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The importance of ownership for wind power project acceptance: Evidence from Swedish municipalities

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ABSTRACT: The transition into a renewable energy sector is becoming increasingly important in the face of climate change and aging nuclear power plants. While national policies on wind power development enjoy strong public support, individual projects are often met by local resistance. As this lack of acceptance from the local community poses a serious obstacle for wind power development, an understanding of its drivers may facilitate further deployment. This study investigates whether the ownership of a wind power project has any effect on the level of local acceptance by estimating a probit model using data from 4 886 Swedish wind power applications. The results conclusively indicate that community owned wind power projects have a significantly higher probability for receiving application approval from local authorities, and thus appear to enjoy higher levels of acceptance among local decision-makers.

Keywords: wind energy, public acceptance, community ownership
JEL: Q42, R11, Q40

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1. Introduction

With an increasing awareness among national policy makers of the importance of reducing CO_2 emissions and transitioning into a more sustainable energy sector not based on fossil fuels, renewable energy sources are on the rise. Wind power is an energy source that globally has been found to have strong public support (Krohn & Damborg 1999, Ek 2002) and the industry has experienced an incredible growth in the past ten years (GWEC 2014). National policy makers proceed to set ambitious goals for a continuing increase in energy production from wind power. In Sweden, the current national planning frame for wind power requires 30 TWh of wind energy to be produced by 2020 (SEA 2007), a substantive increase from the current level of 11.5 TWh (2014) (Swedenergy 2015). In addition to playing a significant role in the transition of the energy sector, wind power is proving to be increasingly important in the face of an aging Swedish nuclear power park. With high investment costs and extensive lead times for new investments bringing down the nuclear sector's future competitiveness, other energy sources are necessary to secure future energy supply (SEA 2015a).

While policy makers generally agree on the goal of increased wind power, the experiences of several European countries show a large variation in implementation. Most successful in their implementation have historically been Germany, with the largest amount of total installed capacity in Europe (GWEC 2014), and Denmark, with almost 40 % of their total energy supply generated from wind power in 2014 (GWEC 2015). Both countries have industries characterized by a bottom-up implementation with high levels of locally owned wind power[1], a factor that is considered to have greatly contributed to not only an extensive deployment but also high levels of public acceptance (Wizelius, 2014). The German and Danish experiences would thus suggest a relationship between successful wind power deployment, high levels of public acceptance and widespread local ownership.

When turning our eyes back to the Swedish wind power industry, it is found to be lagging in these areas. In spite of strong public support and ambitious energy goals, wind power deployment is impeded by a lack of *local* acceptance of specific projects (Söderholm et al. 2007). With a much smaller proportion of local ownership, the economic return of the projects accrues to external parties while the environmental benefits of wind power are primarily enjoyed at a national level. The costs however, in the form of noise pollution and property devaluation, are borne by the local community. As the power to grant project approval resides with local authorities concerned about public opinion

[1] Both Germany and Denmark had above 80 % locally owned wind power in the year 2000. This can be compared to the modest 13 % of Sweden in the same year (Bolinger et al. 2004).

in the community, the inherent tension of the current system between national policies and local implementation becomes evident. An enhanced understanding of the drivers of local acceptance thus appears as a prime field for research.

The significance of ownership of wind power projects has received some attention in recent literature, mostly in the form of case studies analyzing the relative support from the local community or models estimating the relative impact to the local community in terms of employment and income. The distinction is often made between community wind projects and corporate wind projects, with the difference in essence expressed in terms of risk and return – for a community project, the risk is borne locally and the return of the project accrues to the local community. While several case studies indicate that benefit-sharing has an effect on acceptance (Devlin 2005, Jobert et al. 2007, Warren & McFadyen 2010, Ek & Persson 2014), and additional research concluding that the benefits to the local economy are indeed larger for community wind projects (Kildegaard & Myers-Kuykindall 2006, Lantz & Tegen 2009, Allan et al. 2011), there is still room in the existing literature for more focused studies on the importance of project ownership for acceptance. In particular, there is to our knowledge no existing studies of ownership importance on an aggregated level, and thus little support for a wider applicability. The contribution of Economics may in this context not only be the provision of a method for such an analysis, but also the provision of a framework for understanding the drivers behind the observed behavior of local decision-makers. The aim of this study is to fill the identified gap by applying an economic framework and econometric methods of analysis to further investigate the significance of ownership for local acceptance by the community in general and local decision-makers in particular.

The paper is organized as follows. Section 2 provides the setting for this study with a description of the energy market's structure and development in Sweden, including current investment cost and incentives for wind power. In section 3, the existing literature in this field is reviewed. Section 4 further defines our research question and presents a framework for the decision-making process of local authorities. It also describes the method and data used for our analysis. Section 5 presents the results from our econometric analysis. In section 6 we perform an extended analysis on a subset of our data. Section 7 provides a more thorough discussion of our results and their robustness. Our final conclusions are presented in section 8, and we identify areas for future research.

2. Background

Historical development of wind power in Sweden

Sweden was first introduced to wind power technology in the early 1980's as a response to politicians' ambitions to reduce oil dependency. In the early years, most wind farms consisted of only one or a few wind turbines owned by individuals or municipal utility companies, while a few larger wind farms were owned by national utility companies. With the introduction of an investment subsidy for wind power plants in the 1990's, the industry growth took off and ownership was extended to include small private enterprises, partnerships, cooperatives and shareholding companies dedicated to wind power (Åstrand & Neij, 2004). Since then, the Swedish wind power industry has experienced a near exponential growth in terms of both capacity installed and energy produced. In spite of impressive growth figures however, the total amount of wind energy produced in 2013 was 10 TWh, representing only 8 % of Sweden's total energy production (Statistics Sweden 2014). This places Sweden far behind the 39.1 % (2014) of market leader Denmark (GWEC 2015).

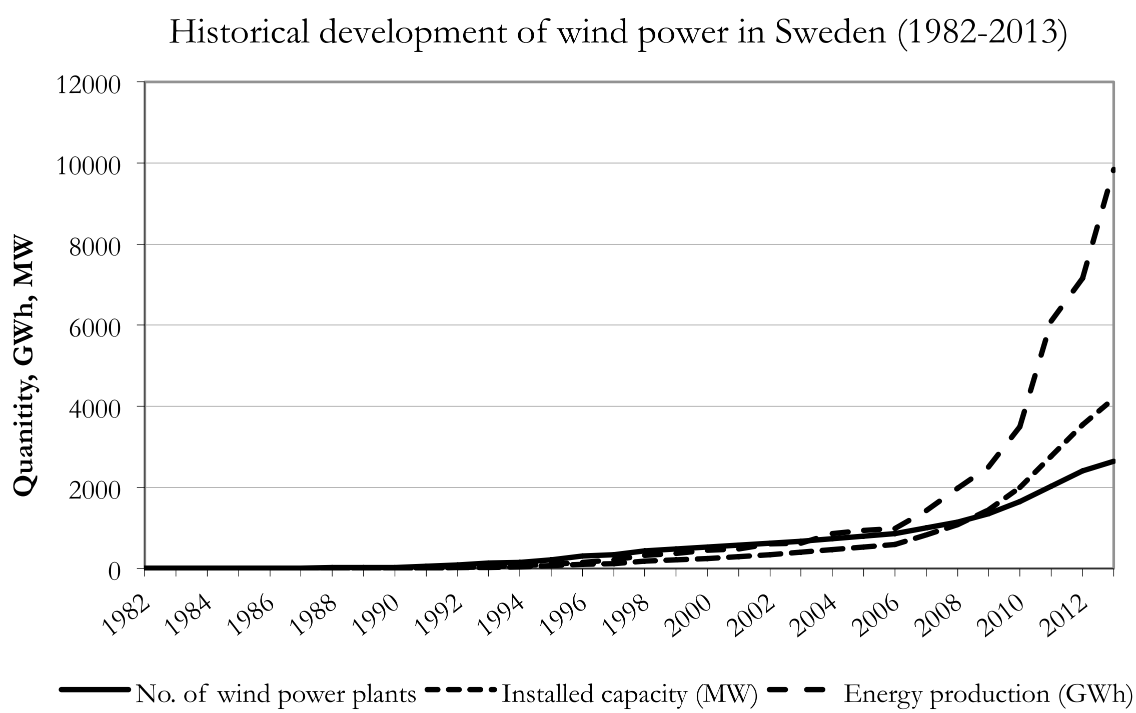

Figure 1: Development of wind power in Sweden 1982-2013. Data from Swedish Energy Authority (2015b).

Characteristics of the Swedish energy market

Aside from wind power, Sweden's energy sources include hydropower, nuclear power, thermal power and solar power. Hydropower and nuclear power provide the vast majority of total energy production, with a much smaller thermal power sector coming in third (Statistics Sweden 2014).

An important aspect of wind power is its dependence on complementary energy sources, as wind cannot be stored or guaranteed. Hydropower is considered one of the most appropriate energy sources to manage these fluctuations as it can be stored in times of excess and released when needed. Due to the possession of a large hydropower sector, Sweden is well equipped for an increase in wind power capacity (Swedenergy 2015).

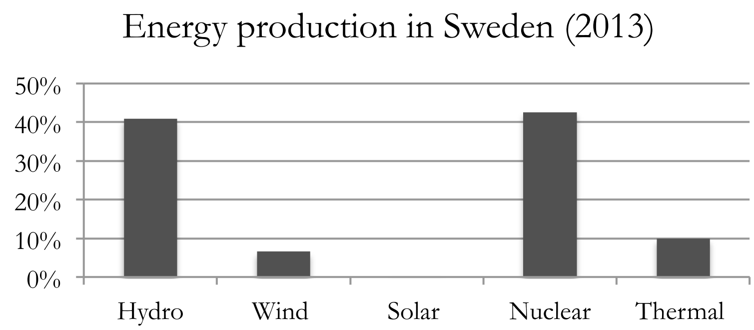

Figure 2: Energy production in Sweden by source. Data from Statistics Sweden (2014).

In the past decades, the Swedish government has employed several policy instruments to promote wind power, including R&D support systems, investment subsidies and an environmental bonus system (Åstrand & Neij, 2004). In 2003, Sweden adopted a green certificates system in order to create incentives for investments in renewable electricity production. The green certificates system is a market based system that supports producers of renewable electricity by giving them an electricity certificate for each MWh produced. The certificates can be sold to electricity suppliers, who are obliged to buy certificates corresponding to the total amount of electricity sold to consumers, as are energy intensive industries registered with the Swedish Energy Authority and certain other actors buying electricity directly from the Nordic electricity market, Nord Pool (SEA 2015c). The price of these certificates is set by the supply and demand of the certificates market, where supply is determined by the total supply of renewable electricity and demand is set by the total demand for electricity. Wind energy producers are among the beneficiaries of the green certificates system as it provides them with an additional income per unit electricity produced. Being a market based system, the certificates are expected to create incentives for investment into the most profitable renewable energy projects (Government Offices of Sweden 2015a).

An additional policy affecting the energy market is the European Union's Emission Trading Scheme, first introduced in 2005. The system includes certain energy producers in Sweden, and by raising the cost for these producers it creates an increase in the price of electricity in the Nordic market. Unaffected producers, including wind power producers, thus receive an increase in revenue (SEA

2012), enhancing the incentives for investing in this form of energy production. Neither is this policy specifically targeted towards wind power nor certain ownership structures, but is instead intended to result in efficient investments into renewable energy production.

The permit process

The number of permit applications for wind power has steadily increased over time, signaling that wind power is considered an increasingly attractive investment opportunity. Several municipality and county authorities confirm a sharp increase in the 21st century, in particular around the year 2009[2]. Before 2009, wind power projects had to go through an extensive application process and be examined under both the Planning and Building Act and the Environmental Code in order to get construction approval. This double assessment of wind power projects was abolished in an effort to simplify the application process, and replaced by new guidelines determining which type of approval is necessary depending on the size of a project. Today, smaller projects must seek building approval from the municipality under the Planning and Building Act, while larger projects must receive approval from the county authorities under the Environmental Code. In order to maintain the municipal planning monopoly regarding the usage of land and water areas within their boundaries, the larger projects must also receive project approval from the municipality. The municipal authorities' exclusive right to grant final project approval is often referred to as the municipal veto (SEA 2015d). The immediate effect of the new legislation was a sharp increase in the number of applications. However, contrary to the intended outcome, a recent study from the industry organization Swedish Wind Energy (2010) found that the municipal veto has come to make it even more difficult to get project approval. If the municipal authorities are hesitant or uninterested, the project may not even be properly examined as there is no need for the authorities to justify their decision. As the attitudes of the local authorities can be difficult for investors to predict, this causes an increase in investment uncertainty. The only time the municipal veto may be circumvented is if the project is considered to be of national interest.

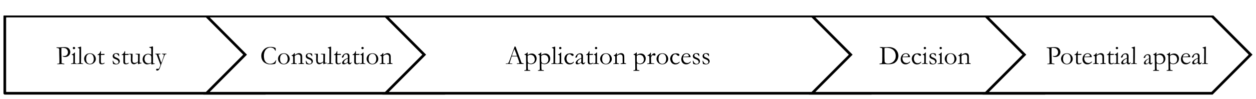

Figure 3: Stages of the permit process (SEA 2012).

The permit process remains a lengthy process, with an average time period of 2.7 years for a project to receive a permit decision under the Environmental Code. This can be extended into 3.3 years if

[2] Correspondence with the municipal authorities in Borgholm municipality, Falkenberg municipality, Laholm municipality, Malå municipality and Strömsund municipality as well as the county authorities in Gävleborg county, Halland county, Jämtland county, Jönköping county, Kalmar county, Västerbotten county, Västra Götaland county and Östergötland county conclusively confirm this development.

the decision is appealed. Moreover, there has been an increase in the length of the permit process in recent years (SEA 2012)[3].

Private investment costs and incentives

The production of energy is a function of capital, fuel and labor in the form of operation and maintenance work (O&M). For wind power, fuel costs are equal to zero due to free access to wind. O&M costs are also comparatively small for wind power, rendering the variable costs of wind power considerably lower than those of other energy sources. Nevertheless, due to large capital investment costs in the construction phase[4], the total production cost for wind power remains comparatively high (Krohn 2009). There is little evidence for economies of scale in the production of wind power related to the size of a project affecting the investment calculation of investors (Vindmark 2015). It is instead the size of the turbine that is considered to give rise to economies of scale as larger turbines are more effective. Apart from the price of the turbine, important external factors affecting the investment cost include the local infrastructure, access to the power grid and site wind endowments. Offshore wind power projects remain more expensive than their onshore equivalents due to higher building and installation costs. All of the above mentioned costs are project specific, and thus independent of the ownership structure (SEA 2014).

Given this high fixed-low variable cost structure, the initial investment is recovered after several years of operation and the cost of capital thus becomes an important factor in any investment calculation (SEA 2014). One of the main determinants of the cost of capital is the inherent risk of a project, a function of mainly future revenue uncertainty and institutional uncertainty. Revenue uncertainty is affected by the price volatility of electricity and green certificates, and thus developer independent. The institutional uncertainty for wind power pertains to changing governmental policies and tax rules, in addition to the uncertainty of the attitudes of local decision-makers (Krohn 2009). The latter group of risk factors can potentially be influenced by ownership structure, e.g. different ownership types have historically been subject to slightly different tax rules[5] and have thus been differently affected by changes in the rules. Another factor proposed to affect the cost of capital is the differing access to capital for different ownership structures. While large firms engaged

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[3] The time frame includes the preliminary steps that must be taken by wind power developers such as pilot studies and consultations with the local authorities, as well as the actual application process. Between 2007 and 2010, the application process was increased from an average of 43 weeks to 65, representing an increase of 51 %.

[4] The upfront investment is estimated to represent an average of 76 % of total production costs (Krohn 2009).

[5] Wind power producers are subject to a number of state taxes, including property tax, corporate tax, energy tax and VAT (Gyland 2009, Swedenergy 2014). Producers producing electricity only for private use have previously been exempted from paying energy tax (Swedish District Heating Association 2014).

in several projects have an opportunity to diversify the risk of each project and thus secure debt-financing at low interest rates, small firms are not so blessed (SEA 2014).

Production costs for wind power plants has continuously decreased over the past decades. This cost decrease is mainly the result of a reduction in turbine prices and technological development in the industry (SEA 2014). In spite of these lower production costs, wind power is not a profitable investment for private investors without any government intervention in the form of policies promoting renewable energy production. In a study carried out by Söderholm et al. (2005), production costs for wind power are compared to those of other available energy sources in Sweden. When the effect of policies promoting renewable energy sources (e.g. green certificates) are taken into account, wind power – and in particular onshore power plants – emerge as one of the most financially viable options for private investors.

Other than the general trend in investment costs, a legislative change in 2009 changed the cost for certain ownership structures. The Council for Advanced Tax Rulings (2009) decided that wind cooperative members must pay a tax on the price difference between their membership electricity price and the market price at Nord Pool. This change reduced the advantage of lower electricity prices enjoyed by cooperative members, thus affecting the incentives to invest in cooperative wind projects. Another potential legislative change affecting investment incentives is a proposal by the current government to remove the energy tax exemption for wind power producers only producing electricity for private usage (Government Offices of Sweden 2015b). This removal would affect both certain community owners (e.g. municipal utility companies) and certain corporate owners (e.g. real estate companies).

3. Literature review

National policies and local implementation

An important aspect of energy production that has received much attention in previous literature is the presence of externalities. The presence of externalities in the energy market can be described as a market failure as some of the positive and negative effects of production are not included in the market price. In order to correct these market failures, government action in the form of incentive-changing policies can be justified (Fisher & Rothkopf 1989). In the case of energy production, there are both negative externalities in the form of CO_2 emissions from certain energy sources and positive externalities in the form of learning curve effects[6] present. Wind power is both exempt from producing said negative externalities and is considered to produce learning curve effects that have a positive impact on the technological development in the industry (Söderholm et al. 2007). By not being reliant on politically unstable fuel exporting countries, wind power further has the potential to create an additional positive externality in the form of improved political and economic national independence (IEA 2012).

While the reduction of negative externalities and the generation of positives ones can create incentives for investing in wind power at a national level, they make little difference at the local level. This is the reason for the current tension between national and local decision-makers, as well as contributing to the local opposition to wind power (Larsson 2011). The positive consequences of wind power are enjoyed nationwide, and can be described as a public good due to the characteristics of non-rivalry and non-exclusivity (Wiser & Pickle 1997). As there are significant local costs present from wind power production, such as noise pollution and visual intrusion, local communities would rather see the production of the public good taking place elsewhere (Krohn & Damborg 1999). This is often described as a *Not-In-My-Backyard* (NIMBY) syndrome, or, in the words of economists, a tendency towards free riding. This free riding tendency among local communities would result in the public good being underproduced (Wolsink 2000).

A possible solution to the free riding problem that has been proposed in other cases of NIMBY-inducing facilities, such as prisons, is distributing compensation to those living in the vicinity of the unwanted facilities (O'Hare 1977). Community involvement – including profits being distributed to the local community and the possibility of local ownership – have indeed proved to be an influential factor in several European case studies of public acceptance of wind power projects (Devlin 2005, Jobert et al. 2007, Warren & McFadyen 2010, Ek & Persson 2014). The perceived economic impact of wind power projects is further described as a determinant for the public attitude towards a project

[6] The concept of learning curves describes cost reductions as a function of cumulative production, i.e. the more wind power that is installed, the more cost efficient it will be (Coulomb & Neuhoff 2006).

by Toke (2005), which is in turn concluded to affect the planning decision by local authorities. In a more recent comparative study of six European countries by Toke et al. (2008), local ownership patterns are found to coincide with higher rates of wind power deployment than do corporate ownership, further strengthening this conclusion.

Further insights into the local implementation of national policies in Sweden can be gained from a study performed by Waldo et al. (2012), focusing on how different municipal-specific social and physical factors affect the deployment of wind power. The study finds that physical factors, such as municipal land area and being a coastal municipality, lack statistical significance in this context, whereas social factors such as population growth and population density are statistically significant.

Costs and benefits to the local community

Several previous studies have been aimed at measuring the positive and negative effects of wind power projects on the local community. While noise pollution and visual intrusion are some of the most commonly cited negative impacts of wind power plants, these costs are difficult to quantify. Instead, efforts have been made to estimate the resulting devaluation of property in the vicinity of wind power plants. Several studies have been able to establish significant negative effects on property prices (Jensen et al. 2014, Gibbons 2014), whereas other studies have found no significant effect of wind power plant proximity (Sterzinger et al. 2003, Sims et al. 2008, ÅF 2010, Lang et al. 2014). The differences in results may be explained by different modeling approaches and different samples, however these contradictory results imply that no clear conclusions can be drawn regarding the effects of wind power on property value.

The benefits to the local community have received increased attention in recent studies. Brown et al. (2012) study the effect of wind power on local employment and personal income at county level in the United States using an instrumental variable approach, and find that both factors are affected positively by wind power development in the county. Moreover, in a report initiated by Swedish Wind Energy (2009) the number of Swedish jobs related to the wind power industry are estimated to increase from 2 000 in 2009 to 14 000 in 2020[7], many of which may be held by the local labor force. Both the production of energy and the land rents represent additional sources of income for the local community (Wizelius 2012).

[7] The estimation is performed by application of a model developed by the American energy department. The numbers are, among other things, based on the assumptions of an increased domestic production of wind turbine components and an increase to 25 TWh produced wind energy in 2020, with the national planning frame currently at 30 TWh by 2020.

Further studies attempt to analyze these positive effects on the local economy more closely by comparing the effects from different types of projects. A common approach is to compare the magnitude of the economic benefits of community wind projects to those of corporate wind projects (Kildegaard & Myers-Kuykindall 2006, Lantz & Tegen 2009, Allan et al. 2011). The underlying hypotheses of these studies are that the return of community wind projects will to a greater extent remain in the local community and that community based developers are more likely to employ local workers, leading to larger positive effects on local employment and income. Using varying sets of approaches, including input-output models and social accounting matrices, this is indeed what is found in these studies.

Planning approval uncertainty

As described in the previous section, the uncertainty of receiving planning approval constitutes an important risk factor for wind power developers. This uncertainty has motivated a recent study of what factors affect the probability of receiving planning approval performed by Rensburg et al. (2015) on a dataset from Ireland. Their study includes a large number of factors pertaining to wind endowment, institutional processes, project technology and other project specific factors. By the application of econometric analysis they find that institutional factors such as the duration of the appeal process and the initial decisions made by local authorities have the most significant effect on receiving final project planning approval. Less important, but still statistically significant, factors include project specific factors such as output capacity, height and site wind endowment. Ownership is included in the study, although with a different categorization than the commonly used community–corporate categorization, but statistical significance is only found for one of their subgroups[8]. The importance of ownership would thus appear to be under question on the basis of these results, although the difference in categorization makes the interpretation less clear.

However, in addition to the ambiguity caused by the employed categorization, several of the institutional variables included – indeed those that prove to be most significant – are factors determined as part of the permit process. While it is perfectly reasonable for the duration of the appeal process and the decision made at the first level of the permit process to be highly relevant for the final planning decision, this knowledge does little to reduce the risk for investors *before* initiating the permit process and making an initial investment. The study provides little insight into why these

8 Developers are categorized as individual (for individual applicants), limited corporation (for limited liability corporations), subsidiary (for corporate subsidiaries) or other (for all other ownership structures), with the latter group being dropped in the model to avoid the dummy variable trap. The subsidiary group is the only one being found statistically significant, which should be interpreted as significantly different in its effect on planning approval from the "other" group. They also include a variable for domestic versus non-domestic developers, but it is not found to be significant.

institutional factors differ between projects, thus lessening its capacity to reduce the uncertainty faced by investors.

In order to truly address the investment uncertainty related to the application process, a further study of the underlying driver of all of these factors – the initial decision by local authorities, the length of the appeal process and the final planning decision – is necessary. Based on the previous case studies, the level of local acceptance of a wind power project emerges as a prime candidate.

4. Research design

Research question

Previous studies seem to agree on the significance of project ownership for the level of economic return to the local community from wind power projects. With additional research emphasizing the importance of economic benefits being returned to the local community for the level of public acceptance, it would appear as if ownership matters for acceptance. While there is an abundance of studies of public acceptance and measurements of the economic impact for the community, very little previous research has been done on this specific link between ownership and acceptance. This is the area where we wish to direct the focus of this study.

In order to study this link, we need to find a measure for the public acceptance of a project. It was proposed in the case study by Toke (2005) that public acceptance would influence the decision of local authorities regarding a project. With the link between ownership and acceptance being described in terms of economic benefits to the community, or more broadly, in terms of additional utility to the community, the connection between public acceptance and project approval appears more clearly. The local community will accept a project contributing to their total utility. It follows that a rational decision-maker wishing to maximize the total utility of the community would approve the very same projects. As it is the utility to the *community* that matters for local decision-makers, not the overall utility effect at a national level, their decisions may deviate from what is socially optimal for the nation. While ownership may have only a minor impact on the national utility increase, previous studies conclude that it does have an effect on the local utility increase. Under the assumption of rational local decision-makers, the level of local utility increase of a project, and thus the ownership of a project, should influence the decision on whether to approve or reject a project.

What remains for us to investigate is whether this reasoning has significant support in the empirical data. Thus the main hypothesis we propose, and wish to test in this study, is this:

Community ownership will increase the likelihood of a project being accepted by local authorities.

With this setup we limit ourselves to the decision local authorities face in choosing how to allocate land (and water) resources between projects with different ownership structures – community wind projects or corporate wind projects. We thus exclude the part of the decision-making process where local authorities determine whether they believe allocating land to wind power projects to be a good idea at all. The basis for this limitation is the considerable influence externally determined physical factors such as local wind conditions and available land area may have on this initial decision of municipal authorities when developing a land use plan[9], in addition to the level of local acceptance of wind power. Due to this greater dependence on external factors, a study of the underlying drivers of this decision-making process would be less useful to investors as investors themselves are likely to take these external factors into account before initiating the permit process.

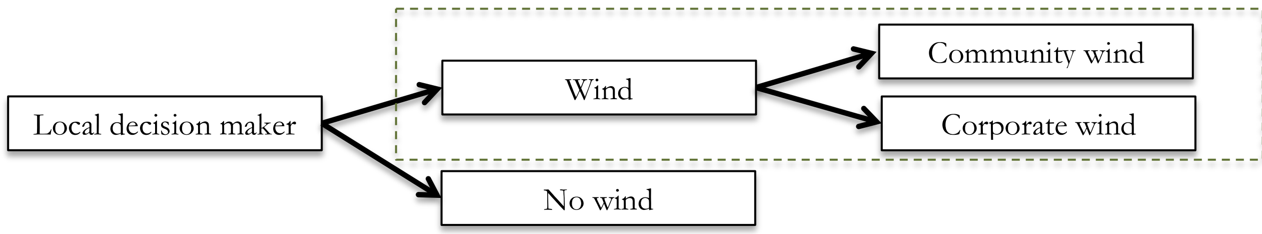

Figure 4: Decision-making process in focus (authors' own).

We expect that the findings of our study could be of importance for two sets of actors in the wind power market. Firstly, the determination of different approval rates for different project types could help in reducing the risk wind power developers face when applying for a permit. As this risk previously has been shown to have a significant effect on investments in wind power, a reduced risk would reduce the investment cost and lead to more efficient investment decisions by private actors. Secondly, we believe that our results could be of some importance to national policy makers wishing to further the deployment of wind power. If a certain ownership structure for wind power projects are favored by local authorities, national policy makers may wish to adopt further policies making this type of ownership structure more attractive to investors, and in that way advance wind power deployment in Sweden without limiting the municipal autonomy.

A decision-making framework for local authorities

In order to better understand the drivers behind the decisions of local authorities, a decision-making framework will be constructed. When constructing a framework for individuals' or organizations' decision-making processes, the concept of utility has found extensive applicability in the economic literature. The basic assumptions made when utilizing such a framework are those of a rational decision-maker that is fully informed and has clear preferences between different choices trying to maximize utility (Edwards 1954). When the decision is taken in a risky or uncertain environment, it is not the actual utility but the *expected* utility that forms the basis for decision-making. The presence of uncertainty could in turn impose an additional assumption – the result-oriented decision-maker, who does not show particular aversion to taking a risk (i.e. a risk-neutral decision-maker). While this is rarely considered to be the case for individual decision-makers, a public decision-maker making a

[9] Swedish municipalities are under the Planning and Building Act obliged to develop a land use plan for the use of municipal territory, where areas suitable for wind power deployment can be denoted. The denotation should be based on landscape analyses, wind conditions and the presence of opposing national interests (Vindlov 2012a; 2012b).

decision on important policy issues can to a greater degree be assumed to act in not just a rational but also a result-oriented manner (Harsanyi 1978). Based on these underlying assumptions, Halstead et al. (1999) developed an expected utility framework for the siting of NIMBY-inducing facilities. By modifying their framework to our setting, we can derive a simplistic model for the decision-making process of local authorities.

In our setting, local authorities are unable to approve all project applications that would create a net benefit to the community due to the scarcity of land. They must thus choose the projects that provide the largest amount of net benefit, i.e. the largest amount of utility. To illustrate this, local decision-makers will in our simplistic utility model have the choice between two types of projects: community wind projects and corporate wind projects. Each project provides the local community with different amounts of expected utility in the form of expected benefits to the community and disutility in the form of expected costs to the community. Local decision-makers are in the model further defined as the municipal authorities as the decision-making power resides with them, and the local community is thus defined as the municipality in question.

The expected benefits of a wind power project mainly come in the form of increased employment, increased average income and indirect spending effects. In accordance with previous research, these benefits are larger for community projects than for corporate projects (Kildegaard & Myers-Kuykindall 2006, Lantz & Tegen 2009, Allan et al. 2011). While neither local nor national wind power firms pay taxes to the municipality, the increase in local employment and increase in average income will have a direct positive effect on municipal tax revenue, further strengthening the importance of these benefits for the municipality as a whole.

The expected costs can be separated into two parts – developer independent and developer dependent. Developer independent costs include noise pollution, negative effects on the landscape and (potentially) lower property value for properties in the vicinity of a wind power project. The magnitude of these costs is instead determined by project specific factors, such as the size of the project and the proximity to residential areas. We also choose to include a developer dependent cost parameter in the model representing the cost from an increase in locally borne risk that only accompanies community projects. If a community project proves to be unprofitable, this could negatively affect other parts of the local owner’s business and thus have negative effects on employment, income and local spending. The same is not true for corporate projects as the risk is borne by external parties. The expected costs to the community are thus larger for community projects, and the size of the difference is partly determined by the probability of a project being unprofitable.

The expected utility to the municipality in the presence of a wind power project can thus be defined:

$$E[U_i] = \theta[V + b_i - p_i - c_i] + (1 - \theta)[V + b_i - p_i]$$

where:
$V = municipal$ "wealth equivalent" $(i.e. current\ state)$
$b_i = benefits\ to\ the\ municipality\ for\ project\ i$
$p_i = project\ specific\ costs\ (i.e. developer\ independent)\ to\ the\ municipality\ for\ project\ i$
$c_i = developer\ dependent\ cost\ for\ project\ i$
$\theta = probability\ of\ the\ project\ being\ unprofitable$ [10]

and $i = \{com, corp\}$ where *com* denotes a community project and *corp* denotes a corporate project.

The utility effects of the different parameters can be summarized as:

$$\frac{\partial U}{\partial b} > 0 \ , \frac{\partial U}{\partial p} < 0, \frac{\partial U}{\partial c} < 0$$

When choosing between two projects, a rational and informed decision-maker will choose the project that provides the largest amount of expected utility to the municipality, i. e. will choose project *i* if $E[U_i] > E[U_j]$.

For the different project types, community projects and corporate projects, we further define the following relationships:

$$b_{com} > b_{corp}$$
$$p_{com} = p_{corp}$$
$$c_{com} > c_{corp} = 0$$

While previous studies have concluded that the benefits for the local community are larger for community wind projects than for their corporate equivalents, none of these studies incorporate the additional risk of community projects for the local community, and the cost this represents. It is thus not obvious which of the two alternatives at hand a rational decision-maker will choose as this depends on the probability and cost of an unprofitable project relative to the increased benefits of a community project.

[10] As the probability of project profitability is determined by external factors, such as the electricity and certificate price and changing governmental policies, it is considered to be independent of project ownership and thus equal for both ownership types.

A rational decision-maker will only choose a community project over a corporate project if the following is true:

$b_{com} - \theta c_{com} > b_{corp}$ (see **Appendix 1** for a more detailed derivation of this expression.)

Defining community and corporate wind

The categorization of a project as either community wind or corporate wind used in many previous studies is a simplification of the great variety in ownership structures that can be observed. According to the World Wind Energy Association a project is defined as a community wind project if two out of the following criteria are met:

1. Local stakeholders own the majority or the entire project
2. Voting control rests with a community-based organization
3. The majority of social and economic benefits are distributed locally

Figure 5: Criteria for community wind project categorization. Source: Wizelius (2014).

In line with this definition, and the definitions used in previous work, we base our distinction between community and corporate wind developers on the concepts of control, risk and return. If a project is controlled by local actors (either by direct ownership or voting rights) and the return and accompanying risk of the project pertains to local actors, it is considered a community wind project. If not, it is considered a corporate wind project, and the owners are categorized as corporate wind developers.

This categorization has been more explicitly defined in previous research by Bolinger (2001) and Kildegaard & Myers-Kuykindall (2006), and we use their definitions as a starting point for our more detailed categorization:

Corporate wind developers	Community wind developers
Commercial power companies Regional companies National companies International companies	Municipal utility companies Real estate communes Cooperatives Individual owners Locally owned companies

Figure 6: Categorization of wind power developers (authors' own).

Locally owned companies are defined as companies registered in the same or in a neighboring municipality as the relevant wind power project. This category includes small firms active in an adjoining line of business such as agriculture or forestry as well as what Kildegaard and Myers-Kuykindall call *Multiple Local Investors*, where several local landowners or business owners jointly register a company for the specific purpose of investing in wind power locally. The latter is often characterized by being run by a locally based board of directors[11].

Method

In order to study our chosen research question at a more aggregate level, we turn our attention to econometrics. Given the specific setting of the Swedish wind power industry, and the hypothesis we propose on the basis of previous research, our econometric approach will have to be chosen accordingly.

Choice of econometric approach

As our econometric model will have to reflect the binary outcome of either approval or rejection of a project, we wish to employ a binary response model measuring the probability of a specific outcome. The two most commonly used models for this setting is either a probit model or a logit model. In line with the modeling choice of Rensburg et al. (2015) when modeling planning approval, we have chosen to employ a probit model. This is the model choice commonly made by economists as it assumes normal distribution of standard errors, thus making it easier to analyze (Woolridge 2013).

A probit model takes the following form:

$$P(Y = 1|x) = \Phi(\beta_0 + \beta_1 x_1 + \ldots + \beta_k x_k) = \Phi(\beta_0 + x\beta) \quad (1)$$

where $\Phi(z)$ is the standard normal cumulative distribution function. By using the standard normal cumulative distribution function in the model, the value of equation (1) falls between 0 and 1 for all values of the model parameters.

The probit model is derived from an underlying latent variable model,

$$y^* = \beta_0 + x\beta + \varepsilon \quad (2)$$

where y^* represents an unobserved (latent) variable. This latent variable determines the value of y from equation (1):

[11] Information on group structure, municipal registration, line of business and the identity of the board members have been collected from the Swedish online database allabolag.se.

$y = (0\ if\ y^* \leq 0;\ 1\ if\ y^* > 0)$

The error term, ε, is assumed to be independent from x and assumed to follow a standard normal distribution:

$\varepsilon_i \sim N(0, \sigma^2)$

The probit model is estimated using maximum likelihood estimation (MLE). The MLE technique will calculate the betas maximizing the product of the log-likelihoods for all observations in the data. When using MLE, heteroskedasticity in the variance of y is automatically accounted for (Woolridge 2013).

Designing the regression model

To test the importance of ownership for the probability of receiving project approval, the probit model should ideally be applied to a dataset with information on all wind power project applications in Sweden. In order to compare the effect of ownership *ceteris paribus*, control variables for project specific factors that might influence the magnitude of the positive and negative effects to the municipality (e.g. size, onshore or offshore placing, site wind conditions) as well as for municipal specific factors that might influence the relative importance of added benefits (i.e. the marginal utility) to the municipality (e.g. unemployment rates, average income, taxpaying power, municipal tax rates) must be included. In order to exclude the effect of a changing institutional environment, additional control variables for time ought to be added to the probit regression model.

Extending the analysis

The probability of approval is in our framework expected to reflect greater levels of local public acceptance for these projects. In order to provide additional depth to our analysis, we will explore another potential measure of local acceptance. Given that the length of the application process can be significantly influenced by the number of appeals from local stakeholders, and the number of appeals being related to the level of acceptance in the local community, the total length of time between the application date and the final decision date can provide an additional measure of the level of acceptance for a project in the local community. With the underlying hypothesis that community projects receive greater levels of acceptance from both community members and local decision-makers, we wish to test whether this has a real effect on the length of the application process. We thus formulate a second hypothesis:

Community ownership will decrease the length of the application process.

This can be tested using an Ordinary Least Squares (OLS) regression with the dependent variable defined as the number of days a given project spends in the application process. As in the previous model, control variables would have to be added for project specific factors, municipal specific factors and time in order to exclude these effects from the variable for ownership.

Data description

The econometric model described above will be applied to a dataset provided by the Swedish Energy Authority on all registered wind power applications in Sweden between 1983 and 2014. While this dataset includes the majority of applications, data on some wind power applications is either missing or incomplete. The risk of bias this poses for our analysis must thus be taken into account when examining the robustness of our results. When having excluded all wind power applications with incomplete information, we are left with data on applications for 4 886 wind power turbines. Out of these, 1 847 have been built (of which 18 have subsequently been taken down), 2 251 have been approved but not yet built and 788 have been denied building approval. The rate of approval for our data is thus 83.87 % (given 4 886 observations). The dataset includes information on the identity of the developer, in what municipality it has or is planned to be built, the project ID (as most projects consist of several wind turbines) and whether the placing is onshore or offshore. Based on the information on project ID, the size of the project each turbine belongs to can be calculated and added to the dataset. The total number of projects is 1 056, with the smallest project consisting of only one turbine and the largest project comprising 314 turbines. To this initial dataset we have manually added a categorization of each project developer as either a community wind developer or a corporate wind developer in line with the definitions described above. Community developers are behind 15.96 % of turbine applications (given 4 886 observations), and represent 30.16 % of the built turbines[12].

Table 1: Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
approval	4888	.8383797	.3681398	0	1
community	4888	.1603928	.3670075	0	1
project size	4886	35.98977	74.72445	1	314
offshore	4888	.0270049	.1621142	0	1
coast	4888	.4279869	.4948376	0	1

Table 1: Descriptive statistics for the main analysis.

12 Applications for 780 turbines have been filed by community developers. 557 of these turbines have been built. The remainder have either been rejected or accepted but not yet built.

Extended analysis

For our extended analysis of the application time for different wind power projects, we use a dataset from the County Administrative Board of Halland. This dataset does not only contain all of the above mentioned information, but also the application and decision dates for all wind power projects with applications administered by the County Administrative Board between 2006 and 2012. It is thus possible to calculate the number of days each project has been in the application process. Notably, the spread is quite large among projects, with the shortest application process only lasting for 84 days while the longest lasted for 902 days. While Halland is one of the most wind power dense counties in Sweden, this dataset is restricted to only 45 projects where decisions have been made. This poses a severe restriction on the significance of the results from an econometric analysis of this data, and the results must thus be interpreted with much caution.

Table 2: Descriptive statistics (extended analysis)

Variable	Obs	Mean	Std. Dev.	Min	Max
days	45	490.1778	195.1162	84	902
community	45	.1555556	.3665289	0	1
project size	45	8.755556	5.515085	1	25
year	45	2009.844	1.476414	2006	2012

Table 2: Descriptive statistics for the extended analysis.

Application of the model

The core part of our probit regression model tests the effect of ownership on application approval. Thus we define our dependent variable as the probability of approval, with application approval generating a value of 1 and application rejection generating a value of 0. The independent ownership variable is defined as a dummy variable taking on the value of 1 for community wind developers and 0 for corporate wind developers.

In light of the restricted data, adjustments have to be made to our ideal probit regression model for testing the importance of ownership. These adjustments are related to our included control variables.

Project specific factors

With the aim of testing the importance of ownership on application approval *ceteris paribus*, we must control for project specific factors that may have an effect on approval. While our decision-making framework describes project specific costs as independent of ownership, our data shows that the size of a project, and thus of the accompanying cost to the local community, is partly related to ownership[13]. Corporate developers more often invest in large projects than community developers do, mainly due to better access to funding (SEA 2014). To adjust for the project size bias, we will add a control variable for the size of the project. We will also add a dummy variable to control for whether the project is onshore or offshore, as the perceived negative effects of wind power are smaller for offshore projects with no neighbors experiencing noise, visual disturbance or property devaluation. Due to larger investment costs for offshore wind power, offshore investments are more commonly made by corporate developers. We wish to exclude this effect from the ownership variable.

Institutional environment

The institutional environment for wind power projects has undergone several changes in the history of Swedish wind power. Some of these changes, such as the introduction of green certificates in 2003, have had similar effects on all types of projects, while others have affected one type more than the other (e.g. the change in taxation rules for cooperatives in 2009). For this reason we would have liked to add additional controls for time, and in particular for specific years when important policy changes took place. Due to data restrictions we are not able to do this, as the reporting of building dates is incomplete and there is no collected data on the date of approval or rejection for each project. However, the institutional changes mentioned above may have affected investment incentives, but they are not directly linked to municipal utility (e.g. as taxes are paid to the state, tax rule changes have no direct effect on the municipality). Thus, while we are deprived of the additional insights these variables might have provided, we do not believe them to be essential for the result of our study. Moreover, in our correspondence with several municipal and county authorities we have received confirmation that the increased number of approved projects over time has mainly been an effect of an increased number of applications, and not an increase in the approval rate over time. In light of this, the necessity to control for time in our model becomes much smaller.

Municipal specific factors

The restriction in time data also presents a problem when controlling for municipal specific factors. Several factors could be influencing the marginal utility for a municipality of approving a wind power project, and thus the overall rate of approval in that municipality, such as the current unemployment rate, current average income, taxpaying power and current tax rates. These are however factors that have not only changed over time, but are also subject to the effects of *existing* wind power projects in

[13] While some studies suggest the presence of economies of scale related to turbine size, there is weak support for economies of scale related to project size (SEA 2012, Vindmark 2015). Thus the project size is not likely to affect the production function for wind power production, and therefore not the benefits and costs to the *investors*. Based on this, we can assume that there are no significant benefits of large projects in the form of increased profitability margins that might have a positive impact on the community.

the municipality[14]. As we are not able to control for this directly, we employ two different methods in two steps. First, we add municipal fixed effects to our probit regression model in order to capture all municipal specific institutional and environmental factors affecting the rate of approval. This allows us to test for whether the rate of approval differs between projects within the same municipality.

In a second step, we instead apply a classification system of Swedish municipalities that has been proposed by the Swedish Association of Local Authorities and Regions to be used in comparative regional analysis. This system groups municipalities into ten groups[15] based mainly on population density, commuter patterns and economic and commercial life in the municipality (see **Appendix 2**). The most important dimension of this classification system for our framework is that of population density, whose importance for wind power deployment previously has been proposed by Waldo et al. (2012). While the benefits of wind power projects are not linked to population density, the magnitude of the costs is. The main costs to the community are effects that are only experienced by those living in the vicinity of the projects (e.g. noise pollution and visual intrusion). In a sparsely populated municipality, fewer people are likely to live close enough to experience these costs, thus making the *total* cost to the municipality smaller. In addition to providing a measure of population density, this grouping of municipalities allows us to simultaneously test for the potential influence of factors concerning municipal economic and commercial conditions. As the above-mentioned grouping has remained fairly constant over time and represents long-term trends, we believe it to be a good basis for the grouping of municipalities over the full time period (1983-2014). In order to capture the differing physical conditions of the municipalities in our second step, we add a control for whether a municipality is coastal or non-coastal as a proxy for different wind conditions. With coastal municipalities generally experiencing higher wind speeds, this should imply better physical conditions for wind power production (Blekinge County Administrative Board 2005) and thus higher revenues and increased profitability of projects. These conditions would increase the economic benefits of the project, and thus have the potential of influencing the general level of acceptance of wind power projects, independent of ownership. By adding this control variable we can separate the effect of different physical conditions from our ownership variable.

While neither of these methods fully captures the above-mentioned variables of interest and their potential effect on marginal utility, they provide some additional information to our research. And as

14 E.g. the municipal unemployment rate for a more recent project would have been affected by the number of projects already in place in the municipality and their effect on municipal employment. Applying the same unemployment rate for all projects within a municipality would thus be ill-advised if applications were not made in the same year.

15 Municipal groups according to the Swedish Association of Local Authorities and Regions: Metropolitan municipalities, Suburban municipalities, Large cities, Suburban municipalities to large cities, Commuter municipalities, Tourism and travel industry municipalities, Manufacturing municipalities, Sparsely populated municipalities, Municipalities in densely populated regions and Municipalities in sparsely populated regions.

the inclusion of these variables is not pivotal to our main research question, we leave the more extensive study of their influence for future research.

The probit regression models we propose are thus:

$$Prob(Approval = Yes) = \beta_0 + \delta_1(community) + \beta_1(projectsize) + \delta_2(offshore) + \delta_{3-187}(municipality) + \varepsilon$$

(Model 1)

$$Prob(Approval = Yes) = \beta_0 + \delta_1(community) + \beta_1(projectsize) + \delta_2(offshore) + \delta_3(coast) + \delta_{4-13}(municipalgroup) + \varepsilon$$

(Model 2)

Additional controls

While our data is structured by individual wind turbine, permit applications are made on a project basis with one or more wind turbines per project. Final approval is often made per wind turbine as the specific placing of a wind turbine is a central issue for local planning authorities, but nevertheless the variability in approval is much smaller within projects than between projects. To control for this, we have clustered our data according to their project ID. Clustering controls for intraclass correlation, i.e. smaller within-cluster variance than the variance between clusters. By clustering, we will automatically generate robust standard errors for our probit regression (UCLA 2015).

The explanatory value of a binary response model, such as the probit model, can be estimated by McFadden's pseudo R-square. The pseudo R-square has the following equation:

$$\text{McFadden's pseudo R-square} = 1 - \frac{L_{ur}}{L_0}$$

Where L_{ur} is the log-likelihood function for the estimated model and, L_0 the log-likelihood function for the model with only an intercept. In the case that our independent variables have no explanatory power, $\frac{L_{ur}}{L_0} = 1$, resulting in a pseudo R-square of zero. While the McFadden value cannot be interpreted directly in the way of a regular R-square, a higher pseudo R-square signifies higher explanatory power of the model (Woolridge 2013).

Due to the design and the underlying assumptions of our probit regression model, the coefficients for our independent variables cannot be interpreted as their direct effect on probability given a one unit change. Instead, coefficients signify the effect on the z-score of the probability. As this effect differs depending on the starting point, it has no constant effect on actual probability. In order to estimate the constant effect our independent variables have on the probability of approval, we will calculate marginal effects. The marginal effect of an independent dummy variable is the change in probability given a change from 0 to 1, holding all other variables fixed at their means (O'Halloran 2010). Applying this method to our ownership variable would thus generate the change in probability for community versus corporate projects.

In order to exclude the risk of multicollinearity in our regression, we will examine the correlation between our project specific variables. We believe this examination to be of particular importance between our ownership variable and the project size variable, as corporate projects generally appear to be larger than community projects.

Extended analysis

In testing the effect of ownership on the length of the application process we employ a simple OLS regression with the number of days between filing an application to receiving a final decision from local authorities as the dependent variable. The regression is run per project, not per wind turbine as in the previous regressions. This is due to the fact that while approval may be given on an individual turbine basis, the application and decision dates are the same for all turbines in a project. The independent variable describing ownership is the same dummy variable used in the probit regressions above. In line with our main regression models, we include a control variable for project size as well as municipal control variables[16]. No control for offshore placing is necessary as all projects in the dataset are placed onshore.

The OLS regression we propose is thus:

$$Days = \beta_0 + \delta_1(community) + \beta_1(projectsize) + \delta_{2-8}(municipality) + \varepsilon \tag{Model 3}$$

Ideally, the municipal control variables would consist of the time-varying municipal factors mentioned above, and we would include other time-varying institutional variables in the regression. However, as the dataset is very limited, both in terms of projects per municipality and projects per year, we instead use municipal dummy variables, and the result will fill a primarily indicative role.

16 The dataset only comprises large projects (as only large projects are reviewed by the county authority), and several of them range over more than one municipality. We let these projects generate the value 1 for the municipal dummy variables for both of the relevant municipalities as the impacts will be distributed over them both.

5. Results

First analysis

To examine the effect of ownership on the probability of approval *within the same municipality*, and thus subject to the same institutional and environmental conditions, we apply a probit model including municipal fixed effects to our dataset. This immediately reveals that 123 out of the total 184 municipalities with registered wind power applications (representing 66.85 %) display perfect rates of either success or failure[17]. These observations are thus dropped from our regression. For most of these municipalities, the perfect prediction is due to very limited number of projects within their borders. A perfect success rate is also revealed for offshore wind projects, and these observations are dropped from the regression as well. When these observations are removed, we are left with 576 projects (clusters) in 61 municipalities[18]. In applying our model to this reduced dataset, applications made to the same municipal authorities are compared against each other. We thus receive insights on how the same municipal authority assesses projects with differing ownership structure. Coefficients and significance levels for the independent variables are shown in the table below.

Table 3: Probit regression with municipal fixed effects
Dependent variable: probability of application approval

	coefficient	z-value
community	1.267	(4.68)**
project size	0.010	(0.69)
_cons	-0.801	(2.13)*
Municipal fixed effects	*Yes*	
Number of observations	2,197	
Number of clusters	576	
Wald chi2 (62)	233.08	
Prob > chi2	0.0000	
Pseudo R2	0.2578	

Table 3: Probit regression with municipal fixed effects. * p<0.05; ** p<0.01

17 A municipality displays a perfect rate of success (failure) if all wind power applications in our dataset from the municipality have been approved (rejected). The observations must be dropped from the regression as the perfect rate of success (failure) of a variable would imply a coefficient taking on the value of infinity (minus infinity), and no probit model can be fitted.

18 We drop the variable for the most prevalent municipality out of those not displaying perfect success or failure rates to avoid the dummy variable trap, and an additional municipality variable must be dropped as it only comprises one cluster and thus would hinder us from performing the Wald Chi-Square test on our full model. We thus include 59 municipal variables in the regression.

The ownership variable displays a positive effect on the probability of approval at a high significance level (p-value<0.01), and thus supports the hypothesis that community projects are more likely to receive approval within a given municipality. The Wald Chi-Square statistic is significantly separated from 0, and we can thus reject the null hypothesis that the coefficients for all of our independent variables are equal to 0.

Next we calculate the marginal effect of changing our ownership variable from 0 to 1 while holding all other variables at their means in order to estimate the change in probability of approval for community projects relative to corporate projects. This shows an estimated increase in the probability of approval of 0.4121, or 41.21 percentage points, for community projects compared to corporate projects. Due to high levels of significance (p-value<0.01), we can reject the null hypothesis that ownership does not affect the probability of approval.

Table 4: Marginal effect (municipal fixed effects)
Dependent variable: probability of application approval

variable	dy/dx	z-value
community	.4121491	(4.75)**
Number of observations	2,197	

Table 4: Marginal effect of ownership for probit regression with municipal fixed effects.
* p<0.05; ** p<0.01

While having found support in the data for our hypothesis that municipal authorities' decisions on project applications are influenced by whether the developer is a community-based developer or not, this has been at the cost of omitting a large part of our data, rendering our results less representative of the full dataset. Furthermore, we believe there to be potential for additional insights in our data. While the probability of approval is suggested to differ between municipalities, the model tells us nothing of the underlying cause of this municipal difference. We thus believe a different classification of municipalities could provide further insights into the drivers behind municipal differences when it comes to project approval, and not merely which municipalities in the past have proven beneficial to apply in.

Second analysis

In applying our second model to our dataset, dummy variables are added for coastal municipalities and for each municipal group. The Sparsely populated municipal group is chosen as a baseline[19], as it is the most prevalent group in addition to providing us with an interpretable result for our municipal group coefficients. The observations relating to offshore projects are dropped due to perfectly predicting success, as is the observations for municipal group 7: Metropolitan municipalities. This municipal group quite surprisingly perfectly predicts success. However, given the very limited number of projects in this group[20], this result has no clear interpretation and conclusions should be drawn with great caution regarding these observations. With these observations removed, our econometric analysis is performed on 1 043 projects, a significantly larger number than in the previous analysis. Coefficients and significance levels for the remaining independent variables are shown in the table below.

[19] The variable for this group is dropped to avoid the dummy variable trap.

[20] This municipal group includes the municipalities of Göteborg, Malmö and Stockholm, i.e. the three largest and most densely populated cities in Sweden. There are two projects registered in Göteborg municipality, one consisting of a single turbine, and another single-turbine project in Malmö. There are no projects registered in Stockholm municipality. The small number of projects likely represents the difficulty in finding suitable land for construction in such densely populated areas.

Table 5: Probit regression with municipal groups
Dependent variable: probability of application approval

	coefficient	z-value
community	1.151	(6.81)**
project size	0.007	(1.88)
coast	-0.197	(1.10)
municipal group 1	-1.329	(2.76)**
municipal group 2	-1.244	(3.02)**
municipal group 3	-2.023	(4.71)**
municipal group 4	-1.178	(2.73)**
municipal group 5	-0.761	(1.87)
municipal group 6	-1.229	(3.26)**
municipal group 8	-1.269	(3.16)**
municipal group 9	-0.679	(1.20)
_cons	1.874	(5.31)**
Number of observations	4,739	
Number of clusters	1,043	
Wald chi2 (11)	97.73	
Prob > chi2	0.0000	
Pseudo R2	0.1760	

Table 5: Probit regression with municipal groups. *p<0.05; ** p<0.01

This second model withstands the Wald test, and we can reject the null hypothesis that all variable coefficients are equal to zero. McFadden's pseudo R-square for this model is lower than in the model with fixed effects, as could be expected due to the less detailed grouping of municipalities used. The ownership variable is still highly significant (p-value<0.01), and we can yet again reject the null hypothesis of ownership being insignificant.

For a more interpretable description of the effect of ownership on approval, we estimate marginal effects. This time, we estimate marginal effects for all independent variables.

Table 6: Marginal effects (municipal groups)
Dependent variable: probability of application approval

variable	dy/dx	z-value
community	0.238	(5.81)**
project size	0.001	(1.96)*
coast	-0.041	(1.12)
municipal group 1	-0.275	(2.76)**
municipal group 2	-0.257	(2.93)**
municipal group 3	-0.418	(4.70)**
municipal group 4	-0.244	(2.64)**
municipal group 5	-0.157	(1.84)
municipal group 6	-0.254	(3.25)**
municipal group 8	-0.262	(3.08)**
municipal group 9	-0.140	(1.19)
Number of observations	4,739	

Table 6: Marginal effects for probit regression with municipal groups. * p<0.05; ** p<0.01

Community ownership is estimated to increase the probability of receiving approval by 0.2377, or by 23.77 percentage points, compared to corporate ownership. This demonstrates a strong positive effect on the probability of approval for community ownership, further strengthening our previous results and providing a measure of the *economic* significance of ownership[21].

In order to test for potential multicollinearity, we estimate the correlation between our project specific independent variables. The primarily interesting variable pair, ownership and project size, is found to have a small negative correlation (confirming that large projects more often are developed by corporate developers). This correlation is however sufficiently small to be considered negligible, as are the correlations between the other project specific variables (see **Appendix 5**). We may thus exclude the risk of multicollinearity in our model.

[21] The lower marginal effect of ownership for this second model compared to that of the first model is likely to be a result of the inclusion of observations that were previously dropped as they belonged to municipality variables that perfectly predicted success of failure. As this measure of the effect of ownership is representative of a larger number of observations, we believe this to be a better measure of the economic significance of ownership.

6. Extended analysis

Having asserted that ownership has a significant effect on the probability of approval in our data, we now test whether ownership has any additional effect on the length of the application process. The result of our simple OLS regression is presented below.

Table 7: OLS regression
Dependent variable: Number of days in the application process

	coefficient	t-value
community	-141.196	(1.46)
project size	3.931	(0.58)
falkenberg	129.782	(1.46)
halmstad	19.981	(0.18)
hylte	76.272	(0.94)
kungsbacka	245.641	(1.77)
ljungby	-186.170	(0.83)
markaryd	-44.100	(0.27)
varberg	234.539	(1.98)
_cons	393.676	(5.42)**
Number of observations	45	
F (10, 34)	0.69	
Prob > F	0.7279	
R^2	0.17	

Table 7: OLS regression with number of days in the application process. * p<0.05; ** p<0.01

When applying our model on the subset of data from Halland county, the resulting coefficient for our ownership variable is negative, indicating that community projects on average experience shorter application processes. While this is indeed in line with our second hypothesis that community projects enjoy higher levels of acceptance and thus are subject to shorter application processes, the result is statistically insignificant (as are the coefficients for our control variables). Given the limited data used for this regression, this insignificance could well be expected. With our small dataset we are unable to reject the null hypothesis of the all coefficient being equal to zero[22]. We thus believe the value of this test to be primarily indicative, and should not be considered to validate the underlying hypothesis. For this purpose, further studies on larger datasets must be performed, potentially with additional control variables added (as described in previous sections).

[22] Small sample size is generally considered to increase the risk of a type II error, i.e. the risk of not rejecting a false null hypothesis (Newbold et al. 2013). The extremely limited sample size, with only 7 data points for community projects and 38 for corporate projects, means that statistically significant differences are unlikely to appear.

7. Discussion

In our framework with a utility maximizing local decision-maker, municipal authorities will only chose a community project over a corporate project if the benefit net the risk of a community project exceeds the benefit of a corporate project. The results of our econometric analyses conclusively point in the direction that community projects are favored by municipal authorities. Within the same municipality, community projects enjoy a higher rate of approval than corporate projects. While this first analysis excludes a large proportion of municipalities, and can thus not be considered fully representative, the results are consistent with those of the second analysis. This would support that benefits are sufficiently higher for community projects than for corporate projects to have an effect on municipal decision-making.

Additional insights

In addition to providing support for our main hypothesis, our analyses present us with some unanticipated and intriguing results. Firstly, while the positive effect of an offshore placing on the probability of approval is in line with the underlying decision-making framework, the perfect rate of success displayed in our dataset is somewhat surprising. The framework takes into account the magnitude of the benefits and costs each project creates for the community, and thus the net effect it has on total utility. In the case of offshore projects, the magnitude of the costs to the community is likely to be smaller than for onshore projects due to larger distances to neighboring properties. The utility to the community should thus be higher, leading to higher rates of approval for offshore projects. The predicted outcome thus receives support from the extreme rate of approval displayed for offshore projects in our data. However, due to a relatively small number of offshore projects (nine), we suggest that interpretation of this extreme rate should be made with caution. We also wish to stress that while this result may contribute to lowering the risk of offshore investments, offshore projects generally require larger initial investments. For investors, this trade-off must be properly taken into account before making an investment decision.

Secondly, in our second analysis we control for a project being built in a coastal municipality as a proxy for municipal wind conditions. In our framework, this is expected to improve the potential profitability of projects and therefore have a general positive impact on attitudes in the community and among local decision-makers. Nevertheless, the coastal variable is rendered insignificant in our analysis. While not being in line with the underlying framework, this is less surprising in light of the result of Waldo et al. (2012). Their study found no statistically significant effect of this variable on the amount of installed capacity in a municipality, making our result more conceivable. While their dependent variable differs from ours, it is likely that the amount of installed capacity is correlated with the probability of approval in a municipality. The lack of significance found for this variable may also result from it being an inadequate proxy for wind conditions.

Thirdly, our second analysis further shows that municipal factors other than purely physical conditions are of importance for project approval. With the least densely populated municipal group used as a baseline in our analysis, our result suggests that the population density of a municipality has a significant negative effect on the rate of approval. All included municipal group variables have negative coefficients (and displays negative marginal effects), signifying the comparatively lower approval rates for these municipal groups. The only municipal groups not significantly different from our baseline group are the group for Municipalities in sparsely populated regions and the group for Tourism and travel industry municipalities, the latter being characterized as being relatively sparsely populated. This supports the hypothesis that approval rates are higher in sparsely populated regions. This result is in line with the underlying framework, as sparsely populated areas are expected to experience smaller total costs of wind power projects and thus higher total utility to the community. It is also consistent with the results of Waldo et al. where population density is found to be statistically significant for the amount of installed capacity in a municipality.

Limitations

The results from our analyses presented above are however subject to a number of limitations that must be taken into account when considering their robustness and wider applicability. An important limitation is the potential bias caused by restricted data. As the dataset consists of self-reported information from each municipality, there is a risk of the missing and incomplete information not being random, thus causing a systematic bias. For instance, there is a risk of certain municipalities underreporting information on their wind power projects and thus not being properly represented in the data.

Another potential source of biased results is the ownership categorization manually added to the dataset. While the categorization is based on the owners registered with the Swedish Energy Authority, it is not uncommon for projects to be sold after construction. The owner during the application process may thus differ from the registered owner.

A third limitation of our data is related to the restrictions discussed in section 4. As data on application and decision dates are missing, we are unable to control for time-dependent institutional and municipal specific factors. The inclusion of these factors would generate more robust results in addition to provide our analysis with additional insights on factors influencing the wind power industry and the decision-making process of municipal authorities.

In spite of these limitations we believe that the strong significance levels of our results (a majority of our results are significant at the 1 %-level) in addition to their uniformity render the results resilient enough to offer validity to our main hypothesis. We thus believe that the results of our study are not only able to offer a contribution to the existing literature in the field, but also provide certain agents in the wind power market, such as private investors and national policy makers, with useful information.

8. Concluding remarks

The contribution of our results to the existing literature in the field is twofold. Firstly, through the analysis of a large dataset comprising the majority of wind power applications in Sweden between 1983 and 2014, we have been able to test the wider applicability of a hypothesis previously only studied in the form of individual case studies. Based on our first analysis, we have found statistical support that municipal authorities appear to favor wind power projects with community ownership over projects with corporate ownership within the same municipality. The importance of ownership receives further support in our second analysis, where the increased probability of receiving project approval for community projects compared to corporate projects is estimated to be not only statistically significant, but also economically significant. Secondly, by applying a utility framework to the decision-making process of municipal authorities, our study is able provide explanations for the drivers behind the local decision-making process and thus further explain our findings.

Our analysis furthermore proposes that the conditions for wind power projects significantly differ between municipalities. One such condition that appears to have a significant effect on the rate of approval is population density. This is in line with the underlying decision-making framework, where sparsely populated municipalities are subject to lower total costs from wind power and thus more often experience net benefits from wind power projects. A more extensive study of other municipal specific conditions could provide investors with additional information on other aspects that may affect the probability of receiving project approval, thus further lowering the risk of their investments.

In light of these findings, an intriguing question emerges. While community projects enjoy higher rates of approval, they represent only about 30 % of current wind power turbines. This can to a large extent be explained by a small proportion of total applications (16 %). While higher approval rates would contribute to lowering the risk of investments in community wind, thus lowering the cost of capital, these figures imply that there are other factors negatively influencing the investment incentives for community wind projects compared to corporate wind projects. One potential source of influence would be the difference in access to capital for community versus corporate investors. With the exception of municipal utility companies, investors in community projects are often individuals or small-scale business owners with more restricted access to both equity capital and debt financing. Larger firms, such as national power companies, more often have a possibility to spread the risk over a larger number of projects. This could lead to lower costs of capital for corporate investors, thus increasing the potential profitability of their projects and making an increased number of investment opportunities attractive in the eyes of the investors. A more extensive study into the factors leading to differing investment incentives for community and corporate wind projects could shed more clarity to this aspect of the wind power market.

Another aspect of the wind power market and its investment conditions brought forward in this study is the possibility of ownership having a real effect on the application *process*. This process is both long and costly, for all parties involved, and a significant contributor to the risk of wind power projects. The results indicating a greater level of acceptance for community projects among local decision-makers are however likely to reflect a greater level of general acceptance in the local community. With the number of appeals made in the permit process for a wind power project reflecting this level of acceptance in the community, the length of the process could serve as a proxy for this more general acceptance. We perform a preliminary study of this relationship on a small subset of data, and while the results can only at best be considered indicative, they do open up for future research into this question.

Previous research into this area has concluded that not only are there benefits from wind power projects to be gained by the local community, but the magnitude of these benefits is influenced by the project ownership. With the addition of our findings, we can further advert that this increase in benefits appears to provide a link between the ownership of a project and the level of acceptance among local decision-makers. Our findings thus support the underlying hypothesis that community based projects enjoy higher levels of acceptance in the local community in general, and among local decision-makers in particular. These findings have two important implications. Firstly, as mentioned above this may contribute to lowering the risk of investing in community wind power projects and thus lead to more efficient investment decisions by private investors. Secondly, these findings could prove useful for national policy makers interested in furthering the deployment of wind power in Sweden. With the successful local implementation of national policies being essential for the development of the Swedish wind power industry, national policy makers not wishing to limit the municipal autonomy are presented with another option. By changing the current investment incentives towards projects favored by municipal decision-makers, they may achieve higher deployment rates for wind power through the use of market forces.

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Appendix 1: Derivation of the municipal decision-making rule

Expected utility for project *i*:

$$E[U_i] = \theta[V + b_i - p_i - c_i] + (1 - \theta)[V + b_i - p_i]$$

Where:

$V = municipal$ "wealth equivalent"

$b_i = benefits\ to\ the\ municipality\ for\ project\ i$

$p_i = project\ specific\ costs\ (i.e. developer\ independent)\ to\ the\ municipality\ for\ project\ i$

$c_i = developer\ dependent\ cost\ for\ project\ i$

$\theta = probability\ of\ the\ project\ being\ unprofitable$

Expected utility for a community project:

$$E[U_{com}] = \theta[V + b_{com} - p_{com} - c_{com}] + (1 - \theta)[V + b_{com} - p_{com}]$$

Expected utility for a corporate project:

$$E[U_{corp}] = \theta[V + b_{corp} - p_{corp} - c_{corp}] + (1 - \theta)[V + b_{corp} - p_{corp}]$$

The municipal decision-maker will favor a community project over a corporate project if:

$$E[U_{com}] = \theta[V + b_{com} - p_{com} - c_{com}] + (1 - \theta)[V + b_{com} - p_{com}] > \theta[V + b_{corp} - p_{corp} - c_{corp}] + (1 - \theta)[V + b_{corp} - p_{corp}] = E[U_{corp}]$$

Given the following assumptions,

$b_{com} > b_{corp}$

$p_{com} = p_{corp}$

$c_{com} > c_{corp} = 0$

The municipal decision rule can be further simplified:

$$\theta[V + b_{com} - p_{com} - c_{com}] + (1 - \theta)[V + b_{com} - p_{com}] > \theta[V + b_{corp} - p_{corp} - c_{corp}] + (1 - \theta)[V + b_{corp} - p_{corp}]$$

$$\theta[V + b_{com} - p_{com} - c_{com}] + (1 - \theta)[V + b_{com} - p_{com}] > \theta[V + b_{corp} - p_{corp}] + (1 - \theta)[V + b_{corp} - p_{corp}]$$

$$\theta[V + b_{com} - p_{com} - c_{com}] + (1 - \theta)[V + b_{com} - p_{com}] > V + b_{corp} - p_{corp}$$

$$V + b_{com} - p_{com} - \theta c_{com} > V + b_{corp} - p_{corp}$$

$$b_{com} - \theta c_{com} > b_{corp}$$

Appendix 2: Municipal classification

A2 Municipal classification by the Swedish Association of Local Authorities and Regions (2011)

Municipalities in bold are included in our dataset.

1. Metropolitan municipalities (3 municipalities)

Municipalities with a population of over 200 000 inhabitants.

Stockholm	**Göteborg**	**Malmö**

2. Suburban municipalities (38 municipalities)

Municipalities in which more than 50 % of the inhabitants commute to work in a metropolitan municipality.

Upplands Väsby	Tyresö	Burlöv
Vallentuna	Upplands-Bro	Vellinge
Österåker	Täby	**Lomma**
Värmdö	Danderyd	**Svedala**
Järfälla	Sollentuna	Skurup
Ekerö	Nacka	**Kungsbacka**
Huddinge	Sundbyberg	Härryda
Botkyrka	Solna	Partille
Salem	Lidingö	**Öckerö**
Haninge	Vaxholm	Ale
Kungälv	Nynäshamn	**Lerum**
Lilla Edet	**Håbo**	Bollebygd
Mölndal	**Staffanstorp**	

3. Large cities (31 municipalities)

Municipalities with 50 000 - 200 000 inhabitants.

Södertälje	**Helsingborg**	Västerås
Uppsala	**Kristianstad**	**Falun**

Nyköping	**Hässleholm**	**Gävle**
Eskilstuna	**Halmstad**	**Sundsvall**
Linköping	**Varberg**	**Örnsköldsvik**
Norrköping	**Uddevalla**	**Östersund**
Jönköping	**Trollhättan**	**Umeå**
Växjö	**Borås**	**Skellefteå**
Kalmar	**Skövde**	Luleå
Karlskrona	**Karlstad**	
Lund	**Örebro**	

4. **Suburban municipalities to large cities** (22 municipalities)

Municipalities in which more than 50 % of the inhabitants commute to work in a large city.

Nykvarn	**Mörbylånga**	**Grästorp**
Älvkarleby	Bjuv	Kil
Knivsta	**Kävlinge**	**Hammarö**
Gnesta	**Sjöbo**	Forshaga
Timrå	**Hörby**	**Lekeberg**
Trosa	Höör	**Kumla**
Söderköping	**Åstorp**	
Habo	**Eslöv**	

5. **Commuter municipalities** (51 municipalities)

Municipalities in which more than 40 % of the inhabitants commute to work in another municipality.

Sigtuna	**Bromölla**	Storfors
Heby	Osby	**Hallsberg**
Vingåker	**Klippan**	**Degerfors**
Strängnäs	**Höganäs**	Nora
Ödeshög	**Trelleborg**	Skinnskatteberg
Ydre	**Ängelholm**	Surahammar
Boxholm	**Stenungsund**	Kungsör

Åtvidaberg	**Tjörn**	Hallstahammar
Vadstena	**Orust**	Norberg
Aneby	**Munkedal**	Gagnef
Mullsjö	**Färgelanda**	**Orsa**
Lessebo	**Vårgårda**	**Smedjebacken**
Alvesta	**Essunga**	Säter
Högsby	**Tibro**	**Ockelbo**
Svalöv	**Vänersborg**	**Krokom**
Östra Göinge	**Alingsås**	Bjurholm
Tomelilla	**Hjo**	Vännäs

6. Tourism and travel industry municipalities (20 municipalities)

Municipalities in which the number of guest nights in hotels, youth hostels and camping sites is higher than 21 nights per inhabitant and the number of vacation houses is higher than 0.20 per inhabitant.

Norrtälje	**Tanum**	**Berg**
Östhammar	**Lysekil**	**Härjedalen**
Valdemarsvik	**Strömstad**	**Storuman**
Borgholm	**Malung-Sälen**	**Dorotea**
Gotland	**Rättvik**	**Arjeplog**
Båstad	Älvdalen	**Jokkmokk**
Sotenäs	**Åre**	

7. Manufacturing municipalities (54 municipalities)

Municipalities in which more than 34 % of the inhabitants aged 16 to 64 are employed in manufacturing, mining, energy, environmental and construction industries.

Tierp	**Uppvidinge**	**Vimmerby**
Oxelösund	Tingsryd	**Olofström**
Finspång	Markaryd	Örkelljunga
Gnosjö	Ljungby	Perstorp
Gislaved	**Torsås**	**Hylte**
Vaggeryd	**Hultsfred**	**Gullspång**

Värnamo	**Mönsterås**	**Tranemo**
Sävsjö	Emmaboda	Bengtsfors
Vetlanda	**Nybro**	Herrljunga
Tranås	Oskarshamn	**Vara**
Götene	**Laxå**	Avesta
Töreboda	Ljusnarsberg	**Ludvika**
Tidaholm	**Askersund**	**Hofors**
Munkfors	Karlskoga	Ovanåker
Grums	**Lindesberg**	**Sandviken**
Filipstad	Fagersta	Norsjö
Hagfors	Köping	**Malå**
Arvika	Arboga	Gällivare

8. **Sparsely populated municipalities** (20 municipalities)

Municipalities in which less than 70 % of the population lives in urban areas and less than eight inhabitants per km²

Dals-Ed	**Sollefteå**	**Sorsele**
Torsby	**Ragunda**	**Vilhelmina**
Årjäng	**Bräcke**	**Åsele**
Vansbro	**Strömsund**	Överkalix
Nordanstig	**Nordmaling**	**Övertorneå**
Ljusdal	**Vindeln**	Pajala
Ånge	**Robertsfors**	

9. **Municipalities in densely populated regions** (35 municipalities)

Municipalities with more than 300 000 inhabitants within a 112.5 km radius.

Enköping	**Sölvesborg**	**Mariestad**
Flen	**Landskrona**	**Lidköping**
Katrineholm	**Ystad**	**Skara**
Kinda	**Simrishamn**	**Falköping**
Motala	**Laholm**	**Kristinehamn**

Mjölby	**Falkenberg**	**Säffle**
Nässjö	**Karlsborg**	Hällefors
Eksjö	**Mellerud**	Sala
Älmhult	**Mark**	**Leksand**
Västervik	Svenljunga	Borlänge
Ronneby	**Ulricehamn**	**Hedemora**
Karlshamn	**Åmål**	

10. Municipalities in sparsely populated regions (16 municipalities)

Municipalities with less than 300 000 inhabitants within a 112.5 km radius.

Eda	**Härnösand**	**Piteå**
Sunne	**Kramfors**	Boden
Mora	**Lycksele**	**Haparanda**
Söderhamn	Arvidsjaur	**Kiruna**
Bollnäs	**Kalix**	
Hudiksvall	Älvsbyn	

Appendix 3: Description of variables

A3-1a	Project specific variables
Variables	Description
approval	permit application approved, dependent variable
community	developer categorization, community = 1 ; corporate = 0
project size	total number of turbines in the project
offshore	located offshore, yes = 1 ; no = 0
coast	located in a coastal municipality, yes = 1 ; no = 0

A3-1b	Municipal groups
Variable	Description
municipal group 1	Suburban municipalities
municipal group 2	Large cities
municipal group 3	Suburban municipalities to large cities
municipal group 4	Commuter municipalities
municipal group 5	Tourism and travel industry municipalities
municipal group 6	Manufacturing municipalities
municipal group 7	Metropolitan municipalities
municipal group 8	Municipalities in densely populated regions
municipal group 9	Municipalities in sparsely populated regions

A3-2 Regression variables: Municipal groups

Number of obs	4739
Number of clusters	1043
Obs per cluster: min	1
avg	4.5
max	314

Variable	Mean	Std. Dev.	Min	Max
approval	.8337202	.3723709	0	1
community	.1631146	.3695092	0	1
project size	36.26862	75.80649	1	314
offshore	(omitted)			
coast	.4159105	.4929303	0	1
municipal group 1	.0105507	.1021843	0	1
municipal group 2	.1331505	.3397731	0	1
municipal group 3	.0552859	.2285616	0	1
municipal group 4	.112682	.316237	0	1
municipal group 5	.1339945	.3406824	0	1
municipal group 6	.1323064	.3388593	0	1
municipal group 7	(omitted)			
municipal group 8	.1572062	.3640334	0	1
municipal group 9	.1040304	.3053322	0	1

Appendix 4: Regressions

A4-1a Probit: Municipal fixed effects

Log pseudolikelihood	-1015.8552	Number of obs	2197
		Wald chi2(62)	233.08
		Prob > chi2	0.0000
		Pseudo R2	0.2578

(Std. Err. adjusted for 576 clusters in ProjectID)

approval	Robust Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
community	1.266676	.2709374	4.68	0.000	.7356482	1.797703
project size	.0103132	.0150311	0.69	0.493	-.0191472	.0397737
offshore	0 (omitted)					
_cons	-.8012361	.3760529	-2.13	0.033	-1.538286	-.064186
Municipal fixed effects	Yes					

A4-1b Marginal effect of ownership (at means): Municipal fixed effects

	Delta-method dy/dx	Std. Err.	z	P>|z|	[95% Conf.	Interval]
community	.4121491	.0867145	4.75	0.000	.2421918	.5821065

A4-2a Probit: Municipal groups

Log pseudolikelihood	-1756.9568	Number of obs	4739
		Wald chi2(11)	97.73
		Prob > chi2	0.0000
		Pseudo R2	0.1760

(Std. Err. adjusted for 1043 clusters in ProjectID)

approval	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf. Interval]	
community	1.150519	.1689269	6.81	0.000	.8194287	1.48161
project size	.0066216	.0035293	1.88	0.061	-.0002957	.0135389
offshore	0 (omitted)					
coast	.1974528	.1791	-1.10	0.270	-.5484823	.1535767
municipal group 1	-1.329159	.4822063	-2.76	0.006	-2.274266	-.3840521
municipal group 2	-1.244022	.4113637	-3.02	0.002	-2.05028	-.4377643
municipal group 3	-2.022908	.4299387	-4.71	0.000	-2.865572	-1.180244
municipal group 4	-1.178016	.4321634	-2.73	0.006	-2.025041	-.3309916
municipal group 5	.7612584	.4081564	-1.87	0.062	-1.56123	.0387135
municipal group 6	-1.228764	.376624	-3.26	0.001	-1.966933	-.4905945
municipal group 7	0 (omitted)					
municipal group 8	-1.269136	.4022092	-3.16	0.002	-2.057452	-.4808208
municipal group 9	-.6794051	.5667428	-1.20	0.231	-1.790201	.4313903
_cons	1.873898	.3528289	5.31	0.000	1.182366	2.56543

A4-2b Marginal effects (at means): Municipal groups

	Delta-method dy/dx	Std. Err.	z	P>|z|	[95% Conf. Interval]	
community	.2378691	.0409272	5.81	0.000	.1576531	.318085
project size	.001369	.0006973	1.96	0.050	2.27e-06	.0027358
offshore	0 (omitted)					
coast	-.0408232	.03631	-1.12	0.261	-.1119894	.030343
municipal group 1	-.2748027	.0995401	-2.76	0.006	-.4698977	-.0797077
municipal group 2	-.2572007	.0877101	-2.93	0.003	-.4291095	-.085292
municipal group 3	-.4182348	.0890502	-4.70	0.000	-.59277	-.2436996
municipal group 4	-.243554	.0920914	-2.64	0.008	-.4240499	-.0630582
municipal group 5	-.1573896	.085483	-1.84	0.066	-.3249332	.0101539
municipal group 6	-.2540461	.0781192	-3.25	0.001	-.407157	-.1009352
municipal group 7	0 (omitted)					
municipal group 8	-.262393	.0851365	-3.08	0.002	-.4292576	-.0955285
municipal group 9	-.1404665	.1181447	-1.19	0.234	-.3720259	.0910929

Appendix 5: Variable correlation

A5 Correlation: Project specific variables

	community	project size	offshore	coast
community	1.0000			
project size	-0.1609	1.0000		
offshore	-0.0522	-0.0157	1.0000	
coast	-0.0684	0.2583	0.1262	1.0000

Appendix 6: Extended analysis

A6-1 Description of variables

Number of obs 45

Variable	Mean	Std. Dev.	Min	Max	Description
days	490.1778	195.1162	84	902	number of days between application and decision, dependent variable
community	.1555556	.3665289	0	1	developer categorization, community = 1 ; corporate = 0
project size	8.755556	5.515085	1	25	total number of turbines in the project
falkenberg	.2	.4045199	0	1	Falkenberg municipality
halmstad	.1555556	.3665289	0	1	Halmstad municipality
hylte	.2444444	.4346135	0	1	Hylte municipality
kungsbacka	.0666667	.2522625	0	1	Kungsbacka municipality
ljungby	.0222222	.1490712	0	1	Ljungby municipality
markaryd	.0444444	.2084091	0	1	Markaryd municipality
varberg	.1111111	.3178209	0	1	Varbeg municipality
year	2009.844	1.476414	2006	2012	year of application

A6-2a OLS regression: Municipalities

Number of obs	45
F(9, 35)	0.79
Prob > F	0.6306
R-squared	0.1681
Adj R-squared	-0.0458
Root MSE	199.53

Days	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
community	-141.1964	96.94045	-1.46	0.154	-337.9959	55.60321
project size	3.930981	6.744084	0.58	0.564	-9.760238	17.6222
falkenberg	129.7818	89.08714	1.46	0.154	-51.07469	310.6383
halmstad	19.98126	110.7715	0.18	0.858	-204.8969	244.8594
hylte	76.27183	81.07097	0.94	0.353	-88.31099	240.8547
kungsbacka	245.6414	138.6477	1.77	0.085	-35.8284	527.1111
ljungby	-186.17	223.5785	-0.83	0.411	-640.0585	267.7186
markaryd	-44.09952	165.0928	-0.27	0.791	-379.2558	291.0567
varberg	234.5387	118.3503	1.98	0.055	-5.725195	474.802
_cons	393.6761	72.67366	5.42	0.000	246.1407	541.2115

A6-2b OLS regression: Municipalities and year

Number of obs	45
F(10, 34)	0.69
Prob > F	0.7279
R-squared	0.1684
Adj R-squared	-0.0762
Root MSE	202.42

Days	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
community	-139.5506	99.96481	-1.40	0.172	-342.7036	63.60229
project size	3.937385	6.842052	0.58	0.569	-9.967337	17.84211
falkenberg	127.4704	93.81986	1.36	0.183	-63.19453	318.1353
halmstad	18.13025	114.1701	0.16	0.875	-213.8914	250.1519
hylte	75.50334	82.66948	0.91	0.368	-92.50125	243.5079
kungsbacka	247.2424	141.732	1.74	0.090	-40.79167	535.2765
ljungby	-188.8719	228.717	-0.83	0.415	-653.6808	275.9369
markaryd	-44.82737	167.6699	-0.27	0.791	-385.5737	295.919
varberg	234.7424	120.0838	1.95	0.059	-9.297152	478.782
year	2.162774	23.56418	0.09	0.927	-45.72539	50.05094
_cons	-3952.575	47353.97	-0.08	0.934	-100187.4	92282.27