Comparative Capitalisms and Energy Transitions: Renewable Energy in the European Union

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Abstract

We develop new theory pertaining to institutional determinants of renewable-energy usage across countries and over time. Building on key strands of the comparative capitalisms literature, we introduce new hypotheses relating to the 2009 Directive from the European Union (EU) on energy generation, as well as the impact of labour market regimes, national stock markets and M&A activity, among other 'doing business' conditions across countries. Based on a renewable energy data across 27 EU countries over a period of 11 years, we provide new tests of the determinants of renewable-energy usage. The data show strong and robust evidence of a causal impact of institutional determinants on renewable energy usage, consistent with a positive impact of the EU's 2009 Directive, and other specific institutional factors. We discuss the implications for policy and practice.

Keywords: Institutional Theory; International Business; Varieties of Capitalism; Renewable Energy; European Union

INTRODUCTION

The comparative capitalisms (CC) literature has recently placed renewed emphasis on explaining market dynamics (Streeck, 2014a; Whitley, 2012; Witt & Jackson, 2016; Wood, 2013). Whilst sharing some commonalities, such as the focus on finance and financialization (Morgan, 2016; Streeck, 2014a), key strands of the CC literature differ in the relative stress they place, first, on capitalism, institutions and sectoral variation to explain changes in markets, and, second, the ability of capitalism to develop markets that will not have a detrimental impact on the environment (Streeck, 2009; Wood, 2013). These conflicting perspectives on capitalism and markets have yet to be examined, limiting our ability to assess important and contrasting prognoses of the development of capitalism and capitalist markets in renewable energies and beyond (Wood, 2015).

The historical institutional (HI) approach is pessimistic about the ability of capitalism to develop markets that limit environment damage, arguing that capitalism will continue to consume environmental resources at unsustainable levels (Crouch, 2011, 2013, Streeck, 2013, 2014b). As Streeck (2014b, p. 57) has noted: 'One question that nobody seems able to answer is […] what actors and institutions are to secure the public good of a livable environment in a world devoted to the private vice of competitive production and consumption.' A corollary of this argument is that 'capitalism [is] on its way out' (Streeck, 2014b). Although not as pessimistic as Streeck, Crouch (2011, 2013) has argued that improvements in, *inter alia*, environmental outcomes require fundamental changes to capitalist systems in advanced economies.

By contrast, what we term the Varieties approach, which encompasses the Varieties of Capitalism and business systems frameworks (Goergen, Brewster, & Wood, 2013; Hall & Soskice, 2001; Whitley, 1999, 2007), argues that national institutional differences will

encourage such markets in some countries and impede them in others (Wood, 2015). For instance, Wood (2015, p. 55) has noted that 'As different nations have fundamentally different approaches to energy policy, this is likely to make for a resurgence in capitalist diversity […].' Hence, the advantages and disadvantages – environmental and social – associated with different models are likely to persist (Judge, Fainshmidt, & Lee Brown III, 2014; Whitley, 2010a) and, hence, capitalist diversity will endure (Witt & Jackson, 2016; Wood, 2015).

Despite the importance of moving from fossil fuels to renewable energy, neither the Varieties nor the HI approach has, in general, assessed how capitalism and market dynamics impact on the environment (Crouch, 2015; Wood, 2015; Wood & Lane, 2012; Wood, Szamosi, & Psychogios, 2015). In addition, much of the recent comparative capitalisms literature has focused on national developments, downplaying key insights from 1) earlier work that highlighted how institutional arrangements at the national level are nested within supranational levels, including, for some countries, the European Union (EU) (Hollingsworth & Boyer, 1997; Wood, 2013: 10) and 2) more recent studies that emphasize sectoral institutional specificities (Allen, 2013; Wood, 2013).

Drawing on these insights, we examine national energy markets that are embedded within EU policies (Verbong & Geels, 2007). We do so, to assess the links between the contrasting causal mechanisms of the HI and Varieties approaches and the percentage of total energy used in each EU member state that comes from renewable sources. We focus on the effects of the European Union's 2009 Directive to promote the use of energy from renewable sources in EU member states (European Union, 2009). Generating (more) energy from renewable sources represents the creation (or extension) of a market that arguably has many societal benefits, including limiting increases in global temperatures and the creation of new jobs (OECD, 2016).

Examining changes in energy markets, therefore, offers an opportunity to examine competing arguments about the nature of capitalism and the ability of capitalist societies and national institutional systems to create (or expand) markets that reduce the environmental impact of economic activities. We, therefore, examine 1) how much variation there is, if any, between countries in increases in energy generation from renewable sources and 2) how societal values and national institutional configurations, including financial systems, labour-market regimes, the role of the state and specific energy-related regulations, moderate transnational policies that aim to increase renewable energy (Wood, 2015, 2016). In short, we ask: how, if at all, have national institutions moderated EU attempts to encourage member states to generate more energy from renewable sources?

HISTORICAL INSTITUTIONALISM

The HI approach tends to argue that the nature of *capitalism* leads to pressures on firms to expand into 1) new areas that were previously governed by social relations and 2) additional activities within existing markets (Crouch, 2014, 2016, Streeck, 2013, 2014b). Consequently, the dynamism of capitalism itself is the key mechanism that leads to market-based transactions in ever more areas of social activity and to the consumption of natural resources at unsustainable levels (Crouch, 2013; Streeck, 2014a). One mechanism that the HI approach emphasizes as a possible impediment to greater marketization is Polanyi's (2001) notion of a 'double movement' that denotes how periods of market excess can result in a counter-movement that leads to greater state mediation (Crouch, 2014; Streeck, 2014a). However, HI analyses tend to argue that those collective actors, such as worker representatives, within societies in developed economies that seek to hinder greater marketization have, at best, a very limited chance of success (Dobbins & Dundon, 2015; Kinderman, 2017; Streeck, 2014b; cf. Crouch, 2013).

Within historical institutionalism, Streeck's recent work is probably the most pessimistic about the possibility that capitalism will develop in ways that are not deleterious to the environment (Streeck, 2011, 2013, 2014b, 2014a). He emphasizes, first and foremost, the immanent dynamic within capitalism to expand market relations, downplaying any real role for either individual firms or societies to limit that expansion. Tellingly, he has argued that: 'This [two world wars] was capitalism's [sic] way of making space and providing for a modicum of stability for a socially sustainable but, as we now know, only temporary rebuilding of modern societies after 1945' (Streeck, 2014b: 47).

By focusing on *capitalism* rather than markets or firms, Streeck implicitly invokes a view of capitalism that is non-agential and that pursues an unimpeded and autogenic logic of ever greater expansion (cf. Polanyi, 2001). In other words, the expansion of market-based transactions that have detrimental environmental consequences is not co-constituted by actors, including firms, governments, and individuals; it is therefore, neither reliant on, nor limited by, them. More specifically, whilst recognizing the urgent need to develop new, efficacious limits to the expansion of capitalism at the expense, *inter alia*, of the environment, Streeck (2014b: 55–57) argues that the collective action that is needed to achieve this outcome is unlikely within capitalist societies. A corollary is that there are few, if any, possibilities for societies and international organizations, such as the European Union, to create new, less environmentally damaging markets, (Streeck, 2014a: 52).

In his arguments, Streeck draws directly on Polanyi's contention that capitalism and markets will 'annihilate' the very environment that they need to operate, if left unchecked by society (Polanyi, 2001: 3–4). Although Streeck downplays the role that society can play in embedding capitalism and limiting environmental damage, other HI research highlights the potential for some collective actors to shape market developments (Baccaro & Benassi, 2017; Benassi, Doellgast, & Sarmiento-Mirwaldt, 2016; Crouch, 2013). However, that work tends

to conclude that such actors are generally too weak to prevent much liberalization (Greer & Doellgast, n.d.; Kinderman, 2017; Regini, 2014). Drawing on these theoretical arguments and empirical findings, HI has two null hypotheses that contrast, as we will show, with expectations that draw on a Varieties approach. First, the EU's 2009 Directive on renewable energy will not increase the share of total energy that comes from renewable sources. Second, individual EU member states will not increase their share of total energy that comes from renewable sources.

THE VARIETIES APPROACH

In contrast to HI, the Varieties approach, whilst acknowledging how capitalism, in general, increases the pressures for greater marketization and liberalization (Morgan, 2016; Wood, 2015; Wood, Deeg, & Wilkinson, 2014), tends to place greater emphasis on variation in national and sectoral institutions and their complementarities to explain important outcomes, including market dynamics (Allen, Allen, & Lange, 2018; Morgan & Kristensen, 2014; Walker, Zhang, & Ni, n.d.; Whitley, 1987, 2010b; Wood, 2013).

Within the Varieties approach, three key institutions are national financial systems, labour-market regimes and the role of the government in economic activities (Fainshmidt, Judge, Aguilera, & Smith, 2018; Hall & Soskice, 2001; Hancké, Rhodes, & Thatcher, 2007; Whitley, 2005; Wood & Lane, 2012). The Varieties literature often distinguishes between national financial systems that typically provide financing to companies through capital markets and those that provide it through banks (Aguilera & Jackson, 2003; Hall & Soskice, 2001; Lange, Geppert, Saka-Helmhout, & Becker-Ritterspach, 2015; Whitley, 1999; Zysman, 1983). Although this distinction is not as clear in practice as it in theory (Goergen, O'Sullivan, Wood, & Baric, 2018; Goyer, 2011), it highlights the typical and contrasting priorities that those providing funding to companies have and how these variable objectives,

in turn, are likely to shape company and market developments (Allen, 2013; Judge et al., 2014; Shirodkar, Konara, & McGuire, 2017; Walker et al., n.d.; Whitley, 1999: 49–50, 2007).

By investing in a large number of companies and not owning a large proportion of the shares in any one company, institutional investors typically diversify their risk, decrease their commitment to the individual firms that they have invested in and enhance their ability to switch their investments to other, potentially more lucrative, companies (Hall & Soskice, 2001; Whitley, 1999). In addition, if institutional investors are assessed regularly on their short-term, financial performance, they are likely to switch their investments relatively frequently and rapidly; they are also likely to contribute towards a market for corporate control, signified by comparatively high volumes of mergers and acquisitions and resulting, on the whole, in companies emphasizing short-term profitability (Whitley, 2010b).

By contrast, in 'stakeholder-oriented' countries in which banks and other 'patient investors' tend to provide finance to companies, the pressures on firms to focus on short-term financial results are less (Aoki, 2010; Hall & Soskice, 2001; Whitley, 1999). Such investors often own a relatively large block of shares, making it difficult to switch their investments from one firm to another; as a result, their commitment to, and knowledge of, the companies that they have invested in increases (Whitley, 2010b). In such countries, the market for corporate control is likely to be less than it is in capital-market based financial systems, leading to less emphasis on short-term profits, in general (Hall & Soskice, 2001; Whitley, 2007).

Within the broader literature that assesses these claims, there is, in general, support for them (Hotho, 2014). For instance, evidence suggests that firms in shareholder-oriented countries are more likely to succeed in sectors that require investors with a relatively short-term focus than are firms in stakeholder-oriented countries (Allen, Funk, & Tüselmann, 2006). Research has, however, revealed that stakeholder-oriented countries can promote the

success of companies in sectors that require co-operative relationships both within and between firms (Allen & Whitley, 2012; Kristensen & Morgan, 2018; Witt & Jackson, 2016).

The evidence on energy markets indicates that, in countries in which 1) fragmented share ownership amongst institutional investors characterizes firms and 2) an active market for corporate control exists, investors have often sought short-term financial gains by investing in hydrocarbon-focused companies rather than renewable-energy ones (Frynas, Wood, & Hinks, 2017; Lehn & Zhu, 2016). This, in part, reflects renewable-energy's high set-up costs (Stigka, Paravantis, & Mihalakakou, 2014), which would appear to increase patient investors' interest in it and decrease that of institutional investors (Salm, 2018; Wood, 2016). This evidence suggests that the characteristics of national financial systems play a role in promoting or hindering the move towards increasing the amount of energy generated from renewable sources. We, therefore, hypothesize:

H1: Countries in which the stock market plays a greater role in economic activities will be associated with lower increases in the share of countries' total energy from renewable-energy sources.

H2: Countries with a larger market for corporate control will be associated with lower increases in the share of countries' total energy from renewable-energy sources.

In the Varieties perspectives, key institutions within labour-market systems are employers' ability to lay-off workers, the degree to which employees or their representatives have a voice within companies and the degree to which bargaining over pay and conditions is centralized (Hall & Soskice, 2001; Whitley, 1999). These institutions influence how likely workers are to move between companies and sectors, shaping the development of new markets (Hall & Soskice, 2001; Whitley, 1999). For instance, labour-market institutions that

provide employee representatives with a say in companies' strategic decisions are likely to hamper firms' abilities to switch their investments to radically new technologies and markets as these may risk the employment of existing employees (Hall & Soskice, 2001; Whitley, 1999).

By contrast, labour-market institutions that do not restrict senior managers' investment decisions and enable firms to lay-off workers relatively easily are likely to promote firms' abilities to change their focus relatively quickly (Witt & Jackson, 2016: 784). In addition, the centralization of wage bargaining at the sectoral or national level means that employees with similar skills will receive a comparable wage in many other firms, limiting employees' financial gain from and, hence, their likelihood of moving between companies and sectors (Hall & Soskice, 2001; Whitley, 1999). By contrast, the de-centralization of wage bargaining will promote the movement of workers between firms and sectors (Allen, 2013).

Empirical research that has examined these claims has, in general, found support for them, highlighting how liberal institutions promote the development of radical technologies and, hence, new markets, whilst institutions the limit senior managers' room for manoeuvre tend to restrict the growth of these markets (Allen, 2013; Hotho, 2014). Building on this work, we hypothesize:

H3: Labour-market institutions that restrict managers' ability to change firm activities will be associated with lower increases in the share of countries' total energy from renewable sources.

Another key institution in the Varieties approach is the role of the state in economic activity (Hancké et al., 2007; Judge et al., 2014; Whitley, 2005, 2010b). Numerous typologies exist to capture the differential role of the state (Carney & Witt, 2014; Wood & Frynas,

2006). To stress the fundamental differences that exist between states and the amount of 'risk' they share with economic actors in developing new markets, the literature often distinguishes between 'regulatory' and 'developmental' states (Johnson, 1982; Judge et al., 2014; Whitley, 2005). Regulatory states, as an ideal type, set regulations that seek to establish a 'level playing field' for all companies; they neither intervene directly in company activities nor seek to promote certain sectors of the economy with an extensive industrial policy (Johnson, 1982; Whitley, 2005). In contrast, developmental states adopt a strategic or planned approach to the economy, seeking to enhance the competitiveness of particular companies or sectors by providing government-guaranteed funding, targeted tax policies, investment incentives, and/or measures to co-ordinate firm activities within selected industries (Carney & Witt, 2014; Evans, 1989; Johnson, 1982; Whitley, 2005).

The distinction between regulatory and developmental states is useful as it highlights how different states share the market and technology risks of new products with companies and how that variation can explain important socio-economic outcomes (Hancké et al., 2007; Judge et al., 2014; Whitley, 2005; Wood & Frynas, 2006). However, any particular state's role in the economy is likely to vary across different sectors and over time (Keller & Block, 2015; Whitley, 2005), underlining the importance of examining how state support varies within specific sectors over time when explaining the development of particular markets (Carney & Witt, 2014; Keller & Block, 2015).

Although the interplay between markets, the state and the environment featured in seminal comparative capitalisms texts (Johnson, 1982; Polanyi, 2001), recent work has, with a few notable exceptions, not discussed the links between capitalism and the environment (Crouch, 2011, 2013; Streeck, 2014b). Even fewer studies have analysed how different models of capitalism shape the development of new markets for environmental products (Allen & Whitley, 2012; Kim & Thurbon, 2015). In particular, some studies have highlighted

how institutions, such as the role of the state in promoting new, green technologies, influence the growth of markets for those products. For instance, the growth in markets that generate energy from renewable sources is less in countries whose governments typically adopt a regulatory-state approach than it is in countries where governments pursue a developmental-state approach (Allen & Whitley, 2012).

H4a: States that invest more in renewable-energy technologies will be associated with increases in the share of total energy from renewable sources.
H4b: States that invest more in nuclear energy will be associated with decreases in the share of total energy from renewable sources.
H4c: States that invest more in fossil-fuel technologies will be associated with decreases in the share of total energy from renewable sources.

Similarly, although seminal research within the Varieties approach highlighted the potential impact of the EU on national outcomes (Hall & Soskice, 2001: 51–52; Hollingsworth & Boyer, 1997), relevant empirical studies are few and tend to come to diverging results. While some research finds that EU institutions play a minimal role and national-level ones the key role (Tregaskis & Brewster, 2006), other studies conclude that EU institutions are important, but their impact varies according to national-level institutions (Thatcher, 2007). Building on these theoretical and empirical insights, we hypothesize both a moderated and 'un-moderated' EU effect:

H5: The EU's 2009 Directive on renewable energy will lead member states to increase their share of total energy that comes from renewable sources.

H6: Member-state institutions will moderate the link between the EU's 2009 Directive and member states' share of total energy that comes from renewable sources.

In the same way that the state's involvement in economic activities varies by sector, the impact of regulations will differ across different industries (Rugman & Verbeke, 1998; Wood, 2013), meaning that existing regulations that apply across the economy are likely to impact on an emerging market, such as energy from renewable sources, differently compared to existing ones (Komendantova, Patt, Barras, & Battaglini, 2012). In particular, regulations that affect both the supply and demand of renewable energy are likely to influence how much energy is generated from renewable sources in a country (Battaglini, Komendantova, Brtnik, & Patt, 2012; Komendantova et al., 2012). For instance, the costs associated with obtaining a permanent electricity supply may influence companies' decisions to establish new facilities and change electricity providers. The ease of starting a business, obtaining construction permits and enforcing contracts may influence the ability of new energy providers that use renewable sources to construct their facilities and begin trading. Regulations on resolving insolvencies may also influence how easily new businesses with limited assets are established and operate.

CONTEXT AND DATA

The EU's Directive 2009/28/EC (Renewable Energy Directive) aims to promote the use of energy generated from renewable sources (European Union, 2009). It requires EU member states, collectively, to meet a target of at least 20 per cent of the group's total energy needs from renewables by 2020. It is an integral part of the EU's comprehensive policy framework to promote the use of renewable energy (European Commission, 2015: 2). The Directive stipulates legally binding targets for individual countries in order to achieve the EU's overall

goal and to reflect countries' existing and potential use of renewables. Malta's target is the lowest (10%); Sweden's, the highest (49%). In order to assess member states' progress on their individual targets, each country has a national renewable energy action plan and publish biennial progress reports (European Union, 2009).

The Directive also encourages member states to facilitate and implement measures to promote the efficient use of energy regardless of how it is generated. This has an important implication for our analysis: if the amount of energy consumed decreases over our time period, but the amount of energy generated from renewable sources remains constant, the share of renewable energy as a share of total energy consumed will go up. As we detail below, we use the percentage of gross final consumption of energy from renewable sources as our dependent variable. Any increase in this figure for countries could, therefore, reflect greater energy efficiency rather than more energy generation from renewable sources. Eurostat figures show that, in kilotonnes of oil equivalent (ktoe), gross final energy consumption was 1,221,677 in 2004 and 1,100,607 in 2014, a drop of around 10 per cent (Eurostat, 2016). The share (amount) of renewable energy increased significantly over the same period from approximately 8.5 per cent (103,365 ktoe) to just over 16 per cent (177,628 ktoe) of the total (Eurostat, 2016). Although total energy consumption declined over our time period, there was a significant increase in the amount of energy generated from renewables. We, therefore, focus on the amount of energy from renewables rather than total energy use to assess the EU and member states' abilities to transition to renewable sources,. In addition, gross final consumption can reflect changes in the location of industrial facilities rather than greater energy efficiency alone.

The European Commission proposed a revised Renewable Energy Directive in November 2016 with a new target of at least 27 per cent of final energy consumption to be from renewable sources by 2030 (European Commission, n.d.). The latest year for which we

have data is 2014, well before the Commission proposed the new target so this will not influence our findings, but far enough from the 2009 Directive to assess any potential impact.

The EU uses other mechanisms to seek to reduce the environmental impact of economic activity on the environment. Most notably, the European Union's Emissions Trading Scheme (ETS) started in 2005; it uses a 'cap and trade' principle that seeks to cap EU emissions by requiring organizations that overshoot their targets to purchase additional allowances and enabling other organizations that undershoot their targets to sell their surplus allowances. The total amount of carbon that organizations collectively can emit reduces over time.

Surveying the existing research on the impact of the ETS on reduction carbon-dioxide emissions, Laing et al. (2013) found that the policy has led to a decrease in greenhouse-gas emissions; however, evidence suggests that, in the electricity-generating sector, a switch to more efficient gas-powered generating facilities from coal-fired ones largely accounts for this reduction (Ellerman & Buchner, 2007). Thus, ETS data do not fully capture the transition to renewable energies. Although the ETS regulates emissions from over 11,000 facilities and 1,400 aircraft operators, it focuses on relatively large organizations that either generate electricity or use a lot of energy, such as steel and aluminium production (European Commission, n.d.). It, therefore, overlooks the use of energy by private households and many organizations. For instance, transportation, excluding aviation, accounts for approximately one third of energy used in the EU (Eurostat, 2016). Hence, ETS data do not, necessarily, capture the extent of energy transitions in different countries. We, therefore, argue that any change in the use of renewables between 2004 and 2014 will result from the EU's 2009 Directive rather than any other policy (European Commission, 2015).

Table 1 summarizes the data and their sources. The countries in the sample are: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France,

Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain, Sweden, United , Kingdom and span the years 2004-2014 (inclusive).

[Insert Table 1 About Here]

Outcome Measure: Overall Share of Energy from Renewable Sources

Our outcomes measure is the overall share of energy that comes from renewable sources in each of the EU member states; it is based on definitions in the EU's 2009 Renewable Energy directive and covers energy for electricity, transport, aviation, and heating and cooling (European Union, 2009). The Directive does not consider nuclear energy a renewable source (European Union, 2009).

Explanatory Variables

In deciding which measures of institutions to use, we drew on previous studies (Allen & Aldred, 2013; Fainshmidt et al., 2018; Hotho, 2014; Judge et al., 2014; Witt & Jackson, 2016). We sought, where possible, to draw on data that are available for all of the years that we examine to ensure that we capture any changes in institutions and the possible impacts that those changes may have on energy generated from renewable sources. We cover key institutions discussed in seminal HI and Varieties texts (Hall & Soskice, 2001; Streeck, 1997; Whitley, 1999), including corporate governance systems, labour-market institutions and the role of the state.

We used three measures to capture corporate governance: stock market capitalization as a percentage of GDP, total number of mergers and acquisitions divided by GDP (constant USD), number of mergers and acquisitions by foreign acquirers divided by GDP (constant

USD), private credit by deposit money banks and other financial institutions to GDP (%). We drew on six measures to capture labour-market institutions: the OECD's overall employment protection index, collective wage bargaining, works councils status, works council structure, works council rights, and hiring and firing practices. To capture the role of the state, we include three variables: government R&D spending on renewable energy sources, fossil fuels and nuclear energy as percentages of GDP.

We used data from the Doing Business database on 'getting electricity', the ease of starting a business, dealing with construction permits, enforcing contracts, and resolving insolvency. We note that there are of course numerous other legal and institutional variables in this dataset, We focus on those that are most likely to influence the share of total energy from renewable sources, reducing the risk of running kitchen-sink econometrics. The chosen variables reflect interest in renewable energy as they capture entrepreneurial interests in new technologies, and costs of construction and insolvency.

RESULTS

The data indicate that the 2009 EU Energy Reform was effective in stimulating a greater percentage of renewable energy resource usage. Table 2 shows that for country-years with renewable energy is greater than the median, those years are more likely to be after the 2009 reform, and the difference is significant at the 1 per-cent level. Notably, this effect is not merely due to a year-time trend, as there is no statistically significant difference over time based on the year-time trend variable.

Table 2 also shows that there is a higher percentage of renewable energy usage in countries with lower stock market capitalization relative to GDP (significant at the 1 per-cent level), lower numbers of M&A in total (significant at the 10 per-cent level), lower number of foreign M&As (significant at the 1% level), and lower levels of GDP (significant at the 1 per-

cent level). However, the ratio of M&As to GDP is positively related to renewable energy usage (significant at the 1 per-cent level) for both foreign and domestic M&As.

Table 2 indicates that government investment in renewable energy sources is positively associated with renewable energy usage, and this different is significant at the 1 per-cent level. There is no significant effect of investment in fossil fuels, and the investment in nuclear is negatively associated with renewable energy usage (significant at the 10 per-cent level).

Finally, the comparison tests in Table 2 show that the cost of getting electricity in terms of the number of days is associated with a lower level of renewable energy usage, while the cost of getting electricity in terms of the percentage of income per capita is positively associated with renewable energy usage. Both of these differences are significant at the 1 per-cent level. The other variables from doingbusiness.org are insignificant in the comparison of means tests in Table 2. With national-level panel data, we do not see a large influence of outlier observations. As such, we do not present comparison of medians for brevity, and we do not winsorize our data.

[Insert Table 2 Here]

A correlation matrix is provided in Table 3. The correlations are very consistent with the comparison of means tests in Table 2. Clearly some of the variables are highly correlated, such as domestic and foreign M&A activity, and government investment. In our regression analyses we assess robustness by including and excluding alternative variables that are potentially influential due to collinearity.

[Insert Table 3 Here]

REGRESSION EVIDENCE

Tables 4 and 5 present the regression evidence, displaying six alternative models to show robustness. We use country fixed effects in all models, and as such, we do not (in fact, cannot) include country-level institutional variables that are time-invariant. Table 4 presents the base estimates, and Table 5 includes additional tests with time-varying country-level legal and institutional variables from the Doing Business database. The reported regressions in Tables 4 and 5 are country-fixed effects panel models, estimated with STATA, and without clustered standard errors. When we include the vce(robust) option in stata (equivalent to clustering standard errors at the country level) we observe very minor changes in the standard errors of the models such that the t-values change by a small fraction but not enough to change the statistical significance of the results at the 1%, 5%, or 10% levels. Clustering in no way changes in the magnitude of the estimated coefficients. Since clustering in different ways may appear to be artificially selected to engineer a particular set of results, we present the models without clustering.

[Insert Table 4 Here]

Table 4 shows strong support for the effectiveness of the 2009 EU energy policy reform. The test makes use of a dummy variable equal to 1 in the post reform period. We also include a time trend to account for the fact that renewable-energy usage could be increasing over time regardless of the EU policy change. The policy variable's coefficient shows that renewable energy usage went up by 4.0 per cent relative to the average country level usage in the sample in the most conservative estimate (Model 2), and by 5.9 per cent in the least conservative estimate (Model 1).

Table 4 further shows that M&A activity is positively associated with renewable energy usage, whereby a 1-standard deviation increase in M&A relative to GDP is associated with approximately a 2.0 per-cent increase in renewable energy usage relative to the average level in the sample (Models 1 and 3). Note, however, that this estimate is sensitive to the inclusion/exclusion of the interpolated variables in Models 1 and 3 versus removing those observations as done in Model 2.

The rights of works councils variable negatively affects renewable energy usage. A 1-standard deviation increase in the Right causes a 4.9 (Model 1) to 11.2 (Model 2) reduction in renewable energy usage relative to the average level in the full country-year sample, and these effects are significant at the 5 per-cent levels in Models 1 and 3 and at the 1 per-cent level in Model 2.

Table 5 presents the same models as in Table 4 with additional variables for country-year level 'Doing Business' variables. Table 5 shows not only these institutional variables, but also the interaction effect with the 2009 EU policy change. There may be a moderating effect of national institutions on the effectiveness of EU's efforts in producing more renewable energy. The evidence in Table 5 reveals that a higher costs of per-capita of getting electricity positively influences the use of renewable energy, such that a 1-standard deviation increase causes a 3 per-cent (Model 4) to 6 per-cent (Models 5 and 6) increase in renewable energy usage relative to the average level. Note that this effect is only observed after the 2009 reform. Note as well that the inclusion of the interaction terms with the post 2009 variable reduced the statistical significance of the post 2009 dummy variable by itself, but the significant interaction effect we observe in Table 5 is showing us that the 2009 Reform changed the slope effect of some of the variables. For example, the country cost of getting electricity did not have a direct impact on renewable energy usage, but with the 2009 reform, it does have a significant impact as a result of the reform. This inference is not artificially

attributable to correlations across the variables; instead, it is consistent with what we would expect with the 2009 reform.

Also, note that the other costs associated with grid connections from the Doing Business database, such as time, procedures, and the overall index averaging all factors, are insignificant.

[Insert Table 5 Here]

The other variables from that database show a 1-standard deviation increase in variable that captures the ease of starting a business (meaning it is easier to do so) causes a 2.8 per-cent increase in renewable energy usage, probably attributable to the rise in 'cleantech' entrepreneurship (Cumming, Leboeuf, & Schwienbacher, 2017; Cumming & Schwienbacher, 2018). The EU's 2009 Directive did not change this effect. Conversely, there is mixed evidence about the impact of the costs of business with construction contract permits, enforcing contracts, and resolving insolvency. Higher index values (lower costs) for dealing with construction permits and enforcing contracts are associated with lower renewable energy usage, although the effect of dealing with construction permits reverses after 2009. Insolvency is weakly significant or insignificant. Our data do not enable a full assessment of these nuanced impacts. Future research with micro-level data would be useful to assess these firm-level impacts in more detail.

CONCLUSION

Our research refutes key arguments from the HI literature: EU member states have increased the share of energy that comes from renewable sources over time and the EU's 2009 Directive has had a demonstrable effect on promoting greater increases in the share of energy

from renewable sources across the member states. HI's general pessimism about the ability of capitalism to develop markets that have environmental as well as social benefits is, therefore, unwarranted.

Our results provide some support for key arguments within the Varieties approach. First, some evidence suggests that countries that have higher levels of stock market capitalization as a percentage of GDP have experienced lower increases in the share of total energy from renewable sources. This confirms H1. However, our panel estimates find no significant causal link between stock market capitalization and renewable-energy use. Although this may suggest that stock-market funding to firms does not play a role in explaining the transition to renewable-energy sources, finding such a causal link is likely to be difficult as our outcome variable increases over time for all member states and levels of stock-market capitalization in different countries tend to be highly correlated with one another in a statistically significant way. In other words, whilst the share of energy used from renewables has increased for all member states, stock-market capitalization as a percentage of GDP tends to go up or down for all member states at the same time over the period we have examined.

Second and contrary to H2, countries with larger markets for corporate control, as captured by our M&A data, have higher – not lower – increases in the share of total energy from renewable sources, as shown in models 1, 3 and 4. This suggests that M&As create operating efficiencies and allow for restructuring, thereby saving on traditional energy and giving rise to opportunity to invest in new energy. Greater M&A activity does not support the argument that firms will not move to renewable energy as it may have short-term costs and long-term benefits.

Third, labour-market institutions, on the whole, have very little effect on renewable-energy usage. Only the variables that measure employment protection and the rights of works councils, which are significant in models 5 and 6 and models 1, 2, 3, 4, and 5, respectively, affect the share of energy from renewable sources. The effects of both are negative, confirming H3 and suggesting that the more

workers' representatives have a say over important company decisions and the more restrictions there are on companies to lay-off workers, the lower renewable-energy use will be.

Fourth, our results do not support H4a, H4b or H4c. Our measures for the role of the state in promoting different types of energy do not, with one exception, affect the share of energy from renewable sources. The exception is in model 6: paradoxically, higher levels of public R&D spending on renewable energy decrease the share of total energy from renewable sources. The reasons for this effect require further research. Possible reasons could be that government investments focus more on technologies that may have long-term returns rather than short-term benefits or that they invest in technologies that do not have much benefit in the home country.

Fifth, our results confirm H5: the EU's Directive has had a positive impact on the share of total energy from renewable sources, which is at odds with HI expectations. Finally, our results, on the whole, confirm H6: the effects of the EU's Directive are moderated by specific national institutions, as shown by some of the interaction terms in models 4, 5, and 6. These results underline the importance of key insights from the Varieties approach on the importance of institutional specificities for market developments. For instance, our research demonstrates that the cost of establishing a connection to the grid is positively related to the share of total energy from renewable resources. Whilst this may seem paradoxical, it may be explained by the fact that some costs to connect customers to the grid may include charges to support renewable-energy technologies (European Commission, 2016). This area requires greater scrutiny. It should also be remembered that these connection costs do not vary as much within Europe as they do within, say, Africa (World Bank, 2012).

Model 6 indicates, as expected, that the easier it is to establish a business, the higher the share of total energy from renewable sources will be, suggesting that greater regulation may prevent new providers and distributors from entering the market. However, the interaction term for this variable is not statistically significant. The 'distance to frontier' measure for the ease of dealing with construction permits is statistically significant and negative, indicating that countries in which it is easier to obtain construction permits have higher increases in the energy generated from renewables. (The distance to frontier measure ranges from 0 to 100; countries closer to 100 perform 'better' on that measure

(World Bank, 2018a).) However, the interaction term for the ease of dealing with constructing permits is significant and positively related to the share of total energy from renewable sources, suggesting that restrictions on the establishment of renewable-energy facilities will promote energy generation from renewable sources and that this became particular important after the EU's Directive. This paradoxical result warrants further investigation, as other research indicates that lengthier procedures to obtain various permits for renewable-energy facilities reduce the amount of electricity generated from renewables (European Commission, 2015; Roland Berger Strategy Consultants, 2011).

However, the 'distance to frontier' variable that captures the ease of enforcing contracts and its interaction term are significant and have a negative effect on energy from renewable sources. In other words, the easier it is to enforce a contract, the lower the share of total energy from renewable sources will be. The finding may be explained by the readiness and ability of firms to dispute any changes in contracts that may promote greater use of renewable energy.

Overall, our analysis demonstrates the importance of explaining market dynamics from an institutional perspective as we have revealed important causal links between institutions and renewable energy. In particular, the EU has played a pivotal role in promoting renewable energy, highlighting the importance of theories and research that embed countries within broader institutional settings. Our research also suggests that particular institutions, such as the ease of starting a business, are important to explain energy transitions rather than more typical national-level ones, such as stock-market capitalization as a percentage of GDP, emphasizing the need to examine a range of institutions that are likely to be important to the research focus, which, in our case, is the transition to renewable energies. This paper's final contribution lies in its examination of a market that seeks to mitigate the harmful effects of economic activity, of varieties of capitalism, on the environment. Whilst related studies have focused on inequality and innovation, the environment has tended to be neglected, despite its increasing human, social, economic and political importance.

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Table 1 Summary Statistics

	Definition	Source	Mean	Median	Std Dev	Min	Max	Number of Observations
Share of total energy from renewable sources	Overall share of energy from renewable sources (Directive 2009/28/EC)	Eurostat	14.72%	11.49%	11.14%	0.10%	52.52%	297
Private credit	Bank lending to private enterprises as a percentage of GDP	World Bank	93.321	87.34	47.704	13.24	260.7	297
Stock market capitalization	Stock market capitalization as a percentage of GDP	World Bank	48.468	36.58	38.511	3.42	249.96	297
M&A absolute totalAbsolute No. TOTAL	M&A involving 100% acquisition by foreign acquirers, count	Zephyr database	350.785	111	536.492	3	2552	297
M&A absolute by foreign acquirer	M&A involving 100% acquisition, total count	Zephyr database	85.266	42	114.248	0	618	297
GDP in Current USD	GDP in current USD	World Bank	6.27E+11	2.38E+11	9.38E+11	6.06E+09	3.89E+12	297
M&A total divided by GDP	Number of 100% acquisitions divided by GDP (current USD)	Zephyr database; own calculations	1.251	0.55	3.042	0.052	38.373	297
M&A by foreign acquirer dvided by GDP	Number of full acquisitions by foreign firm divided by GDP (current USD)	Zephyr database; own calculations	0.322	0.199	0.606	0	8.161	297
EMPLOYMENT PROTECTION INDEX OVERALL		OECD	2.617	2.66	0.376	1.53	3.98	297
Collective Wage Bargaining	The 'actual level of wage bargaining'	ICTWSS Version 5.0 database, Version 5 - November 2015, available at: http://uva-aias.net/en/ictwss. See also, (Visser, 2015)	2.475	2.4	1.201	1	5.75	297
Works Councils status	Existence, and legal supports for, works councils	ICTWSS Version 5.0 database, Version 5 - November 2015, available at: http://uva-aias.net/en/ictwss. See also, (Visser, 2015)	1.623	2	0.532	0	2	297
Works council structure	Structure and channels of works council representation	ICTWSS Version 5.0 database, Version 5 - November 2015, available at: http://uva-aias.net/en/ictwss. See also, (Visser, 2015)	2.606	3	0.852	0	4	297
Works council rights	Scope and degree of works councils' rights	ICTWSS Version 5.0 database, Version 5 - November 2015, available at: http://uva-aias.net/en/ictwss. See also, (Visser, 2015)	1.582	1	0.767	0	3	297
Hiring and firing practices, 1-7 (most liberal)	Measure of ease of hiring and firing	World Economic Forum's Global Competitiveness Report	3.426	3.315	0.733	2.099	6.106	297
Govt R&D FOSSIL FUELS	Government R&D expenditure on fossil fuels as a percentage of GDP	International Energy Association	0.10%	0.01%	0.20%	0.00%	1.24%	297

	Definition	Source	Mean	Median	Std Dev	Min	Max	Number of Observations
Govt R&D RENEWABLE ENERGY SOURCES	Government R&D expenditure on renewable energy sources as a percentage of GDP	International Energy Association	0.42%	0.25%	0.60%	0.00%	3.14%	297
Govt R&D NUCLEAR	Government R&D expenditure on nucelar energy as a percentage of GDP	International Energy Association	0.29%	0.04%	0.56%	0.00%	2.83%	297
Getting Electricity - DTF	Getting an electricity connection and supply to a 'standardized warehouse'; distance to frontier	Doing Business database	73.31933	73.88	13.34816	35.16	98.36	297
Getting Electricity - Procedures (number)	Number of procedures need ed to connect to grid	Doing Business database	5.148148	5	1.416	3	10	297
Getting Electricity - Time (days)	Time to connect 'warehouse' to electricity grid	Doing Business database	117.1549	116	62.47953	23	252	297
Getting Electricity - Cost (% of income per capita)	Connection costs as a percentage of per-capita income	Doing Business database	142.9379	92.5	170.8711	6.4	894.3	297
Starting a Business - DTF	Ease of starting a business	Doing Business database	83.55795	86.61	9.300448	51.47	94.38	297
Dealing with Construction Permits DTF	Ease of dealing with construction permits	Doing Business database	69.49569	69.75	9.898117	48.05	91.59	297
Enforcing Contracts - DTF	Ease of enforcing contracts	Doing Business database	68.04054	68.68	10.57427	34.66	86.04	297
Resolving Insolvency - DTF	Ease of insolvency procedures	Doing Business database	63.41436	60.475	23.12753	7.39	97.11	297

This table provides summary statistics for the data. The sample comprises 27 EU countries from 2004 to 2014. Some variables were constructed with interpolation. Variables were interpolated with the following decision rules: if the first year or last year in the sample was missing, then the closest year's value was used. If a middle year was missing then the linear interpolation between the years was used. If all values for a country were missing, the the median across the other countries was used.
Notes: : 'DTF' denotes 'distance to frontier'. Values that are closer to 100 for data from the Doing Business database that are calibrated by their 'distance to the frontier' represent a better performance. In other words, 'An economy's distance to frontier score is indicated on a scale from 0 to 100, where 0 represents the worst performance and 100 the frontier [best performer]' (World Bank, 2018a: 122); see also (World Bank, 2018b)

Table 2. Comparison of Means

This table provides comparison of means tests for the main variables in the data for the subsample of observations where the share of total energy from renewable sources is greater than the median, relative to the subsample of observations where the share of total energy renewable sources is less than the median. The sample comprises 27 EU countries from 2004 to 2014. *, **, *** significant at the 10%, 5% and 1% levels, respectively.

	Share of total energy from renewable sources > Median			Share of total energy from renewable sources <= Median				
	Mean	Std. Dev.	Number of Observations	Mean	Std. Dev.	Number of Observations	Comparison of Means	
2009 EU Energy Reform Dummy Variable	0.66	0.47	148	0.43	0.50	149	3.42	***
Year Time Trend	2009.77	3.15	148	2008.24	3.01	149	0.01	
PRIVATE CREDIT BY DEPOSIT MONEY BANKS AND OTHER FINANCIAL INSTITUTIONS to GDP (%)	90.50	42.92	148	96.12	52.02	149	-0.66	
STOCK MARKET CAPITALIZATION to GDP (%)	38.07	30.17	148	58.79	42.97	149	-4.40	***
M&A Absolute No. TOTAL	295.97	406.42	148	405.23	636.87	149	-1.90	*
M&A Absolute No. Foreign acquirer	62.18	73.76	148	108.20	140.14	149	-3.66	***
GDP in Current USD	4.75E+11	7.97E+11	148	7.79E+11	1.04E+12	149	-3.24	***
M&A Absolute No. TOTAL divided by GDP current USD	1.89	4.20	148	0.62	0.40	149	8.02	***
M&A Absolute No. Foreign acquirer divided by GDP current USD	0.38	0.82	148	0.26	0.23	149	3.39	***
EMPLOYMENT PROTECTION INDEX OVERALL	2.64	0.37	148	2.59	0.38	149	0.21	
Collective Wage Bargaining	2.56	1.14	148	2.39	1.26	149	0.72	
Works Councils status	1.66	0.52	148	1.59	0.55	149	0.45	
Works council structure	2.76	0.94	148	2.45	0.73	149	1.34	
Works council right	1.64	0.78	148	1.53	0.75	149	0.71	
Hiring and firing practices, 1-7 (most liberal)	3.53	0.82	148	3.32	0.62	149	0.72	
Govt R&D as a percentage of GDP FOSSIL FUELS	0.09%	0.17%	148	0.11%	0.21%	149	-1.26	
Govt R&D as a percentage of GDP RENEWABLE ENERGY SOURCES	0.53%	0.73%	148	0.31%	0.38%	149	4.16	***
Govt R&D as a percentage of GDP NUCLEAR	0.23%	0.48%	148	0.34%	0.63%	149	-1.98	**
Getting Electricity - DTF	76.01	15.39	148	70.65	10.32	149	0.85	
Getting Electricity - Procedures (number)	5.22	1.76	148	5.08	0.96	149	0.31	
Getting Electricity - Time (days)	96.26	62.93	148	137.91	54.80	149	-4.58	***
Getting Electricity - Cost (% of income per capita)	186.57	220.53	148	99.60	79.35	149	5.22	***
Starting a Business - DTF	85.51	7.36	148	81.62	10.56	149	0.55	
Dealing with Construction Permits DTF	71.17	11.26	148	67.83	8.02	149	0.57	
Enforcing Contracts - DTF	68.27	10.19	148	67.82	10.97	149	0.08	
Resolving Insolvency - DTF	61.17	22.36	148	65.64	23.73	149	-0.83	

Table 3. Correlation Matrix

Note: Correlations greater than or equal to 0.12 [0.15] {0.10} in absolute value are significant at the 5% [1%] {10%} level.

		[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10	[11]	[12]	[13]	[14]	[15]	[16]	[17]	[18]
[1]	Share of total energy from renewable sources	1.00																	
[2]	2009 EU Energy Reform Dummy Variable	0.20	1.00																
[3]	Year Time Trend	0.23	0.87	1.00															
[4]	PRIVATE CREDIT BY DEPOSIT MONEY BANKS AND OTHER FINANCIAL INSTITUTIONS to GDP (%)	-0.04	0.16	0.16	1.00														
[5]	STOCK MARKET CAPITALIZATION to GDP (%)	-0.16	-0.19	-0.14	0.33	1.00													
[6]	GDP in Current USD	-0.19	0.03	0.05	0.20	0.28	1.00												
[7]	M&A Absolute No. TOTAL	-0.08	0.07	0.09	0.32	0.43	0.66	1.00											
[8]	M&A Absolute No. Foreign acquirer	-0.17	-0.03	0.02	0.28	0.42	0.81	0.88	1.00										
[9]	M&A Absolute No. TOTAL divided by GDP current USD	0.20	0.13	0.15	-0.06	-0.13	-0.15	0.21	0.12	1.00									
[10	M&A Absolute No. Foreign acquirer divided by GDP current USD	0.06	0.01	0.05	-0.03	-0.11	-0.21	0.10	0.10	0.85	1.00								
[11]	EMPLOYMENT PROTECTION INDEX OVERALL	-0.01	-0.11	-0.13	-0.13	-0.16	0.01	-0.35	-0.25	-0.14	-0.04	1.00							
[12]	Collective Wage Bargaining	0.08	-0.18	-0.20	-0.07	0.10	0.01	-0.07	-0.08	-0.11	-0.15	0.32	1.00						
[13]	Works Councils status	0.12	0.09	0.11	0.12	0.37	0.38	0.32	0.31	-0.08	-0.24	0.07	0.12	1.00					
[14]	Works council structure	0.31	0.09	0.11	0.15	0.34	0.24	0.14	0.12	-0.11	-0.20	0.09	0.28	0.66	1.00				
[15]	Works council right	0.24	0.02	0.03	0.03	0.31	0.33	0.15	0.25	-0.13	-0.17	0.18	0.22	0.66	0.72	1.00			
[16]	Hiring and firing practices, 1-7 (most liberal)	0.10	0.11	0.11	0.19	-0.14	-0.28	0.01	-0.05	0.18	0.17	-0.55	-0.35	-0.14	-0.12	-0.23	1.00		
[17]	Govt R&D as a percentage of GDP FOSSIL FUELS	0.00	0.12	0.10	-0.07	0.09	0.32	0.24	0.20	0.03	-0.11	-0.15	-0.07	0.31	0.16	0.11	-0.06	1.00	
[18]	Govt R&D as a percentage of GDP RENEWABLE ENERGY SOURCES	0.32	0.26	0.25	0.19	0.13	0.09	0.19	0.10	0.01	-0.13	-0.30	0.11	0.40	0.51	0.42	0.27	0.38	1.00
[19]	Govt R&D as a percentage of GDP NUCLEAR	-0.07	0.09	0.09	-0.11	0.13	0.51	0.24	0.31	-0.09	-0.15	0.06	0.11	0.27	0.24	0.24	-0.32	0.55	0.22

Table 4. Panel Estimates

This table presents country-level fixed effects panel estimates of the factors that impact the share of total energy from renewable sources. Variables are as defined in Table 1. Model 1 presents a parsimonious model without variables influenced by overly correlated included right-hand-side variables. Model 2 is run in the subset of data where no interpolated variables with missing observations were included. Model 3 presents the full sample and the full set of right-hand-side variables. *, **, *** significant at the 10%, 5%, and 1% levels, respectively.

	Model 1		Model 2		Model 3	
	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic
2009 EU Energy Reform Dummy Variable	0.867	2.49**	0.598	1.69*	0.742	1.99**
Year Time Trend	0.684	12.17***	0.737	10.80***	0.700	11.55***
PRIVATE CREDIT BY DEPOSIT MONEY BANKS AND OTHER FINANCIAL INSTITUTIONS to GDP (%)	-0.006	-0.98	-0.009	-0.96	-0.007	-1.15
STOCK MARKET CAPITALIZATION to GDP (%)	0.004	0.69	-0.005	-0.6	0.005	0.72
GDP in Current USD	-3.550E-13	-0.45	-3.500E-13	-0.32	-3.470E-13	-0.44
M&A Absolute No. TOTAL					0.000	-0.56
M&A Absolute No. Foreign acquirer					-0.002	-0.62
M&A Absolute No. TOTAL divided by GDP current USD	0.096	3.00***	0.002	0.01	0.170	2.39**
M&A Absolute No. Foreign acquirer divided by GDP current USD					-0.186	-0.51
EMPLOYMENT PROTECTION INDEX OVERALL	-0.886	-1.19	0.313	0.38	-0.876	-1.15
Collective Wage Bargaining	-0.028	-0.24	0.032	0.19	-0.029	-0.23
Works Councils status					-0.172	-0.23
Works council structure					0.480	0.91
Works council right	-0.931	-2.08**	-2.155	-3.85***	-1.365	-2.18**
Hiring and firing practices, 1-7 (most liberal)	0.099	0.33	-0.837	-2.11**	0.023	0.07
Govt R&D % of GDP FOSSIL FUELS					-39.117	-0.5
Govt R&D % of GDP RENEWABLE ENERGY SOURCES	-4.295	-0.16	16.050	0.55	8.518	0.28
Govt R&D % of GDP NUCLEAR					-37.639	-1.05
Constant	-1356.880	-12.01***	-1459.711	-10.63***	-1387.108	-11.40***
Number of observations	297		141		297	
Number of groups	27		22		27	
R2 within	0.8146		0.8184		0.7178	
R2 between	0.0045		0.1105		0.0043	
R2 overall	0.0349		0.0232		0.0534	
F statistic	103.47***		44.26***		62.83***	

Table 5. Panel Estimates with World Bank Institutional Variables

This table presents country-level fixed effects panel estimates of the factors that impact the share of total energy from renewable sources. Variables are as defined in Table 1. Model 4 presents a parsimonious model without variables influenced by overly correlated included right-hand-side variables. Models 5 and 6 include additional right-hand-side variables.*, **, *** significant at the 10%, 5%, and 1% levels, respectively.

	Model 4		Model 5		Model 6	
	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic
2009 EU Energy Reform Dummy Variable	0.416	1.09	-53.263	-1.45	-11.247	-0.3
Year Time Trend	0.687	12.32***	0.659	10.47***	0.585	9.05***
Private credit by deposit money banks and other financial institutions % GDP	-0.006	-1.00	-0.003	-0.53	-0.010	-1.6
Stock market capitalization % GDP	0.002	0.33	0.000	0.03	0.003	0.51
GDP in Current USD	-2.540E-13	-0.33	-4.650E-13	-0.6	7.130E-14	0.09
M&A Abs No. TOTAL			0.000	0.49	0.000	-0.24
M&A Abs No. Foreign acquirer			-0.002	-0.41	0.000	-0.09
M&A AbsNo. TOTAL divided by GDP current USD	0.084	2.62***	-0.004	-0.05	-0.048	-0.57
M&A Abs No. Foreign acquirer divided by GDP current USD			0.453	1.17	0.676	1.77*
Employment Protection Index	-1.058	-1.46	-1.994	-2.46**	-2.471	-2.87***
Collective Wage Bargaining			-0.037	-0.28	0.135	1.04
Works Councils status			-0.090	-0.12	-0.146	-0.21
Works council structure			0.449	0.85	0.247	0.51
Works council right	-1.204	-2.71***	-1.446	-2.31**	-0.944	-1.61
Hiring and firing practices, 1-7 (most liberal)	0.124	0.41	-0.085	-0.27	-0.027	-0.09
Govt R&D % GDP FOSSIL FUELS			-11.377	-0.15	78.294	1
Govt R&D % GDP RENEWABLE ENERGY SOURCES	8.084	0.30	-17.228	-0.56	-60.201	-1.96**
Govt R&D % GDP NUCLEAR			11.110	0.31	-15.172	-0.44
World Bank Institutional Variables						
Getting Electricity - DTF			-41.448	-0.99	-24.614	-0.62
Getting Electricity - DTF * Post 2009			0.486	1.56	0.094	0.28
Getting Electricity - Procedures (number)			-229.077	-0.98	-136.091	-0.62
Getting Electricity - Procedures (number) * Post 2009			1.942	1.15	0.010	0.01
Getting Electricity - Time (days)			-6.013	-0.99	-3.572	-0.62
Getting Electricity - Time (days) * Post 2009			0.065	1.43	0.012	0.25
Getting Electricity - Cost (% of income per capita)	-0.001	-0.25	-0.175	-1.02	-0.108	-0.66
Getting Electricity - Cost (% of income per capita) * Post 2009	0.003	2.74***	0.006	4.74***	0.006	4.08***
Starting a Business - DTF					0.044	2.06**
Starting a Business - DTF * Post 2009					0.017	0.61
Dealing with Construction Permits DTF					-0.123	-3.86***
Dealing with Construction Permits DTF * Post 2009					0.078	3.34***
Enforcing Contracts - DTF					-0.086	-1.66*
Enforcing Contracts - DTF * Post 2009					-0.063	-3.77***
Resolving Insolvency - DTF					0.028	1.90*
Resolving Insolvency - DTF * Post 2009					0.011	1.25
Constant	-1360.091	-12.14***	3645.699	0.73	1795.491	0.38
Number of observations	297		297		297	
Number of groups	27		27		27	
R2 within	0.8199		0.839		0.8704	
R2 between	0.007		0.0146		0.0183	
R2 overall	0.0297		0.0105		0.0113	
F statistic	97.90***		48.90***		46.64***	