978, Esping-Anderson 1985), even in the context of developing countries (Rudra 2002). In sum, the government (or individual legislators in the American context) seeks re-election by distributing state support to interest groups; those groups that are able to lend more support (as in direct monetary contribution, information, expertise, votes, organization capacity to mobilize general voters, etc.) are likely to receive more state aid in return.

Therefore, the final amount of state support that each sector can receive is likely to be a product of the left-right partisanship of the government, which affects a government's weight towards taking bribes against maximizing aggregate social welfare, and the amount of electoral support the sector can offer to the incumbent, relative the other sector. We assume that one sector's electoral support is positive function of its political strength. The best scenario for the green sector, therefore, is a situation in which there is a right party government and the brown sector is minuscule and politically weak. Note that this is very unlikely in the real world because for most countries, the green sector is smaller and more likely to be politically less influential than the brown sector. Having a right government means a higher weight for the government to offer state aid in exchange for electoral support from industrial organized interests, that is, a higher level of total potential state support to both sectors. With a weak brown sector, a larger proportion of the state aid is going to flow to the green sector. However, as the brown sector gets stronger, the government channels the money away from the green sector which results in lower state support for the green sector, and consequently a lower level of renewable energy production. Table 1 summarizes the theoretical expectations regarding the interactive effects of government partisanship and the relative strength of green and brown sectors in simple 2 by 2 scenarios.

TABLE 1. Theoretical expectations of the best and worst scenarios for the green sector.

	Strong Green	Strong Brown
Right Govt	best	in between
Left Govt	in between	worst

[6]More recently, interest groups have been found to affect public policies by "subsidizing" their similar-minded legislators with information, intelligence, and legislative labor (Hall & Deardorff 2006).

Before stepping into next section's empirical analysis, we want to reiterate some of the assumptions we made in the previous discussion. First, we assume that the size of the renewable sector is a function of the *absolute* amount of support it receives from the government,[7] not the ratio between green and brown support. For example, from the perspective of the green sector, given 50-50 split of the state aid between the green and the brown sector, 10 billion dollars of total aid (5 billion for the green and 5 billion for the brown) is a better situation than if the total aid is only 10 millions dollars (5 million for the green and 5 million for the brown). This makes intuitive sense because the green sector, often new entrant of the market and in need of more state support because of its price disadvantage, is often the one that requires more state aid per unit of production.

Moreover, we argue that the tendency of a government to exchange rents with electoral support with industrial organized interests (both the green and sector in our model) is a function of left-right partisanship of the government. We implicitly assumes that this tendency or weight associated with taking bribes from industrial organized interests (against maximizing aggregate social welfare) is not a function of the total political influence of industrial organized interests, that is, the sum of the green's and the brown's political strengths, against a third, non-industrial interest group. (We have simply argued that consumers and general voters are too disorganized to act as an interest group.) This is a reasonable assumption if the total political influence of industrial organized interests is more or less at a similar level across countries and over time. We study the OECD countries from 1980-2008. Assuming an industry's GDP contribution is a reasonable proxy for its political strength,[8] most of these countries' industrial production value added as a percentage of GDP is indeed around 30% through the whole period.[9]

Data

Renewable Electricity. For the dependent variable of this paper, we use the share of non-hydro renewable electricity in total electricity generation for 30 OECD countries from 1980 to 2009: note most model specifications in our regression analysis cover 27 countries, 1980 to 2004, because of missing values in independent variables.[10] Data are from the U.S. Energy Information Administration (EIA).[11] Two clarifications in terms of the choice of our dependent variable are needed: first, we exclude hydroelectricity following previous research (Lipp 2007, Aklin & Urpelainen Forthcoming), because hydroelectricity is a mature technology that does not require the same level of state support as in geothermal, solar, wind, and tide and wave. Moreover, hydroelectricity is not always considered green given its potential negative ecological and climatic impacts.

Second, we only look at renewable electricity data rather than all types of renewable energy because of higher quality of the electricity data. Data sources on total renewable

[7]This needs to be standardized by the size of the economy.

[8]We have more discussion on why this might or might not be a good proxy in the empirical section of the paper.

[9]Own calculation based on data from World Development Indicators.

[10]Total non-hydroelectric renewables include geothermal, wind, solar, tide, biomass and waste. The 27 countries are Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Poland, Portugal, Spain, Sweden, Switzerland, Turkey, United Kingdom, and the United States. Slovak Republic, Korea, and Mexico are the three countries that are not included in the regression analysis because of missing data in some independent variables.

[11]See `www.eia.gov`, data last extracted on October 10, 2011

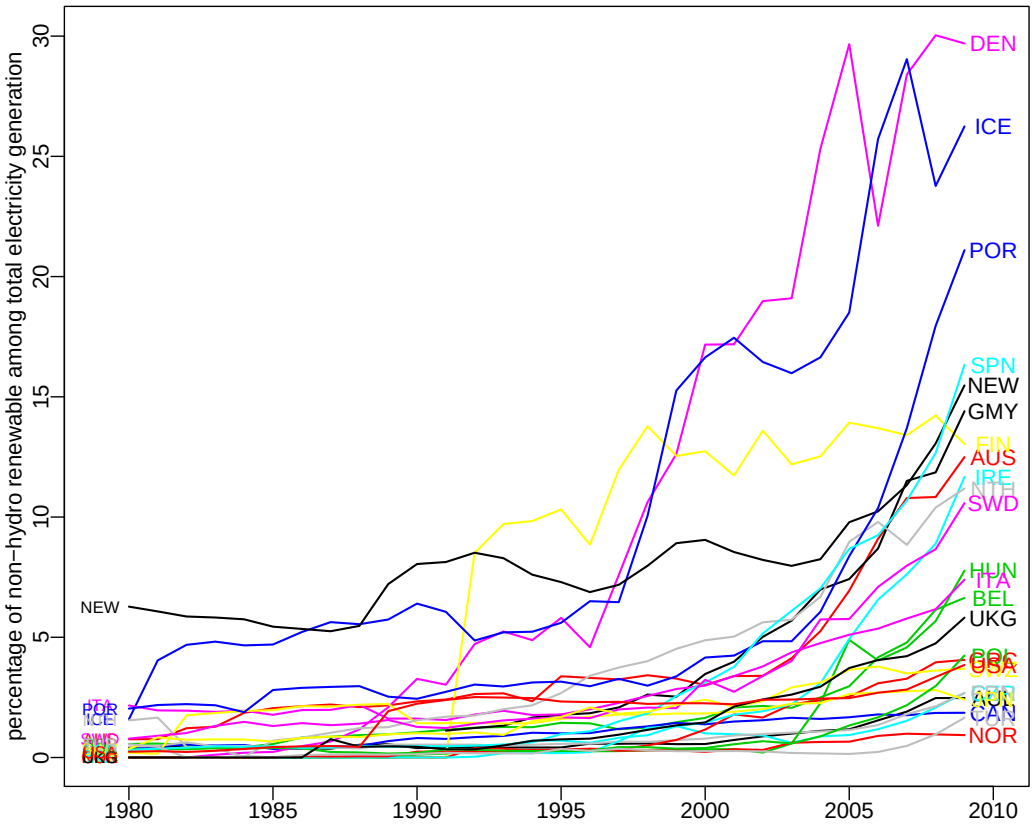


FIGURE 1. Non-Hydro Renewable Electricity, 1980-2009.

energy exist, for example, OECD (2012) carries data on the contribution of renewables to total primary energy supply in the OECD countries.[12] But the data set covers a much briefer time period (1971, 1990, and 1999-2010).[13] More importantly, the data do not distinguish different components of renewables.[14] Hydro-electricity accounts for a disproportionably large shares of renewables for quite a few countries. Using the total renewable energy from OECD (2012) as the dependent variable is almost equivalent to modeling hydro-electricity for many countries.

Figure 1 shows the share of non-hydro renewable electricity in total electricity generation for the OECD countries. Enough cross-country and temporal variation is displayed. Renewable electricity, for most of the OECD countries, only accounted for a small share of total electricity (smaller than 2-3%) until quite recently (early and mid 1990s). European countries on average have larger shares of renewable electricity generation: in countries

[12] `http://dx.doi.org/10.1787/888932504937`, last accessed on July 30, 2012.

[13] The correlation between our dependent variable (the non-hydro renewable electricity share) and the contribution of renewables to total primary energy supply is about 0.3 for overlapping countries and years.

[14] Renewables include the primary energy equivalent of hydro (excluding pumped storage), geothermal, solar, wind, tide and wave as well as energy derived from solid biofuels, biogasoline, biodiesels, other liquid biofuels, biogases, and the renewable fraction of municipal waste. Biofuels are defined as fuels derived directly or indirectly from biomass (material obtained from living or recently living organisms). Included here are wood, vegetal waste (including wood waste and crops used for energy production), ethanol, animal materials/wastes and sulphite lyes.

such as Denmark (DEN), Iceland (ICE), and Finland (FIN), the renewable share became more than 10% after 2000. We log the dependent variable in our regression analyses to approximate a normal distribution.

Left-Right Dimension of the Government. There are different measures of government partisanship. Simple measures include the comparative institution data by Beck et al (2007), which essentially provide a three-category measure, left(3)-center(2)-right(1), of the executive party. Its advantage is the data coverage as it also includes countries outside the developed world; its disadvantage is its lack of precision when estimating "how" left (or right) the party is.[15] Similar to Beck et al (2007), Armingeon et al (2011) provides a variable measuring the cabinet proportion of the left-leaning party member: here, partisanship (weighted by cabinet posts) is still a binary measure which is based on Schmidt (1996).

There are two common sources for detailed measures on the left-right ideological positions of the political parties (Gabel & Huber 2000). One consists of expert surveys on specific party systems, where experts are asked to provide estimates of party left-right positions (Castles & Mair 1984, Huber & Inglehart 1995). These surveys are widely used to measure party positions. However, they have been administered infrequently and only cover the period up to the mid 1990s and for about 20 OECD countries. Note that the development of renewable electricity production is a recent phenomenon even for many of the OECD countries. Moreover, the cross-country and temporal variation is much more significant in recent years, especially after the early 1990s. Using partisan variable based on expert surveys, for example, from Cusack (1997),[16] will exclude years after 1996 and countries such as New Zealand, Poland, Czech Republic, and Luxembourg.

The second source is based on data from the Comparative Manifestoes Project (CMP).[17] The Manifestos Research Group (MRG) has carefully coded the content of party election manifestos, using a large number of substantive categories. The CMP content analyses quasi sentences. Left right scores are based on the percentage of sentences that are held to reflect themes of the ideological right *minus* the percentage held to reflect themes of the ideological left. They have then used these data to estimate the party left-right positions for most parties and elections in a large number of democracies. These data are very attractive for us, not only because they currently provide the only comparable means of estimating party left-right positions over a long time period in a large number of countries (Gabel & Huber 2000), but also because they include data up to recent elections. Gabel and Huber (2000), in their analysis of the manifesto data, suggest that the data can be fruitfully employed to estimate party positions.[18]

We choose to use data from the Comparative Manifestoes Project (CMP) and follow Ward and Cao (2012) to calculate the left-right partisan variable. For the period up to the last national election before the year 2000, we used Cusack and Fuchs (n.d.) data set, tying the CMP data to data on governing coalitions. For the remaining years up to 2004 when the Cusack and Fuchs data set ceases to be available, we extracted information about which

[15]For the key variable, "EXECRLC", the categorization of left, center, right party is based on reading the name of the parties or the handbooks associated with the party. In case of lack of information from party names and handbooks, the coders consult the web-site `www.agora.stm.it/elections/parties.htm`.

[16]Which uses ideological position of parties based on Castles and Mair's expert survey data (Castles & Mair 1984).

[17]See Volkens et al (2012).

[18]They also encourage future research on improving how political scientists use manifestos data to estimate party positions.

coalitions formed from the Inter-Parliamentary Union's Parline database.[19] If no party or coalition held an overall majority, we operationalize the Left-right partisan variable as the average of all parties' positions, weighting by number of seats. If there was a single-party majority government, we use that party's position. If there is a majority coalition, we use the weighted average by seat shares in the coalition of members of the coalition, which is consistent with the evidence that this is the most important determinant of coalition policy (Warwick 2001).

The distribution of the Left-right variable is almost normal with a mean of 1.52 and a standard deviation of 16.40. Higher values represent a more right-leaning government. Australia from 1998 to 2000 and the United States in 2004 have the most right-leaning governments with the Left-right variable scoring more than 40. On the other hand, Norway in 1980 and 1991-1993 as well as Finland in 1988-1990 have the most left-leaning governments with left-right values lower than -30. To check the validity of our measure, we take the correlation between the Left-right partisan variable based on manifesto data and the expert-survey based "cabinet center of political gravity" variable from from Cusack (1997). The correlation is about 0.6 for country-years that are available for both variables.

Political Strength of the Brown Sector. We measure the political strength of an interest group based on the potential resources that it can mobilize. We assume this is a positive function of the size of the sector. Large groups, despite a more challenging free-riding problem, also have broader political base of support (Schonhardt-Bailey 1991). They also have more (electoral) resources such as direct monetary contribution, information, expertise, votes, and organization capacity to mobilize general voters. In principle, the relative size of the sector can be measured as its contribution to the total GDP of the economy.[20]

In theoretical section of the paper, we use general terms "green vs. brown sector". Here, in order to measure their sizes, we need to be more specific about what these sectors are. On the one hand, we can narrowly define the green sector as renewable energy sector and the brown sector as its rival fossil fuel energy sector. On the other hand, broader definitions might also apply in which the green sector include those that might benefit from more renewable energy production, for example, firms that engage in renewables-related R&Ds

[19]We assume parties' left-right scores do not change between elections. In election years or years when there was a breakdown of the coalition, we weight scores proportionally to the number of months before the election/coalition shift.

[20]The actual lobby effort of an interest group can be considered a function of not only the potential resources it can mobilize, but also its ability to coordinate (i.e., to solve collective action problem). The empirical tests of Grossman-Helpman or other menu auction models for international trade and environmental policies emphasize the importance of these factors (e.g., Gawande and Bandyopadhyay (2000) and Fredriksson et al (2004)). The theoretical argument behind the second factor (i.e., free-riding effects) follows Olsen's theory of collective action: it is often easier to solve the collective action problem if production is controlled by a small number of firms and/or the industry is geographically concentrated (Olson 1965). Four-firm concentration ratio and difference between population and industry production patterns across the 50 states (US context), for example, are often used to test the concentration argument (Trefler 1993). However, the empirical findings on the free-riding effect is mixed. Potters and Sloof (1996), in a review of the empirical research on interest group politics, find that there is relatively little empirical support for Olsen's theoretical argument on collective action. More importantly for our analysis, concentration measures are often only available for a small number countries, usually the US; Ferreira and Facchini (2005) provide a test on industrial concentration and trade liberalization in Brazil.

and provide goods and services in energy efficiency and pollution reduction.[21] A broader definition of the brown sector might include the energy intensive industries as well: these industries benefit from cheaper, fossil fuel energies and might share common interest with the fossil fuel energy sector.[22] In this paper, we choose to use the narrow definitions: given the diversity within each sector implied by broader definitions, for example, the brown sector would include industries as diverse as paper and paper products, non-metallic industry, basic metal industry, and transport, it is difficult to assume *ex ante* they can act as a single interest group.

Systematic data on renewable energy sector's GDP contribution are not available as far as we know. But the relative strength of the green sector (vs. the brown sector) is a negative function of the brown sector's GDP contribution. Available breakdowns of GDP are not fine enough to measure fossil fuel energy sector's GDP contribution for a large enough number of countries.[23] Things are more straightforward on the production side. We use World Development Indicators (WDI) data on national energy production in oil equivalent and divided by real GDP. This gives energy production per unit of real gross domestic product (Energy Production per GDP), which we use as a proxy for the relative political strength of the brown sector.[24]

The unit of this variable is in kilograms of oil equivalent per dollar of GDP: the mean in our sample is 0.17 with a standard deviation of 0.22. Denmark in 1980-81, Luxembourg in 1980-2005, Portugal in 1980-1992 and 2002-2005, and Ireland and Italy both in 2000-2005 have the lowest per GDP energy production, below 0.2 kilos per dollar. On the other side of the continuum, Norway tops the list with per GDP energy production over 0.65 kilos through the whole period; its per GDP energy production have been increasing over the years and reached 1.4 kilos in mid 1990s. Norway is followed by Canada and Australia though their levels of per GDP energy production are much lower, around 0.4 kilos.

[21]The US Bureau of Labor Statistics, for example, considers green goods and services as those that fall into the following five categories: 1) production of energy from renewable sources; 2) energy efficiency; 3) pollution reduction and removal, greenhouse gas reduction, recycling and reuse; 4) natural resource conservation; and 5) environmental compliance, education and training, and public awareness.

[22]Energy intensive sectors can be identified, for instance by reference to those included in the EU's CO2 emissions trading scheme such as electricity generation, cement production, and glass making; or by looking at sector level energy intensity, such as paper and paper products, non-metallic industry, basic metal industry, and transport (Fredriksson, Vollebergh & Dijkgraaf 2004).

[23]OECD Structural Analysis Statistics (STAN) have GDP (and employment) data for different industries at the 2-digits ISIC (rev 3.1) level. Data for total mining and quarrying of energy producing minerals are available, which is the closest proxy for the size of fossil fuel energy sector. But this variable also includes the GDP contribution from mining of uranium and thorium ores. Moreover, many activities related to fossil fuel energy sector are not included, for example, refining of petroleum products, test drilling and boring, geophysical surveying and mapping, and oil and gas well exploration.

[24]We take the correlation between the variable Energy Production per GDP (based on WDI data) and total mining and quarrying of energy producing minerals per GDP (based on STAN data). The correlation is very high (0.90). However, the variable from STAN has many more missing values. Indeed replacing the Energy Production per GDP variable with the STAN variable would result in a loss of more than 200 observations. This is another reason we choose to use the more straightforward Energy Production per GDP variable.

Control Variables. In addition to government partisanship and the political strength of brown sector (as well as their interaction term), we control for factors that might also affect renewable energy production. We include both GDP per capita (in purchasing power parity) to capture the relationship between wealth and renewable energy. We also control for GDP growth rate. While higher growth rates often require more intensive use of resources and lead to higher levels of energy consumption, they may also encourage technological advancements including those related to renewable energies. Our model includes the share of industrial production in GDP because the industrial production is often associated with higher levels of energy use, therefore a stronger demand for the less expensive, fossil fuel based energy. We include a demographic variable, urban population (as a share of total population), as urban population is likely to be associated with environmental activism and green demand. We also control for the potential effect of globalization by including the trade openness variable (sum of imports and exports as a percentage of GDP).[25]

In addition to the left-right partisan nature of the government, we also consider how "green" the government is. A government with more environmental emphasis is more likely to encourage renewable energies. We create a government environmental emphasis variable following the same strategy used to create the left-right government partisanship variable, only replacing the parties' left-right position scores with their environmental scores that are also from the Party Manifesto Projects (Volkens, Lacewell, Lehmann, Regel, Schultze & Werner 2012). Environmental scores are based on percentage of sentences mentioning the environment.[26] Moreover, to control for the effects of popular demand on environmental protection and sustainable energy, we control for the number of green NGOs per million pollution.[27] We also control for the effects of international oil price. Other things equal the higher the price of fossil fuels, it is often argued, the higher the incentives to search for alternative energy sources. It is hard to get consistent time series data on coal and natural gas prices, but changes in these correlate with changes in oil prices because they are partial substitutes. The longest consistent time series data on oil prices is an index of the 2010 dollar price of Illinois crude oil at the production pump. We call this variable Real oil price.[28]

Finally, we control the potential effects of political regime types and electoral rules. Our model is ultimately about interest groups competing for rents doled out by the government and we assume that left-right partisanship affects the extent to which the incumbent government is responsive to industrial interest group pressures. Other political variables might also affect the propensity of government to supply state aid to industries. The difference between presidential and parliamentary systems has been argued to affect the ways that governments tax and spend (Dewan & Shepsle 2008): compared to presidential systems, parliamentary systems are associated with larger public sectors (more taxation), more rents enjoyed by politicians and more spending on both the public good and redistribution (Persson, Roland & Tabellini 2000). Moreover, differences in electoral rules have also been shown to affect interest group politics (Lizzeri & Persico 2001). For instance, Rogowski and Kayser (2002) argue that majoritarian systems are less likely to respond to organized interests because they

[25]Data on GDP per capita, GDP growth rate, industrial production, urban population, and trade openness are from the World Development Indicators.

[26]It seems that on this valence issue negative comment was largely absent during the period the data covers.

[27]Data on green NGOs are from International Union for Conservation of Nature (IUCN). See `www.iucn.org`. For a recent paper using the data, see Bohmelt et al (2013).

[28]See `www.ioga.com/Special/crudeoil_Hist.htm`, downloaded December 2010.

are more responsive to consumers thanks to a large seat-vote disproportionality.[29] Compared with the winning-take-all electoral systems, majoritarian systems are therefore likely to be associated with lower levels of rents for interest groups.[30]

Empirical Findings

We model the share of non-hydro renewable electricity in total electricity generation as a function of left-right government partisanship, the strength of brown sector, their interaction effect, and a battery of control variables, using a simple OLS regression with lagged dependent variable as well as year and region fixed effects. Year fixed effects are important because it is of great importance that common external shocks (for example, oil crisis) are controlled. We did not use country fixed effects because of the time-invariant/slowing-moving nature of the political regime type and electoral rules variables. Moreover, models with both fixed effects and a lagged dependent variable might be problematic because the lagged dependent variable is correlated with the error term by its correlation with the time-invariant component of the error term. When country fixed effects are included, "Nickell bias" results because the lagged dependent variable is still correlated with the error term.[31]

The empirical results are presented in Table 2. The first model specification does not include the interaction term between the Left-right government partisanship and the energy production per GDP variables. Here, in terms of short-term effects, that is, the direct interpretation of the coefficients associated with the independent variables in the regression analysis, only a few statistically significant relationships stand out. First, even without the interaction term, both the left-right government partisanship and energy production per GDP variables are associated with renewable energy production (at $p < 0.1$ level): right-leaning governments are associated with higher level of renewable electricity and per GDP energy production, as a proxy for the political strength of the brown sector, reduces renewable energy production.

The second model specification includes the interactive effect and the third model specification further includes region dummy variables. In both cases, the interaction term itself is actually not statistically significant. However, there are still reasons to include the interactive effect. The most important justification is that a model with an interaction term yields coefficients that provide a more detailed description of the relationship between a dependent variable and a set of independent variables than a model without an interaction term (Friedrich 1982). Rather than assuming that the relationship between variables are the same everywhere, an interactive model assesses the possibility that relationships between variables change with changes in other variables. Moreover, in models with interaction terms, it is well known that not only the marginal effect but also the associated standard errors vary with the value of the other lower-order variable (Friedrich 1982, Braumoeller 2004). In other words, it is hard to get a sense of the conditional effects by looking at coefficients and standard errors in the table only. In Figure 2, we show the marginal effects of the left-right government partisanship and energy production per GDP variables with their 95%

[29]For the effects of electoral rules in recent research, see also Park and Jensen (2007) and Lipscy (2011).

[30]Data on political regime types and electoral rules are both from Golder (2005).

[31]However, Kiviet (1995) shows that panel data models that use instrumental variable estimation often lead to poor finite sample efficiency and bias. Adolph, Butler, and Wilson (2005) show that Nickell bias is often negligible and suggest that all remedies (e.g., Anderson-Hsiao or Arellano-bond) are worse than the original problem. As the number of years gets larger, this bias becomes less of a problem. We have 23 years in the analysis which might not be large enough based on simulation results from Adolph, Butler, and Wilson (2005) .

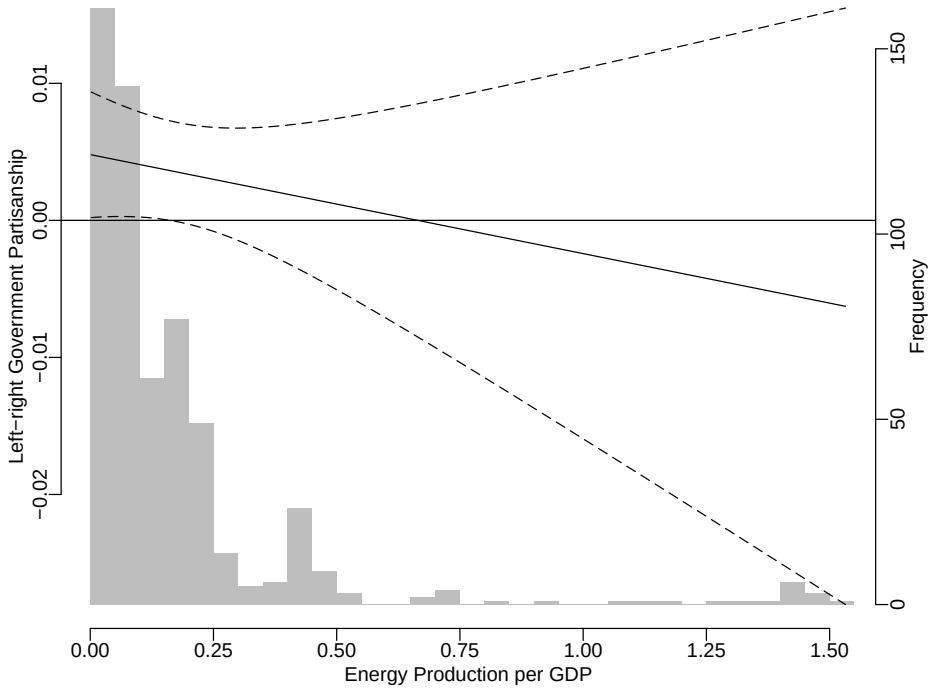
TABLE 2. Modeling Renewable Electricity Share in the OECD countries, 1981-2004. Year fixed effects are estimated but not reported because of space limit.

	Model 1		Model 2		Model 3	
	$Coef.$	$\hat{\sigma}$ ($p>\|t\|$)	$Coef.$	$\hat{\sigma}$ ($p>\|t\|$)	$Coef.$	$\hat{\sigma}$ ($p>\|t\|$)
Intercept	-1.034	1.209 (0.39)	-0.972	1.212 (0.42)	0.278	2.021 (0.89)
Lagged dependent variable	0.896	0.015 (0.00)	0.895	0.015 (0.00)	0.892	0.015 (0.00)
GDP per cap	0.185	0.109 (0.09)	0.181	0.109 (0.10)	0.058	0.194 (0.76)
Industry (% GDP)	-0.000	0.007 (0.99)	0.000	0.007 (0.96)	-0.001	0.008 (0.92)
GDP growth	-0.009	0.013 (0.47)	-0.009	0.013 (0.46)	-0.009	0.013 (0.49)
Urban population (% of total)	0.000	0.003 (0.87)	0.001	0.003 (0.81)	0.002	0.003 (0.58)
Trade openness	-0.039	0.073 (0.59)	-0.043	0.073 (0.56)	-0.006	0.090 (0.94)
Govt. environ. emphasis	0.010	0.010 (0.34)	0.010	0.010 (0.31)	0.012	0.010 (0.25)
Green NGOs	0.061	0.051 (0.23)	0.066	0.051 (0.20)	0.075	0.054 (0.16)
Real oil price	-0.010	0.005 (0.06)	-0.010	0.005 (0.05)	-0.012	0.006 (0.04)
Regime, baseline: parliamentary						
Mixed democracy	0.040	0.077 (0.60)	0.044	0.077 (0.57)	0.053	0.081 (0.51)
Presidential democracy	-0.118	0.129 (0.36)	-0.121	0.129 (0.35)	-0.113	0.159 (0.48)
Electoral, baseline: majoritarian						
Proportional	0.037	0.085 (0.67)	0.019	0.088 (0.82)	0.048	0.095 (0.61)
Mixed	0.002	0.121 (0.99)	-0.023	0.125 (0.86)	0.006	0.130 (0.96)
Energy production per GDP	-0.238	0.132 (0.07)	-0.311	0.161 (0.05)	-0.287	0.186 (0.12)
Left-right govt. partisanship	0.003	0.002 (0.08)	0.004	0.002 (0.06)	0.005	0.002 (0.05)
Energy prod. × Left-right			-0.006	0.008 (0.43)	-0.007	0.008 (0.39)
Region, baseline: East Asia						
Eastern Europe					-0.262	0.301 (0.39)
North Africa/Middle East					-0.293	0.339 (0.39)
North America					-0.053	0.234 (0.82)
Western Europe					-0.172	0.200 (0.39)
Adjusted R^2		0.92		0.92		0.92
N. of observations/Countries		575/27		575/27		575/27

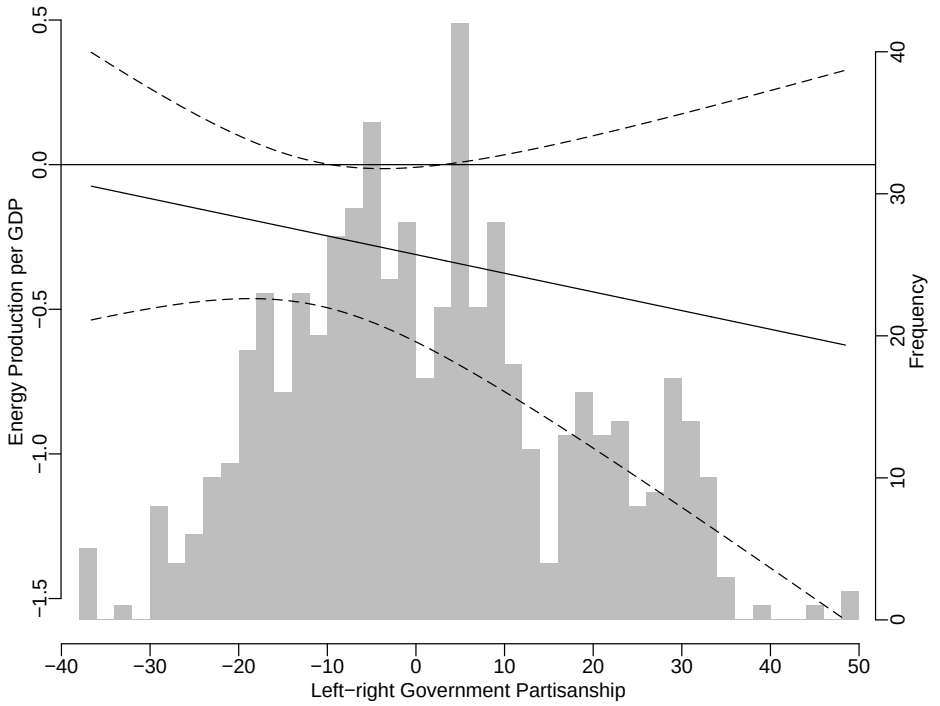
confidence intervals. In both figures, the long-dashed lines are the upper and lower bounds of the 95% confidence intervals of the estimated effect; the dark line in between the dashed lines represents the mean coefficient estimated.

Figure 2(a) shows the effects of Left-right partisanship on renewable energy, conditional on different levels of per GDP energy production which we use as a proxy for the strength of the brown sector. The conditional effect of brown sector strength revealed by the figure supports our theory. When the brown sector's strength is low, Left-right partisanship is positively associated with renewable energy production; increasing brown sector strength (energy production per GDP) reduces this positive effect and the statistically significant effect disappears when per GDP energy production reaches about 0.25 kilo per dollar of GDP. With a relatively weak brown sector, right-leaning government is good news for renewable energies: right government is more responsive to industrial pressures therefore is associated with a higher level of state support to industries in general; a weak brown sector means a relatively strong green sector which might be able to capture a larger share of the state support compared with situations in which the brown sector is stronger. Indeed, the increasing

FIGURE 2. Conditional Effects: left-right partisanship and per GDP energy production.



(a) Effects of partisanship conditional on the size of the brown sector.



(b) Effects of the size of the brown sector conditional on partisanship.

strength of the brown sector drives state aid away from the green sector and the beneficial effect (regarding green sector) of a right-leaning government disappears eventually.

Figure 2(b) shows the effects of per GDP energy production (proxy for brown sector strength) on renewable energy, conditional on different levels of left-right government partisanship. The mean estimated effects are always negative. Note the statistical significance, indicated by the 95% confidence intervals, is also a function of the number observations associated with different levels of the lower-order variable, left-right government partisanship in the case of Figure 2(b). The negative effects of brown sector strength are significant when the left-right government partisanship variable is about between -20 and 20: this is where most of the values of the left-right government partisanship are concentrated. Note the distributions of the the lower-order variables are displayed by their histograms, in gray color, for both Figure 2(a) and (b). More importantly for our theory, the negative effect associated with size of the brown sector gets stronger with the government becoming more right-leaning. This implies that compared with the case of a left-leaning government, one unit of increase in the size of the brown sector under a right government is associated with larger amount of decrease in renewable production. Right government is in general associated with more state support to industries; with the same level of increase in the political strength of the brown sector, a higher amount of resources are moved away from the green sector. In other words, a right-leaning government amplifies the negative effect of brown sector strength on renewable production. This is consistent with our assumption that the size of the renewable sector is a function of the *absolute* amount of support it receives from the government, not the ratio between green and brown support. This is a key assumption of the model without which, it won't make a difference whether we have a left or right government as long as the division of the rents is a function of the strength between two sectors. The finding as shown Figure 2(b) empirically supports this assumption.

The models estimated here include the lagged dependent variable, because we do not think that shocks to the political variables are likely to have their full impact in one year. If changes in the nature of the political system are to have an effect, we would not expect this to occur within a single year; this requires that we look at least at the medium term. We know that in a model with a lagged dependent variable, for example, $Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \beta_0 X_t + \varepsilon_t$, the mean long-term effects, also sometimes called long-run multiplier (LRM), for an independent variable is determined by $\frac{\beta_0}{1-\alpha_1}$. The less straightforward part is to estimate the standard errors for the LRM. But the long term effect is ultimately the ratio of two coefficients, the approximation of the variance of a ratio of coefficients with known variances can be used (De Boef & Keele 2008): $Var(\frac{a}{b}) = \frac{1}{b^2}Var(a) + \frac{a^2}{b^4}Var(b) - 2\frac{a}{b^3}Cov(a,b)$.

It is difficult to calculate long-run multipliers for variables in interaction terms given that the marginal effects and the associated standard errors vary with the value of the other lower-order variable in the interaction term. But for model specification 1 in Table 2 in which no interaction term is included, we can follow the formula and calculate the "unconditional" long-term effects. For instance, the mean coefficient estimate for government partisanship is only 0.003; but this is short-term effect. The mean long-term effect, calculated by $\frac{\beta_0}{1-\alpha_1}$, is ten times larger — 0.033. To show the statistical distribution of the estimated long-term effects, we calculate the variance and the 95% confidence interval is $\{-0.002, 0.068\}$; the 90% confidence interval is $\{0.002, 0.064\}$. Using the mean estimated long-term effect of 0.033, we can get a sense of how salient its the substantive effect is on renewable energy production: we hold every variable in the first model specification at its mean value, including the government partisanship variable, the predicted value of the dependent variable is 1.38 (non-hydro renewable as a percentage of total electricity generation); next, we keep all other variables at their mean levels, but increase the government partisanship variable by one standard deviation, that is, the government becomes more right-leaning, this increases the

predicted value of the dependent variable to 1.47, which is about a 6% increase compared with the previous situation.[32]

Table 2 also suggests that few of the control variables affect renewable electricity production. Government environmental emphasis and Green NGOs per million population are positively associated with renewable electricity, but the these associations are not statistically significant based on normal standards (e.g., $p < 0.05$ or $p < 0.10$). Wealth seems to increase renewable electricity as indicated by the positive effect of GDP per capita; but this relationship disappears when region dummy variables are added (in Model 3).

One interesting and yet counterintuitive finding is the effect of real oil price: an increase in real oil price seems to drive down the level of non-hydro electricity production. This is just the opposite from our common sense: with increasing fossil fuel prices, people turn to alternative sources of energy. Searching "oil price and renewable energy" in popular press, most of what we find argues that increase in oil price is going to bring hope to renewable energy sectors; there is often no data analysis in these optimistic predictions though. Moreover, very few studies have looked at this relationship systematically. Modeling the change in renewable electricity in a non-dynamic model context, Aklin and Uperlanein (Forthcoming) find that oil price increases renewables but only when what they call "positive reinforcement factor" (measured by renewable technology patents standardized by population size) is low, reason being that, somehow counter-intuitively, government worries about over-investment in renewable sectors in the future, therefore when the current renewable investment is already strong, the effect of oil price as exogenous shock would be limited. What we find in our empirical analysis, based on data covering a longer and slightly different period of time (1980-2004 in this paper vs. 1990-2008 in Aklin and Urpelainen (Forthcoming)), is a different story. Here, at least in terms of the short-term effect, higher oil prices reduce renewable energy production.

However, this is less surprising if we look at the long-term trend of international oil price (Figure 3): since late 1970s and early 1980s, real oil price has been dropping until early 2000s; but the renewable electricity production, for many OECD countries, has started to take off way before that, some even in the late 1980s and early 1990s (Figure 1).[33] This only explains why we might find a non-effect of oil price on renewables. What can further explains the negative effect might be an increased competition from the brown industries for government support with higher oil prices: assuming more or less constant government budget for energy sectors, with oil price on the rise, often industries' first response is to look for quick and cheap replacement, for instance, shale gas and oil sand, both those already in operation and those at exploration stage. They are quick and relatively cheaper (at least compared to renewable energies) replacement for conventional oil and natural gas. If they compete also for government support, the money available for renewable sectors would be reduced. Whether this is the reason behind the negative relationship between real oil price and non-hydro electricity production is an open question for future research.

Conclusion and Discussion

In this paper, we present a model based on interest group and partisan politics to explain the size of renewable energy sector in the OECD countries. We start with the assumption that a country's renewable energy production, given the price disadvantage of

[32]We can also add one more standard deviation to the the government partisanship variable; this increases the predicted value to 1.55, which is about 12% increase compared with the first scenario in which the government partisanship variable is held at its mean level.

[33]As a robustness check, you might want to try with nominal price instead of real oil price because this might be the real "shock" for non-experts.

FIGURE 3. Real Oil Price, 1960-2005: two gray vertical lines mark the period of time covered by this study.

renewable energies compared with fossil fuels, depends on the size of the state support that it receives. State support here is conceptualized as rents doled out by governments in exchange for electoral supports from interest groups. We choose a simple two interest groups setup in the context of domestic energy production: a green sector competes with a brown sector for state industrial aid. The intuition of the model is similar to many manu-auction types of models of interest group politics (Grossman & Helpman 1994, Aidt 1998, Damania 2001, Fredriksson, Vollebergh & Dijkgraaf 2004). While maximizing supports from industrial interest groups (green and brown sectors) in addition to aggregate social welfare, governments differ in the weights they place on taking "bribes" from industrial interest groups; this difference, we argue, is a function of the partisan nature of the government, with right-leaning governments being more responsive to lobby activities from industrial interest groups (both the green and brown sectors). Moreover, when dividing the total state industry support between the green and brown sectors, the relative strength of two sectors matters, with the stronger one (that is able to offer more contributions) more likely to reap a larger share. Therefore, government partisanship and relative strength of the green sector affect renewable energy production in an interactive way: a right-party government plus a strong green (weak brown) sector is the best scenario for the development of renewable energies, because the former is often associated with higher levels of total state support to industries and the latter a larger share of the total state support for the green sector. A left-ward shift in government partisanship and/or a weakening of the green sector, on the other hand, results in lower state support to the green sector and therefore decreased renewable energy production.

We model geographical and temporal variation in non-hydro renewable electricity generation using panel data on the OECD member states from 1980 to 2004. We measure government partisanship on the left-right dimension (Armingeon, Weisstanner, Engler, Potolidis, Gerber & Leimgruber 2011) and we use energy production per unit of GDP as a proxy for the relative strength of the brown sector. We find that when a country's per

GDP energy production is low, right-leaning governments are associated with higher levels of renewable electricity generation; this positive association weakens and disappears with increasing strength of the brown sector (Figure 2(a)). We think that these empirical findings largely support the theory. However, there are issues that need to be further resolved in future research. First issue concerns the use of per GDP energy production as a proxy for the relative strength of the brown sector. As we have discussed in the empirical section, in an ideal situation, we should use the ratio of the political strength of the green sector to that of the brown sector. Political strength can be a positive function of the size of the sector, often measured by its GDP contribution to the economy. However, data on the size of the green sector are unavailable. We therefore can only use the brown sector side of the information: the relative strength of the green sector is a negative function of the size of the brown sector — the larger the brown sector, all else equal, the lower the relative strength of the green sector. This is by no means a perfect way to operationalize the relative strength of an interest group; but it is what we can do given available data. We need to acknowledge the weakness of such a proxy and interpret our empirical findings with caution.

Moreover, the political strength of an interest group can be considered a function of not only the potential resources it can mobilize, but also its ability to coordinate (i.e., to solve collective action problem). Potential resources can be measured by the size of the interest group, for instance, its GDP contribution or its size of employment. The ability to coordinate is much trickier to measure. The theoretical argument behind it is straightforward and follows Olsen's theory of collective action: it is often easier to solve the collective action problem if production is controlled by a small number of firms and/or the industry is geographically concentrated (Olson 1965). However, the empirical findings on the free-riding effect is mixed. Potters and Sloof (1996) find that there is relatively little empirical support for the theoretical argument on collective action. More importantly for our analysis, concentration measures are often only available for a small number of countries, usually the US, at sub-national level. Again, in an ideal situation, we should operationalize the political strength of each sector as a product of their size (by its GDP or employment) and concentration.

Finally, our theoretical model is about interest groups and partisan politics and it posits that the strength of competing interest groups and the nature of government affect renewable energy production via state aid to the green sector. We want to emphasize that interest groups and partisan politics probably is only one of the many underlying causal mechanisms that account for renewable energy developments across countries and over time. The existing literature has also revealed other important determinants of renewable production. For instance, Aklin and Urpelainen (Forthcoming) shows how existing renewable technology capacities (measured by patents), in interaction with global oil prices, affect renewable electricity capacities in the OECD countries. Lipp (2007) and many other studies from the policy side of the literature pay more attention to factors such as the role of history, governments' choices of particular policies (e.g., feed-in-tariffs vs. renewable portfolio standards), and the consistency of government support schemes as well as private market actors' incentives to invest.[34] We hope this study can add to this emerging political economy literature on renewable energies and climate change and stimulate more research in the future.

[34]Our key findings concerning the interactive effects between the strength of competing interest groups and the nature of government do not change after controlling for technology capacities (measured by patents) of the country and other variables such as unemployment rates. Results are available upon request.

References

Adolph, Christopher, Daniel M. Butler & Sven E. Wilson. 2005. "Like shoes and shirt, one size does not fit all: Evidence on time series cross-section estimators and specifications from Monte Carlo experiments." *Working paper* .

Aidt, Toke S. 1998. "Political internalization of economic externalities and environmental policy." *Journal of Public Economics* 69(1):1 – 16.

Aklin, Michael & Johannes Urpelainen. Forthcoming. "The Strategy of Sustainable Energy Transitions: Political Competition and Path Dependence." *American Journal of Political Science* .

Armingeon, Klaus, David Weisstanner, Sarah Engler, Panajotis Potolidis, Marlene Gerber & Philipp Leimgruber. 2011. *Comparative Political Data Set 1960-2009*. Institute of Political Science, University of Berne.

Austen-Smith, David. 1996. Interest Groups: Money, Information and Influence. In *Perspectives on Public Choice*, ed. Dennis Mueller. Cambridge: .

Beck, Thorsten, George Clarke, Alberto Groff, Philip Keefer & Patrick Walsh. 2007. "New tools in comparative political economy: The Database of Political Institutions." *World Bank Economic Review* 15(1):165–176.

Blais, Andre. 1986. *A Political Sociology of Public Aid to Industry*. Toronto: University of Toronto Press.

Bohmelt, Tobias, Thomas Bernauer & Vally Koubi. 2013. "Is There a Democracy-Civil Society Paradox in Global Environmental Governance?" *Global Environmental Politics* 13(1).

Braumoeller, Bear F. 2004. "Hypothesis Testing and Multiplicative Interaction Terms." *International Organization* 58(4):807–820.

Cao, Xun, Aseem Prakash & Michael D. Ward. 2007. "Protecting Jobs in the Age of Globalization: Examining the Relative Salience of Social Welfare to Industrial Subsidies in OECD Countries." *International Studies Quarterly* 51(2):301–327.

Castles, Francis G. 1978. *The Social Democratic Image of Society*. London: Routledge.

Castles, Francis & Peter Mair. 1984. "Left-Right Political Scales: Some Expert Judgements." *European Journal of Political Research* 12:73–88.

Clark, William R. 2003. *Capitalism, Not Globalism*. Ann Arbor, MI: University of Michigan Press.

Cusack, Thomas R. 1997. "Partisan Politics and Public Spending." *Public Choice* 91(3-4):375–395.

Cusack, Thomas R. & Susanne Fuchs. n.d. *Documentation notes for Parties, Governments, and Legislatures data set version from 6.11.2002*. Berlin, Germany: Wissenschaftszentrum Berlin fur Sozialforschung.

Damania, Richard. 2001. "When the Weak Win: The Role of Investment in Environmental Lobbying." *Journal of Environmental Economics and Management* 42(1):1 – 22.

De Boef, Suzanna & Luke Keele. 2008. "Taking Time Seriously." *American Journal of Political Science* 52(1):184–200.

Dewan, Torun & Kenneth A. Shepsle. 2008. "Recent Economic Perspectives on Political Economy, Part II." *British Journal of Political Science* 38(03):543–564.

Esping-Anderson, Gosta. 1985. *Politics against Markets*. Princeton, NJ: Princeton University Press.

Ferreira, Pedro Cavalcanti & Giovanni Facchini. 2005. "Trade liberalization and industrial concentration: Evidence from Brazil." *The Quarterly Review of Economics and Finance* 45(23):432 – 446.

Flanagan, Scott C. & Aie-Rie Lee. 2003. "The New Politics, Culture Wars, and The Authoritarian-Libertarian Value Change in Advanced Industrial Democracies." *Comparative Political Studies* 36(3):235–270.

Fredriksson, Per G., Herman R.J. Vollebergh & Elbert Dijkgraaf. 2004. "Corruption and energy efficiency in OECD countries: theory and evidence." *Journal of Environmental Economics and Management* 47(2):207 – 231.

Friedrich, Robert J. 1982. "In Defense of Multiplicative Terms in Multiple Regression Equations." *American Journal of Political Science* 26(4):797–835.

Gabel, Matthew J. & John D. Huber. 2000. "Putting parties in their place: Inferring party left-right ideological positions from party." *American Journal of Political Science* 44(1):94–103.

Garrett, Geoffrey. 1998. *Partisan Politics in the Global Economy*. New York: Cambridge University Press.

Gawande, Kishore & Usree Bandyopadhyay. 2000. "Is Protection for Sale? Evidence on the Grossman-Helpman Theory of Endogenous Protection." *The Review of Economics and Statistics* 82(1):139–152.

Golder, Matt. 2005. "Democratic Electoral Systems around the World." *Electoral Studies* 24:103–121.

Grossman, Gene M. & Elhanan Helpman. 1994. "Protection for Sale." *The American Economic Review* 84(4):833–850.

Hall, Richard L. & Alan V. Deardorff. 2006. "Lobbying as Legislative Subsidy." *American Political Science Review* 100(01):69–84.

Hellwig, Timothy. 2008. "Explaining the salience of left?ight ideology in postindustrial democracies: The role of structural economic change." *European Journal of Political Research* 47(6):687–709.

Hibbs, Douglas A. 1977. "Political Parties and Macroeconomic Polciy." *American Political Science Review* 71:1467–1487.

Hooghe, Liesbet, Gary Marks & Carole J. Wilson. 2002. "Does Left/Right Structure Party Positions on European Integration?" *Comparative Political Studies* 35(8):965–989.

Huber, John & Ronald Inglehart. 1995. "Expert Interpretations of Party Space and Party Locations in 42 Societies." *Party Politics* 1:73–111.

Inglehart, Ronald. 1995. "Public Support for Environmental Protection: Objective Problems and Subjective Values in 43 Societies." *PS: Political Science and Politics* 28(1):57–72.

Kiviet, Jan F. 1995. "On bias, inconsistency, and efficiency of various estimators in dynamic panel data models." *Journal of Econometrics* 68:53–78.

Korpi, Walter. 1989. "Power, Politics, and State Autonomy in the Development of Social Citizenship: Social Rights During Sickness in Eighteen OECD Countries Since 1930." *American Sociological Review* 54(3):pp. 309–328.

Lipp, Judith. 2007. "Lessons for effective renewable electricity policy from Denmark, Germany and the United Kingdom." *Energy Policy* 35(11):5481 – 5495.

Lipscy, Phillip. 2011. "Efficiency Clientelism." *Working paper* .

Lizzeri, Alesandro & Nicola Persico. 2001. "The Provision of Public Goods under Alternative Electoral Incentives." *American Economic Review* 91:225–239.

Lowery, David & Holly Brasher. 2004. *Organized Interests and American Government*. New York, NY: McGraw-Hill.

McGillivray, Fiona. 2004. *Privileging Industry: The Comparative Politics of Trade and Industrial Policy*. Princeton, NJ: Princeton University Press.

Milner, Helen V. & Benjamin Judkins. 2004. "Partisanship, Trade Policy, and Globalization: Is There a Left-Right Divide on Trade Policy?" *International Studies Quarterly* 48:95–119.

Neven, David J. 1994. The Political Economy of State Aids in the European Community: Some Econometric Evidence. Discussion Papers 945 London: Centre for Economic Policy Research.

OECD. 2012. *OECD Factbook 2011-2012: Economic, Environmental and Social Statistics*. OECD Publishing.

Olson, Mancur. 1965. *The Logic of Collective Action*. Cambridge, MA: Harvard University Press.

Park, Jong Hee. 2012. "What Determines the Specificity of Subsidies?" *International Studies Quarterly* 56(2):413–426.

Park, Jong Hee & Nathan Jensen. 2007. "Electoral Competition and Agricultural Support in OECD Countries." *American Journal of Political Science* 51(2):314–329.

Persson, Torsten, Gerard Roland & Guido Tabellini. 2000. "Comparative Politics and Public Finance." *Journal of Political Economy* 108:1121–61.

Potters, Jan & Randolph Sloof. 1996. "Interest groups: A survey of empirical models that try to assess their influence." *European Journal of Political Economy* 12(3):403 – 442.

Rogowski, Ronald & Mark Andreas Kayser. 2002. "Majoritarian Electoral Systems and Consumer Power: Price-Level Evidence from the OECD Countries." *American Journal of Political Science* 46(3):pp. 526–539.

Rudra, Nita. 2002. "Globalization and the Decline of the Welfare State in Less-Developed Countries." *International Organization* 56(2):411–445.

Schmidt, Manfred G. 1996. "When parties matter: A review of the possibilities and limits of partisan influence on public policy." *European Journal of Political Research* 30(2):155–183.

Schonhardt-Bailey, Cheryl. 1991. "Lessons in Lobbying for Free Trade in 19th-Century Britain: To Concentrate or Not." *The American Political Science Review* 85(1):37–58.

Trefler, Daniel. 1993. "Trade Liberalization and the Theory of Endogenous Protection: An Econometric Study of U.S. Import Policy." *Journal of Political Economy* 101(1):138–160.

Volkens, Andrea, Onawa Lacewell, Pola Lehmann, Sven Regel, Henrike Schultze & Annika Werner. 2012. *The Manifesto Data Collection. Manifesto Project (MRG/CMP/MARPOR)*. Berlin, Germany: Wissenschaftszentrum Berlin fur Sozialforschung (WZB).

Ward, Hugh & Xun Cao. 2012. "Domestic and International Influences on Green Taxation." *Comparative Political Studies* 45(9):1075–1103.

Warwick, Paul V. 2001. "Coalition policy in parliamentary democracies: Who gets how much and why." *Comparative Political Studies* 34(1):1212–1236.

Wright, John R. 1996. *Interest Groups and Congress: Lobbying, Contributions, and Influence*. Needham Heights, MA: Allyn and Bacon.

Zahariadis, Nikolaos. 2010. "State Aid and Partisan Government in the European Union*." *Social Science Quarterly* 91(2):436–454.

Appendix A. Partisan Government and State Aid to Industries

We use the state aid data from European Union's scoreboard. State aid is broken down in two types: sectoral and horizontal. Sectoral aid is the sum of all state aid granted to specific sectors (agriculture, fisheries, manufacturing, coal, transport except railways and other services) and state aid given on an ad-hoc basis to individual companies, for example, for rescue and restructuring. It is characterized by its selectivity and its distortive effects on the market. Governments use sectoral aid to target more precisely their key constituencies. Horizontal aid, on the other hand, is much less distortive. Horizontal aid addresses well-defined common interests such as growth, employment, and the environment; it includes state aid that is not granted to specific sectors, which is usually considered as being targeted to market failures.[35] In our theoretical model, state aid is essentially rents distributed by a partisan government to buy support. Therefore, the sectoral type of aid is the one that fits our theoretical model. If our assumption on the relationship between government partisanship and state support is empirically valid, we should see a positive relationship between right-leaning government and state sectoral aid.

Table A-1. Empirical tests on the relationship between government partisanship and state aid, 1992-2004. Year and country fixed effects are estimated not reported because of space limit.

	Sectoral Aid			Horizontal Aid		
	$Coef.$	$\hat{\sigma}$	p(>|t|)	$Coef.$	$\hat{\sigma}$	p(>|t|)
(Intercept)	-71.776	25.604	0.006	1.366	6.872	0.843
GDP per capita	6.624	2.260	0.004	-0.551	0.611	0.369
Industry (% of GDP)	-0.210	0.077	0.007	-0.010	0.025	0.701
GDP growth rate	0.026	0.094	0.784	-0.048	0.024	0.045
Urban population (% pop.)	-0.202	0.137	0.142	0.009	0.029	0.763
Trade openness	4.639	1.626	0.005	0.689	0.492	0.164
FDI (% of GDP)	-0.394	0.129	0.002	-0.003	0.026	0.906
Election	-0.011	0.256	0.966	0.035	0.054	0.513
Left-Right	0.021	0.010	0.045	-0.000	0.002	0.990
N of countries			18			18
N of Observations			223			191
Ad. R-squared			0.598			0.629

Table A-1 presents the empirical findings from two model specifications in which we model sectoral and horizontal aid (both as a percentage of GDP, logged to smooth the screwed distributions) as a function of government partisanship and other relevant variables seen in the recent literature (Zahariadis 2010, Park 2012). Note our partisan variable is essentially a weighted average (by seat shares in the parliament) of governing coalition's right/left scores from the Comparative Manifestoes Project (CMP).[36] Our left-right partisan gravity variable is a continuous measure with higher values indicating more right-leaning

[35]It often includes environmental aid, R&D assistance, energy saving, assistance to small and medium-size enterprises, employment creation, labor training, and aid for regional economic development.

[36]Zahariadis (2010) and Park (2012) both use the percentage of left-leaning party members in the cabinet as the partisan variable. The data are from Armingeon et al (2011). But their measure of left-leaning party is a binary variable. Ours based on the Comparative Manifestoes Project is a big improvement because it continuously measure how "right" the

parties. Table A-1 shows that right-party government is associated with more sectoral state aid — the type of aid given to specific sectors and firms; government partisanship, however has no effect on horizontal type of state aid — the type of aid that is used by the government much less selectively and is used to address market failures.

party is. More details on the operationalization of our variables are in the empirical section of the paper.