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Do parties matter in proportional representation systems? A regression discontinuity analysis of environmental policy in Swedish municipalities

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Abstract: Proportional representation electoral systems can be considered more democratic than majoritarian systems since they better represent minority interests. We study the support for this claim by investigating whether individual parties are able to affect the outcome of a secondary policy, environmental policy. We employ a regression discontinuity design across multiple seat allocation thresholds in Swedish municipalities for the years 2010–2018 and measure environmental policy as an annual index compiled by an environmental journal. Our main finding suggests that a seat share increase of 1 percentage points (pp) for the Green Party increases environmental policy by 1.19 pp. This effect is indicated to be driven by the Green Party being included in the governing coalition, independent of the coalition composition. Our contribution to the public choice theory is two-fold. First, our results indicate that bargaining power can be increased by the mere inclusion in a governing coalition, independent of the type of coalition. Secondly, our results support the theoretical suggestion that parties can benefit from taking on more extreme policy positions when prioritising a well-established secondary policy. Additionally, we provide further empirical support to the existence of partisan effects in a proportional context.

Keywords: Partisan Effects, Environmental Policy, Proportional Representation Electoral Systems, Regression Discontinuity Design
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Contents

1 Introduction

It has been argued that proportional representation (PR) electoral systems can be more democratic than majoritarian systems (see e.g. Lijphart, 2012). The claim rests on the assumption that PR systems better represent the underlying voter preferences – by representing minority interests as well as majority interests. The central idea behind PR systems is that political party representation in the legislature should be proportional to the underlying vote shares. Contrarily, majoritarian systems aim to represent the majority of voters – generally by simply representing the party holding the majority of votes.[1](Lijphart, 2012)

By design, the two electoral systems are predicted to have different party compositions in the legislatures. PR systems foster a development of multiple smaller sized parties, a multiparty system, whilst majoritarian systems marginalise the development of small parties and typically result in a system with two larger parties, a two-party system (Duverger, 1954). For PR systems, however, this means that parties usually need to form majority coalitions in order to decide on policy (see e.g. Ansolabehere et al., 2005; Carroll & Cox, 2007). In such coalitions, it has been argued that the preference of large parties tend to dominate that of the smaller parties (Dahl, 1956). It is thus not clear to what extent small parties can affect the policy decided on – hereafter referred to as policy outcomes – in PR systems. Parties being unable to affect policy outcomes is in line with the canonical public choice theory: the Median Voter Theorem (Black, 1948). This theory suggests that policies offered by parties – hereafter referred to as policy platforms – are predicted to converge in both PR and majoritarian systems. Specifically, policies are expected to converge to match the preferences of the median voter (Downs, 1957).[2] When such convergence is represented in the policy outcomes, we refer to it as the lack of a partisan effect.

In order to evaluate the partisan effect in PR systems, we want to study a policy that represents the interests of small parties. This, since the existence of small parties is one of the main distinguishing feature of PR systems compared to majoritarian systems, as well as that they, by the nature of their size, can be argued to represent a minority interest (see e.g. Duverger, 1954; Lijphart, 2012). These parties tend to be focused on a single issue – hence also referred to as single-issue parties (see e.g. Kitschfelt, 1989; Rohrschneider, 1993). Additionally, in contrast to the typically larger traditional parties, positioned on the left- versus right-wing spectrum, small single-issue parties generally focus on other policy issues – considered to be secondary policies (see e.g. Folke, 2014; List & Sturm, 2006; Rohrschneider, 1993).

Following this, we seek to study a secondary policy outcome. For this purpose, we choose environmental policy, since it is one of the more well-established secondary policies – represented in many PR systems since the late 1900s (Kitschfelt, 1989). Additionally, it is an area that has gained considerable political interest during the past decade, implying that it is also currently an important policy area to voters (see e.g. Ripple et al., 2020; Turner & Clifton, 2009).

Previous research suggests that the political influence of a party in a PR electoral system

[1]Majoritarian systems can also be referred to as plurality-rule systems.

[2]For PR systems as a multiparty system with coalition forming, policy platforms are predicted to converge within coalitions (Downs, 1957).

is positively associated with its legislative representation and probability to be part of the governing coalition (see e.g. Banzhaf, 1965; Lipset & Rokkan, 1967). Thus, this implies that whilst small single-issue parties may be proportionally represented in the legislature, their impact on policy outcomes might be highly dependent on their bargaining power (see e.g. Strom, 1990a). The theoretical predictions regarding small parties with a focus on a secondary policy issue are, however, not univocal. On the one hand, large parties holding less extreme policy positions are more likely to be included in the governing coalition (see e.g. Austen-Smith & Banks, 1988; Freier & Odendahl, 2015). On the other hand, small parties included in the governing coalition could have possibilities to trade support on their secondary policy issue in exchange for supporting large parties on their traditional primary policy issue (see e.g. Folke, 2014). This discussion leads to our research focus, consisting of one main question and a follow-up question: Is there a partisan effect on secondary policies in PR systems? If so, is this effect driven by governing coalitions?

Studying partisan effects introduces substantial endogeneity issues, given that voter preferences are likely to affect the elected parties as well as the policy outcomes. We therefore choose to employ one of the main methods able to provide causal estimates of the partisan effects: a Regression Discontinuity (RD) design (Lee et al., 2004). Using this approach, causality can be claimed by exploiting the source of exogenous variation provided by the seat allocation thresholds. Studies using this method to examine partisan effects are mostly carried out in the majoritarian context and on primary policy issues (see e.g. Besley & Case, 1995; Fredriksson & Wang, 2019; Leigh, 2008). The corresponding studies in a PR context tend to simplify the party structure into coalitions (see e.g. Bernard, 2017; Lakomaa & Korpi, 2014; Pettersson-Lidbom, 2008). To our knowledge, the only study employing this methodology to evaluate the individual partisan effect on a secondary policy in a PR system is Folke (2014). While this study finds a partisan effect on secondary policy outcomes, it is not investigated whether this is affected by governing coalitions.

To study our research questions, we employ the method for identifying the causal effect of individual parties in a PR system developed by Folke (2014). More specifically, we perform an RD design over the seat allocation thresholds in the legislature. We choose to study Swedish municipalities, for which the motivation is two-fold. First, Sweden has 290 municipalities setting environmental policy more or less independently. As such, the setting provides a significant number of governments to study and a great degree of variation in the environmental policy across municipalities. Secondly, as opposed to cross-country studies, all legislatures adhere to the same institutional framework which implies that environmental policy outcomes and political parties are more comparable across legislatures. The environmental policy outcome in Swedish municipalities is measured based on the annual index compiled by the environmental journal *Aktuell Hållbarhet*. We choose the time frame of the election years 2010, 2014 and 2018 to provide the most current implications possible.

Our main finding is that the Green Party seems to have a positive effect on environmental policy of 1.19 percentage point (pp) for a 1 pp increase in seat share, statistically significant at the 5% level. A part of this effect is indicated to be driven by the inclusion of the Green

Party in the governing coalition. We contribute to the public choice theory in two main ways. First, our findings indicate that bargaining power of a small party can be increased by the mere inclusion in a governing coalition, independent of the type of coalition (see e.g. Strom, 1990a). Secondly, our results support the theoretical suggestion that, when prioritising a well-established secondary policy, parties can benefit from taking on more extreme policy positions (see e.g. Duch et al., 2010; Kedar, 2005). Additionally, our findings contribute further empirical support to the results of Folke (2014), by studying a more recent time frame and using a different environmental policy index.

Our findings also have important institutional implications. The main implication for policymakers is that a PR electoral system can support the claim for why they can be considered more democratic. This is however indicated to be dependent on the proportionality of the seat allocation method – it is thus important for policymakers to consider this when designing the electoral system. From the perspective of voters, the findings are also important as they imply that a vote for a secondary policy, despite being represented by a small party, does have an impact. The implications are especially strong for voters who prioritise environmental policy. Additionally, given that governing coalitions are found to be one of the drivers of this effect, voters should consider the probability for their preferred party to be included in the governing coalition for their possibilities to have an impact on policy.

The structure of this thesis will be as the following. First, we review previous research within the fields of partisan effects and environmental policy. Secondly, we present the theoretical framework to provide theoretical expectations. Thirdly, we present the background to the institutional context of Swedish municipalities. Following this, we present the method and thereafter describe the structure and the characteristics of the data. In the results section following, we first evaluate the robustness of the approach and then present our main results. The results section furthermore includes a number of sensitivity analyses as well as an investigation of potential mechanisms behind our results. Thereafter, we relate our results to previous research as well as discuss policy implications. Lastly, we conclude our findings, contributions and suggest areas for future research.

2 Previous research

This section reviews previous research and is divided into three main parts. Each part contains a brief theoretical introduction followed by a review of empirical findings. First, we present findings related to partisan effects on general policy outcomes. Secondly, we turn to environmental policy as an outcome. Thirdly and lastly, we review the research related to our topic of focus: partisan effects on environmental policy.

2.1 Partisan effects on general policy outcomes

We begin by presenting the findings of partisan effects on general policy outcomes mainly focusing on the traditional policy dimension – namely economic outcomes such as tax rates and government spending. To understand why it is important to study partisan effect in the first place, we begin by presenting theories of policy convergence. Having established this, we then turn to a review of the empirical findings in majoritarian and in PR electoral systems, respectively. The empirical findings are mainly focused on studies employing an RD approach, for comparability reasons as well as empirical advantages.

2.1.1 The theory of policy convergence

Although parties can appear to offer diametrically different policy platforms, there is a large body of theoretical support for that the final policy outcome decided upon is not expected to differ between governments ruled by different parties. This is referred to as *policy convergence*, or alternatively, it could be said that there is no *partisan effect* on policy (see e.g. Fiva et al., 2018). One of the bedrock theories within the public choice literature is the *Median Voter Theorem* (MVT), first formulated by Black (1948). The theory predicts that in a two-party context, the policy platforms of the parties will converge to the preferences of the median voter. For systems with more than two parties, the opposite is generally predicted: *policy divergence* (Downs, 1957). The extent of convergence or divergence depends on the number of parties as well as the distribution of voter preferences (Downs, 1957). A greater number of parties and more dispersed voter preferences, are predicted to be associated with more diverging policy platforms. Moreover, parties in a PR system typically form coalitions in order to hold power in government (Downs, 1957). Taken together, while individual parties might offer or promise more divergent policies in the PR context, policy outcomes are predicted to converge within the coalitions. In the PR electoral system, the prediction is then that policy convergence occurs when there are two coalitions, whereas policy divergence occurs when there are three or more possible coalitions. We present a more thorough discussion of the formation of coalitions in Section 3.

The MVT has however been criticised for lacking empirical support in real-life applications (Besley & Case, 2003). A possible explanation for this could be that one of the fundamental assumptions for the MVT is that there is only one policy dimension (Black, 1948). As supported by for instance Taylor and Laver (1973) and Kitschfelt (1989), it is likely that there are multiple policy dimensions, including environmental policy issues. A strand of literature with more elaborate assumptions compared to the MVT is the one of probabilistic voting

models. General predictions of such models, however, differ depending on the basic assumptions of voter behaviour. On the one hand, in two-party and multiparty models presented by Enelow and Hinich (1989) and Lin et al. (1999) policy convergence is predicted, based on that voters are uncertain about the behaviour of political candidates. On the other hand, the multiparty model by Merrill and Adams (2001) predicts policy divergence, based on that voters take into account the behaviour of candidates from past elections as well as non-policy factors such as sociodemographic characteristics and party identification.

2.1.2 Majoritarian electoral systems

The studies in a majoritarian system are mainly from the US context and focus on economic policy outcomes, such as tax rate and government spending. One of the fundamental studies in the area is Lee et al. (2004), which investigates policy outcomes in the US House through an RD approach on majority thresholds. Lee et al. (2004) finds support for a partisan effect, and synonymously, policy divergence. These findings hence contradict the MVT prediction of policy convergence in a two-party system. Other studies finding support for a partisan effect include Besley and Case (1995), showing that expenditure per capita is higher when Democratic governors hold office, as well as Beland (2016), showing that Democratic governments spend more on education, health care and public safety compared to Republican governments. Contrarily, Ferreira and Gyourko (2009) do not find any partisan effect when studying factors such as local public spending. Although plenty of studies find support for partisan effects, some findings suggest that policy differences between parties are in fact quite negligible (see e.g. Leigh, 2008).

2.1.3 PR electoral systems

The studies carried out in PR systems also tend to focus on studying economic outcomes, and the findings are similar to that of majoritarian systems. Due to the importance of coalition formation in PR systems, however, several studies investigate this factor. Employing an RD design on the legislative majority threshold, by using a similar methodology as Lee et al. (2004), Pettersson-Lidbom (2008) finds support for a partisan effect on economic outcomes in Swedish municipalities. More specifically, the results show that municipal left-wing governments in Sweden spend and tax more as well as have lower unemployment rates than the right-wing equivalent. However, Lakomaa and Korpi (2014) criticise Pettersson-Lidbom (2008) for using a set of predetermined coalition groups – based on the coalitions set on the national level – rather than using data on the actual governing coalitions on the municipal level. Arguing that the results of Pettersson-Lidbom (2008) leads to systematic bias, Lakomaa and Korpi (2014) replicate the study and incorporate data on governing coalitions on the municipal level. Their results support that there is a partisan effect on government revenue and spending, although not on differences in tax rates. By comparing single-party governments to coalition governments in PR electoral systems, other studies in the field give implications on whether a combination of smaller parties can have a different impact under the ruling of one large party (Artés & Jurado, 2018; Bernard, 2017; Persson et al., 2007). Findings from these studies suggest that, while having more parties governing in the legislature seems to have an effect on

economic outcomes, the direction of this effect can differ depending on the context studied.

Furthermore, Folke (2014) criticise both the approach of Pettersson-Lidbom (2008) and Lakomaa and Korpi (2014) for simplifying the PR system into a two-party system with two blocs. Studying Swedish municipalities, Folke (2014) estimates the effects of individual parties and does not find a significant effect on tax rates. Folke (2014) does, however, find a significant (negative) effect for a nationalist party on immigration policy. This can arguably be connected to the case of a single-issue party having a partisan effect on their secondary policy of focus. Similar results for primary policies have been found in studies conducted in other European countries. Fiva et al. (2018) study Norwegian municipalities and show that increased representation of the left-wing government has no effect on local public goods provision, yet does have a significant effect on property taxation and spending on child and elderly care. As for other parties than left- and right-wing parties, Palguta (2019) finds that increased representation of local parties in Czech Republic governments affects public procurement spending. Additionally, Freier and Odendahl (2015) study German municipalities and find partisan effects on tax policies for the centre-left party – associated with lower taxes – and the green party – associated with higher taxes. Taken all together, there seems to be a partisan effect in certain policy areas in PR electoral systems as well. Overall, the main difference for the effect in PR compared to majoritarian electoral systems seems to be that smaller parties, not primarily aligned on the left- or right wing dimension, can have a partisan effect on general policy outcomes as well.

2.2 Environmental policy as an outcome

Since we study environmental policy as the outcome, it is important to assess the characteristics which are specific to this type of policy compared to other policy outcomes, such as economic outcomes discussed above. We first present the role of environmental policy in the public choice theory. Thereafter, we present the factors that are expected to affect the preference for environmental policy amongst voters.

2.2.1 Environmental policy in the public choice theory

Before reviewing the implications of studying environmental policy outcomes, we should define two key concepts: public goods and externalities. *Public goods* are defined as goods that in their nature are non-excludable – not possible to exclude people from using – as well as non-rivalrous – the usage of one individual does not decrease the possibility for another individual (Varian, 1992). *Externalities* are defined as costs imposed, or benefits conferred, on other actors that are not taken into account in the function of the decision-making actor (Pigou, 1932). That is, it is not considered in the production function of the firm or the utility function of the individual when deciding on an action. *Negative externalities* relate to the externalities leading to that costs are conferred, such as the societal costs from the adverse effects caused by a polluting factory. In the context of the environment, environmental externalities are commonly referred to as negative externalities on environmental quality, such as clean air. These externalities are generally defined as a quantity of polluting substances such as CO_2 emissions. Although this is arguably a major source of degradation of the environmental *quality*, it might not be

perfectly applied to a broader definition of environmental *policy*. As noted by Arrow et al. (1995), to improve environmental sustainability, it is important to consider inputs such as environmental resources and outputs such as waste products.

Having defined these two concepts, environmental policy can be defined as a public good provided by the government in order to correct for negative externalities.[3] The aim of environmental policy to maximise welfare from the point of view of the society. (McLean, 1987) The issue of externalities relates to the specific factor being external to the function of the decision maker. Had the externality factor been internalised, the market would have been expected to provide an efficient resource allocation. Although different ideologies have different perceptions with regard to what extent the state should be organised by the government versus the market, environmental externalities are argued to require internalisation through government's interference since they, per definition, cannot be internalised by the market (Baumol & Oates, 1975; McLean, 1987; Pigou, 1932).[4] This is one of the fundamental differences of environmental policy compared to other policies, which has implications for how parties and voters assess and deals with this topic. We elaborate on the latter in the following part.

2.2.2 Environmental policy and voter preferences

Although theorists argue that the government should be involved to correct for environmental externalities, voters have different preferences for the level of environmental policy which can influence the final outcome. In this subsection, we discuss a set of factors which affect voters' perceived importance of environmental policy, based on theoretical and primarily empirical evidence.

As for theoretical findings, income is a commonly mentioned factor influencing the perceived importance of environmental policy. One such theory is the Environmental Kuznets Curve (EKC) – an inverted U-shaped relationship between economic development and environmental quality deterioration (Yandle et al., 2002). As such, the theory suggests that environmental quality deteriorates with rising national income up until a point when the reverse relationship is true. These effects are furthermore supported by the theory of Baumol and Oates (1975), ascribing environmental policy a "luxury good" status. This, since the preference for environmental policy is likely to vary with income – with the upper-income groups demanding more environmental policy compared to the lower-income groups.

Reviewing the empirical findings in the area, the main determinants can be categorised into four groups: population features, environmental conditions, economic factors and political factors (Facchini et al., 2017). Examples of studies finding that population features are important include Franzen and Meyer (2010) and Aklin et al. (2013), showing that the public demand for environmental policy is predicted to decrease with a greater share of older inhabitants and increase with population density. In terms of environmental conditions, environmental degradation has been found to be positively related to the societal level of

[3] Although there is a discussion to what extent environmental policy is a public good, there is no other commonly used definition of a good that is deemed more appropriate (Baumol & Oates, 1975).

[4] The discussion of whether externalities in general should be internalised by the government is not univocal. Yet, such solutions are in general not well-suited for environmental externalities given the dispersed property rights. (see e.g. Coase, 1960)

concern for the environment (see e.g. Dunlap & York, 2008). One of the economic factors mentioned is the level of economic wealth in the society, which exhibit a positive association with environmental policy issues (Arrow et al., 1995; Franzen & Meyer, 2010). While these results are in line with the EKC, it should be noted that the EKC concerns environmental quality and not environmental policy.[5] Additionally, political preferences for environmental concern have shown to be negatively related to low economic growth, high unemployment and high income inequality (see e.g. Boyce, 1994; Kirchgässner & Schneider, 2003).

2.3 Partisan effects on environmental policy

Having established the foundation for partisan effect as well as the distinguishing features of environmental policy, we in this part connect the two to form an understanding of how different parties can affect environmental policy. As established in Section 2.1, the distribution of voter preferences is expected to affect how parties position their policy platforms. In this part we first present theoretical expectations of party preferences for environmental policy. We secondly present the empirical findings of how this affects the environmental policy outcomes by different parties, or coalitions.

2.3.1 Expectations of environmental policy party preferences

Although the aim of environmental policy is to enhance welfare for society as a whole, it has a long time frame, which implies that discrete costs and benefits are imposed on different groups (King & Borchardt, 1994; N. Stern, 2007). In simple terms, improving environmental quality is typically a long-term project that has positive net benefits for everyone in the long-run, yet in the short-term some actors have to bear the costs of introducing it. Given the long time frame, it is likely that the actors bearing the costs are not able to ripe the benefits conferred (N. Stern, 2007). As a consequence, parties with different ideologies catering to voters with different preferences, are expected to prefer different degrees of environmental policy. Taken all together, the preferred level of environmental policy intervention for a party in the current time frame can either be due to different views on the level of redistribution – which can be linked to the position on the left- and right-wing dimension – or due to its positioning on the environmental dimension – which can be unrelated to their position on the left- and right-wing dimension.

We begin by presenting the expected relationship between the traditional policy dimension of the left- versus right-wing ideology and preference for level of environmental policy (see e.g. Pettersson-Lidbom, 2008). There is a relatively large body of support for that environmentalism tends to be positively correlated with the left-wing ideology (see e.g. Kitschfelt, 1989; Neumayer, 2004). This relation can be summarised into two main factors. First, stricter environmental policies require more government involvement and introducing more restrictions on the market and private actors – something that left-wing parties are more inclined to introduce than right-wing parties (Buttel & Flinn, 1976; Chang & Berdiev, 2011; King & Borchardt, 1994; Potrafke, 2010). Secondly, left-wing parties are more inclined to present stricter environmental

[5]The empirical evidence for the EKC on environmental quality are inconclusive, where most findings are mainly based on air quality measures and on industrial countries (Dinda, 2004; D. Stern, 2004).

policy to protect their largely supporting group of working-class people, which are argued to be more vulnerable to environmental degradation compared to higher-income groups (Lamla, 2009; Neumayer, 2003; Wen et al., 2016).

2.3.2 Empirical findings of partisan effects on environmental policy

Reviewing the empirical findings of partisan effects on environmental policy, we note that most studies are performed on the cross-country level. The findings carried out in both majoritarian and PR systems generally lean towards that there is a partisan effect (see e.g. Carter, 2013; Facchini et al., 2017; Garmann, 2014; King & Borchardt, 1994; Lim & Duit, 2018; Neumayer, 2004; Tobin, 2017; Wen et al., 2016). Some studies, however, show no or a limited effect (see e.g. Aidt et al., 2018; Fankhauser et al., 2015; Holzinger et al., 2008). Worth noticing is that many study the effect on environmental quality rather than on the environmental policy. The general findings suggest a positive relationship between left-wing party representation and environmental quality or stringency of environmental policy (see e.g. Facchini et al., 2017; King & Borchardt, 1994; Neumayer, 2004; Wen et al., 2016).

There are arguably issues with studying partisan effects on the cross-country level, given that there is a large variation of the political parties and preconditions for environmental outcomes. Also, the lack of comparability introduces difficulties in estimating the effect of an individual party. Apart from issues introduced by studying the cross-country level, many of the above mentioned authors claim to investigate association rather than the causal effect. Turning to studies aiming to capture the causal effect from a country-specific context, we begin by presenting findings from a majoritarian context – mainly based on the RD design introduced by Lee et al. (2004). For instance, Fredriksson and Wang (2019) find that Republican governors are on average more supportive of enforcing environmental policies than their Democratic counterparts. Beland (2016), however, finds that Democratic governors cause lower pollution levels. A distinguishing feature of environmental policy in the US system is the influence of political lobbying, for which the findings suggest that environmental lobby groups have an impact on environmental policies (see e.g. Cropper et al., 1992; Riddel, 2003).

Disentangling the difference between the majoritarian and PR context in this case, one of the distinguishing features of the PR electoral system is the opportunities for green parties to rise (Paehlke, 1989). The success of green parties is shown to be facilitated if there is an unresponsiveness of the existing parties to address the environmental questions (Kitschfelt, 1989). Following we present some examples of studies carried out in PR systems. Ashworth et al. (2006) study Flemish municipalities and finds that coalition governments are more likely to implement environmental taxes than single-party governments, for which left-wing coalitions show a stronger effect. On the note of the impact of coalitions, Sjöberg (2016) finds that environmental law enforcement is stronger when the Green Party is included in the governing coalition in Swedish municipalities.[6] To our knowledge, there is only one study that aims to measure the causal effect of individual partisan representation – of green parties as well as other parties – on environmental policy in a PR system. This is the study by

[6]The study by Sjöberg (2016) employs a Differences-in-Difference design as well as an IV approach in Swedish municipalities for the years 2003–2010.

Folke (2014), who performs an RD design to investigate partisan effects on environmental policy on the local governmental level for the time period 1993–2001. The results show that increased representation of the Green Party has the largest positive and significant effect on the environmental policy carried out in Sweden. However, Folke (2014) does not investigate if the partisan effect could be affected by the governing coalition. Based on the results of Sjöberg (2016) presented above, this might be an important mechanism behind the individual partisan effect.

3 Theoretical framework

This section outlines the theoretical framework employed for studying the partisan effect. First, we present the theoretical setting. Secondly, we discuss the theoretical framework in our context. We have chosen to adopt the conceptual framework used by Fiva et al. (2018). The main theoretical difference compared to our study is that we investigate a secondary policy, and not a primary policy. We present elaborations of this difference in the second part.

3.1 Theoretical foundation

This part reviews the underlying setting and assumptions for the theoretical framework by discussing two main concepts in the sequential order: the supply and demand of public goods as well as the role of political parties.

3.1.1 The supply and demand of public goods

The public choice literature can be described as the application of economics to political science. Public choice models generally seek to explain how public goods are supplied and demanded in the market represented by the government. The theory adhere to the neoclassical framework and the fundamental assumptions are that agents are rational and utility maximising (Buchanan & Tullock, 1962; Stretton & Orchard, 1994).[7] A public choice model in the context of legislation can be described as the following (see Stigler, 1971). There are citizens who demand laws, for instance the supply of a certain public good, and political actors who control the supply-demand process (see Tollison, 1988). Comparing the political context, labeled as the democratic market, to the economic market, voters can be regarded as consumers with a demand for a policy, and parties and politicians can be regarded as firms or entrepreneurs who provide different policies (Fiva et al., 2018; McLean, 1987; Strom, 1990a). The policy outcome in this market is determined by demand – based on voter preferences – and supply – based on policy platforms. The final equilibrium is set based on market clearing expectations and the strategic coordination by voters and politicians in the electoral system (Cox, 1997). Voters can affect policy outcomes directly by voting for a certain party (see e.g. Lee et al., 2004), or indirectly by signalling their preferences to parties such that they adjust their platforms towards these preferences (see e.g. Downs, 1957).[8] Since we are interested in studying the partisan effect, we will continue to present the assumptions for political parties more in-depth below.

3.1.2 The role of political parties

In understanding the behaviour of political agents, there are three major theories with different assumptions about the specific interests of parties (Strom, 1990a). While these theories are mainly designed to give implications in two-party systems, they can be extended to be applicable to multiparty systems. First, Downs (1957) assumes that parties are only interested

[7] As mentioned in Section 2.2.1, environmental policy can be classified as a public good (Baumol & Oates, 1975).

[8] An example is that a greater vote share for the green party can signal greater environmental concern, for which the other parties could adjust to.

in winning the election, and not about political ideology. Therefore, it is the aggregate voter preferences which determine the policy outcomes and hence parties are expected to converge at the preferences of the median voter. This assumption has, however, been criticised. In addition to the concerns raised in Section 2.1, it has been theoretically criticised for leaving out the supply-side mechanism (Holcombe, 1989).[9] Following this, two contrasting assumptions with regard to the behaviour of parties in the MVT framework argues that parties might have other interests than simply winning the election. Wittman (1983), on the one hand, assumes that political parties have an interest in winning the election as well as setting policy in line with their preferences. Riker (1962), on the other hand, assumes that parties seek to maximise their control, or power, in the elected legislature.

A study by Alesina (1988) takes these theories one step further and presents a model which assumes that politicians might present a policy platform that they do not necessarily follow once elected. In line with Downs (1957), parties are assumed to adapt their platforms to voter preferences in order to win votes; and in line with Wittman (1983), parties are assumed to have their own political agenda. As a consequence, based on that parties have political preferences, Alesina (1988) predicts divergent policy outcomes.

3.2 Theoretical findings

Having presented the important elements for the theoretical setting, we now discuss the implications for our context of a PR system. The theoretical findings are first presented through the conceptual framework of the power of parties to affect policy outcomes in PR systems. Thereafter, we summarise the implications for our specific context of study.

3.2.1 Partisan ability to affect policy outcomes

According to Fiva et al. (2018), parties can affect policy in three main ways. First, parties can adjust their policy platforms. Secondly, parties can exert influence on policies through increasing their legislative representation. Thirdly, parties can increase their bargaining power in the decision-making processes of the final policy outcomes. These three are discussed below in the same order.

Policy divergence

The first way in which parties can affect policy outcomes is by adjusting their policy positions in relation to the other parties. Fiva et al. (2018) argues that divergence of policy platforms is a fundamental condition for a partisan effect to exist. Setting the interests of parties aside, this relationship implies that parties hold their policy platforms even after being elected. Indeed, although research does not show univocal prediction,[10] there is both strong theoretical and empirical support for that party platforms diverge in multiparty systems (see e.g. Merrill & Adams, 2001).

[9] For instance, Niskanen (1971) and Romer and Rosenthal (1978) employ the MVT framework for the demand side and models a budget-maximising agent on the supply side to explain how the supply side can influence the decisions of voters.

[10] See for instance studies by Enelow and Hinich (1989), Coughlin (1992) and Lin et al. (1999) investigating the spatial equilibrium with probabilistic voting in two-party and multiparty systems including both one or several policy dimensions.

Further, given that voters are aware of that a bargaining process takes place in PR systems, parties can benefit from taking on more extreme policy positions (Duch et al., 2010; Kedar, 2005). This is also shown in a model of a secondary policy, which specifically tests the assumptions on environmental policy (Roelfsema, 2007). In the model, voters are shown to have incentives to elect political representatives with a stronger preference for environmental policy than themselves, given that the median voter cares enough about the environment. Hence, a PR context could imply further divergence of policy platforms, which in turn strengthens the expectation of a partisan effect.

Partisan representation

The second step in which parties can influence policy outcomes is by increasing their legislative representation (see e.g. Lipset & Rokkan, 1967). This representation is determined through the process of converting vote shares into seat shares. To recall, PR systems, as opposed to majoritarian systems, allow representation of a broader range of voter preference in terms of representing a variety of parties, including small single-issue parties (Lijphart, 2012). Shifts in voter preferences can thus be expected to have a stronger effect on partisan representation, and hence policy outcomes. In addition, given that voters make decisions based on the policy platforms presented, parties can alter their policy platforms in order to attain legislative representation. It has furthermore been theorised that the aggregate policy preferences of parties determine the policy outcomes (Fiva et al., 2018). As such, assuming party coalitions are not binding, a change in the representation of a party will affect the position of the median party, which in turn sets the policy outcome (Strom, 1990b). This implies that, regardless of its size, the median party can be crucial for determining the final policy outcome.

Decision-making processes

Once parties have been elected into the legislature, the last step in which parties can affect policy outcomes is through the decision-making and bargaining processes. This can be understood as the process of which seat shares are converted into bargaining power weights. In line with Riker (1962) and Wittman (1983), we can assume that parties at this stage seek to implement their policy platforms, or alternatively maximise their control. Naturally, to have a partisan effect on policy outcomes, parties must possess the power to pursue their agendas. The theoretical implications are that the seat shares of parties are not necessarily equal to their policy influence in PR systems (Strom, 1990a). Taking this into account, the power of parties is often assumed to be determined by their probability to take part of the governing coalition.

Some theories argue that the size of the party matters for the level of its bargaining power. For instance, the influential theory known as Gamson's Law, predicts that the expected payoff of parties will be proportional to their seats in the governing coalition (Browne & Franklin, 1973). Lijphart (2012) seeks to explain the power of parties through assessing theories of different types of possible coalition formations. One commonly applied method is put forward by Riker (1962), which predicts that the winning coalition will be the smallest combination of the parties necessary to attain a majority status. However, minority coalitions can also be formed, including merely one or several parties. In the minority coalition context, the ruling party, or parties, seeks legislative support from other parties separately for different policies

(Strom, 1997). A way to systematise the ability for a party to take part in a winning coalition is to employ power indices. For instance, the Banzhaf index gives higher bargaining power to parties who are more likely to have hold a swing-vote position (Banzhaf, 1965). However, such indices have been criticised for applying predetermined decision rules as well as assuming that all different coalitions are possible, although not necessarily equally likely, regardless of policy position (Strom, 1990a). Taken all together, the predicted power of a party is highly dependent on which conditions coalitions are expected to be formed upon. However, in most applications, the size of the parties do not seem to be of most importance.

Furthermore, the influence of a particular party is determined through a bargaining process (Strom, 1990a). As such, the bargaining power of parties will be decisive for the final political outcomes. An important institutional determinant is that when there is a greater variation of policy dimensions represented, vote share weights become closer to bargaining weights (Strom, 1990a). In order to further understand which coalitions are most likely to be formed and the payoffs of each party, non-cooperative game theoretic models of bargaining have been presented (Ansolabehere et al., 2005). Employing such models, Baron and Ferejohn (1989) and Snyder et al. (2005) expect the party proposing the coalition to have greater bargaining power.[11] Austen-Smith and Banks (1988) extends this framework to include the voting process – determined by strategic voting on policy outcomes – in addition to the bargaining process – determined by the seat shares and policy platforms of parties. Austen-Smith and Banks (1988) and Snyder et al. (2005) both assume that the party proposing the coalition is not random, seeing that larger parties are more likely to propose. While most theories tend to focus on primary policy outcomes, List and Sturm (2006) additionally considers the influence of secondary policy outcomes, with a focus on environmental policy, in the bargaining process. Although the model is presented in a two-party setting, it has interesting implications for the multiparty setting (Folke, 2014). When voters are presented with the opportunity to choose between several parties, secondary policy preferences can affect the decision taken by the voter. This is because a multiparty system allows political parties to attract voters with strong preferences for their secondary policy choices. As a consequence, the legislative representation of small parties becomes increasingly important for predicting bargaining power in PR systems (Folke, 2014).

3.2.2 Summary of theoretical implications in our context

The baseline theories are set out in a two-party system with a one-dimensional policy space. When adding multiple parties, policy dimensions and policy positions, generalisations of the outcome are difficult to predict (see e.g. Strom, 1990a). Additionally, the specific institutional structures are important in determining the final outcome. With this said, we can draw some overall conclusions on the predicted power of parties within PR systems from the theoretical review above. In terms of the size of the party, there is both research suggesting that large parties are predicted to have greater influence (see e.g. Austen-Smith & Banks, 1988; Browne

[11] Baron and Ferejohn (1989) and Snyder et al. (2005) present non-cooperative game theoretic models of bargaining taking into account the existence of multiple election rounds. The findings of bargaining power are contingent on that the parties are elected.

& Franklin, 1973; Snyder et al., 2005), yet also that there is potential for small parties to exert important influence (see e.g. Lijphart, 2012; List & Sturm, 2006; Roelfsema, 2007). Others, however, predict that the absolute size of a party does not matter and places greater importance on the relative size and policy position of party – for its possibilities to be included in the winning coalition – given that coalitions are not predetermined (see e.g. Austen-Smith & Banks, 1988; Banzhaf, 1965; Riker, 1962; Strom, 1990a). Here, it has been argued that the median party of the primary policy dimension has important influence (see e.g. Strom, 1990b). In this case, for parties focusing on a secondary policy, their position on the primary policy can be important for determining their power. Whether parties can gain power by taking on more extreme policy positions is not clear. On the one hand, Snyder et al. (2005) and Freier and Odendahl (2015) claims that small parties as well as parties taking on more extreme policy preferences are more costly to include in a coalition. On the other hand, it has been shown that parties can increase their vote shares by taking on more extreme policy positions (Duch et al., 2010; Kedar, 2005).

4 Context of Swedish municipalities

Adapting the study to our context, Swedish municipalities, there are two main elements we need to consider. The first is the political climate in Sweden, with focus on the context of municipal elections. The second is the institutional structure and characteristics of the municipalities. These are presented in the same order below. Since we study the partisan effect on environmental policy, we direct additional focus on environmental issues and the Green Party in Sweden.

4.1 Political climate

Municipal governments in Sweden adhere to the electoral rule of proportional representation. This provides possibilities for multiple parties with different policy offerings to arise. The eight main parties which are most commonly represented in the municipal legislatures are also the ones that are represented on the national level. These parties are the following: the Social Democrats (S), the Left Party (V), the Conservative Party (M), the Centre Party (C), the Liberal Party (L), the Christian Democrats (KD), the Green Party (MP) and the Sweden Democrats (SD). Additionally, a few municipalities have significant representation of local parties only existing in the own municipality.[12] These are collectively referred to as Other Parties (O). The parties are henceforth interchangeably referred to as their name in English or as the abbreviation of the Swedish name displayed within brackets.

4.1.1 Coalitions

As is the case in PR electoral systems, the parties most often enter into coalitions in order to reach representational majority. In Sweden, coalition forming on the municipal level differs somewhat from on the national level, in which the governing coalition is generally formed with either left- or right-wing parties. Based on the data from Swedish Association of Local Authorities and Regions (SKR) (Kullander & Langlet, 2020) on governing coalitions on municipal level, four groups of coalitions are defined, presented in Table 1 below.

Table 1: Structure and statistics of governing coalitions

Coalition	**Right-wing**	**Left-wing**	**Mixed**	**Other**
Main parties	Conservative Party (M) Centre Party (C) Liberal Party (L) Christian Democrats (KD)	Social Democrats (S) Left Party (V)	Parties from left- and right-wing	Other Parties (O)
Frequency (n)	363	247	254	6
Frequency (%)	41.7%	28.4%	29.2%	0.7%
MP incl. (n)	85	110	92	0

Notes: Table presenting the governing coalition groups based on the definition and data of the Swedish Association of Local Authorities and Regions (SKR) for the election years 2010, 2014 and 2018. "MP incl." refers to the number of times the governing coalition includes the Green Party (MP).

Table 1 shows that a majority of the governing coalitions are either a left- or a right-wing

[12] An example of a local party is Lidingöpartiet, which received 13,64% of votes in the 2018 municipal election in Lidingö (a suburb to Stockholm) (Swedish Election Authority, 2019).

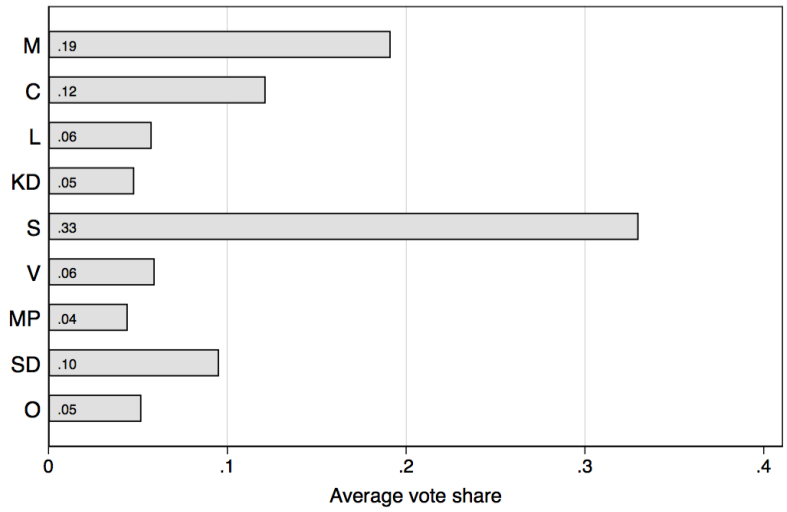
coalition. However, as much as thirty percent of the coalitions are made up of a mixed coalition, including both left- and right-wing parties. As opposed to the other main parties, the Green Party (MP) and the Sweden Democrats (SD) are not defined into either the left- or the right-wing coalitions. Focusing on the Green Party, which is represented in the governing coalition roughly 30% of the time, the left-wing coalition is the most common coalition for the party to be included in (about 40% of the time). However, MP is more likely to be part of another coalition – right-wing coalition or mixed coalition together (about 60% of the time). This supports the fact that the Green Party can be considered as a single-issue party with environmental policy as its primary policy preference. Additionally, the Sweden Democrats, often included in the category of (Western) European new radical right-wing populist parties (Strömblad & Malmberg, 2016), is mainly part of governing coalitions together with the Other Parties (O). Thus, this party can also be considered as a single-issue party with immigration policy as its primary policy preference.

4.1.2 Party landscape

Vote share distribution

Figure 1 below presents the average vote share for each party across all municipalities for the municipal elections held in 2010, 2014 and 2018. The Social Democrats (S) is clearly the most popular party with on average 33% of the votes. Next is the Conservative Party (M) with on average 19% of votes, the Centre Party (C) with on average 12% of votes, and then the Sweden Democrats (SD) with on average 10% of votes. The remaining parties are similar in size with on average 4–6% of votes. Further details on how these votes shares have developed over time are presented in Section 6.2.2.

Figure 1: Average vote share per party 2010–2018

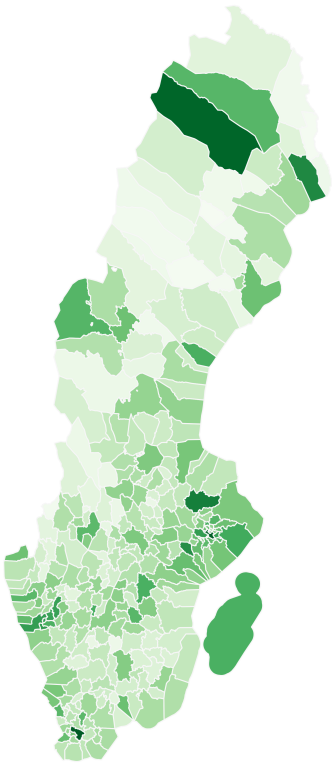


Notes: Graph showing the average vote share per party across all municipalities for the municipal elections in 2010, 2014 and 2018 based on data from Swedish Election Authority (2010,2014,2018). Data are on the municipal level.

Glancing at the geographical distribution of left- versus right-wing support, as presented in Figure 9 in Appendix A, it is shown that the support for left-wing parties is strongest in the North as well as in mid-Sweden. The municipalities in the South, and especially the ones in the coastal areas of the South, are dominated by right-wing support. For instance, the support for the left-wing parties together, S and V, ranges from 8.2% in Danderyd (an affluent suburb to Stockholm), to 71.8% in Degerfors (a steel manufacturing community close to Örebro in the middle of Sweden).

The support for the Green Party across the country is presented in Figure 2 and overall follows a similar trend as the left-wing support. Although not as clear as of a pattern, the Green Party support seems to be on average stronger in the South and along the coast line. However, there are some significant outliers, such as Jokkmokk (a municipality in the northwest of Sweden) that has an average Green Party support of 11.9% – significantly above the country-average of 4%. The greatest support of the Green Party at 12.2% is found in Lund (a university town in the south of Sweden).

Figure 2: Geographical distribution of Green Party vote share 2010–2018



Notes: Map showing the geographical distribution of municipal average vote share of the Green Party for the time period 2010–2018. A higher the vote share is represented by a darker green color. The vote share ranges from 0.2% in Malå (a sparsely populated municipality in the mid-north) to 12.2% in Lund (a university town in the South). Source: Authors' compilation (2020) of data from the Swedish Election Authority (2010, 2015, 2019).

Environmental policy party positions

In line with the discussions on the relationship between policy platform and policy outcome in Section 2 and 3, it is important that we review the policy platform of the parties when it comes to environmental policy. It is especially interesting to see this position from the perspectives of the voters, since they are the ones casting their votes according to their preferences. In Table 2 below, we present data from the National Election Survey carried out in conjunction with the election in 2010,[13] in which the perceived environmental policy position of the party is ranked by voters on a scale from 1 to 10, with 10 representing the strongest position (Holmberg & Oscarsson, 2017). Although voters are asked to rank the parties on the national level, it is likely heavily corresponding to the perceived ranking for the municipal parties, given that the elections occur on the same day. The data clearly show that voters perceive that the Green Party is focusing the most on environmental policy, compared to all other parties. The score of 8.57 is far from the second and third highest environmental policy score of 5.83 for the Centre Party and 5.25 for the Social Democrats. The lowest score of 1.89 is found for the Sweden Democrats followed by Other of 3.35.[14] On average, in line with the predictions discussed in Section 2.3, the left-wing parties show a slightly higher average environmental policy score than the right-wing parties, except for the Centre Party. Taken all together, policies seem to diverge in terms of the policy platforms, especially for the Green Party, vis-à-vis the other parties. Therefore, as discussed in previous section, Section 3, there is clear potential for a partisan effect on the policy outcome as well.

Table 2: Average environmental policy positions

Conservative Party (M)	4.06
Centre Party (C)	5.83
Liberal Party (L)	4.14
Christian Democrats (KD)	4.49
Social Democrats (S)	5.42
Left Party (V)	5.25
Green Party (MP)	8.57
Sweden Democrats (SD)	1.89
Other (O)	3.35

Notes: Perceived environmental policy position of the parties by voters, as measured by the National Election Survey 2010. The policy position for Other (O) is calculated using the policy position of the information available on other parties, which was for the Feminist Party (FI) and the Pirate Party (PP).

[13] The surveys carried out for the later elections are not available since they have not been de-personalised yet.

[14] The figure for Other should not be interpreted as the average policy position of all other parties represented in the municipal legislatures, since it only represents the average of two other parties.

4.2 Institutional and municipal characteristics

Having presented the political climate in Swedish municipalities, it is important to further understand the institutional structure as well as the characteristics of the municipalities. This is presented in the parts below.

4.2.1 Institutional structure of municipalities

The institutional context of Sweden is special mainly in two ways. First, the size of the public sector in relation to the private sector in Sweden is amongst the largest in the world (Karlsson & Montin, 2013). Secondly, the public sector structure is amongst the most decentralised, with significant responsibility delegated from the national government to the regions and municipalities. The country is divided into 21 regions, which are responsible for the more costly areas requiring collaboration across geographical areas, such as health care and transportation. The regions are in turn divided into a total of 290 municipalities, which carry the main responsibility for the majority of the public services provided, such as day care, schools and elderly care (Kullander & Langlet, 2020). The main source of income for the municipalities is the municipal tax, which accounts for 70% of the total income. While the national government regulates which items the municipalities can tax, the municipal tax rate is set by the municipalities.[15] However, there is an equalisation system (*utjämningssystemet*) in place, such that tax revenue from municipalities with higher income is distributed to municipalities with lower income (Karlsson & Montin, 2013). Hence, it is likely that the municipalities, despite substantial differences in population, are relatively comparable in available resources to spend on environmental policy.

Municipal responsibilities for environmental policy

The municipalities also have a key role in setting environmental policy since they are responsible for areas where great environmental impact can be made. Examples of such areas are: city and social planning, waste management, energy supply, water and sewage management as well as public procurement (Aktuell Hållbarhet, 2019). The national government sets the overarching goals, such as "achieve net zero emissions at 2045" for the municipalities (Ministry of the Environment in Sweden, 2017). However, it is mainly the municipal councils who are responsible for breaking down these overarching goals into concrete objectives and for implementing them (Aktuell Hållbarhet, 2019). Although there is an annual evaluation of the environmental policy work on the regional level compiled by the Swedish Association of Local Authorities and Regions (SKR), the follow-up on the municipal level is very limited and vague, according to a report compiled by PwC (2019) as well as according to an interview conducted with an employee responsible for the energy and climate strategy in the municipality Danderyd (Meyer, 2020, February 18, personal communication).

[15] The municipal tax rates 2018 range from 17.12% in Solna (a small municipality in the Stockholm region) to 33.60% in Gotland (an island in the Southeast) (Statistics Sweden, 2020c).

Municipal governance structure

The municipalities are governed by elected municipal councils (*kommunfullmäktige*) which comprise roughly 38,000 politicians across the nation, of which nearly all (97%) carry out this responsibility outside of their primary occupation. The municipal council in turn appoints the council board and the subcommittees. The council board (*kommunstyrelse*) is responsible for leading and coordinating the municipal work. The subcommittees (*nämnder*) are responsible for different policy areas – such as environmental issues or city planning – and for preparing material on issues that are decided on in the municipal council. The subcommittees can however take decisions on some smaller issues, such as building permits. The municipal council both decides which subcommittees should exist in the municipality, as well as appoints the members. The structure of the municipal council is "quasi-parliamentary", meaning there is a governing coalition formed to lead the council but the coalition is not binding. Therefore, alternative coalitions can be formed on specific policy issues. (Folke, 2014; Kullander & Langlet, 2020)

Municipal elections and seat allocation

Elections to the municipal council are held every fourth year in conjunction with the national election. The seats of the council are allocated on the electoral district (*valkrets*) level. A clear majority of the municipalities has only one electoral district, whilst the larger municipalities have multiple (two to six) electoral districts.[16] The regulations with regard to the number of electoral districts changed somewhat for the 2018 election. Prior to 2018, a municipality with more than 24,000 eligible voters, or a legislative council with more than 50 seats, was obliged to have at least two electoral districts (Folke, 2014). As of 2018, municipalities are not obliged to have more electoral districts, yet they can choose to have multiple electoral districts if it constitutes more than 36,000 eligible voters (Swedish Election Authority, 2018).

The seats are allocated within each electoral district according to the modified Sainte-Laguë method (Swedish Election Authority, 2018).[17] Simply put, this is a method to convert vote shares into legislative seats employed in PR electoral systems. Further information about this seat allocation method is provided in Appendix B. However, important to note is that there has been a slight change in the seat allocation as of 2018. The changes introduced are: 1) explicit vote share threshold for small parties, 2) improved proportionality of seat allocation for parties with at least one seat, and 3) adjustment seats (*utjämningsmandat*) for differential seat allocation in municipalities with several electoral districts (Swedish Election Authority, 2018). The implications following this change are further discussed in Section 6.2. The total number of seats in the municipal council is decided by the municipal council itself and the number of seats in each electoral district is decided by the regional council (Swedish Election Authority, 2018).

[16] 70% of the municipalities (209 of 290) in 2010–2014 and 90% of the municipalities (268 of 290) in 2018 had one electoral district (Swedish Election Authority, 2010, 2015, 2019).

[17] The decision to use the modified Sainte-Laguë method in Sweden 1952 was allegedly made to give the Communist Party a disadvantage in the seat allocation to the national parliament in Sweden at the time (Grofman & Lijphart, 2002).

4.2.2 Municipal characteristics

As briefly introduced by Figure 2, the Swedish municipalities are of varying sizes. In Table 3 above, we see that the characteristics differ rather substantially. For instance, the population size ranges from 2,400 inhabitants, for Bjurholm in the North, to 968,000 inhabitants, for the municipality Stockholm, and the overall mean population size across Sweden is 34,200 inhabitants. Equivalently, the population density ranges from 0.2 inhabitants per km^2, for Arjeplog in the North, to 5,925.1 inhabitants per km^2, for Sundbyberg in the Stockholm region. As implied by the examples, the north of Sweden is significantly more sparsely populated than the South, especially the coastal areas. The municipalities with the strongest support for the Green Party have on average a higher income, more inhabitants, a more dense population, a higher share of people with a university degree and a slightly higher share of young people. This is in line with the discussion in Section 2.2, suggesting that population characteristics affect perceived importance of environmental issues. Connecting to the finding above, that the university town Lund exhibits the greatest support the Green Party, it can be hypothesised that driving forces behind this strong support is an average younger age and a relatively higher level of education. However, in the case of the other outlier in the North, Jokkmokk, anecdotal evidence suggests that the support is mainly due to the position of the Green Party being against mining in a local mine (Nyberg, 2018).

Table 3: Municipal characteristics

Municipality	**All**	**All**	**Strong MP support**	**All**
Statistics	Min	Mean	Mean	Max
Income (1000s SEK/yr)	190	249	266	499
Population (1000s)	2.4	34.2	70.3	968
Population density (n per km^2)	0.2	149.0	405.6	5925.1
Share with university education (%)	14%	26%	32%	62%
Share aged 25-34 (%)	6%	11%	12%	23%
Share aged 65-84 (%)	11%	20%	20%	30%

Notes: Data on average municipal characteristics for the time period 2010–2018 from Statistics Sweden. Strong support for the Green Party (MP) is defined as having an average vote share above the 75th percentile (5.89%).

5 Method

From a theoretical point of view, we follow the method of Fiva et al. (2018) and study the effect of a small change in the vote share of a party leading to a seat share change. Holding the voter preferences fixed – the demand side – we study the effect on the environmental policy outcome from a change in the representation of parties – the supply side – in the legislature. Empirically, our approach closely follows Folke (2014), who estimates the partisan effect on primary and secondary policies, including environmental policy, in Sweden for the period 1993–2001. Based on the empirical robustness of the approach as well as due comparability reasons, we follow the procedure and empirical model of this study as closely as possible. Our study differs compared to that of Folke (2014) in four main ways: 1) we study a different time period, 2) our environmental policy index can be considered more informative,[18] 3) the seat allocation function in 2018 is slightly different, 4) we investigate whether governing coalitions can drive the possible partisan effect. Additionally, in order to remain critical where need be, we discuss the methodological approach in relation to similar studies in this section as well as perform a set of additional sensitivity and robustness checks in Section 7. We begin by explaining the identification problem associated with studying partisan effects. Thereafter, we present the key assumptions of the method and explain how relevant variables are defined. Lastly, we specify the main empirical model.

Notations

To begin with, we introduce some useful notations.[19] P refers to the number of parties, and each party is indexed by $p = \{1, 2, 3, ..., P\}$. With regards to votes, v_p refers to the number of votes for party p; $V = \sum_{p=1}^{P} v_p$ is the sum of votes for all parties; and the vector $\boldsymbol{V}_P = (v_1, v_2, v_3, ..., v_P)$ contains the votes for all parties. The notations for seats follow a similar logic, with $\tilde{s}_p$ denoting the number of seats allocated to party p; and $S = \sum_{n=1}^{P} \tilde{s}_p$ referring to the total number of seats. The relative number of seats, the seat share of party p, is denoted $s_p = \frac{\tilde{s}_p}{S}$; and the vector $\boldsymbol{S}_P = (s_1, s_2, s_3, ..., s_P)$ denotes the vector of seat shares for the parties. The environmental policy measurement is denoted y.

5.1 Identification problem

In order to estimate the effect of party representation on environmental policy, we look at the effect of the seat share of the parties ($\boldsymbol{S}_{Pit}$) on the environmental policy (y_{it}). A basic linear representation of such a specification can be described as the following:

$$y_{it} = \alpha + \beta_1 s_{1it} + \beta_2 s_{2it} + ... + \beta_{P-1} s_{P-1,it} + \pi_t + \delta_i + \varepsilon_{it} \tag{1}$$

Where π_t is the election period fixed effect, δ_i is the municipality fixed effect, and ε_{it} is the error term. In this specification, party P is used as the reference case and is thus omitted from the specification. The coefficient of interest, β_p, is therefore interpreted as the effect

[18] For an elaborate discussion on the environmental policy index we use in this study and how it differs from the one compared to Folke (2014), please refer to Section 6.1.

[19] All the following notations, except for the number of parties, considers the value for a specific electoral district e in a specific election year t. For simplicity, we include these notations later when presenting the model.

of increased representation of party p at the expense of party P. However, it is likely that the estimates of β_p in the simple specification above suffer from omitted variable bias and reverse causality issues. This, since it is likely that party representation ($\boldsymbol{S}_{Pit}$) is correlated with preferences for environmental policy in a municipality, which in turn determines the level of environmental policy (y_{it}). Additionally, it is likely that there is a part of the preferences for environmental policy that is unobservable, which would be captured by the error term (ε_{it}) and thus bias the estimates of the partisan effect on environmental policy (β_p).

These unobserved voter preferences can be due to a number of factors such as differences in municipal history, culture, norms or the random existence of one or more committed individuals mobilising support for environmental policy. These municipal characteristics are difficult to measure, and thus difficult to control for. Following is an example how such a bias could arise. Consider a municipality with an unobserved stronger culture of environmental awareness, where the estimates are biased through the direct effect of voting decisions on environmental policy. Since voting signals the unobserved preferences, an increase of the votes for the Green Party could then influence the other parties to increase environmental policy as well to gain voter support.

5.2 Regression Discontinuity Design

Identifying assumption

In order to overcome this identification problem, we employ a sharp Regression Discontinuity (RD) design. Through using an RD method we can exploit the seat allocation thresholds as a source of exogenous variation of party representation in legislature, through the number of seats allocated, for very similar levels of vote shares. In appropriate terminology, gaining or losing a seat in the legislature, the treatment status, changes discontinuously at the seat thresholds – where the position is assigned by a function of the vote shares, the running variable. As such, the causal partisan effects can be identified, which should be unrelated to other unobserved characteristics such as voter preferences, given that all assumptions are fulfilled. The fundamental identifying assumption is that the marginal seat is randomly allocated when a party is sufficiently close to the threshold of a seat change. In general terms, this is known as the continuity assumption – requiring that the only variation is the shift in treatment status – or the random allocation assumption. The latter is more stringent and additionally requires that the treatment is randomly determined (de la Cuesta & Imai, 2016). We test the fulfillment of these assumptions in Section 7.1.

RD approach in the partisan setting

The RD methodology in a partisan setting was pioneered by Lee et al. (2004), studying partisan effects in a majoritarian system. By identifying close elections, policy outcomes for a party can be compared between legislatures in which it won the election, and legislatures in which it was close to winning the election. In such two-party system, defining close elections is rather straightforward. When a party reaches above 50% of the votes, it wins the election. The vote share of one of the two parties in legislature i can be used as the running variable, denoted x_i. The threshold value, denoted x_0, is then defined at 50% of the votes. That is, the running

variable measures the distance to the threshold, and determines whether a close election occurs in the legislature (Palguta, 2019). The treatment effect can be estimated by using a binary indicator variable, D_i, indicating whether the party won ($D_i = 1$) or lost ($D_i = 0$) the election in a legislature i (Bernard, 2017). The conditions for being assigned treatment can thus be written as:

$$D_i = \begin{cases} 1, & \text{if } x_i > x_0 \\ 0, & \text{if } x_i \leq x_0 \end{cases}$$

The treatment effect can thereafter be measured through estimating the difference in policy outcomes for observations just below the threshold ($D_i = 0$) and for observations just above the threshold ($D_i = 1$).

In multiparty systems, the partisan effect can be estimated by studying the effect of an additional seat held by a party in the legislature. Including more than two parties immediately complicates the methodological approach, since the seat allocation of a party depends not only on its own vote share, yet also on the vote shares of other parties. Moreover, there are now multiple thresholds, which are not predetermined at a particular vote share, for winning an additional seat, as well as multiple combinations of legislative representation. These features are a consequence of the seat allocation method.

Based on the methodology developed by Lee et al. (2004), Folke (2014) designs an RD model to estimate individual partisan effects in PR electoral systems.[20] The model is described in detail in the following subsection.

5.3 Defining RD elements for multiparty systems

In order to specify our RD model, we first present the definition of close elections in multiparty systems. In doing this, we have to construct a running variable which determines the position of the observations relative to multiple thresholds. We use the algorithm developed by Folke (2014) and compute our running variable as the minimum vote change for experiencing a seat change. In the following step, we set the conditions for defining observations as being close to the threshold. Worth noticing is that these variables are computed on the electoral district level, e, which is the level on which seats are allocated. The relevant variables are then aggregated on the municipal level, i, in order to match the municipal level data of the dependent variable and the control variables. This aggregation procedure will be described in detail in Appendix D.

[20] Other RD approaches of studying partisan effects on political outcomes in the US two-party system have been carried through by for instance Leigh (2008), Ferreira and Gyourko (2009), and Lee (2008); in multiparty systems examples are studies by Fiva et al. (2018) in Norway, Palguta (2019) in the Czech Republic, Lopes Da Fonseca (2015) in Portugal, Artés and Jurado (2018) in Spain, and Freier and Odendahl (2015) in Germany.

Vote shares and seat allocation

With our chosen method, we measure the impact of an additional seat held by each party. Given the set number of seats in the legislature, an additional seat for one party must correspond to a seat loss of another party, hereafter referred to as the reference party P. The seat allocation for a party is described in detail in Appendix B. In simple terms, the number of seats allocated is determined by its own vote shares as well the vote shares for all other parties, $\boldsymbol{V}_P = (v_1, v_2, v_3, ..., v_P)$, in an electoral district e in an election year t, according to a function $\tilde{s}_p = f(\boldsymbol{V}_P, S)$. There are however two important implications following the seat allocation method worth mentioning here. First, the probability for a party to experience a seat change increases with its vote shares and the size of the legislature. Secondly, a party can experience a seat change without having a change in its own vote share. We present a graphical example of how seat share can vary with vote shares in Figure 10 in Appendix A.

Running variable

Based on the above, the seat allocation for party p changes when crossing a certain threshold of the vote shares for all parties.[21] Thus, the *distance* is defined in terms of the total vote change across all parties. $\boldsymbol{V}^0_{Pet}$ and $\boldsymbol{V}^1_{Pet}$ represent two different vectors of the vote shares of all parties, in electoral district e in election year t. The distance between two vote vectors is the sum across parties of the absolute vote differences and can be written as the following:

$$d(\boldsymbol{V}^0_{Pet}, \boldsymbol{V}^1_{Pet}) = \sum_{p=1}^{p=P} |v^1_{pet} - v^0_{pet}|$$

As described in Appendix B, there are several combinations of vote changes that can cause a seat change for party p. Since we are interested in comparing observations *close* to the threshold of gaining or losing a seat, we use the *minimum distance* to a seat change as the running variable. For a given election outcome, referred to as $\boldsymbol{V}^0_{Pet}$, there is an associated allocation of seats to party p, described as $s^0_{pet} = f(\boldsymbol{V}^0_{Pet}, S_i t)$. The notation $\boldsymbol{V}^1_{Pet}$, in this case, symbolises the point leading to a vote change for party p. Since this point implies a vote change, the seat allocation is different compared to the one at $\boldsymbol{V}^0_{Pet}$. The *running variable* – the minimum distance to a seat change for party p – is thus defined as the minimum distance, $d(\boldsymbol{V}^0_{Pet}, \boldsymbol{V}^1_{Pet})$, to any point $\boldsymbol{V}^1_{Pet}$ at which the seat allocation for party p is different than at $\boldsymbol{V}^0_{Pet}$, which can be written as: $f_{pet}(\boldsymbol{V}^0_{Pet}, S_{it}) \neq f_{pet}(\boldsymbol{V}^1_{Pet}, S_{it})$.

Bandwidth

Lastly, we have to set the condition under which a party is defined as being *close* to a threshold of a seat change. In RD design terminology, this is referred to as the bandwidth. In our context, the bandwidth is a predetermined value, denoted λ, of the minimum distance to a seat change, for which the observations are defined as being close to a threshold of vote change. Recalling that the minimum distance to a seat change is defined in aggregate vote shares of all parties, the bandwidth is therefore also defined in these terms. As such, observations close to the threshold are observations that require less than 0.25% change of the aggregate vote

[21] The considerable variation of legislature sizes presented in Section 4 implies that there is a great number of thresholds and combinations of vote shares of the parties leading to changes in seat allocations.

share to experience a seat change. While we test several bandwidths, we follow Folke (2014) in the main specification and set $\lambda = 0.25\%$. A further elaboration on different bandwidths is discussed in Section 7.3. The bandwidth is not completely straightforward to interpret, yet to give an indication of the magnitude, $\lambda = 0.25\%$ corresponds to an average change of 42.2 votes in absolute numbers across all election years.[22] By comparison, our alternative bandwidths $\lambda = 0.5\%$ and $\lambda = 0.1\%$ correspond to 84.5 and 1.7 number of votes changed respectively.

5.4 Empirical model

Having specified the two main elements in our RD design model, the running variable and the bandwidth, we now present the empirical model. First, however, we provide some intuition in relation to the RD approach. In technical terms, we identify control groups – parties with vote shares close to winning or losing a seat – and treatment groups – parties with vote shares just winning an additional seat or just losing one of their seats. Given that the identifying assumption holds, we are able to compare the control group and the treatment group to estimate the causal partisan effect on environmental policy. Since we estimate the effect both for when a party just won a seat and for when a party just lost a seat, we find observations included in the treatment group and the control group on both sides of the threshold. These specificities of the model are described in detail below.

Indicator variables

Our model includes two indicator variables: a treatment variable and a control variable. The *treatment variable*, denoted as t_{pet}, indicates whether a party is close to a seat threshold and whether a party is above or below the threshold.[23] If a party is close and below the threshold, it takes the value $-\frac{1}{2}$; if a party is close and above the threshold, it takes the value $\frac{1}{2}$. If a party is not close to the threshold it takes the value 0. With the threshold denoted x_{0t} and the running variable denoted x_{pet}, we can write the conditions as:

$$t_{pet} = \begin{cases} -\frac{1}{2}, & \text{if } x_{pet} < \lambda \text{ and } x_{pet} \geq x_{0t} \\ \frac{1}{2}, & \text{if } x_{pet} < \lambda \text{ and } x_{pet} \geq x_{0t} \\ 0, & \text{if } x_{pet} \geq \lambda \end{cases}$$

The *control variable*, denoted as c_{pet}, indicates whether a party is close to a threshold. Note that this variable is not to be confounded with the control group described above. Rather, this variable controls for the fact that neither the size of the treatment effect nor being close to a threshold is random. This, since the probability of being close to a seat change increases with the size of the legislature – more available seats increase the number of seat thresholds – and the vote share of the party – a seat change is more likely when vote shares are high. The latter is a consequence of how the seat allocation function is defined. For a visual representation of this please refer to Figure 10 in Appendix A. The control variable is defined as the absolute

[22] Based on the average of absolute number of votes in electoral districts across all election years studied, which is equal to 16,897.58.

[23] Using 1 instead of $\frac{1}{2}$ would underestimate the treatment effect on the seat share by a factor of 2 (Folke, 2009).

value of the treatment value and takes the value $\frac{1}{2}$ if the party is close to the threshold and above or below the threshold. Similar to the treatment variable, we can write the conditions for the control variable as the following:

$$c_{pet} = \begin{cases} \frac{1}{2}, & \text{if } x_{pet} < \lambda \\ 0, & \text{otherwise} \end{cases}$$

Control function approach

As for the choice of the RD approach, we use the parametric *control function approach* to estimate the treatment effect, which is in line with other RD specifications estimating partisan effects (see e.g. Bernard, 2017; Folke, 2014; Lee et al., 2004; Palguta, 2019; Pettersson-Lidbom, 2008). As highlighted by Bernard (2017), the vote shares of parties that constitute the assignment variable is a rather discrete measurement, for which a parametric approach is more appropriate (Lee & Lemieux, 2010). The control function approach means that we use all observations to regress the outcome variable, y_{et}, on a polynomial in the assignment variable, V_{Pet}, and the indicator variables, t_{pet} and c_{pet}. Given that the control function is correctly specified, the results of the specification present unbiased estimates (Lee & Lemieux, 2010). This can be explained by the fact that the assignment variable is the only systematic determinant of the indicator variables, and hence the control function captures any correlation between the indicator variable and the error term (Pettersson-Lidbom, 2008). An alternative approach would be to compare average outcomes close to the threshold. This method, however, requires that there is a large amount of observations around the threshold, and is less straightforward in this case where we have treated observations on both sides of the threshold. Defining the k-th order of the polynomial, the control function $g(\boldsymbol{V}_{Pet})$ can be written as:

$$g(\boldsymbol{V}_{Pet}) = \sum_{p=1}^{p=P} \sum_{k=1}^{k=K} \beta_{pk} \left(\frac{v_{pet}}{V_{et}} \right)^k \tag{2}$$

Where the parties included in the function are only the ones with at least one seat in the electoral district, $\tilde{s}_{pet} \geq 1$. Following Folke (2014), we use a fourth-order polynomial in our main specification, yet test for other degrees as well.

Other elements

Further, we follow Folke (2014) and include election year fixed effects, π_t, and municipality fixed effects, δ_i.[24] It should be noted that the control variables and control function are not required for the actual identification, yet they improve the precision of the estimates (Folke, 2014). The same reasoning applies to the fixed effects (Lee & Lemieux, 2010). Lastly, robust standard errors are clustered on the municipality level to account for the fact that the error terms for a municipality, ε_{it}, are likely auto-correlated (Bertrand et al., 2004).

[24]This is also employed by Pettersson-Lidbom (2008), Bernard (2017), Leigh (2008) and Fiva et al. (2018) amongst others.

Model specification

We now specify the model. For simplicity, the below specification is presented on the municipal level i, aggregated across electoral districts e. The aggregation procedure is described in Appendix D. The specification is composed of the treatment variable (t_{pit}), the control variable (c_{pit}), the vote share control function ($g(\boldsymbol{V}_{Pit})$), the election year fixed effects (π_t) and the municipality fixed effects (δ_i). Given that municipal legislature sizes differ and that we are interested in the relative effect that a party can have, we divide the treatment and control variables by the total amount of seats in the legislature. This computation implies that we measure the effect a party can have based on the seat shares held, rather than on the absolute number of seats held. The empirical model is specified as the following:

$$y_{it} = \alpha + \beta_1 \frac{t_{1it}}{S_{it}} + ... + \beta_{P-1} \frac{t_{P-1,it}}{S_{it}} + \gamma_1 \frac{c_{1it}}{S_{it}} + ... + \gamma_{P-1} \frac{c_{P-1,it}}{S_{it}} + g(\boldsymbol{V}_{Pit}) + \pi_t + \delta_i + \varepsilon_{it} \quad (3)$$

This specification compares the environmental policy outcomes for when parties are just above or just below the threshold to obtain more seats. The coefficient before the treatment variable, β_p, is the coefficient of interest and estimates the average effect on environmental policy that a party has as its seat share increases or decreases. As can be seen in the specification, one party, Party P, is always omitted in the regression. This party represents the reference party for which the coefficients of the other parties can be compared to. For instance, β_1 estimates the effect on environmental policy outcomes that Party 1 has, when its representation increases at the expense of Party P. Furthermore, by estimating the effect of all parties simultaneously, the model takes into consideration to or from which party a particular party wins or loses a seat. This is important because if, for instance, a left-wing party wins a seat from another left-wing party the effect possibly differs from if a left-wing party wins a seat from a right-wing party.

Alternative specification

Following Folke (2014), we also estimate a 2SLS specification which can be compared with the main RD design specification. Given that there is a strong effect of the treatment variable on the seat share for each party, defined as the first stage, we can use a 2SLS specification. The equation for the first stage is defined as the following:

$$\hat{s}_{pit} = \eta + \nu_1 \frac{1}{S_{it}} \sum_{i=1}^{P} t_{pit} + ... + \nu_P \frac{1}{S_{it}} \sum_{i=1}^{P} t_{P-1,it} + e_{it} \quad (4)$$

Where ν_p is the coefficients of interest and e_{it} is the error term. The strength of the first stage is tested in Section 7.1. In the second stage, the seat shares instrumented through the treatment variable are used to estimate the effect of each party on environmental policy outcomes. The equation for the second stage, 2SLS, is defined as the following:

$$y_{it} = \alpha + \beta_1 \hat{s}_{1it} + ... + \beta_{P-1} \hat{s}_{P-1,it} + \gamma_1 \frac{c'_{1it}}{S_{it}} + ... + \gamma_{P-1} \frac{c'_{P-1,it}}{S_{it}} + g(\boldsymbol{V}_{Pit}) + \pi_t + \delta_i + \varepsilon_{it} \quad (5)$$

5.5 Internal validity

As for the two core concepts of validity, internal and external validity, there is a clear trade-off with the RD design: high internal validity at the expense of possibly lower external validity (Imbens & Lemieux, 2008). As discussed above in this section, the seat allocation threshold provides a source of exogenous variation of an additional seat across observations that are shown to be very similar in all other aspects. This identifying assumption is further strengthened by the fact that the vote share thresholds for seat allocation are not predetermined – based on the design of PR systems and consequently this methodological approach. Hence, our chosen method can be considered as strong in terms of internal validity. The main limitation with the internal validity is the fact that there were modifications introduced to the seat allocation method for legislatures in Swedish municipalities in 2018. First, this might have had consequences on the partisan effect found. This, in particular since the change implied differences in proportionality – which is, in a sense, what we are evaluating the effect for. However, given the combined availability of election data and environmental policy data, we could not exclude 2018 for the same bandwidth without a significant loss of power in terms of number of observations. Although we could simulate the new seat allocation method for historical vote shares, we do not have environmental policy data to compare it with. In a few years time, however, when there are enough data points, it would be interesting to study the effect of the seat allocation change on partisan effects in PR systems.[25] However, given that the changes introduced are small and that the representational effects move in opposite directions for small parties,[26] we do not have reason to believe that there is a strong bias in one direction. Further details on the inferred changes in the seat allocation method and their implications following are presented in Section 6.2. Secondly, the fact that we do not correct our running variable for the adjustments seats allocated in the 2018 poses another limitation for our internal validity. Although it concerns a very limited amount of observations, we carefully study that this does not disturb the validity of our treatment variable in Section 7.1 as well as run our main regression excluding these municipalities in Section 7.3.

[25] For instance, Baskaran and Lopes Da Fonseca (2016) examine the abolishing of the vote share threshold for a party to receive a seat in the legislature in German municipalities. The results show that the increased representation of small parties had a notable effect on political outcomes.

[26] The representational effects for small parties with regards to the change in the seat allocation method are two-fold. On the one hand, the threshold for small parties to receive a seat in the legislature is higher. On the other hand, once in the legislature, their opportunities to receive additional representation are improved.

6 Data

In this section we present the data used in this study. The section is divided into three parts, with each part describing one type of variable: dependent variable, independent variable and control variables.

6.1 Dependent variable

6.1.1 Description of variable

The dependent variable in our study is the environmental policy outcome in a municipal government. To recall, the environmental policy outcome is defined as the environmental policy that is set by the government. In order to measure this, we use data from the Swedish environmental journal *Aktuell Hållbarhet*. The data consist of an index of the environmental policy in each Swedish municipality and each year during the period 2012–2019 (Offerman, 2018). The index is a broad evaluation of the environmental policy set in the municipalities and consists of two parts: key indicators from external actors – such as governmental authorities and environmental organisations – and a survey conducted by *Aktuell Hållbarhet*. To our knowledge, this is the only broader evaluation of environmental policy in the Swedish municipalities for the relevant time frame. Previous research has employed a similar evaluation posted in the no longer active environmental journal *Miljö-Eko* (see e.g. Dahlberg & Johansson, 2002; Folke, 2014; Forslund et al., 2008). In the evaluation of the two parts, municipalities receive points depending on to which extent a set of requirements are fulfilled, related to their environmental policy. These points are subsequently weighted and combined into a total score for each municipality. It is worth noting that the indicators, survey questions, weighting of points and total points differ somewhat across years. In the journal, the results are presented as rankings, with the municipality receiving the highest score placed as number 1 and the municipality receiving the lowest score placed as number 290. We have however chosen to use the total points from the combined evaluation used to compute the ranking, in order to take into account the distribution of environmental policy levels. Since the maximum total points differ somewhat across the years, we use the share of the maximum point for each municipality per year. This share is then averaged out over the years following the election year in order to match the electoral data, presented in this section below. This procedure is presented in detail in Appendix C.

As mentioned, the content from the external sources and the survey covers a great number of areas. Following is a description of the main content of the two parts. As for the external sources, the most frequently used indicators refer to: organic share of food procured, share of organisations holding an environmental certification, perceived level of municipal environmental policy by companies, indicators for environmental sustainability of the built environment, initiatives to achieve good water quality, number of nature reserves, as well as perceived level of environmental policy by the citizens on topics such as bike lanes and heating. Consequently, the indicators covers a wide range of perspectives from different actors – both companies and citizens. As for the survey, it consists of mainly of yes-or-no questions answered by a public servant in the municipality. Recurring questions relate to: climate and environmental targets

in general, environmental targets for the built environment, procurement, transport, food, capital management, energy as well as recycling and nature conservation. An example of a question of climate and environmental targets in general is: "is there a policy in place to reduce green house gas (GHG) emissions within the own geographical area that at least corresponds to the suggestions by the national government?". An example of the alternations of the survey questions is that this question has been alternated across the years to adjust to differences in the national suggestions. For instance, the question in 2016 and onward included an addition of "by the national government to achieve net zero emissions at 2045".

6.1.2 Descriptive statistics

The descriptive statistics for our dependent variable is presented in Table 4 and show that the average score on total points is 39%. There is significant variation between the best and worst performing municipalities, seeing that the total score ranges between 1–90% and that the 75th percentile is at 51%. On average, the survey points are somewhat higher than the total points, and the external points are below the average total points. This implies that survey points are relatively more important. However, there is greater variation in the survey points, showing a higher standard deviation. This is probably driven by the fact that not all municipalities have answered the survey. The limitations introduced by the non-perfect response rate is discussed in Section 6.4. With this being said, the average response rate can still be considered to be high, at 88%.

Table 4 further shows that there are no considerable differences between the mean and the distribution of the election year averages computed. Thus, our computed averages can be considered representable of the underlying data.

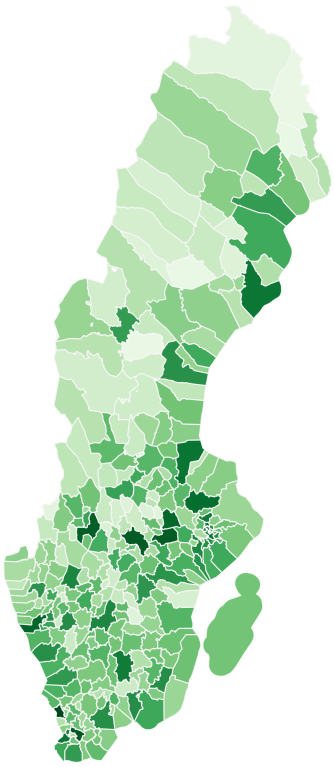
Table 4: Environmental policy index

	Obs.	Mean	Std dev.	p25	p50	p75	Min	Max
Per year average								
Total points	2320	0.39	0.18	0.26	0.39	0.51	0.01	0.90
Survey points	2320	0.42	0.24	0.27	0.45	0.60	-0.00	1.00
Response rate	2320	0.88	0.17	0.88	1.00	1.00	0.25	1.00
External points	2320	0.34	0.16	0.22	0.34	0.46	0.00	0.86
Election year average								
Total points	870	0.39	0.17	0.26	0.38	0.50	0.01	0.90
Survey points	870	0.44	0.21	0.31	0.45	0.58	0.00	0.94
External points	870	0.34	0.15	0.23	0.33	0.44	0.02	0.85

Notes: The points are presented in percentages of the total maximal points achievable. In the survey of year 2013 negative points were given on certain questions.

Figure 3 presents the geographical distribution of the environmental policy index score across Sweden. The map supports the above mentioned observation, that there is considerable variation across municipalities. A geographical pattern is not evident, yet it seems like the higher performing municipalities are generally located further South, and in the North they are located closer to the coast. The environmental policy index share ranges from 7.7% in Bräcke (a municipality in the middle of Sweden) to 79.9% in Helsingborg (a municipality in the South, close to Malmö).

Figure 3: Geographical distribution of the environmental policy



Notes: Map showing the geographical distribution of municipal average environmental policy score. A higher environmental policy score is represented by a darker green color. Source: Authors' compilation of data from *Aktuell Hållbarhet* (Offerman, 2018) (2020).

6.2 Independent variable

6.2.1 Description of variable

The independent variable is based on election data from the municipal elections in 2010, 2014 and 2018, and have been gathered from Swedish Election Authority (2010, 2015, 2019). The variable consists of both vote shares for each party as well as the number of seats held by each party, in each municipality in each election year. To retrieve the value of the seat shares on the municipal level, we divide the number of seats for each party by the total number of seats

available in the municipal government for the relevant election year. A similar procedure is adopted for computing the seat share on the electoral district level. However, in this case, we use the total number of seats in the relevant electoral district rather than for the whole legislature.

As for the related data of governing coalitions, data is retrieved from Swedish Association of Local Authorities and Regions (SKR) (Kullander & Lidhamn, 2020).

6.2.2 Descriptive statistics

Overall, the total number of seats in the electoral districts ranges from 15 to 81, with a mean of 33 for the election years 2010 and 2014. The same range of seats is covered in the election year 2018, yet the mean number of seats is higher, at 39, meaning that electoral districts are on average somewhat larger. This is likely driven by the fact that there are fewer municipalities with several electoral districts as of 2018. As for the whole municipal council, the total number of seat ranges from 21 to 101, with a mean of around 44 seats for all election years. As a complement to the average vote shares by parties introduced by Figure 1, we present a more detailed description of the average vote shares as well as seat shares in this section.[27] Table 5 presents the details of the vote shares by each party and shows that there is great variation in vote shares, both within and across parties. Additionally, there is considerable variation over the years, with an overall trend of less support for the largest parties – the Conservative Party and the Social Democrats – and considerably stronger support for the Sweden Democrats – with an average vote share of 4.9% in 2010 and 14.1% in 2018. As for the Green Party, there is a considerable loss of support in the 2018 election – reaching 6.0% of votes in 2014 and only 4.2% in 2018.

Table 5: Vote shares per party 2010–2018

	Min (%)	2010 (%)	2014 (%)	2018 (%)	Max (%)
Conservative Party (M)	0.5	23.1	19.0	18.9	51.9
Centre Party (C)	0.5	10.2	10.5	13.1	42.5
Liberal Party (L)	0.1	7.2	5.8	6.3	34.2
Christian Democrats (KD)	0.0	4.7	4.2	6.1	44.9
Social Democrats (S)	5.3	34.7	33.3	30.0	63.3
Left Party (V)	0.4	5.4	6.0	6.8	55.6
Green Party (MP)	0.0	5.5	6.0	4.2	19.0
Sweden Democrats (SD)	0.4	4.9	9.9	14.1	35.3
Other (O)	0.0	4.4	5.2	9.6	51.9

Notes: The values represent the minimum and maximum values of vote shares (%) per party across all election years as well as the average vote share by party (%) for the election years individually. Data are on the electoral district level.

[27] Please note that these tables are presented on the electoral district level for comparability with the seat shares which are allocated at this level. In Figure 1, the average vote shares over the years are presented on the municipal level.

Table 6: Average seat shares per party 2010–2018

	2010 (%)	2014 (%)	2018 (%)
Conservative Party (M)	23.9	19.7	18.1
Centre Party (C)	11.1	11.2	12.7
Liberal Party (L)	7.6	6.4	5.4
Christian Democrats (KD)	5.3	5.1	5.4
Social Democrats (S)	35.2	34.0	29.6
Left Party (V)	6.2	6.6	6.5
Green Party (MP)	6.1	6.5	3.2
Sweden Democrats (SD)	5.6	10.4	13.7
Other (O)	3.7	4.2	5.2

Notes: The values represent the average seat share by party (%) for the election years individually. Data are on the electoral district level.

Comparing the vote shares with the seat shares, presented in Table 6, we highlight the impact of the seat allocation method briefly introduced in Section 5.2. Overall, we see that seat shares follow the vote shares closely – implying a great degree of proportional representation. Still, the two are not perfectly aligned. Given the effect that the seat allocation has on proportionality of representation, as well as the slight change introduced in 2018, it is interesting to evaluate the differences. In general, there seems to be a greater variation in the relative differences between seat shares and vote shares for the smaller parties, compared to the larger parties, across all election years. This observation is likely the result of that smaller parties, such as the local parties, do not receive a first seat in many electoral districts. Technically, this can be explained for 2010–2014 by the larger divisor (1.4) in the seat allocation for the first seat, and for 2018 by the introduced small party threshold. As for the comparison between vote shares and seat shares in 2018, the overall indication is that the average seat shares are lower than average vote shares for all parties. However, the difference between the two shares is somewhat smaller for all parties, apart from for the smallest ones. This is likely explained by the combination of changes introduced in 2018. First, the lower average seat shares are likely driven by the introduced small party thresholds, which means that no seats are allocated to parties in electoral districts where their vote share is below a certain threshold.[28] Specifically, the thresholds are 2% and 3% in municipalities with one electoral district and multiple electoral districts respectively (Swedish Election Authority, 2018). Taking the Green Party in 2018 as an example, with an average vote share of 4.2% and seat share of 3.2%, its low average vote share is likely to be affected by the introduced small party thresholds. Moreover, the lower variation across different party sizes in difference between vote share and seat share is likely the result of the increased proportional seat allocation by reducing the first divisor to 1.2. This is supported by the fact – tested although not presented here – that the median vote share is closer to the median seat share for 2018 compared to 2010 and 2014.

[28]This is supported by the numbers for the average minimum vote share for a first seat, which is 1.48% and 1.54% for 2010 and 2014 respectively, whilst it is 2.01% for 2018.

6.3 Control variables

The control variables are indicators on the municipal level relating to the following areas: population, demography, income and education. All control areas apart from the population density are the same as used by Folke (2014). Please note, however, that these control variables are not used in the main specification, yet for the sensitivity analysis. All control variables are gathered from the website of Statistics Sweden and cover the period 2010–2018 (Johansson, 2019; Lundberg & Heggemann, 2020; Pettersson & Svanström, 2020; Statistics Sweden, 2020a; Westling & Karlsson, 2020). As for the environmental policy index, the data on the control variables are gathered for each year, yet are aggregated and averaged across years in order to match the electoral data. The procedure for these computations are presented in Appendix C. The *population variable* represents the number of inhabitants in the municipality. Controlling for size of population is arguably a way of controlling for the size of the municipality and its resource capabilities. The *population density variable* represents the number of inhabitants in the municipality per km^2. This variable is mentioned by for instance Aklin et al. (2013) to affect perceived importance of environmental policy as well as employed by Pettersson-Lidbom (2008). The *demographic variable* represents the share of the total population in the municipality belonging to different age groups in 10–20 year brackets.[29] In this way, we are controlling for demographic composition, since, as discussed in Section 2.2, age is predicted to affect perceived importance of the environment – decreasing with an older age. The *income variable* represents the inflation-adjusted municipal average yearly income (*sammanräknad förvärvsinkomst*) in 1000s of SEK across all municipal inhabitants in a working age – which is defined as 16 years or older. The inflation measure used is the national yearly average consumer price index gathered from Statistics Sweden (2020b). The *education variable* represents the share of the working age population with different levels of highest completed education. The education levels used are: pre-upper secondary school, upper secondary school or university degree. As mentioned in Section 2.2, income and education could affect perceived importance of environmental policy – increasing with higher levels of income and education.

Relevant descriptive statistics for the control variables is presented in Table 3 in Section 4.

6.4 Data limitations

Our main limitations with regard to data are related to the environmental policy index. As opposed to the data on municipal characteristics and the election data that are collected and recorded for for the purpose of national registers, the environmental policy data contain the most subjective elements and is additionally composed by an independent journal. Yet, due to the lack of a possibly less biased governmental evaluation of the environmental policies set in the municipalities, this index is, to our knowledge, the best data available.[30]

One of the more central sources of subjectivity is the fact that all parameters considered – both the survey questions and external indicators – are chosen manually and altered across the years. This provides a source of error that is impossible to correct for. Still, all municipalities

[29]The groups are the following: 0–14, 15–24, 25–34, 35–54, 55–64, 65–84 and 85–.

[30]The studies by Folke (2014), Forslund et al. (2008) and Dahlberg and Johansson (2002) also use an environmental policy index composed by an independent journal.

are evaluated on the same parameters, which makes the relative comparison informative. More concern should possibly be directed to the survey part alone. For one, not all municipalities have answered the survey and this is rather endogenously determined. As seen in Table 15 in the Appendix, the worst survey responding municipalities also performs notably worse on the environmental policy index. Additionally, given the nature of the total-points system,[31] the total points for the municipalities with worst respond rates are systematically below the relative external points, and vice versa for the municipalities with the best respondent rates. Therefore, the survey part can be argued to somewhat inflate the results by giving lower points to the already low performing. As presented in Table 10, this is confirmed by the increase in the magnitude for the majority of coefficients, when running the regression on the survey points only. Similarly, in the same table, we see that the coefficients decrease in magnitude and significance levels, when studying the external points only. Still, the elements of the survey questions are deemed necessary to be able to complement the evaluation of the environmental performance, as they provide details that are not included by the relatively high-level external indicators. Since controlling for the endogenously worst respondents would pose a "bad control", as defined by Angrist and Pischke (2008), our best solution to this problem is attributing the results with less universal validity as well as presenting the limitations in this section. Related to this is also the fact that the survey respondents might have incentives to skew the survey answers make their own municipality seem to perform better than it does. These incentives are, however, expected to be similar for all municipalities given that the survey is answered by public servants and not politicians. This is hence not expected to cause endogeneity issues yet rather result in an upward bias for all municipalities answering the survey.

Lastly, the time frame for when the environmental policy index is available limits the time frame of our study. With access to earlier data on the index, we could include more observations and thus we would be able to study smaller bandwidths. This would improve the external validity, as discussed in Section 7.4. Additionally, the environmental policy data for the election year 2018 are only available for one year. For the other election years, we have the data available to use the average of the index over three and four years respectively. This provides a source of error, especially if there is a municipality that has not answered to the survey in the specific year relating to the election year of 2018. Therefore, this concern would also be alleviated by adopting a longer time frame when possible in the future.

[31] The total points is the sum of survey points and external points, where municipalities receive zero points if not answering the survey.

7 Results

This section presents the results of the study. We begin by examining the robustness of the approach, before presenting the main results. Thereafter, we perform a sensitivity analyses as well as discuss considerations for the external validity. Lastly, we test possible mechanisms for our main results.

7.1 Robustness of approach

This part evaluates the robustness of our method by examining whether the main assumptions for the RD method are fulfilled, as well as evaluates the validity of the running variable and treatment variables. The rigorous assessment performed by Folke (2014), shows that the internal validity is strong for employing this specific RD approach on seat allocation thresholds on parties in Swedish municipalities. However, given that we do not study the same time period, and that the seat allocation changed somewhat as of 2018, we test the RD assumptions below in order to ensure that our slightly adjusted method is robust for our data set.

7.1.1 Evaluating the RD design assumptions

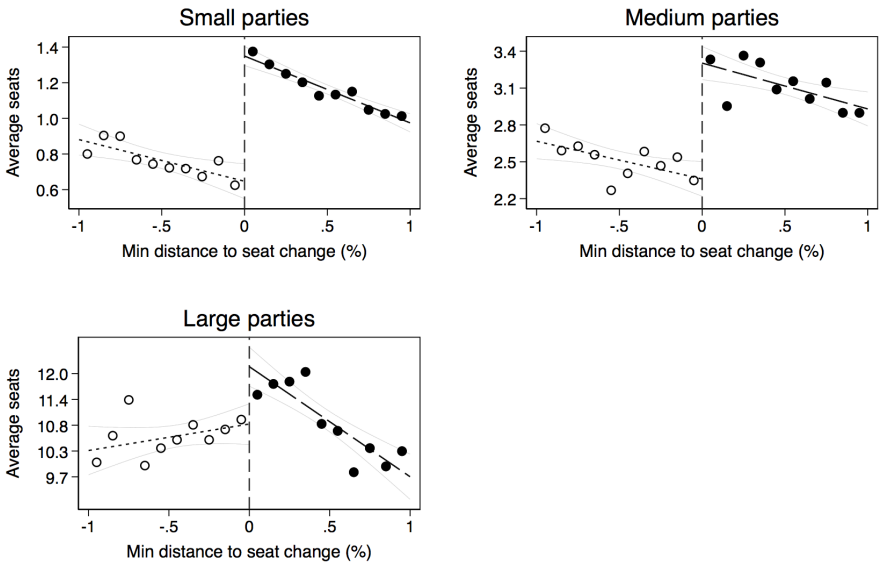
In order to assess the fulfilment of the assumptions of the RD design, we follow the recommendation of Imbens and Lemieux (2008) and use graphical analyses to test the following: the existence of a discontinuous jump in treatment by running variable, continuity of covariates by the running variable and continuous density of the running variable.[32] These are presented in the sequential order.

Discontinuous jump

As discussed in Section 5, the discontinuous jump of treatment, or identifying variable, is what provides the source of exogenous variation that we exploit for investigating the causal effect. We evaluate this by plotting the identifying variable – the average number of seats allocated – against the running variable – the minimum distance to seat change. Due to the nature of how seats are allocated in the legislature, we naturally expect to see a discontinuous jump in the number of seats as a party moves across the threshold of a seat change. In line with Folke (2014), we plot the graphs divided by the party size: small, medium and large. This is to give a more clear presentation of the discontinuity, given that the average number of seats differs greatly across parties with different levels of vote shares. The graphs are presented in Figure 4 below, in which a negative distance to a seat change represents being close to winning a seat and a positive distance to a seat change represents being close to losing a seat.

[32]Please note that all graphs concerning the seat allocation are plotted on the level of the seat distribution, the electoral district level, and that all graphs concerning municipal characteristics are plotted on the municipal level.

Figure 4: Average number of seats by the minimum distance to a seat change



Notes: The figure plots the average number of seats by the minimum distance to a seat change, measured in percentage points (pp) of vote share, by party size, on the electoral district level. Small parties are defined as parties with a vote share less than the 25th percentile of the average vote share (3.7%), medium parties have more than the 25th percentile but less than the 75th percentile (15.1%) and large parties are parties with vote shares above the 75th percentile. The width of intervals is 0.1 pp.

In line with our expectations, observing the results in Figure 4, we identify significant jumps of approximately one seat for all three groups of party sizes.[33] Although the differences in the scale of the y-axis between the party sizes makes the visual comparison less clear, the size of the jump of the fitted trend line on each side of the threshold is practically the same. The discontinuity in the plotted average means, the dots, for large parties seems less distinct. This can be explained by the fact that such parties exhibit a greater variation in the number of seats gained as well as that they are more likely to be both close to winning and losing a seat. This is related to the implication mentioned in Section 5.2 – that the probability of being close to a threshold increases with the size of the party.

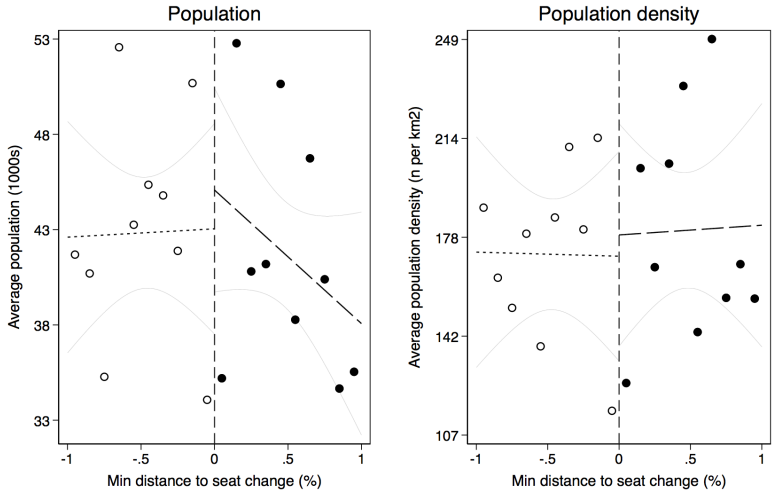
Continuity of covariates

Continuity of covariates is one of the fundamental assumptions for the internal validity of the RD design since it constitutes the identifying assumption: the continuity assumption, which dictates that observations close to the threshold are similar in all aspects, apart from the assigned *treatment* (see e.g. Imbens & Lemieux, 2008; Lee & Lemieux, 2010). If there are any other characteristics that also show a discontinuous jump over the threshold, the identifying assumption is likely not fulfilled. When plotting a range of municipal characteristics – which are likely to influence the perceived importance of environmental policy according to the previous research – we do not find a significant jump in any of the characteristics. Figure 5 below shows the average population and population density over the minimum distance to a seat change. For the continuity of income, education and population age, see Figures 11, 12,

[33]Plotting all parties together also shows that there is a significant discontinuous jump at the threshold.

13 in Appendix A. We see that the fitted lines, with supporting confidence intervals, on both sides of the threshold do not show a jump over the threshold of 0 distance to a seat change. With this being said, an interesting observation discussed further in Section 7.4, is that there is on average notably a lower population size and lower population density for observations very close to the threshold. However, this does not invalidate the assumption of continuity, seeing that this is the case on both sides of the threshold. To conclude, the graphical representation shows that the covariates are balanced across the threshold.

Figure 5: Average municipal population size and density by the minimum distance to a seat change



Notes: The figure plots the average municipal population size (in numbers of people in 1000s) and average population density (in number of people per km^2) by the minimum distance to a seat change, measured in percentage points (pp) of the vote share. The width of intervals is 0.1 pp.

Continuity of vote shares

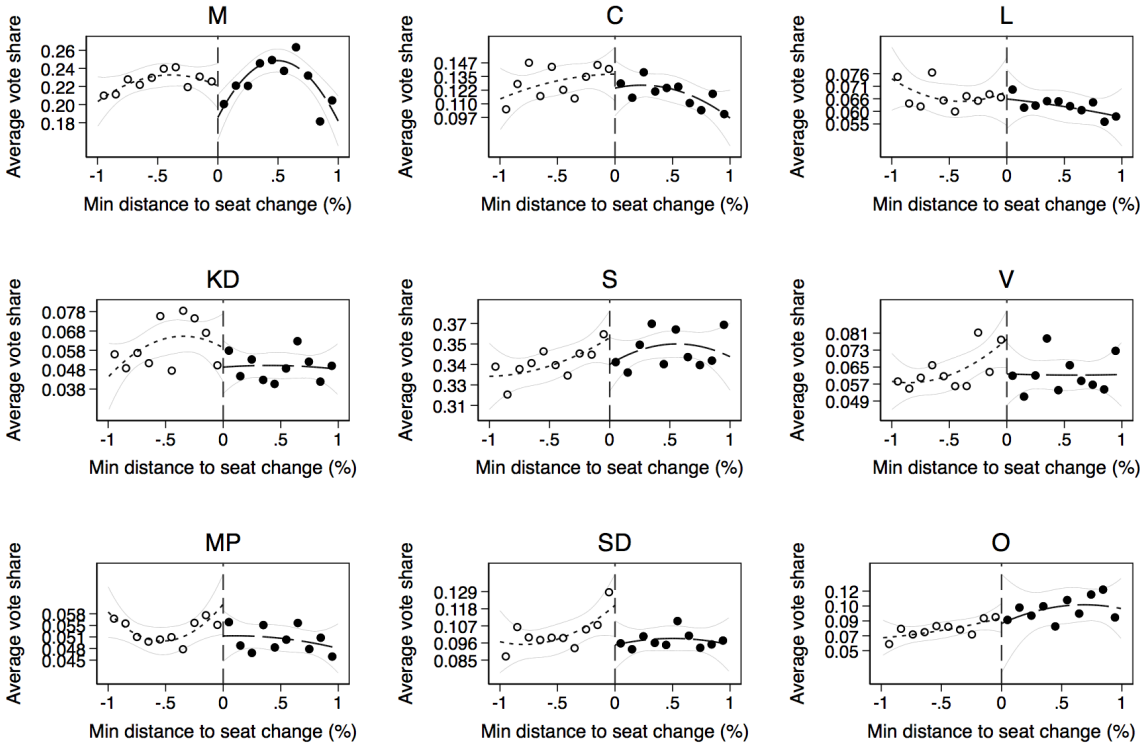
In line with the procedure of Folke (2014), it is furthermore interesting to evaluate the balance of vote shares across the threshold of the running variable. Although the seat share for each party is to one extent determined by its own vote share, it is on the marginal mainly affected by the vote shares of all other parties in the legislature, as mentioned in Section 5.2. Therefore, the vote share of the own party should not necessarily change much over the threshold. This procedure is primarily performed in order to evaluate the definition of the running variable. Additionally, it is especially important that we evaluate this given the slight change of seat allocation in 2018, as discussed in Section 6.2. We account for these changes in all aspects except the adjustment seats, representing 10% of the total seats in the 22 municipalities with multiple electoral districts. These seats correspond to 0.43% of the overall number of observations.[34] To evaluate if this has any significant adverse effect on the validity of the specification, we plot the average vote share over the running variable, as presented below in

[34]This figure is based on the number of compensation seats of 166 divided by the total number of seats 38,458 across all election years as reported by Swedish Election Authority (2018).

Figure 6. There are no significant jumps across the thresholds as shown by the overlapping confidence intervals. Therefore, we do not have reason to believe that the definition of the minimum distance to a seat change violates the continuity assumption.

With this being said, the parties Sweden Democrats (SD) and Left Party (V) however show slight tendencies of discontinuity. In order to make sure that a possible misspecification for the adjustment seats does not drive this, we plot the same graph excluding the affected municipalities in 2018. The results, presented in Figure 14 in Appendix A, are nearly identical to the ones including these observations. Thus, we can conclude that the possible misspecification for these observations does not drive any inconsistencies between the running variable and vote shares. Furthermore, the slight tendencies of discontinuities are therefore more likely to exist due the graphical interpretation not being completely straightforward. This is because the vote shares of a party can differ considerably across municipalities, meaning that there can be a large variation in its likelihood to be close to a seat gain or seat loss. Since we are plotting the vote shares across all municipalities – independent of the vote distribution – it is possible that outliers in some municipalities skew the mean in a way that is not representable of the actual distribution (Folke, 2014).

Figure 6: Average vote share by the minimum distance to a seat change per party

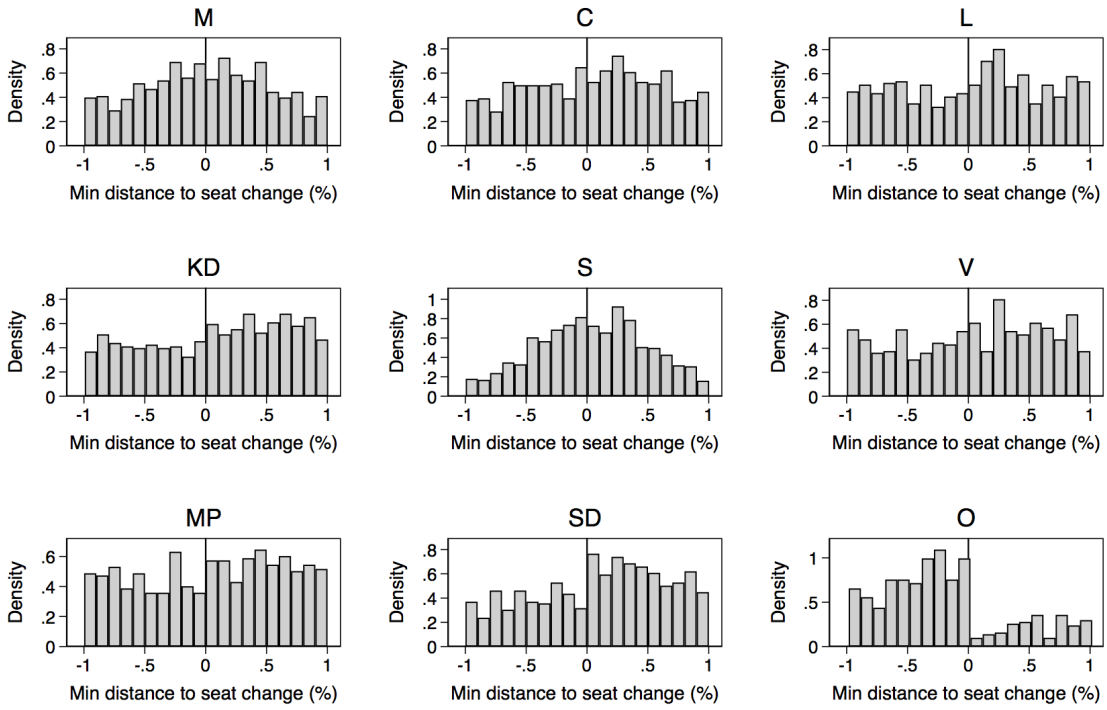


Notes: The figure plots the average vote share by the minimum distance to a seat change, measured in percentage points (pp) of the vote share, by party, on the electoral district level. The width of intervals is 0.1 pp. The graph includes a fitted polynomial as well as confidence intervals.

Density of running variable

We continue to assess the RD assumptions by studying the density of the running variable. The density of the running variable is not strictly required for the validity of the RD design, yet a visible discontinuous jump could be an indication of sorting (Imbens & Lemieux, 2008). This refers to the possible manipulation of the running variable close to the threshold – that some observations close to one side of the threshold are manually moved just across the threshold. This would be manifested in a one-time jump of observations over the threshold. In our context, sorting would be caused by a party close to a seat change being falsely assigned a higher value of votes to cross the threshold, which would be the case of corrupt voting recording. This is not very likely in the proportional context, given that seats are allocated according to a function depending on vote shares of all other parties. Thus, it is difficult to in advance determine the exact vote share for which an additional seat is given to the party. Additionally, this type of election rigging is very uncommon in the Western style democracies (Bernard, 2017). We have reason to believe that it is especially uncommon given that Sweden is amongst the least corrupt counties in the world according to the *Corruption Perceptions Index 2019* published by Transparency International (2020).

Figure 7: Number of observations by the minimum distance to a seat change



Notes: The figure plots histograms of observation density over the minimum distance to a seat change, measured in percentage points (pp) of the vote share, by party, on the electoral district level.

Indeed, reviewing the graphs in Figure 7, overall, there seems to be no bunching over the threshold. However, for the Sweden Democrats (SD), and especially for Other Parties (O), we do see a higher concentration on one side of the threshold. This is probably due to the fact

that the observations of these parties are statistically over-represented at vote shares closer to a certain type of seat change. For instance, the parties included in Other Parties in general have small vote shares, and often have no seats in the legislature. Thus, they are more likely to be close to a seat gain than a seat loss. However, as this is not a sign of sorting, we conclude that the density of the running variable should not be an issue for our analysis.

7.1.2 Evaluating the treatment variable

Table 7: Estimated effect of treatment variable on seat share

	(1)	(2)	(3)	(4)	(5)	(6)
Conservative party (M)	0.77**	0.28	-0.14	0.79***	0.89***	0.95***
	(0.36)	(0.48)	(0.79)	(0.02)	(0.03)	(0.04)
Identifying observations	439	249	104	439	249	104
Centre party (C)	0.65*	0.20	0.43	0.79***	0.88***	0.90***
	(0.37)	(0.58)	(0.74)	(0.02)	(0.03)	(0.04)
Identifying observations	387	205	86	387	205	86
Liberal party (L)	0.66***	0.77**	0.94**	0.74***	0.84***	0.94***
	(0.22)	(0.30)	(0.38)	(0.02)	(0.02)	(0.04)
Identifying observations	342	176	63	342	176	63
Christian democrats (KD)	-0.05	0.15	1.38**	0.74***	0.83***	0.92***
	(0.33)	(0.52)	(0.63)	(0.02)	(0.03)	(0.03)
Identifying observations	312	166	71	312	166	71
Social democrats (S)	0.80***	0.12	-0.09	0.71***	0.80***	0.90***
	(0.28)	(0.39)	(0.53)	(0.03)	(0.04)	(0.05)
Identifying observations	564	324	149	564	324	149
Left party (V)	0.38	-0.19	-0.14	0.78***	0.87***	0.91***
	(0.27)	(0.52)	(0.54)	(0.02)	(0.02)	(0.04)
Identifying observations	332	175	80	332	175	80
Green party (MP)	0.56***	0.60***	0.79***	0.79***	0.89***	0.96***
	(0.12)	(0.18)	(0.25)	(0.02)	(0.02)	(0.04)
Identifying observations	314	161	63	314	161	63
Sweden democrats (SD)	0.26	-0.04	-0.55	0.78***	0.85***	0.95***
	(0.27)	(0.40)	(0.84)	(0.02)	(0.03)	(0.05)
Identifying observations	384	198	82	384	198	82
Other (O)	1.54***	1.37*	1.49**	0.89***	1.05***	1.19***
	(0.54)	(0.79)	(0.67)	(0.04)	(0.05)	(0.09)
Identifying observations	256	134	60	256	134	60
Vote share control	no	no	no	yes	yes	yes
$\lambda =$	0.5%	0.25%	0.1%	0.5%	0.25%	0.1%
Identifying observations	3330	1788	758	3330	1788	758

Notes: Robust standard errors, clustered on the municipality level, in brackets. Regression of treatment variable on seat shares for each individual party with varying levels of thresholds for the treatment variable (0.5%, 0.25% and 0.01%). Control variables (c_{pi}) are included in the regressions. Number of observations refer to the cases where there is a value of the treatment variable for the relevant party. Vote share control refers to a fourth order polynomial of vote share for the party.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Having established that the running variable is valid and that the assumptions for the RD approach are fulfilled, we continue by evaluating the validity of our computed treatment variable. In line with Folke (2014), we evaluate this by regressing the treatment variable (t_{pit}) on the seat shares (s_{pit}) for each party. In this regression, the coefficients represent the probability of experiencing a seat change when the treatment variable takes on a non-zero value – that is $-\frac{1}{2}$ if the observation is close and below the threshold, and $\frac{1}{2}$ if it is close and

above the threshold. Thus, we expect the coefficients to be significant and increasingly close to 1 when the bandwidth is reduced, that is, when we are using observations increasingly close to the threshold. Indeed, as seen in Columns (4), (5) and (6) in Table 7 above, estimates are close to 1 and significant at the 1% level, when including vote share controls. Additionally, coefficients are steadily increasing when moving from a bandwidth of 0.5% to 0.25% and lastly to 0.1%, in which all coefficients are above 0.9 pp. These estimates are very similar to the estimates found by Folke (2014) and implies that the treatment variable is correctly specified. Reconnecting to the issue raised in the part above, with regard to the changes in seat share allocation method of 2018, we also note that it does not impede on the treatment variable to correctly identify the probability of seat share changes.

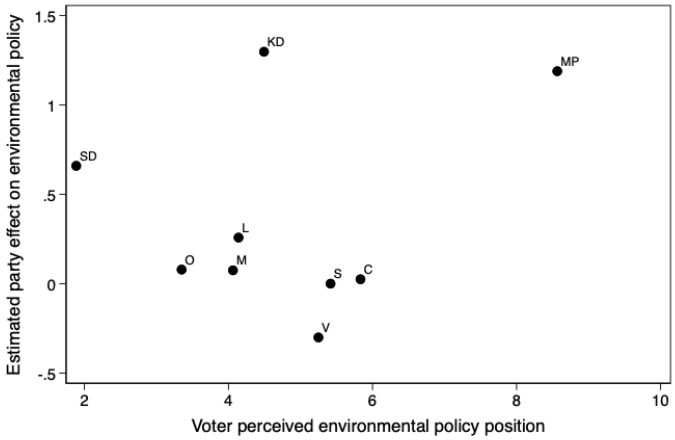
When vote share controls are not included, as presented in Columns (1), (2) and (3) in Table 7, the coefficients are on average smaller in magnitude and have greater standard errors, and hence at lower levels of significance. The likely reason for this is that there is a large variation in the seat shares of the parties across municipalities. As mentioned in Section 5.2, when studying a multiparty framework seat allocation thresholds are not predetermined, yet depend on the vote shares of all parties as well as on the size of the legislature. As an example, the vote share of the largest party, the Social Democrats, ranges from 7% to 67% across municipalities and election years. Given that the same party can differ greatly in size across the local governments, we could expect that the treatment effect on seat share would be sensitive to the vote shares. Contrarily, the Green Party has a rather small variation in its vote shares across municipalities, as seen in Table 5. This could then explain why the coefficients for this party are positive and significant at the 1%-level, even when vote share controls are excluded.

Taken all together, the results from this part indicate that the treatment variable is correctly specified, and that the vote share control is important for obtaining more precise estimates of the treatment effect. Since we employ the control function approach and include these vote share controls for our main specification, this should not be considered as a concern for the validity of our RD approach.

7.2 Main results

We can now turn to interpret the results from our main specification, as presented in Equation 3. To recall, this equation compares the municipal environmental policy outcomes for when parties are just above or just below the threshold to obtain additional seats. Following Folke (2014), the largest party, the Social Democrats, is omitted in the regression and used as the reference party for which the other parties are estimated against.[35] The results from the baseline specification can be interpreted as the effect that each party has on environmental policy outcome, as its representation increases at the expense of the Social Democrats.

Figure 8: Estimated partisan effects on environmental policy relative to perceived policy position



Notes: Figure plotting estimated coefficients from our main specification on the perceived environmental policy position from the perspective of voters for each party based on data from the National Election Survey 2010.

The environmental policy positions of the parties, presented earlier in Table 2, provide a base on which we can form our expectations. The relation between our expectations and results is presented in Figure 8 above, in which we plot our estimated coefficients of the main specification on the policy position of each party. Given these policy positions, some of the results are somewhat unexpected. Both the Left Party and the Centre Party are highly ranked in the policy position index, while the Sweden Democrats is ranked the lowest. The estimated coefficients are, however, not aligned with these expectations. The results for the Conservative Party and the Liberal Party are more in line with the policy position index. The strongest effect is found for the Christian Democrats. However, looking closer at the estimated coefficients, presented in Column (1) of Table 8, we see that this coefficient is only significant at the 10%-level. This coefficient is additionally, as seen in Section 7.3, highly sensitive to alternative specifications. With regard to this, we interpret this result with caution.

[35]This is also the party most likely to experience a seat change, given that probability of seat change increases with party size, as presented in Section 5.2.

Table 8: Estimated effects of seat share on environmental policy outcomes

	(1) Base	(2) 2SLS	(3) OLS
Conservative Party (M)	0.07	0.40	-0.41**
	(0.57)	(0.75)	(0.17)
Centre Party (C)	0.02	0.32	-0.03
	(0.61)	(0.87)	(0.15)
Liberal Party (L)	0.26	0.34	0.11
	(0.73)	(0.91)	(0.25)
Christian Democrats (KD)	1.30*	1.85*	0.17
	(0.73)	(1.08)	(0.20)
Left Party (V)	-0.30	0.03	0.43***
	(0.70)	(0.92)	(0.13)
Green Party (MP)	1.19**	1.45*	0.41
	(0.58)	(0.77)	(0.28)
Sweden Democrats (SD)	0.66	1.01	0.23
	(0.71)	(0.93)	(0.18)
Other (O)	0.08	0.46	-0.21
	(1.10)	(1.12)	(0.13)
Observations	870	870	870

Notes: Robust standard errors, clustered on the municipality level, in brackets. $\lambda = 0.25\%$ for the base and the 2SLS specifications. The three specifications are regressions of seat shares on municipal average environmental policy score (% relative to maximum score) for the election years 2010–2018. The largest party, Social Democrats (S), is used as reference party. All specifications are controlled for municipality fixed effects, election year fixed effects and includes a fourth order polynomial of vote shares for each party. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

With this being said, it is only the Green Party that shows a significant effect at the 5%-level.[36] This coefficient can be interpreted as following: a 1 percentage point (pp) increase in the seat shares of the Green Party, at the expense of the Social Democrats, causes an average increase in the environmental policy index in a municipality with 1.19 pp. Relating these estimates to the specific context of Swedish municipalities, in which the average number of seats in the legislatures is 44 seats, the average seat represents a seat share of approximately 2.3% in a municipality. Thus, as the Green Party gains a single seat in the legislature, at the expense of the Social Democrats, the environmental policy index of the municipality is expected to increase with around 2.7 pp. Relating this to the environmental ranking in 2019, an additional seat corresponds to approximately 1.1 additional total points (out of 41), which is equal to on average better performance in 1.1 survey questions, as most survey questions are worth 1 point each. In Section 7.5 we elaborate on possible mechanisms behind these results.

Comparative specifications

Additionally, Table 8 shows the results from 2SLS and OLS estimations. Column (2) displays the 2SLS regression, following Equation 5. If the treatment effect on the seat share for each party is close to 1, the results from the 2SLS should be similar to the results from the RD

[36] When omitting another party than the Social Democrats in the regression, the results for the Green Party are significant on at least the 10%-level and greater than 1, for all reference parties except the Christian Democrats.

design specification (Folke, 2014). Comparing the estimates in Column (2) to Column (1), a slightly stronger, positive effect can be seen for the coefficients of all parties. However, the standard errors are also slightly greater in magnitude. Given that the results for the Green Party are no longer significant at the 5%-level, we conclude that the results from the main specification should be interpreted with some caution.

The results from the OLS regression, following Equation 1, are presented in Column (3). The specification exhibits a significant negative effect for the Conservative Party on environmental policy of -0.41 pp on the 5%-level, and a significant positive effect of the left-wing Left Party on environmental policy of 0.43 pp on the 1%-level. The majority of the other parties show a less strong positive effect, however without any significance in the estimates. These results are in line with the literature suggesting that left-wing parties seem to be associated with a positive impact on environmental policy outcomes, in contrast to their right-wing counterparts, as presented in Section 2.2. However, as discussed in Section 5.1, these estimates most likely suffer from substantial omitted variable bias. While these results indicate that a somewhat higher (lower) degree of environmental policy outcomes can be found in municipalities where the Left Party (Conservative Party) increases its representation at the expense of the Social Democrats, they do not give us indications of the causal effect.

7.3 Sensitivity analysis

Generally, an estimated effect is more reliable if it is robust to various specifications. In this subsection, we test this by estimating alternative specifications of our main model. In doing this, we mainly focus on interpreting the effect of the Green Party on environmental policy. First, the main specification is estimated using different bandwidths and using different order of the polynomial vote share control, respectively. Secondly, we conduct step-wise alternations to the main specification. Lastly, we discuss the results when alternating the outcome variable with different parts of the environmental policy index.

7.3.1 Changing bandwidths and polynomial orders of control function

Following the recommendations of Lee and Lemieux (2010), we test the baseline specification with different bandwidths and polynomial orders of the control function.

Starting with the specifications including various bandwidths, presented in Table 9, we notice that the main results are in fact sensitive. This implies that the results could rely on a specific group of identifying observations. When the bandwidth is increased to 0.5%, the point estimate for the Green Party becomes close to zero and not significant at any conventional significance level.[37] On the one hand, a smaller bandwidth strengthens the internal validity and identifying assumption, as could be depicted in Table 7. On the other hand, a wider bandwidth provides the estimation with more identifying observations and decreases the standard errors, hence increasing the precision of the estimates. As mentioned in Section 5.4, our methodological approach implies that treated observations lies on both sides of the

[37] The results in Folke (2014) are also sensitive to changes in bandwidth. When using $\lambda = 0.1\%$ and $\lambda = 0.5\%$, the estimate for the effect of the Green Party on environmental policy decreases in magnitude and are not significant at any conventional significance level.

threshold. In technical terms, this means that we have two separate forcing variables on each side of the threshold – a setting for which optimal bandwidth tests are not applicable (Folke, 2014). An important factor to consider when studying PR systems is that the vote shares of parties are rather small, as there are several parties competing for electoral representation. Therefore, the preferred bandwidth should be small enough to capture the closeness to the threshold for smaller vote shares. As put forward by Folke (2009), using $\lambda = 0.5\%$ is arguably a too wide of a bandwidth since for small parties with differences in vote shares, the distance to the threshold does not become arbitrarily close; and using $\lambda = 0.1\%$ is arguably too narrow since the standard errors are too large in this specification.[38]

Table 9: Estimated effects of seat share on environmental policy outcomes with alternative vote share controls and bandwidths

	Order of vote share control				Bandwidths (λ)		
	1st	2nd	3rd	4th	0.5%	0.25%	0.1%
Conservative Party (M)	-0.08	-0.11	-0.04	0.07	-0.05	0.07	1.02
	(0.56)	(0.54)	(0.55)	(0.57)	(0.43)	(0.57)	(1.04)
Centre Party (C)	-0.15	-0.16	0.02	0.02	-0.46	0.02	-0.31
	(0.61)	(0.61)	(0.61)	(0.61)	(0.42)	(0.61)	(1.05)
Liberal Party (L)	0.15	0.16	0.31	0.26	-0.25	0.26	-0.61
	(0.69)	(0.70)	(0.71)	(0.73)	(0.54)	(0.73)	(1.13)
Christian Democrats (KD)	0.88	0.99	1.25*	1.30*	0.28	1.30*	0.60
	(0.70)	(0.70)	(0.73)	(0.73)	(0.50)	(0.73)	(1.07)
Left Party (V)	-0.32	-0.29	-0.40	-0.30	-0.54	-0.30	-0.57
	(0.69)	(0.70)	(0.70)	(0.70)	(0.49)	(0.70)	(1.02)
Green Party (MP)	1.14**	1.00*	1.19**	1.19**	-0.02	1.19**	0.31
	(0.56)	(0.57)	(0.57)	(0.58)	(0.50)	(0.58)	(1.02)
Sweden Democrats (SD)	0.59	0.57	0.56	0.66	0.54	0.66	0.85
	(0.69)	(0.70)	(0.71)	(0.71)	(0.53)	(0.71)	(1.32)
Other (O)	0.00	-0.03	-0.01	0.08	0.66	0.08	1.28
	(1.19)	(1.19)	(1.14)	(1.10)	(0.75)	(1.10)	(1.62)
Observations	870	870	870	870	870	870	870

Notes: Robust standard errors, clustered on the municipality level, in brackets. Columns present the main specification with alternative orders of vote share controls (1st–4th order) and alternative bandwidths (λ equal to 0.5%, 0.25% and 0.1%). The largest party, Social Democrats (S), is used as reference party. All specifications are controlled for municipality fixed effects and election year fixed effects. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

As mentioned in Section 5.4, specifying the incorrect parametric functional form of the polynomial control function can potentially lead to biased estimates (Lee & Lemieux, 2010). In Table 9 we show that the main results are not very sensitive to the choice of the polynomial order of the control function, since the estimates remain positive, similar in size as well as significant. It is only for the second order polynomial control function specification that there is a slight change in the point estimate of the Green Party on environmental policy, which drops to 1 pp and the related significance level is reduced to 10%.

[38] To put these bandwidths in context, recall the average absolute number of votes these bandwidths represent as presented in Section 5.2: 84.5 for 0.5%, 42.2 for 0.25%, and 1.7 for 0.1%.

7.3.2 Alternations of the main specification

Table 14 in Appendix A presents the results of adding elements, one by one, to the main specification. Column (1) shows solely the treatment variable regressed on the environmental policy outcome. As seen in Column (2), adding the control variable – indicating whether an observation is close to the threshold of a seat change or not – barely changes the point estimates. This is probably due to the fact that this effect is mostly captured in the treatment variable. The most noticeable effect is when adding the vote share controls in Column (3). In the subsequent columns, there are in general fewer changes in the point estimates. Including baseline covariates and fixed effects should only reduce the sampling variance in an RD model (Lee & Lemieux, 2010). Adding election period and municipality fixed effects in the Column (4) and Column (5) respectively, slightly increases the point estimates. However, the fixed effects seem to be important for the significance level, implying that there is in fact heterogeneity across municipalities and elections years. This heterogeneity is further discussed in Section 7.4. As for the addition of the fixed effects, Table 14 shows that standard errors remain relatively constant across all columns. This further strengthens our choice of the parametric control function approach, since standard errors would increase in the case of a misspecification in this sense (Lee & Lemieux, 2010).

Given that the identifying assumption holds, the randomisation of the treatment status in the RD approach implies that the treatment effect is independent of underlying covariates. Therefore, including them in the specification should not result in any meaningful changes in the estimates. When adding covariates to our specification,[39] most coefficients decrease slightly in magnitude while the standard errors remains practically unchanged. For the Green Party, the coefficient decreases from 1.19 to 1.08 pp. If notable changes appear in point estimates and standard errors, this would indicate that there could be sorting at the threshold of the running variable. In this case, discontinuities would be shown when plotting the covariates against the running variable (Lee & Lemieux, 2010). However, as shown in Section 7.1, the covariates do not show any particular discontinuities. More importantly, however, we do not believe that there is an important change in the point estimate that would impend the identifying assumption. In Section 7.4, characteristics of the observations close to the threshold are analysed more in detail.

7.3.3 Variations of the outcome variable

In this subsection, we dissect the environmental policy outcome variable. As elaborated on in Section 6.1, the environmental policy index is divided into two parts: survey questions and external sources. The results in Table 10 show the estimated effects on these two parts of the index separately.

The first column in Table 10 presents the results from the baseline specification using the total points of the index. Column (2) displays the results from only using the survey points, which overall show estimates greater in magnitude compared to the baseline specification. These results indicate that the survey part of the environmental policy index is somewhat

[39] Detailed information on the covariates used can be found in Section 6.3.

driving the results. The standard errors are however notably larger in this specification. Moreover, the only significant coefficients are for the Christian Democrats and the Green Party, both at the 5%-level.

Table 10: Estimated effects of seat share on various environmental policy outcomes

	(1) Total	(2) Survey	(3) External
Conservative Party (M)	0.07	0.40	-0.82*
	(0.57)	(0.91)	(0.48)
Centre Party (C)	0.02	1.48	-0.80*
	(0.61)	(0.90)	(0.48)
Liberal Party (L)	0.26	-0.06	0.53
	(0.73)	(1.04)	(0.66)
Christian Democrats (KD)	1.30*	2.11**	0.07
	(0.73)	(0.99)	(0.64)
Left Party (V)	-0.30	-0.46	-0.20
	(0.70)	(1.02)	(0.56)
Green Party (MP)	1.19**	1.84**	-0.21
	(0.58)	(0.88)	(0.58)
Sweden Democrats (SD)	0.66	1.05	-0.14
	(0.71)	(1.01)	(0.57)
Other (O)	0.08	-0.53	1.02
	(1.10)	(1.66)	(0.74)
Observations	870	870	870

Notes: Robust standard errors, clustered on the municipality level, in brackets. $\lambda = 0.25\%$. The largest party, Social Democrats (S), is used as reference party. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The coefficients in Column (3) of Table 10 present the results using only the external points. These coefficients are notably weaker, and more often display a negative sign. Moreover, the standard errors of the estimates are somewhat smaller and none of the estimates are significant below the 10%-level. The parties which do have significant coefficients at the 10% level are the right-wing parties the Conservative Party and the Centre Party. Both show a negative effect, which is not very surprising for the Conservative Party given its relatively weak policy position. The negative effect for the Centre Party is however rather surprising as it has the second highest environmental policy position. It should be noted that these effects are estimated for the case when seat share is gained at the expense of the Social Democrats, which also has a high position. While interpreting these results carefully, given the low level of significance, we further discuss the possible effect of coalitions in Section 7.5.

Taken all together, this shows that the results from our specification are possibly sensitive to the outcome variable. While different measures of environmental policy outcomes are associated with both advantages and flaws, as discussed in Section 6.1, we argue that combining the informative survey-based questions with the less biased external actors should give the most representative evaluation.

7.3.4 Excluding possible misspecifications

Lastly, we aim to evaluate the robustness of our results with regard to the possible misspecification of the running variable for the municipalities with adjustment seats in the seat allocation 2018. To do this, we replicate the main regression table, Table 8, excluding these municipalities. Recalling the details provided in Section 4.2, it is worth noticing that the running variable is correctly specified for the set seats in these municipalities – corresponding to 90% of these seats. Also, these municipalities are endogenously determined, since they are all sufficiently large in population terms to employ more electoral districts. Therefore, excluding these municipalities – and not only the adjustment seats – would arguably introduce a significant source of bias for the estimated effect. Analysing the direction of the bias, however, we can find an estimated bound on the effect. Running the same regressions without these municipalities in 2010 and 2014, the coefficient for the Christian Democrats is notably smaller and the coefficient for the Green Party stronger. Expecting the direction of the bias to move the same way in 2018, we interpret the results without these municipalities as an upper-bound of the effect for the Green Party and as a lower-bound for the effect of the Christian Democrats. In line with our expectations, Table 12 in Appendix A shows that the effect for the Green Party is stronger and that the effect for the Christian Democrats is weaker. As for the main specification, the coefficient of the Green Party is 1.33 pp and still significant at the 5% level, whilst the coefficient of the Christian Democrats is 1.17 pp, and not significant at any conventional significance level. Taken together, this implies that we do not have reason to believe that the significance level for the coefficient of the Green Party is affected by the possible misspecification for these few observations. As for the coefficient of the Christian Democrats, the results are more ambiguous.

7.4 External validity considerations

As a final discussion of the robustness of our results, we discuss the external validity considerations. Despite the strength of the RD method in terms of internal validity, it is considered less strong in external validity since it is based on a narrow set of observations (see e.g. Imbens & Lemieux, 2008). As seen in Figure 5, we see indications of that the characteristics of the observations very close to the threshold differ in comparison to the characteristics of the average over all observations. Indeed, reviewing the average characteristics for different thresholds, presented in Table 13 in Appendix A, we see that observations at the different bandwidths are slightly different compared to the overall average. At $\lambda = 0.1\%$, the municipalities are somewhat below average in terms of population and population density, whilst the municipalities at $\lambda = 0.25\%$ and $\lambda = 0.5\%$ are above average.

Nonetheless, reviewing the seat share distribution in these municipalities compared to all municipalities, presented in Figure 15 in Appendix A, we see that the distribution is quite similar for $\lambda = 0.25\%$. This implies that these municipalities are similar in terms of voter preferences, and hence we should not raise any endogeneity concerns with regard to this. Still, the fact that municipalities in close elections are somewhat different – in combination with the fact that the effect found for the Green Party is rather bandwidth-dependent – propose

that the effect can be questioned for municipalities with different characteristics. Therefore, it is possible that these results are not completely representative for Sweden as a whole, and sets limitations on to which extent these results can be extrapolated. While we do not study heterogeneous effects of the municipalities, we can merely speculate what this observation might imply. Seeing that municipalities with higher population have a greater number of legislative seats, the party composition following this might imply that more parties are then – relative to the size of the legislature – more likely to be close the threshold of gaining or losing a seat. If this is the case, focusing on smaller municipalities with fewer seats in the legislature, we would possibly find a stronger effect, than had we had a more representative sample. While bearing this in mind, a higher external validity comes at the cost of high internal validity, which other methods are often criticised for, especially in the political application (Imbens & Lemieux, 2008).

7.5 Possible mechanisms

The results suggest that there could be a partisan effect on environmental policy for the Green Party. However, they provide little guidance to what mechanisms that might drive this effect. To evaluate this, we test three main hypothesised mechanisms: shifts in governing coalition, shifts in seat majorities as well as legislative representation. Please note that we are investigating implied mechanisms by correlation rather than causation. In this section we use the abbreviations for each party.

7.5.1 Shifts in governing coalition

Parties are expected to enter into governing coalitions in a PR system, and the way these coalitions are formed is likely to affect the ability of an individual party to influence the final policy outcome, as presented in Section 3. As discussed by Lakomaa and Korpi (2014) and as in shown Section 4.1, governing coalitions (GC) on the municipal level in Sweden are in many cases not simply determined by the seat share and a predetermined bloc composition. Therefore, we test the possible impact of governing coalitions by running our baseline specification and adding controls for the actual governing coalitions. This mechanism is mentioned yet not controlled by Folke (2014) due to data availability issues for his time period. As presented in Section 4.1, we use data and definitions of the governing coalitions from SKR.[40]

Controlling for all governing coalitions, shown in Column (2) of Table 11, we see that the estimated coefficient for most parties, except for S and V, decrease somewhat, whilst standard errors are kept relatively stable. For MP and KD, the only parties with significant coefficients, the effect differs. The coefficient for MP is unchanged, whilst the KD coefficient increases from 1.30 to 1.41 pp. The levels of significance are unchanged at 5% and 10% respectively. The fact that the MP coefficient is unchanged leads us to believe that the effect is not influenced by the type of governing coalition. However, the coefficient for KD increases whilst the coefficient for its most common coalition,[41] the right-wing coalition, is negative. This leads us to believe that

[40] To recall, the five coalitions defined are the following: left coalition – consisting of mainly S and V; right coalition – consisting of mainly M, C, KD and L; mixed coalition including MP; and mixed coalition including SD or other mixed coalitions.

[41] Out of the coalitions that KD is part of, KD is represented in the right-wing coalition 84% of the time.

the possibilities for KD to affect environmental policy are better when there is a right-wing governing coalition.

Table 11: Possible mechanisms for the effect of seat share on environmental policy outcomes

	(1) Baseline	(2) All GC	(3) MP in GC	(4) KD in GC	(5) Seat maj.	(6) s>1	(7) s=1
Conservative Party (M)	0.07	0.15	0.15	0.08	-0.00	0.05	1.72
	(0.57)	(0.58)	(0.58)	(0.57)	(0.59)	(0.61)	(2.55)
Center Party (C)	0.02	-0.06	0.06	0.02	0.01	-0.01	-14.03***
	(0.61)	(0.61)	(0.61)	(0.61)	(0.62)	(0.64)	(4.13)
Liberal Party (L)	0.26	0.23	0.27	0.25	0.23	0.59	7.95
	(0.73)	(0.72)	(0.73)	(0.73)	(0.73)	(0.78)	(14.42)
Christian Democrats (KD)	1.30*	1.41*	1.34*	1.30*	1.29*	0.57	4.51
	(0.73)	(0.73)	(0.73)	(0.73)	(0.72)	(0.85)	(7.98)
Left Party (V)	-0.30	-0.24	-0.28	-0.30	-0.42	-0.31	79.04***
	(0.70)	(0.71)	(0.70)	(0.70)	(0.70)	(0.75)	(14.47)
Green Party (MP)	1.19**	1.19**	1.13*	1.19**	1.31**	1.23*	-11.43
	(0.58)	(0.59)	(0.58)	(0.58)	(0.60)	(0.66)	(14.40)
Sweden Democrats (SD)	0.66	0.65	0.70	0.66	0.54	0.44	-107.12*
	(0.71)	(0.71)	(0.71)	(0.71)	(0.69)	(0.80)	(61.38)
Other (O)	0.08	0.07	0.09	0.08	-0.04	0.51	-1.79
	(1.10)	(1.13)	(1.10)	(1.11)	(1.08)	(1.52)	(2.45)
Right-wing		-0.01			0.03		
		(0.01)			(0.02)		
MP in GC/BoP			0.01		-0.01		
			(0.01)		(0.01)		
KD in GC				-0.00			
				(0.01)			
Observations	870	870	870	870	870	870	870

Notes: Robust standard errors, clustered on the municipality level, in brackets. All specifications are alternations of the baseline with a $\lambda = 0.25\%$. All are regressions of the treatment variable for being close to a seat change on municipal average environmental policy score (% relative to maximum score) for the election years 2010–2018. The largest party, Social Democrats (S), is used as reference party. All specifications are controlled for municipality fixed effects, election year fixed effects and includes a fourth order polynomial of vote shares for each party. The first specification is the baseline specification. The second, third and fourth specifications controls for all governing coalitions, MP in governing coalition and KD in the governing coalition respectively, where only the relevant controls are presented. The fifth controls for majority position in terms of seat share, where BoP denotes balance of power. The last two specification refers to the same specification which includes all variables in the baseline as well as all variables interacted with a dummy for the first seat in the legislature, for which the treatment variables are shown in the last column. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

The above finding for MP in combination with the fact that the party is not clearly over-represented in any of the specified coalition types, as presented in Section 4.2, suggests that it is interesting to test whether the inclusion of MP in the governing coalition, independent of the coalition type, could be the mechanism. We test this by including a control for if MP is represented in the governing coalition. The results are presented in Column (3) in Table 11. Despite the significance level being reduced, from 5% to 10%, the MP coefficient decreases, from 1.19 to 1.13 pp. Since the coefficient for MP in GC is also positive, this suggests that a part of the partisan effect showed by MP could be driven by that it is part of a governing coalition. A corresponding test is done for KD, presented in Column (4) in the same table, which shows that the effect of KD does not seem to be driven by independently being part of the governing coalition. Taken together with the results from above, this suggests that the effect for KD could be driven by the type of governing coalition and suggestively the right-wing coalition. Although we are careful to draw any conclusions based on the KD coefficient, we can speculate that the effect indicated for KD can be driven by KD being better able to mobilise

support for environmental questions in the right-wing coalition, in which they have the second highest environmental policy position. Further, given that our policy positions are based on perceptions of the parties on the national level, it is possible that KD could hold the strongest environmental policy position in the right-wing coalition.[42]

7.5.2 Non-binding coalitions

The fact that coalitions are not binding in Swedish municipal legislatures, presented in Section 4.1, means that parties can deviate from the position of the governing coalitions on particular questions – possibly by trading support on other questions (Folke, 2014). It is especially likely that these types of coalitions would be important for MP given that we study environmental policy, for which it holds a strong policy position. Given that there are strong incentives for MP to trade support for environmental issues on other issues, it is interesting to control for the possible majority coalition in which MP could be included in as well. Since there are no available data on what coalitions are formed for each specific topic, we follow Folke (2014) and control for seat share majorities in five groups, based on the most probable coalition forms presented in Section 4.1, which is the left- and right-wing coalitions and MP and SD as individual parties. Specifically, the groups are the following: left majority – V and S together holding more than 50% of seats; right majority – M, C, KD and L together holding more than 50% of seat; MP holding the balance of power (BoP) – left or right majority possible with the support of MP; and SD holding the BoP – left or right majority possible with the support of SD.

When controlling for this, as shown in Table 11, the coefficients for all parties except for MP decrease while the standard errors are largely unchanged compared to the baseline, shown in Table 8. The coefficient for MP is increased from 1.19 to 1.31 pp, while still significant at the 5% level, and the coefficient for MP holding BoP is negative. For KD, the coefficient decreases marginally, from 1.30 to 1.29 pp, while still significant on the 10% level. Thus, we are led to believe that the effect for MP could be driven by its possibility to trade support on specific questions. This could also be the case for SD, however since neither coefficient for SD is significant, we are cautious to draw any conclusions about this. The effect for KD is implied to not be driven by changes in seat majorities. However, given the variability of coalitions and that our approach is based on the left- versus right-wing coalitions, we are cautious to draw any further conclusions based on these findings, even for MP.

7.5.3 Legislative representation

Another possible mechanism which could affect the power of a party to influence policy outcomes is the mere legislative representation – that policy is affected by simply being represented in the legislation or not (see e.g. Fiva et al., 2018; Lipset & Rokkan, 1967). Based on this, we test whether there is a difference in the effect for the first seat compared to the consecutive seats. We follow the procedure by Folke (2014) and run the baseline specification including all variables interacted with a dummy for being close to the first seat, denoted as cr_{pit}.

[42] This is supported by anecdotal evidence of weaker environmental policy position for the Centre Party on the local level (Meyer, 2020, February 18, personal communication).

The variable of interest is the treatment variable, $\frac{t_{pit}}{S_{it}}$, interacted with the first seat dummy variable, cr_{pit}. The regression results of the effect of the interaction variable is presented in Column (7) of Table 11, and are compared with the results showing the effect of the regular treatment variable – now representing the effect of consecutive seats – in the same regression presented in Column (6).

Studying the coefficients for the first seat, we see that all coefficients change notably, especially in magnitude – some estimates even switch signs – and related standard errors are substantially larger. The significant coefficients suggest that there is a positive effect of having L represented in government, and negative effect of having C and especially SD represented in government. However, due to the possibility of false positives associated with such large coefficients, the coefficients of the first seat are considered as weak indications rather than results.

Focusing on the coefficients for the consecutive seats, in Column (6), the coefficient for MP increases slightly, from 1.19 to 1.23 pp, with only slightly greater standard errors. Seeing that the coefficient for MP is greater than the negative coefficient for the first seat, we follow the interpretation of Folke (2014) and suggest that there could be increasing returns to scale for MP – bargaining power could be increased through stronger support from more fellow party representatives in the legislature. The coefficient for consecutive seats for KD is smaller compared to the coefficient for the first seat, which indicates that there might be a positive effect from the mere representation. However, both coefficients for KD in this regression are insignificant and hence we do not draw any conclusions regarding this. Yet, given the substantial standard errors exhibited by the treatment variable for the first seat, we are careful to draw any further conclusions based on this mechanism, even for MP.

8 Discussion

8.1 Relating our results to previous findings

Our results are in line with the findings of Folke (2014), who finds an effect of 1.69 pp per a 1 pp increase in seat share for the Green Party on environmental policy, robust and statistically significant at the 5% level. Our coefficient of 1.19 pp has the same level of significance, yet is weaker. However, due to the fact that we study different environmental policy indices, we are not able to establish that there is a true difference in magnitude when comparing our results. Should the magnitudes be comparable, we can speculate that this could be driven by other parties improving their environmental policy to meet the increase in perceived importance for environmental policy since the early 2000s (see e.g. Ripple et al., 2020; Turner & Clifton, 2009), which is the end of the study period of Folke (2014). We argue that this could be the case based on the following. First, should environmental policy be perceived more important by all voters, parties are expected to align their platforms to match this according to the Median Voter Theorem (Downs, 1957). Secondly, given the already strong position of the Green Party, it is likely that the net effect would be that the difference in environmental policy position between the Green Party and all other parties is decreased, implying less divergence of policy platforms. In that case, referring to the part on policy divergence in the theoretical framework, less divergence of policy outcomes are thus predicted (Fiva et al., 2018). Given that we do not study this relationship specifically however, we cannot draw any further conclusions with regards to this. With this being said, the relationship between perceived importance of environmental policy and the related partisan effect would be an interesting area for future research.

Additionally, perceiving immigration policy as a comparable secondary policy, our results are in line with the result found by Folke (2014) showing a significant effect of a nationalist party on immigration policy. Further, relating our results to the studies of partisan effects on primary policy outcomes, they are in line in the sense that a significant partisan effect seems to exist (see e.g. Fiva et al., 2018; Lakomaa & Korpi, 2014; Palguta, 2019; Pettersson-Lidbom, 2008). In contrast to our study, however, these focus on left- and right-wing parties, or blocs, respectively, as well as study economic policy outcomes. Seeing that we only find a robust result for the Green Party, this makes our findings less comparable. The fact that we do not find any effect on environmental policy outcomes for other parties can possibly be explained by the substantially stronger position that the Green Party holds on environmental policy compared to all other parties. As discussed above, the policy divergence theory predicts that diverging policy platforms lead to diverging policy outcomes. Based on this, the theoretical predictions imply that a partisan effect should be found for left- or right-wing positioned parties had we studied a primary policy. In contrast to the studies mentioned above, however, Folke (2014) finds no partisan effect for any party on tax. Given the contradicting empirical evidence in the field, we must turn to our implied mechanism as well as the theoretical implication of the importance of coalitions and the related decision-making processes, presented in the following subsection.

8.2 Relating our results to the theoretical framework

In this subsection we present our results in light of the theory of coalition forming and bargaining, as outlined and referred to as decision-making in Section 3. Adopting our context to the theory, we can establish the following indications. The context of Swedish municipalities presented in Section 4 shows that even a small single-issue party – such as the Green Party, holding an average vote share of 4% – formed around a single-issue secondary policy is frequently included in the governing coalition. It is also shown that the Sweden Democrats, holding an average vote share of 10%, are barely ever included in a governing coalition. Thus, in this context, the probability for a party to be in the governing coalition does not seem to be strictly based on its size, yet rather on its policy position in relation to the other parties (see e.g. Austen-Smith & Banks, 1988; Strom, 1990a).

With this in mind, we proceed to interpret our the finding that the partisan effect of the Green Party seems to be driven by its inclusion in the governing coalition. The finding supports the theory that the power of the party is not necessarily linear to its representation in terms of seat shares. Rather, the party can have a stronger influence on policy outcome than expected by the mere seat share, should it be part of the governing coalition (see e.g. Banzhaf, 1965; Strom, 1990a). Moreover, we consider the implications of studying a secondary policy and thus the relation between multiple policy dimensions. Seeing that it is only the Green Party, despite its small size, which has a robust effect on environmental policy, supports the theoretical prediction that parties could gain bargaining power from taking on more extreme policy positions (see e.g. Duch et al., 2010; Kedar, 2005). For environmental policy specifically, this furthermore is in line with the theory that voters have incentives to strategically elect politicians with an even stronger preference for the environment (Roelfsema, 2007). When considering what this implies for the formation of coalitions, it is again important to highlight our context – in which the Green Party is not particularly loyal to any certain coalition. While it is most often a part of the left-wing coalition, the majority of times it is part of another type of coalition including the right-wing coalition, as seen in Section 4. This indicates that the Green Party has a rather central policy position in terms of the primary policy. Indeed, there are theoretical predictions for that the median party is crucial for the policy outcome (see e.g. Strom, 1990b). Adapted to our context, this could imply that the Green Party can trade support on environmental policy issues – which is its primary policy consideration – for support on for instance tax policy issues – which is the primary policy for other parties (see e.g. Folke, 2014). As such, if parties can gain from taking extreme positions on the secondary policy issue, this beneficial position could be strengthened if they also take a central position on the primary policy issue. Taken together with the discussion in the previous subsection, specifically the lack of effect found for any parties on primary policies by Folke (2014), our findings imply that bargaining power can be disproportionately increased for parties focusing on a secondary policy.

Furthermore, our results highlight the importance to consider the fact that coalitions are not necessarily predetermined as well as not determined on merely the right- versus left-wing dimension (see e.g. Lakomaa & Korpi, 2014). Given this, multiple policy dimensions should

be taken into account when studying and understanding how coalitions are formed (see e.g. Austen-Smith & Banks, 1988; Strom, 1990a). As such, in line with what coalition bargaining theories suggest, post-election bargaining processes is important for determining the impact of parties on policy outcomes (see e.g. Baron & Ferejohn, 1989; Snyder et al., 2005).

8.2.1 Suggestions for future research

Taking a step back from our specific context, it is worth stressing two factors that are not in the primary focus of our study, yet that our findings are likely to be contingent on. Hence, these two factors pose as interesting topics for future research. First, it might be that the effect of the governing coalition is different should the governing coalitions be binding. Although we are careful to draw conclusions from our other mechanism results, the effect indicated by the seat share majority suggest that non-governing coalitions formed could be important sources of partisan effect for small parties as well. Therefore, it would be interesting to study the effect of this further. Secondly, the Green Party might not always be as coalition independent as it is in Swedish municipalities. For instance, as discussed in Section 2, there is a body of previous research arguing that green parties are positively related to the left-wing ideology (see e.g. King & Borchardt, 1994; Neumayer, 2004; Wen et al., 2016). Further, although the coefficient of the Christian Democrats is not considered robust, the results related to the party indicate that, despite its considerable much lower environmental policy position, the effect seem to be driven by being included in its main coalition of the right-wing. Therefore, it would be interesting to study how the partisan effect on a secondary policy is affected by a context where the single-issue party tend to be tied to a specific coalition.

8.3 Policy implications

What do our results imply in the broader picture? What are the implications for policymakers when evaluating the electoral system? These questions are discussed below in the light of the implications of employing an electoral system based on proportional representation.

Our results suggest that PR systems allow for small parties to have an impact on policy outcomes with regards to their policy preferences. While we cannot test whether this would change in a majoritarian system, our findings support the claim of Lijphart (2012) – stating that PR electoral systems are more democratic by better representing minority interests, whilst still representing the majority interests. More specifically, our results support this claim by indicating that secondary policies – a minority interest represented in a PR system – are not only symbolically represented in the government, yet also represented in the policy outcomes. Our primary policy implication is thus that policymakers should consider a PR system for enhanced representation of minority interests in the final policy outcomes. The degree to which democracy can be improved by a PR systems is, however, dependent on the design. More specifically, PR systems can be designed to be "disproportional" (Lijphart, 2012). For instance, the degree of proportionality can be compromised by the existence or level of the minimum threshold for small parties. This, since introduced thresholds can substantially worsen the possibilities for the minority to be represented (see e.g. Baskaran & Lopes Da Fonseca, 2016).

A secondary policy implication for our findings, from the perspective of voters, is that

voters who perceive environmental policy to be important can have an impact by voting for the Green Party, despite its small size. Contingent on assumptions of the institutional context, this could be generalisable to other secondary policies and small-sized single-issue parties.

Another line of implications is based on the finding that governing coalitions are indicated to be important for the ability for small parties to affect policy. Thus, it cannot be taken for granted that the preferences of these parties are fully taken into account in the final outcomes by the mere representation. Therefore, policymakers should assess the rules for the forming of governing coalitions in order for small parties to be able to impact policy outcomes. This provides the base for more speculative implications, which we cover briefly following. First, from the perspective of voters, it is implied that voters should consider the governing coalition forming and bargaining process in assessing the possibilities for their most preferred policy to be represented. As a consequence, this process might not be completely straightforward, and thus PR systems can be considered to present voters with less clear policy options, which in turn could be a disadvantage for democracy (Lijphart, 2012). This poses an additional implication for policymakers to assess when evaluating the electoral system.

9 Conclusion

Within the public choice literature it has been argued that proportional representation (PR) electoral systems can be more democratic than majoritarian electoral system (see e.g. Lijphart, 2012). This is based on the claim that PR systems tend to be better at representing minority interests in government. The fundamental theory within this field, the Median Voter Theorem, however predicts that different parties are not able to affect the policy outcome (see e.g. Downs, 1957). To investigate if minority interests are represented in the policy outcome in PR systems, we study whether there is a partisan effect for small parties on the environmental policy – a well-established secondary policy. Previous research indicates that this might be the case, yet provide little guidance for the impact of governing coalitions on the individual partisan effect (see e.g. Folke, 2014). We therefore additionally examine whether governing coalitions drive the possible partisan effect.

We investigate the individual partisan effects by employing a regression discontinuity method of measuring individual partisan effects – developed by Folke (2014) – in Swedish municipalities for the years 2010–2018. Environmental policy is measured through an annual index compiled by the Swedish environmental journal *Aktuell Hållbarhet*. The second research focus is tested by using data on governing coalitions by the Swedish Association of Local Authorities and Regions (SKR). Our results suggest that the Green Party has a causal effect on environmental policy of 1.19 pp per 1 pp increase in seat share, significant at the 5% level. The effect is indicated to be driven by the Green Party being included in the governing coalition. Our results are similar to the ones of Folke (2014) concerning environmental policy. However, the effect we find is smaller in magnitude. Although we cannot test the mechanism behind this decrease, we speculate that it could be affected by the increase in perceived importance of environmental policy since the early 2000s (see e.g. Ripple et al., 2020; Turner & Clifton, 2009), as predicted by the Median Voter Theorem (see e.g Downs, 1957) and related theory of the abilities of parties to affect policy by (see e.g. Fiva et al., 2018). The relationship between perceived importance of environmental policy and the related partisan effect is however an interesting area to study in future research.

Our contribution to the public choice theory is two-fold. First, our results indicate that bargaining power can be increased by the mere inclusion in a governing coalition, independent of the type of coalition (see e.g. Strom, 1990a). Secondly, our results support the theoretical suggestion that parties can benefit from taking on more extreme policy positions when prioritising a well-established secondary policy (see e.g. Duch et al., 2010; Kedar, 2005). Additionally, our findings contribute further empirical support to the findings of Folke (2014), by studying a more recent time frame and using a different environmental policy index.

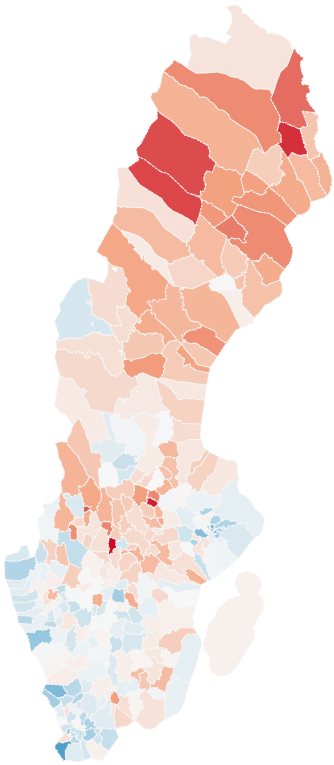
The main implication for policymakers is that a PR system, if designed carefully, can support the claim for why they can be considered more democratic. This is also an implication for voters – showing that their vote for a small party can affect the outcome of a secondary policy. Specifically, voters mostly concerned about the environment should vote for the Green Party.

It is, however, important that we interpret our results in the light of the main limitations

of our study. First, using an environmental policy index including a survey element introduces an unpredictable source of bias for our estimates. Secondly, the fact that there is a change in the seat allocation method in 2018 introduces the uncertainty of how the change affects the abilities of parties to affect policy. For instance, a part of the change is introducing a threshold for small parties – something that is argued to limit the additional effect on democracy of PR systems (Lijphart, 2012). The latter, especially, constitutes an interesting area for future research. In particular, it would be interesting to replicate the same study in a few years, when there are enough data available to compare the partisan effects across both seat allocation rules. Although we could simulate the new seat allocation method based on historical vote shares, we do not have data on the outcome variable to compare it with. Additionally, future research should be directed to evaluate how the findings are affected by another institutional context. Primarily, it would be interesting to carry out the study in a context where the single-issue party of focus is tied to a specific coalition. A second area of interest is studying how the non-binding coalition structure affects the possibilities for parties to affect policy outcomes.

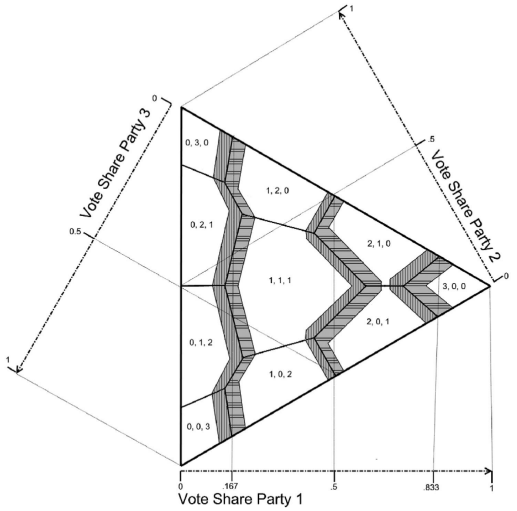
A Appendix

Figure 9: Geographical distribution of left-wing vote share



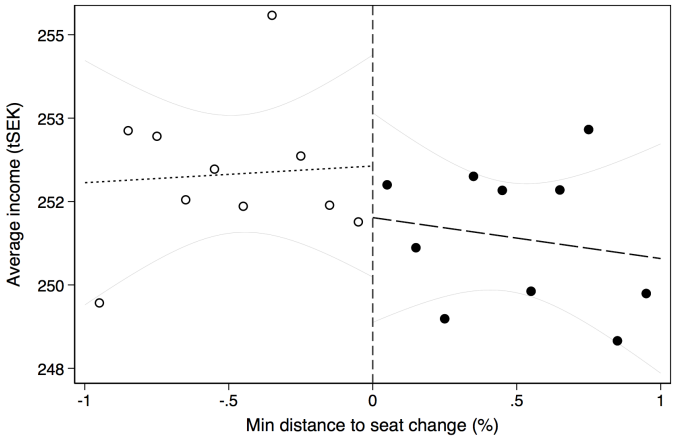
Notes: Map showing the geographical distribution of municipal average left-wing vote share, defined as the vote share for the Left Party and Social Democrats. The higher the left-wing vote share, the darker the shade of red, whilst the lower the left-wing vote share, the darker the shade of blue. The share ranges from 8.2% in Danderyd (an affluent suburb to Stockholm) to 71.8% in Degerfors (a manufacturing community close to Örebro in the middle of Sweden). Source: Authors' compilation (2020) of data from the Swedish Election Authority (2010, 2015, 2019).

Figure 10: Illustration of seat allocation for three parties



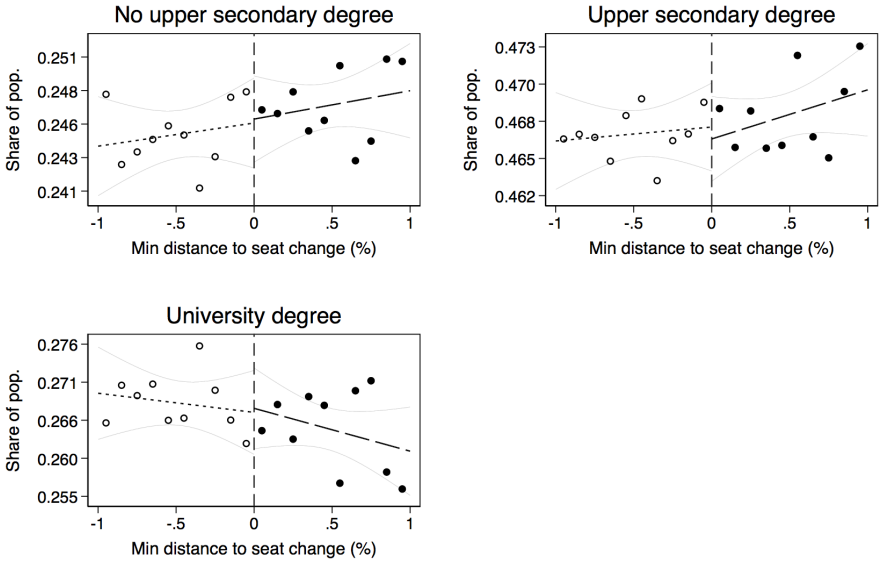
Notes: The figure is composed by Folke (2014) and illustrates the seat allocation between three parties as a function of their vote shares. The number of seats of each party is written within each contiguous "seat outcome" region in the order Party 1, Party 2, and Party 3. Regions defined as close to a threshold for Party 1 are marked in grey. Here, $\lambda = 5\%$ for illustrative purposes. The vertical lines indicate that Party 1 is close to gaining a seat, while the horizontal line indicates its being close to losing a seat. The seats are allocated using the Sainte-Laguë method.

Figure 11: Municipal average of annual income by the minimum distance to a seat change



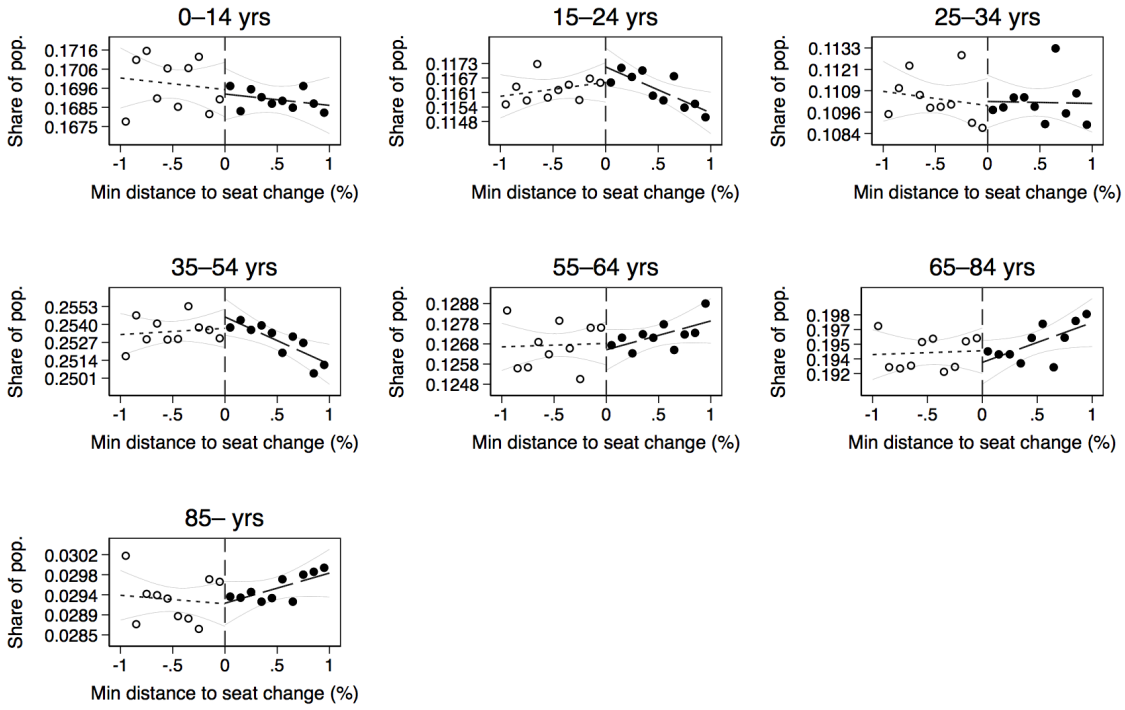
Notes: The figure plots the average annual income (in 1000s of SEK) on the municipal level by the minimum distance to a seat change, measured in percentage points (pp) of the vote share. The width of intervals is 0.1 pp.

Figure 12: Average municipal education level by the minimum distance to a seat change



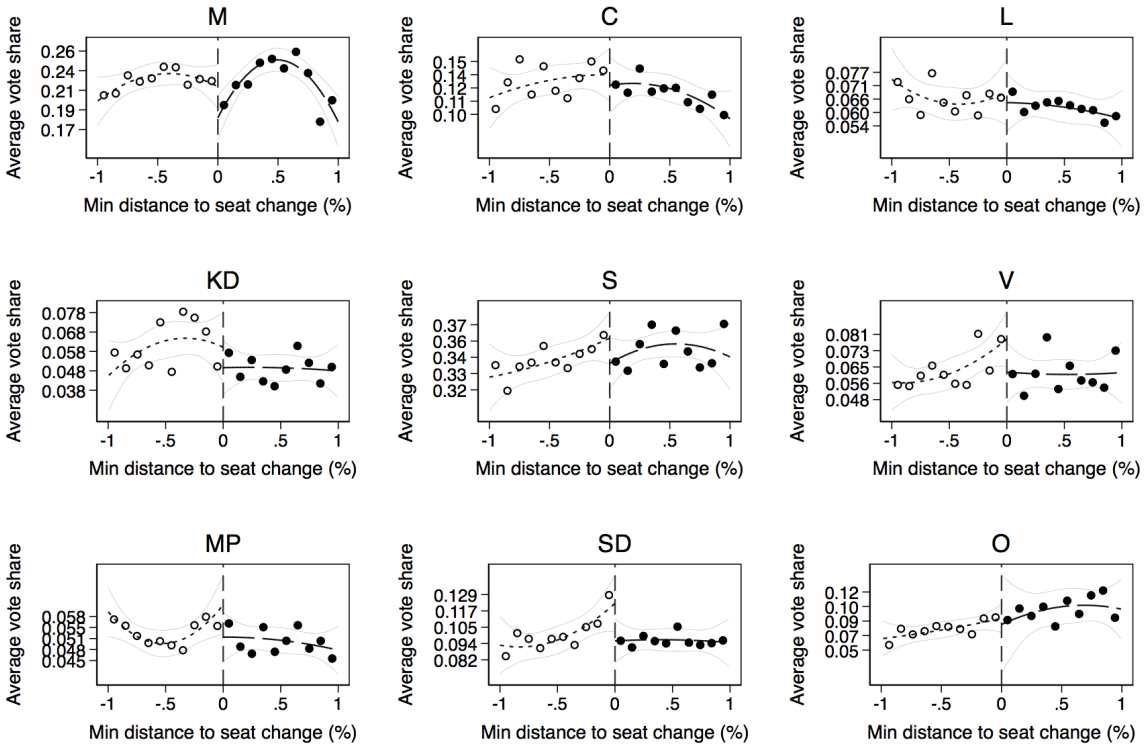
Notes: The figure plots the share of the municipal population with different degrees of highest completed education by the minimum distance to a seat change, measured in percentage points (pp) of the vote share. The width of intervals is 0.1 pp.

Figure 13: Municipal demography by the minimum distance to a seat change



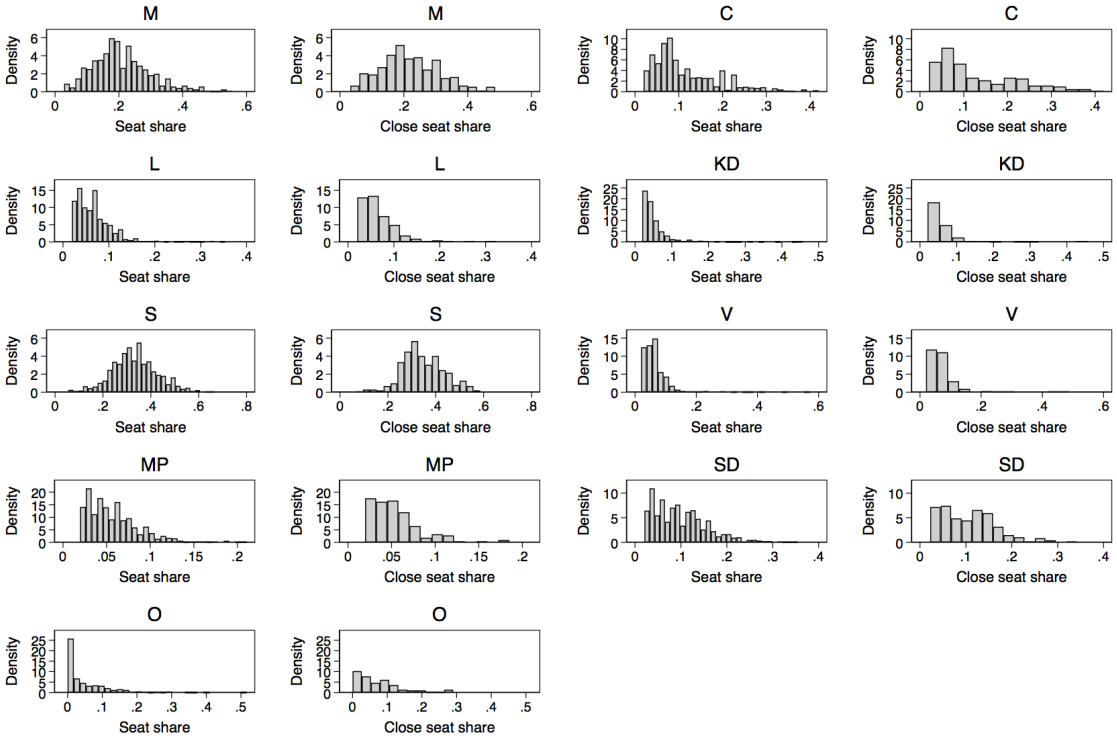
Notes: The figure plots the share of the municipal population belonging to different age groups by the minimum distance to a seat change, measured in percentage points (pp) of the vote share. The width of intervals is 0.1 pp.

Figure 14: Average vote share by the minimum distance to a seat change per party excluding possible misspecifications



Notes: The figure plots the average vote share by the minimum distance to a seat change, measured in percentage points (pp) of the vote share, by party, excluding the observations the 22 municipalities for the election year 2018 adopting adjustment seats. The width of intervals is 0.1 pp. The graph includes a fitted polynomial as well as confidence intervals.

Figure 15: Distribution of seat shares by party for all elections and close elections



Notes: Graphs plotting the density of observations over seat shares, divided by party and for all elections vs. close elections. Close elections are defined as when $\lambda = 0.25\%$.

Table 12: Estimated effects of seat share on environmental policy outcomes excluding possible misspecifications

	(1) Base	(2) 2SLS	(3) OLS
Conservative Party (M)	0.15	0.46	-0.38**
	(0.57)	(0.75)	(0.17)
Centre Party (C)	-0.01	0.27	-0.03
	(0.62)	(0.87)	(0.15)
Liberal Party (L)	0.29	0.38	0.16
	(0.74)	(0.93)	(0.24)
Christian Democrats (KD)	1.17	1.68	0.17
	(0.75)	(1.08)	(0.20)
Left Party (V)	-0.08	0.25	0.44***
	(0.71)	(0.93)	(0.13)
Green Party (MP)	1.33**	1.64**	0.44
	(0.60)	(0.78)	(0.30)
Sweden Democrats (SD)	0.64	0.99	0.23
	(0.70)	(0.95)	(0.19)
Other (O)	-0.02	0.41	-0.20
	(1.09)	(1.11)	(0.13)
Observations	848	848	848

Notes: Robust standard errors, clustered on the municipality level, in brackets. $\lambda = 0.25\%$ for the base and the 2SLS specifications. The three specifications are regressions of seat shares on municipal average environmental policy score (% relative to maximum score) for the election years 2010–2018, excluding municipalities in 2018 with adjustment seats. The largest party, Social Democrats (S), is used as reference party. All specifications are controlled for municipality fixed effects, election year fixed effects and includes a fourth order polynomial of vote shares for each party. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 13: Municipal averages by close elections

	(1) $\lambda = 0.5\%$	(2) $\lambda = 0.25\%$	(3) $\lambda = 0.1\%$	(4) All
Income (1000s SEK/yr)	251	251	251	249
	(35)	(35)	(36)	(35)
Population (000s)	39.5	43.3	33.9	34.2
	(77.3)	(89.2)	(36.5)	(70.3)
Population density (n per km^2)	169.9	177.3	122.1	149.0
	(573.5)	(588.4)	(358.5)	(535.1)
University education share	0.26	0.27	0.26	0.26
	(0.09)	(0.09)	(0.08)	(0.08)
15-24 yr share	0.12	0.12	0.12	0.11
	(0.01)	(0.01)	(0.01)	(0.01)

Notes: Municipal averages of inflation adjusted income (across all people of 16+ years), population, population density as well as share of population with university education and being aged 15–24. Standard errors are within brackets.

Table 14: Estimated effects of seat share on environmental policy outcomes, alternative specifications

	(1)	(2)	(3)	(4)	(5)	(6)
Conservative Party (M)	-0.03	0.00	-0.07	-0.08	0.07	0.12
	(0.56)	(0.56)	(0.57)	(0.57)	(0.57)	(0.56)
Centre Party (C)	-0.45	-0.15	-0.29	-0.30	0.02	0.09
	(0.60)	(0.58)	(0.59)	(0.59)	(0.61)	(0.60)
Liberal Party (L)	-0.21	-0.37	0.02	0.11	0.26	0.32
	(0.65)	(0.66)	(0.69)	(0.68)	(0.73)	(0.70)
Christian Democrats (KD)	0.73	0.68	0.98	1.06	1.30*	1.27*
	(0.70)	(0.67)	(0.69)	(0.70)	(0.73)	(0.74)
Left Party (V)	-0.54	-0.50	-0.25	-0.26	-0.30	-0.33
	(0.71)	(0.68)	(0.71)	(0.72)	(0.70)	(0.70)
Green Party (MP)	0.81	0.87	1.11*	1.17**	1.19**	1.08*
	(0.59)	(0.58)	(0.60)	(0.59)	(0.58)	(0.58)
Sweden Democrats (SD)	0.14	0.45	0.72	0.73	0.66	0.56
	(0.66)	(0.66)	(0.66)	(0.66)	(0.71)	(0.69)
Other (O)	0.43	-0.73	-0.65	-0.64	0.08	0.48
	(0.85)	(1.26)	(1.22)	(1.23)	(1.10)	(1.13)
Close election control	No	Yes	Yes	Yes	Yes	Yes
Vote share control	No	No	Yes	Yes	Yes	Yes
Election period FE	No	No	No	Yes	Yes	Yes
Municipality FE	No	No	No	No	Yes	Yes
Controls	No	No	No	No	No	Yes
Observations	870	870	870	870	870	870

Notes: Robust standard errors, clustered on the municipality level, in parentheses. $\lambda = 0.25\%$. The largest party, Social Democrats (S), is used as reference party. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 15: Average environmental policy scores by response rate

Survey response (%)	Num. of mun.	Total points	External points	Difference
25	3	0.14	0.22	-0.08
37.5	8	0.16	0.21	-0.06
50	11	0.19	0.22	-0.02
62.5	11	0.23	0.25	-0.02
75	36	0.29	0.28	0.01
87.5	69	0.36	0.32	0.04
100	152	0.47	0.39	0.08
Total	290	0.39	0.34	0.05

Notes: Average relative score of environmental policy index for different parts of the index (total points and external points) as well as the difference between the two, by the level of survey response rate.

Table 16: Average environmental policy scores for the worst survey respondents

Municipality	Survey response (%)	Total points	External points
Ljusnarsberg	25	0.14	0.24
Pajala	25	0.09	0.15
Hallefors	25	0.18	0.28
Bracke	38	0.09	0.14
Dorotea	38	0.15	0.10
Landskrona	38	0.27	0.38
Lindesberg	38	0.19	0.29
Overkalix	38	0.10	0.11
Surahammar	38	0.12	0.20
Tibro	38	0.18	0.24
Ydre	38	0.15	0.22
All above	34	0.15	0.21

Notes: Average relative score of environmental policy index for the municipalities in the worst two categories of response rates (25% and 37.5%). "All above" represents the average values of the 11 municipalities presented in the table.

B Appendix

The idea with PR election systems is that the vote shares of parties should be proportional to their seat shares in the legislature. In order to convert vote shares into seat shares, however, different methods can be employed. For Swedish municipal elections, a *highest averages method* is employed – implying that seats are distributed one by one in consecutive rounds using a series of divisors. The divisor series is based on the Sainte-Laugë divisor series with the following sequence: "1, 3, 5, 7, ...". However, Swedish municipalities employs a modified Sainte-Laugë method, using 1.4 as the first divisor.[43] Please note that all elements for the seat allocation are for an electoral district e in election year t, however, for simplicity we do not include these subscripts in the below description.

B.1 Calculating the distance to a seat threshold

Following the methodology of Folke (2014),[44] we describe how the distance to a seat change threshold is calculated using the highest averages method with the modified Sainte-Laguë divisor series below.

B.1.1 Comparison numbers

In order to determine whether a party is close to gaining or losing a seat, we begin by defining the comparison numbers. Based on the votes and seat share for each party in an electoral district each year, a party receives a comparison number which then is later used to indicate if the party is subject to gaining or losing a seat. We calculate two types of comparison numbers. First, we compute the comparison number for when all seats are distributed ($\tilde{s}_p$). Secondly, we compute the comparison number for the last seat distributed ($\tilde{s}_p - 1$). Comparing the two, we can calculate the distance for each party to a seat gain or seat loss.

Given that the first divisor is defined at 1.4, the function for calculating the first seat is somewhat different compared to the computation for the consecutive seats. If the party does not have any seats, it has the potential to *gain* a seat, and its comparison number (for when all seats are distributed) is defined as:

$$c_p(\tilde{s}_p) = \tfrac{v_p}{1.4} \quad if \quad \tilde{s}_p = 0$$

If the party has only one seat, it has potential to *lose* a seat, and its comparison number (for the last seat given) is defined as:

$$c_p(\tilde{s}_p - 1) = \tfrac{v_p}{1.4} \quad if \quad \tilde{s}_p = 1$$

For the consecutive seats, the comparison number can be defined using the standard Sainte-Laguë divisor series, starting from the second seat ("3,5,7,..."). If a party has more than one seat, it will have the potential to both gain or lose a seat. Note that a party can only be

[43] As discussed in Section 6, the first divisor used for the election year 2018 is 1.2.

[44] The methodology for the calculations of the distance to seat thresholds using the highest averages method with the modified Sainte-Laguë divisor series follows the Online Appendix, provided by Folke (2014).

subject to lose a seat if it already has a seat. If the party already has a seat or more, it has the potential to *gain* a seat, and its comparison number (for when all seats are distributed) is defined as:

$$c_p(\tilde{s}_p) = \frac{v_p}{1+2\tilde{s}_p} \quad if \quad \tilde{s}_p > 0$$

If the party has more than one seat, it also has the potential to *lose* a seat, and its comparison number (for the last seat given) is defined as:

$$c_p(\tilde{s}_p - 1) = \frac{v_p}{1+2(\tilde{s}_p-1)} \quad if \quad \tilde{s}_p > 1$$

In order to identify whether a party is close to losing a seat, its comparison number for having the potential to lose a seat is compared to the largest comparison number for all of the comparison numbers of parties having the potential to gain a seat. The largest comparison number (for the last seat given) of all comparison numbers having the potential to *gain* a seat is defined as:

$$c_{max}(\tilde{s}) = max(c_1(\tilde{s}_1), c_2(\tilde{s}_2), ..., c_P(\tilde{s}_P))$$

In order to identify whether a party is close to gaining a seat, its comparison number for having the potential to gain a seat is compared with the smallest comparison number of all of the comparison numbers of parties for having the potential to lose a seat. The smallest comparison number (for the last seat distributed) of all comparison numbers having the potential to *lose* a seat is defined as:

$$c_{min}(\tilde{s} - 1) = min(c_1(\tilde{s}_1 - 1), c_2(\tilde{s}_2 - 1), ..., c_P(\tilde{s}_P - 1))$$

B.1.2 Thresholds for gaining and losing seats

The threshold for *gaining* a seat is defined as the comparison number for the seat distributed in the final round of the seat distribution. The condition for party p to gain a seat can be written as:

$$c_p(\tilde{s}_p) > c_{min}(\tilde{s} - 1)$$

The threshold for *losing* a seat is defined as the comparison number next in line to receive a seat. The condition for party p to lose a seat can be written as:

$$c_p(\tilde{s}_p - 1) < c_{max}(\tilde{s})$$

For a party to gain (lose) a seat, another party must lose (gain) a seat. Therefore, for the condition to hold for one party, the other condition must hold for another party.

B.1.3 Distance to a seat change

As mentioned in Section 5, the seat allocation of a party is dependent on its own votes in relation to all other votes of parties. On this note, there are two important implications to consider. First, a party can experience a seat change without having its votes changed. Secondly, the change in votes required to experience a seat share is also dependent on the number of seats held by the party.

The comparison numbers and the conditions for gaining or losing a seat will now be used in order to define the distance to a seat change. The distance to a seat change is identified in two steps. First, the vote change required for seat changes are calculated through different scenarios. There are three different scenarios for which a party can experience a change in its seat allocation. Secondly, the distance to a seat change is defined as the smallest of these three vote changes.

Scenario 1: A change in the votes of the party

In the first scenario, a seat change for a party p is caused by a change in its own votes. The party p can gain enough votes such that $c_p(\tilde{s}_p) > c_{min}(\tilde{s}-1)$. Here, party p can either be next in line to gain a seat, such that $c_p(\tilde{s}_p) = c_{max}(\tilde{s})$, or second in line to another party $q = \{1, 2, ..., P-1\}$ to gain a seat, such that $c_p(\tilde{s}_p) < c_q(\tilde{s}_q)$. For the first seat and the consecutive seats respectively, the change in votes for party p leading to a seat *gain* for a party p is defined as:

$$\begin{aligned} &\frac{c_{min}(\tilde{s}-1) - c_p(\tilde{s}_p)}{1.4} \quad \textit{if} \quad \tilde{s}_p = 0 \\ &\frac{c_{min}(\tilde{s}-1) - c_p(\tilde{s}_p)}{1+2\tilde{s}_p} \quad \textit{if} \quad \tilde{s}_p > 0 \end{aligned}$$

Party p can also lose enough votes such that $c_p(\tilde{s}_p - 1) < c_{max}(\tilde{s})$. Here, party p can either be next in line to lose a seat, such that $c_p(\tilde{s}_p - 1) = c_{min}(\tilde{s}-1)$, or second in line to another party $q = \{1, 2, ..., P-1\}$ to lose a seat, such that $c_p(\tilde{s}_p - 1) > c_q(\tilde{s}_q - 1)$. For the first seat and the consecutive seats respectively, the change in votes for party p leading to a seat *loss* for a party p is defined as:

$$\begin{aligned} &\frac{c_p(\tilde{s}_p - 1) - c_{max}(\tilde{s})}{1.4} \quad \textit{if} \quad \tilde{s}_p = 1 \\ &\frac{c_p(\tilde{s}_p - 1) - c_{max}(\tilde{s})}{1+2(\tilde{s}_p - 1)} \quad \textit{if} \quad \tilde{s}_p > 1 \end{aligned}$$

Scenario 2: A change in the votes of another party

In the second scenario, a seat change for a party p is caused by a change in the votes of another party $q = \{1, 2, ..., P-1\}$. The other party q can lose enough seats, such that $c_p(\tilde{s}_p) > c_{min}(\tilde{s}-1)$. Additionally, party p has to be next in line to gain a seat, such that $c_p(\tilde{s}_p) = c_{max}(\tilde{s})$. For the first seat and the consecutive seats respectively, the change in votes

for party q leading to a seat *gain* for a party p is defined as:

$$\begin{aligned} &\frac{c_{min}(\tilde{s}-1)-c_p(\tilde{s}_p)}{1.4} \quad \textit{if} \quad \tilde{s}_q = 1 \\ &\frac{c_{min}(\tilde{s}-1)-c_p(\tilde{s}_p)}{1+2(\tilde{s}_q-1)} \quad \textit{if} \quad \tilde{s}_q > 1 \end{aligned}$$

The other party q can also gain enough seats such that $c_p(\tilde{s}_p - 1) < c_{max}(\tilde{s})$. Additionally, party p has to be next in line to lose a seat such that $c_p(\tilde{s}_p - 1) = c_{min}(\tilde{s} - 1)$. For the first seat and the consecutive seats respectively, the change in votes for party q leading to a seat *loss* for a party p is defined as:

$$\begin{aligned} &\frac{c_p(\tilde{s}_p-1)-c_{max}(\tilde{s})}{1.4} \quad \textit{if} \quad \tilde{s}_q = 0 \\ &\frac{c_p(\tilde{s}_p-1)-c_{max}(\tilde{s})}{1+2\tilde{s}_q} \quad \textit{if} \quad \tilde{s}_q > 0 \end{aligned}$$

Scenario 3: A combination of changes in the votes of parties

In the third scenario, a seat change for a party p is caused by a combination of changes in the votes of parties. For party p to gain a seat, two conditions must hold. First, party p must be second in line to another party $q = \{1, 2, ..., P-1\}$ to gain a seat, such that $c_p(\tilde{s}_p) < c_q(\tilde{s}_q)$. This can occur in two cases of votes changes. Either the party p can gain enough votes; or another party q must lose enough votes. Secondly, another party, or a combination of other parties $w = C(P-1, k)$, where k represents the possible combinations of other parties, must lose enough votes, such that $c_p(\tilde{s}_p) > c_{min}(\tilde{s}_p - 1)$. For the first seat and the consecutive seats respectively, the changes in votes for a combination of parties leading to a seat *gain* for a party p, when party p gains enough votes, is defined as:

$$\frac{c_q(\tilde{s}_q)-c_p(\tilde{s}_p)}{1.4}+\frac{c_{min}(\tilde{s}-1)-c_q(\tilde{s}_q)}{1.4} \quad \textit{if} \quad \tilde{s}_p = 0$$

$$\frac{c_q(\tilde{s}_q)-c_p(\tilde{s}_p)}{1+2\tilde{s}_p}+\frac{c_{min}(\tilde{s}-1)-c_q(\tilde{s}_q)}{1+2(\tilde{s}_w-1)} \quad \textit{if} \quad \tilde{s}_p > 0 \;\; \& \;\; \tilde{s}_w > 1$$

For the first seat and the consecutive seats respectively, the changes in votes for a combination of parties leading to a seat *gain* for a party p, when party q loses enough votes, is defined as:

$$\frac{c_q(\tilde{s}_q)-c_p(\tilde{s}_p)}{1.4}+\frac{c_{min}(\tilde{s}-1)-c_p(\tilde{s}_p)}{1.4} \quad \textit{if} \quad \tilde{s}_q = 0$$

$$\frac{c_q(\tilde{s}_q)-c_p(\tilde{s}_p)}{1+2\tilde{s}_q}+\frac{c_{min}(\tilde{s}-1)-c_p(\tilde{s}_p)}{1+2(\tilde{s}_w-1)} \quad \textit{if} \quad \tilde{s}_q > 0 \;\; \& \;\; \tilde{s}_w > 1$$

Similarly, for the party p to lose a seat, two conditions must again hold. First, the party p must be second in line to another party $q = \{1, 2, ..., P-1\}$ to lose a seat, such that $c_p(\tilde{s}_p - 1) > c_q(\tilde{s}_q - 1)$. This can occur in two cases of vote changes. Either the party p can

lose enough votes; or another party q can gain enough votes. Secondly, another party, or a combination of other parties $w = C(P-1, k)$, where k represents the possible combinations of other parties, must gain enough votes, such that $c_p(\tilde{s}_p - 1) < c_{max}(\tilde{s}_p)$. For the first seat and the consecutive seats respectively, the changes in votes for a combination of parties leading to a seat *loss* for a party p, when party p loses enough votes, is defined as:

$$\frac{c_p(\tilde{s}_p - 1) - c_q(\tilde{s}_q - 1)}{1.4} + \frac{c_q(\tilde{s}_q - 1) - c_{max}(\tilde{s})}{1.4} \quad if \quad \tilde{s}_p = 1$$

$$\frac{c_p(\tilde{s}_p - 1) - c_q(\tilde{s}_q - 1)}{1 + 2\tilde{s}_p} + \frac{c_q(\tilde{s}_q - 1) - c_{max}(\tilde{s})}{1 + 2\tilde{s}_w} \quad if \quad \tilde{s}_p > 1 \;\; \& \;\; \tilde{s}_w > 0$$

For the first seat and the consecutive seats respectively, the changes in votes for a combination of parties leading to a seat *loss* for a party p, when party q gains enough votes, is defined as:

$$\frac{c_p(\tilde{s}_p - 1) - c_q(\tilde{s}_q - 1)}{1.4} + \frac{c_p(\tilde{s}_p - 1) - c_{max}(\tilde{s})}{1.4} \quad if \quad \tilde{s}_q = 1$$

$$\frac{c_p(\tilde{s}_p - 1) - c_q(\tilde{s}_q - 1)}{1 + 2\tilde{s}_q} + \frac{c_p(\tilde{s}_p - 1) - c_{max}(\tilde{s})}{1 + 2\tilde{s}_w} \quad if \quad \tilde{s}_q > 1 \;\; \& \;\; \tilde{s}_w > 0$$

For each party, the minimum distance to a seat change will be the smallest of these possible seat share changes.

C Appendix

As mentioned in Section 6, the dependent variable as well as the control variables are collected for each year, yet aggregated and averaged over the years in order to match the data on elections. Below, we present the procedure for how these variables are compiled.

C.1 Computation of the dependent variable

We compile data on the dependent variable, environmental policy, for each year (a), which is then to be corresponding to each election year (t). All data for the index are compiled by *Aktuell Hållbarhet* in the beginning of each year and published shortly thereafter. As for the external sources, they are typically compiled in the end of the year. Therefore, the data gathered for the index in year a is composed of external data for the year $a-1$. As for the survey, when the year a represents an election year (i.e. $a = t$) it is answered by a public servant in the municipality when the incumbent government holds office, since the new government is not elected until in the end of year a. Therefore, the first year when the newly elected government holds office for which the survey is answered by public servant in the municipality is in year $a+1$. To retrieve the most representative value of the environmental policy for the government elected in year $a = t$, we take the average value of the index starting from year $a+1$ and ending with the next election year, $t+1$, that is four years later, in $a+4$. Although the data from the first year $a+1$ of this compilation includes external data from year a – in which the previous government was setting the policy for the majority of the year – we attempt to even out the effect as much as possible by taking the average including the three preceding years. More specifically: for the election year 2010, we take the average of the environmental policy index of 2011–2014; for the election year 2014, we take the average of the environmental policy index of 2015–2018; and for the election year 2018, we take the environmental policy index of 2019.

C.2 Computation of the control variables

We compile the control variables data for each year (a), which is then to be corresponding to each election year (t). To retrieve the value of the control variable for each election year, we follow a similar procedure to that of the environmental index, by taking the average of the values over the election term. However, since the data from Statistics Sweden are compiled in the end of the year we take the average starting at the same year as the election year. In other words, for election year $a = t$, we take the average of the control variables from the year a to the year before the next election year, i.e. $a+3$. Although the first of these years is mainly ruled by the previous government, we argue that this effect is somewhat evened out by taking the average over the four years. More specifically: for the election year 2010, we take the average of the data for years 2010–2013; for the election year 2014, we take the average of the data for years 2014–2017; and for the election year 2018, we take the average of the data for years 2018–2019.

D Appendix

D.1 Aggregating variables across electoral districts

Since the allocation of seats is carried out on the electoral district level, the main variables used in the specification are computed on this level and then aggregated on the municipal level to match the data for the dependent variable and the control variables. In formal terms it can be described as the following. We first aggregate the treatment variables (t_{piet}) over all electoral districts in a municipality (N). With e referring to the electoral district and i to the municipality, this can be written as following:

$$t_{pit} = \sum_{e=1}^{N} t_{piet}$$

We further aggregate the control variable (c_{pit}). The definition is, as the control variable on the electoral district level, defined as the absolute value of the treatment variable and hence the aggregation can be written as:[45]

$$c'_{pit} = abs\left(\sum_{e=1}^{N} t_{piet}\right)$$

For the vote share controls, the vote shares are weighted by district magnitude when aggregated across electoral districts for maximum precision. This aggregation is written as following:

$$v'_{pit} = \sum_{e=1}^{N} \frac{v_{piet}}{V_{iet}} \frac{S_{iet}}{S_{it}}$$

This vote share, v'_{pit}, is then inserted into the vote share equation, Equation 2. The weighing is of little importance for the estimated coefficients but increases the efficiency of the estimation, especially when the seat shares are used as dependent variables (Folke, 2014). Hence, the overall specification, as presented in Equation 3 can be written as the following:

$$y_{it} = \alpha + \beta_1 \frac{1}{S_{it}} \sum_{e=1}^{N} t_{piet} + ... + \beta_{P-1} \frac{1}{S_{it}} \sum_{e=1}^{N} t_{P-1,iet} + \gamma_1 \frac{c'_{1it}}{S_{it}} + ... + \gamma_{P-1} \frac{c'_{P-1,it}}{S_{it}} + \\ + g(\boldsymbol{V'}_{Pit}) + \pi_t + \delta_i + \varepsilon_{it} \tag{6}$$

[45] Taking the absolute value of the aggregate treatment variable rather than aggregating the absolute values of the electoral district level treatment variables provides basically the same results according to Folke (2014), and for comparability reasons, we employ the same approach.

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