Essays on Party Politics

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After all, progress is surely the product of all our joint efforts, so we can practically predict that any real progress is likely to be precisely what nobody wanted.

Finalement, le progrès n'est pas autre chose que le produit de tous les efforts communs, et l'on peut dire d'avance que le véritable progrès sera toujours ce que personne, en particulier, n'avait voulu.

-Robert Musil

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Declaration

All chapters of this thesis are self-containing research articles. Chapters 1 and 3 are from joint research. The first chapter is co-authored with Aggey Semenov and the third chapter is co-authored with Stanley L. Winer.

Abstract

This thesis comprises three essays on party politics. The first chapter discusses the strategic behavior of the central leadership and the grassroots organizations of a political party. The focus is on the degree of centralization of fundraising, which determines the locus of control over the nature of the party's platform. In a model of central and local fundraising, I show that (i) public and private funding at the central level crowd out the fundraising efforts of the national party's local organizations, leading to the centralization of power; and (ii) that there exists a collective action problem among local organizations as they attempt to free-ride on transfers from the center. The equilibrium degree of centralization under various conditions is simulated to develop testable hypotheses. Canadian data from 2005 to 2013 are then used to study the impact of central party funding on net transfers from the center to the party's local organizations. The empirical results show that an increase in central party funding (e.g., public funding) increases net transfers, while higher funding by the national party negatively impacts local fundraising efforts.

In the second chapter, I develop a methodology to deal with continuous treatment levels within a regression discontinuity design, and I apply this to study the effect of public subsidies on fundraising. Introducing continuous treatment allows the estimation of a dose-response function for outcomes conditional on the level of treatment. Using this framework, I study empirically how public subsidies in Canada allocated to grassroots political organizations impact their private fundraising: in the Canadian case I explore, a local candidate who wins over 10% of the vote was eligible for reimbursement of 60% of his electoral expenses. The results uncover a crowding-out effect. Wealthier grassroots organizations exhibit a decrease in fundraising after receiving the reimbursement. A survival effect also appears as the poorer grassroots organizations are found to increase their fundraising activities following reimbursement.

Finally, the third chapter considers issues of randomness and unobserved heterogeneity that typically arise when using a regression discontinuity design (RDD) to study the incumbency effect, or indeed in any controlled experiment. In studies of incumbency, randomness depends on the selection of 'close' elections as typically measured by a 'small' winning vote margin. However, the voters' willingness to change their vote is a critical component of a better, volatility-adjusted, measure of winning margins. We study empirically how the use of volatility-adjusted instead of simple margins alters the outcome of an RDD analysis of incumbency for Canadian federal elections. Unobserved heterogeneity in the selection of constituencies used in such an analysis arises when the electoral readiness of a political organization - a potentially important determinant of its candidate's success - is not considered. We investigate empirically how allowance for the quality of the organizations contesting an

election affects the outcome of an RDD study of incumbency over the history of federal elections. We find that adjusting for volatility alters conclusions about the exact magnitude of the incumbency effect while taking organizational quality into account eliminates the incumbency effect in the Canadian case.

General introduction

Over the last 60 years, political parties in Western democracies have experienced an important decrease in membership subscriptions and volunteer activities. Scholars have raised concerns around the impacts of the decline of grassroots organizations on the efficiency of the political system. Indeed, as local organizations lose influence within political parties, the central leadership gains control over the political platform. The implications of this apparent shift towards centralization are significant for the political system. For instance, the influence of regional special interest groups is reduced, which in turn might limit the intra-party competition of ideas.

The principal aim of this thesis is to provide a general framework to explain the decline of grassroots organizations and the centralization of power over decisions within the hands of the party leadership. The degree of centralization of power is important because it is a critical aspect of the structure of political parties as they are seen as a key link between professional politicians and the civil society. The results of this thesis reveal important tradeoffs to consider when designing optimal campaign finance regulation and subsidizing political parties.

The first chapter "Political Party Centralization" considers the strategic behavior of the central leadership and the grassroots organizations of a political party. The focus is on the degree of centralization of fundraising, which determines the locus of control over the nature of the party's platform. In Canada, the share of total party contributions raised by grassroots organizations significantly decreased from 2005 up until 2013. This is the motivating factor for this chapter, where I develop a model explaining the factors behind the centralization level of a political party. This model is used to shed light on the recent decline in grassroots organizations. The model shows the effect of decentralization on grassroots fundraising efforts. The central leadership determines the optimal level of centralization to acquire sufficient funds. Grassroots organizations also compete for transfers from the central party by reducing their effort to attract funds. This collective action problem incentivizes the central leadership to remain centralized. Canadian data from 2005 to 2013 are then used to confirm the predictions of the model. The empirical results show that an increase in central party funding (e.g., public funding) increases net transfers, while higher funding by the national party negatively impacts local fundraising efforts.

To further study the impact of public funding on grassroots organizations, in chapter 2 "The Effect of Public Subsidies on Political Organization Fundraising," I develop a methodology to provide quasi-experimental estimates of the impact of public subsidies on political organization fundraising. Conventional estimations of the impact of public subsidies to political parties on private fundraising are challenging because both public and private funding

may depend on the organization's ability since public funding schemes generally depend upon electoral outcomes. I use the federal Canadian electoral system because a local candidate is entitled to a 60% reimbursement of his electoral expenses if he received at least 10% of the vote. The results show a significant crowding out of private fundraising following a reimbursement. However, small grassroots have a positive impact on their private fundraising. This is akin to a survival effect where grassroots organizations used the reimbursement to stay afloat and fundraise in the following year.

In the final chapter "Political Competitiveness, Regression Discontinuity Design & the Incumbency Effect" random assignment and the presence of unobserved heterogeneity in the context of the regression discontinuity design (RDD) are used to estimate the incumbency advantage. In this methodology, the vote margin is the running variable. The vote margin is also recognized as a basic measure of current electoral competitiveness. However, the expectation of winning the election is mainly driven by two components: the distance to win the election, and how candidates can expect to close that distance. While the first component is usually represented by the vote margin, the second component depends upon the volatility or how individuals are willing to change their voting allegiance. Indeed, competitive races may not be explained solely by the electoral results since the current vote share is a realization of an expectation. The volatility adjusted vote margin is an alternative measure of competitiveness that we choose to apply with the RDD. The findings show that expected competitiveness could predict challenger readiness and the long-term quality of the local organization and thus limit the incumbency advantage.

Contents

Chapter 1

Political Party Centralization

Co-author: Aggey Semenov

Abstract

This study discusses the strategic behavior of the central leadership and the grassroots organizations of a political party. The focus is on the degree of centralization of fundraising, which determines the locus of control over the nature of the party's platform. In a model of central and local fundraising, I show that (i) public and private funding at the central level crowd out the fundraising efforts of the national party's local organizations, leading to the centralization of power; and (ii) that there exists a collective action problem among local organizations as they attempt to free-ride on transfers from the center.

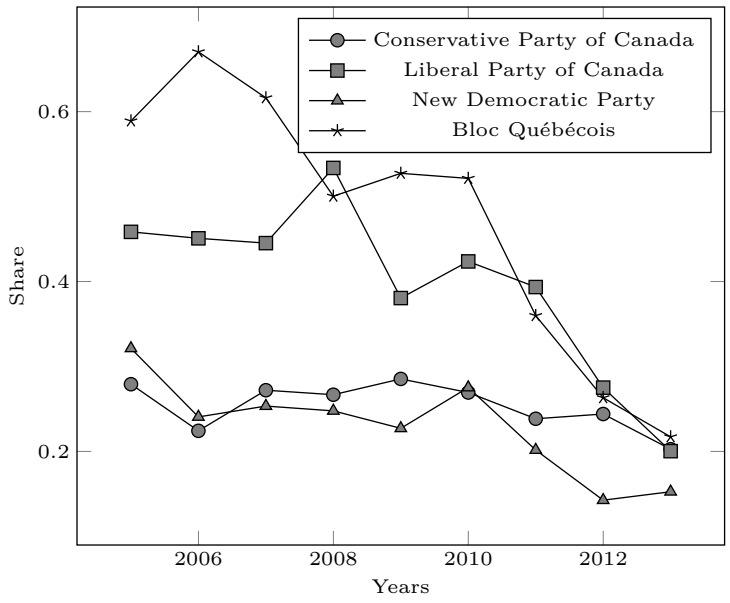
The equilibrium degree of centralization under various conditions is simulated to develop testable hypotheses. Canadian data from 2005 to 2013 are then used to study the impact of central party funding on net transfers from the center to the party's local organizations. The empirical results show that an increase in central party funding (e.g., public funding) increases net transfers, while higher funding by the national party negatively impacts local fundraising efforts.

1.1 Introduction

Over the last 60 years, political parties in Western democracies have experienced an important decrease in membership subscriptions and volunteer activities. Scholars have raised concerns around the impacts of the decline of grassroots organizations on the efficiency of the political system. Indeed, as local organizations lose influence within political parties, the central leadership gains control over the political platform. The implications of this apparent shift towards centralization is significant for the political system. For instance, the influence of regional special interest groups is reduced, which in turn might limit the intra-party competition of ideas.

In Canada, the Electoral District Associations (EDAs) are the grassroots organizations of the party (Carty, 2002; Coletto and Eagles, 2011). The main national political parties usually have an EDA in every constituency. EDAs have three main functions: they participate in the selection of the constituency candidate, they support the party candidate, and, between elections, they represent the party locally. Figure 1.1 depicts the share of total party contributions raised by local grassroots between 2004 and 2013. There has been an overall decrease in funding originating at the local level, even for parties which were already centralized, such as the New Democratic Party and the Conservative Party of Canada. This concerning change is the motivating factor of the following research.

Figure 1.1: Share of total party contributions raised by Electoral District Associations



The aim of this paper is to provide a general framework to explain the decline of grassroots organizations and the centralization of power over decisions within the hands of the party leadership. The degree of centralization of power is important because it is a critical aspect of the structure of political parties. Nassmacher (2009) explained that grassroots organizations

are seen as a key link between professional politicians and the civil society. However, many studies suggest that there has been a continuous decrease in membership subscriptions, as well as in volunteering activities (e.g. Nassmacher, 2009; Fisher, 2012; Van Biezen, Mair and Poguntke, 2012). In the light of such evidence, questions in regards to the efficiency of the democratic process have been raised. The marginalization of grassroots organizations, and their subsequent loss of influence is therefore an important topic to investigate. The results of this paper reveal important tradeoffs to consider when designing optimal campaign finance regulation and subsidy policies.

In the first part of this paper, I construct a model based on the idea that the level of centralization of power of a political party is selected by the central leadership in order to induce fundraising at the EDA level. Similarly to Wittman (1973), the party is mainly interested in policy-making. However, the central leadership and the EDAs are also interested in their respective control over the political platform. Therefore, winning the election does not mean that their preferred policies will be adopted. In this article, I focus on the behavior of factions within the party and I do not attempt to make a complete characterization of the political game. This allows the discussion of public and private funding impacts on the party organization, on the fundraising effort of the local organizations, and on the strategic behaviors between EDAs. Empirical hypotheses are derived from a simulation of the model which demonstrates that increases in public or private funding at the central party level can induce an increase of centralization. Also, increased funding at the central party level has a negative impact on EDAs' fundraising efforts.

In the second part of the paper, the hypotheses suggested by the numerical simulation are tested. In order to do so, I choose to focus on the Canadian political context because financial data are available at the EDAs level, there was an implementation and a fading-out of public funding, and EDA funding varied importantly relative to overall party funding. I estimate a fixed effects model to measure the impact of private contributions and public funding on net transfers to the EDAs. Findings suggest a positive effect of public and private funds on net transfers to the EDAs. This indicates that greater party fundraising at the center increases the control of the local organizations by the central party. Following the model, this would suggest that the influence of the local organization within the parties is decreasing. I also use by-elections at the provincial level as an instrumental variable for local fundraising, as time-variant unobservables might impact both transfers and local fundraising. This follows the idea that by-elections are often unexpected and they will limit the pool of willing contributors to the local federal parties. The reduced form indicates that a high level of central funding might have a negative impact local fundraising activities.

This paper is structured as follows: Section 2 contains a brief literature review. Section 3 presents the model. Section 4 discusses the empirical evidence. Section 5 provides the results and a discussion of the findings. Section 6 concludes.

1.2 Literature review

Economists have developed an extensive body of theoretical and empirical research on the impact of political contributions to political parties. (e.g. Welch, 1974; Austen-Smith, 1987; Grossman and Helpman, 1999; De Figueiredo and Edwards, 2007; Claessens, Feijen and

Laeven, 2008; Jenkins and Roscoe, 2005). A smaller portion of the literature studies how decisions made within a party arise from the interplay between the party factions (e.g. Goodman, 1951; Valen, 1958; Carty, 2002; Arroyo, 2004). These studies generally identify two factions: the central leadership of the party and the local activists, sometimes referred as the membership or the grassroots organizations. Caillaud and Tirole (2002) and Castanheira, Crutzen and Sahuguet (2010) discuss how the organizational decisions of the party impact electoral success through intra-party competition. For example, in many areas of the world, local organizations have historically retained the power over the nomination processes (Katz (2001)). However, the central leadership has the power to alter this process. For instance, the central leadership elects to impose candidates, but this could result in mass withdrawal by local activists and tarnish the public image of the party.

Some studies have linked the question of party finance to the struggle between internal factions. For example, Duverger's (1964) mass party model presents a party where the parliamentary representatives depend on the membership, which provides the financial resources to the party. The catch-all model of Kirchheimer (1966) presents a party which does not rely on its core supporters and therefore allows the possibility to seek new voters. The cartel model of Katz and Mair (1995) describes a party more closely connected to the public sector than to its members. In this context, a party will try to secure its financial sustainability through public subsidies. In contrast, Hopkin and Paolucci (1999) present the business firm model where membership is almost nonexistent and has no control over the party's decisions. In this context, party funding is unstable and can depend either on public funding, on special interest groups, or even on the personal wealth of its leaders. Krouwel (2006) provides a general overview of the possibilities outlined above, especially in regards to party funding.

The terms centralization and decentralization are often used to indicate how information is shared between agents of a system allocating resources.[1] Lynch (1989) explains that this term was also used by other social science scholars to define how control over an organization is shared by its members. Baum et al. (1967) provide a simple definition, "Centralization is the concentration of interpersonal control in a few members (of the organization)". In the context of a political party, the level of centralization can be defined as the relative level of control over the political platform between the central leadership and the local organizations or the members. For example, in the mass-party model of Duverger (1964), the members of a party shape the political platform, while in the business firm party model of Hopkin and Paolucci (1999), it is the central leadership that dictates the political platform. Nevertheless, little attention has been given to understand how intra-party competition between factions could shape the (de)centralization of power.

Identifying the centralization level of a political party is a complex and approximative task. For Whisler (1964), the compensation structure of a business organization is a direct indicator of centralization. However, when it comes to political parties, the compensation level is not suitable since the party compensation structure is usually limited. In Canada, while the Members of Parliament receive a wage from the government, candidates usually receive small to zero compensation for campaigning and many of the EDAs' tasks are performed by volunteers. Also, the EDAs and the party can set the wage and hire independently.

Baum et al. (1967) discuss the span of control in the organization as another measure

[1] See Hurwicz (1973) for a review of that literature.

of centralization. Coletto, Jansen and Young (2011) study transfers between the entities of the parties in Canada at the aggregate level and also relate the centralization of fundraising to the centralization of the political organization. For the purpose of this study, I use the net transfers by the central party to the EDAs as a measure of control over the resources. For instance, negative net transfers to an EDA indicate that the party is being subsidized by the EDA, while positive net transfers indicate that the EDA is being subsidized by the party. Everything else equal, a variation in the net transfers represents a change in funding control.

In the next section, I draw upon the literature discussed above by constructing a model consisting of a central organization and local EDA's in order to evaluate how the degree of centralization of a party is influenced by its funding opportunities.

1.3 The model

There are three players: the central leadership and two EDAs. The utility of the factions relies positively on the expectation of winning the election. However, the party leadership prefers to have control over the party's platform (high centralization level), whilst EDAs also prefer to have control over the party's (centralization level). In other words, control over the party's platform is limited. The expectation of winning the election depends on the level of funding.

The party leadership selects the centralization level and the EDAs select their effort level to attract funding, which indirectly affects their influence over the party policies. Parties can often opt to impose their decisions on the EDAs, but in many cases, they refrain from this due to potentially negative impacts on party reputation and financing. This trade-off is represented in the model by the fact that high centralization results in low EDA fundraising efforts.[2]

Firstly, I formalize the model and look at the trade-off between funding and centralization. Secondly, I adopt explicit utility functions in order to solve the model numerically and to provide graphical representations of hypothesis. These will be tested in the empirical section of the paper.

1.3.1 Formalization

The utility of the central leadership, U^L, and the utility of the EDA i, U_i^D are respectively:

$$U^L\left(C, \phi\left(R_i\right) + \phi(R_j)\right) \qquad [1.1]$$

[2]It must be noted that the bargaining between the two factions is not explicitly modeled. In reality, the central leadership is not necessarily a monolithic group but consists of many individuals who are leading the party at a given time. Indeed, contestants to the leadership usually come from various regions of the country. Therefore, an ongoing bargaining between the central leadership and the EDAs can be difficult to maintain. The idea that the central leadership will most likely opt to restrain itself in order to preserve the unity of the party has been suggested by various scholars (see Katz (2001) for example). The model I am proposing follows a similar rationale. Some scholars have shown a particular interest in investigating the bargaining between factions of different goals. For an example, see Roemer (2001).

and

$$U_i^D\left(C, \phi\left(R_i\right)\right) - \chi \frac{{e_i}^2}{2} \quad [1.2]$$

where

$$R_i = e_i + T_i \quad [1.3]$$

and

$$T_i \leq \kappa + \psi\left(\chi\right) - T_j. \quad [1.4]$$

Where C is the level of centralization of the political party or the degree of control over the party platform by the central leadership. ϕ is the expectation of winning the election at the constituency level. For simplicity, it represents the expectation of the votes. For the central leadership the expectation of winning the election depends on the sum of all the votes. R_i is revenue, χ is the relative cost of fundraising at the EDAs in comparison to the central party, e_i is fundraising effort and T_i is the level of transfer to EDA i that depends on κ the public funding, ψ the private fundraising at the central party, and T_j the transfer to the other EDA denoted by j.[3]

1.3.2 Assumptions

In the model, an increase in C means that the party is centralizing whilst a decrease means that the party is decentralizing. From this normalization, the model assumptions are:

1. The utility of the central leadership depends positively on the level of centralization while the utility of the EDAs depends negatively on the level of centralization. Each faction prefers to have control over the platform.($U_C^L > 0, U_C^D < 0$)

2. The utility of the central leadership and of the EDAs depends positively on the expectation of winning the election. However, the marginal utility of the expectation of winning the election is decreasing. Each faction prefers winning the election. ($U_\phi^L > 0, U_{\phi\phi}^L < 0, U_\phi^D > 0, U_{\phi\phi}^D < 0$)

3. The expectation of winning the election, ϕ, is increasing with revenue R_i and the marginal return of the revenue is decreasing. Spending positively impacts the expectation of winning the election but it is marginally decreasing. ($\phi_{R_i} > 0, \phi_{R_i R_i} < 0$)

4. For the EDAs, centralization and revenue are submodular. In other words, the expectation of winning the election and control over the political platform are complementary. Control over the platform becomes more valuable when the expectation of

[3]In acknowledging the possibility that funds can be transferred between different party entities, it must be noted that the EDAs are required to have different impacts on the expectation of winning the election. To simplify the exposition, the central leadership maximizes the expectation of the overall votes while the EDAs maximize the expectation of the votes in their respective constituency.

winning increases, and winning the election becomes more valuable when control over the platform increases.[4] ($U^D_{C\phi} < 0$)

5. The utility of the EDAs depends negatively on a quadratic cost of effort $\chi(\frac{e_i}{2})^2$ where the marginal disutility of effort depends on the parameter χ which represents the relative cost of fundraising at the EDAs in comparison to the central party. Fundraising activities are costly and both the EDAs and the central party compete partly for contributions. However, for simplicity, only EDAs produce effort. EDAs don't compete for funds, as it is assumed that they can only fundraise within their own constituencies.

6. The impact of effort on fundraising at the EDAs is linear, and private fundraising at the central party ψ depends positively on χ. ($\psi_\chi > 0$). These assumptions simplify the model without the loss of generality.[5]

Assumptions one to four are fairly straightforward assuming that political organization are rational and using the empirical finding that spending has a positive impact on election outcomes. (e.g. Jacobson, 1990; Levitt, 1994; Erikson and Palfrey, 2000) Assumption five is a simplifying assumption where I assume no direct competition for funding between the EDAs and the central party. Introducing this dynamic is not directly insightful while the derivation of the model becomes much more complex. In Canada, a donor can independently give at both the central party and the EDAs. The low contribution limit likely leads to minimal intra party competition for funds. Assumption six simplifies the derivation of the model. Decreasing marginal returns of effort would not alter the conclusions of the model.

1.3.2.1 Timing of central and local organizations decisions

The model has three periods. In the first period, the central leadership determines the level of centralization. In the second period, the level of fundraising effort is determined simultaneously by the EDAs. In the final period, the central leadership selects the level of transfers that each EDAs will receive. The timing reflects the idea that every agent is aware of its own control over the political platform when fundraising occurs, while central leadership is aware of the amount of contributions raised in every EDAs before transferring funds. The model is solved by backward induction.

1.3.2.2 Transfer condition

For simplicity, only the central leadership chooses to make transfers.[6] In the final period, the central leadership maximizes its utility [1] with respect to the transfers for each EDA,

[4]There is no need for the assumption that centralization and revenue are supermodular for the central leadership to obtain the results. Although, if complementarity exists between control of the platform and expectation of winning the election, it may seems reasonable to apply it to all factions.

[5]It has been suggested by Coletto, Jansen and Young (2011) that centralized funding benefits from fundraising activities where economies of scale are possible. If so, technological advancements within communications have increased the relative ability of the central party to raise funding, notably through internet. In the model, χ would have increased.

[6] Coletto, Jansen and Young (2011) demonstrate that the net transfers have remained positive in recent years for all main Canadian political parties. I find that the same pattern seems to have occurred during the 2004 to 2013 period in which around 84% of yearly net funds transferred to an EDA were positive.

T_1 and T_2. From this maximization I obtain that:

$$R_1 = R_2. \quad [1.5]$$

The central leadership equalizes the revenue through transfers. Furthermore, [1.5] implicitly determines $T_1(e_1, e_2, C)$ and $T_2(e_1, e_2, C)$. Taking the derivative of [1.5] with respect to effort, using [1.4] and the symmetry between the EDAs I obtain that:

$$T_{ie_i} = -\frac{1}{2} \quad and \quad T_{ie_j} = \frac{1}{2}. \quad [1.6]$$

An increase in effort leads to the redistribution of the increase in revenue between the EDAs.

1.3.2.3 Effort decision

In the second stage the EDA maximizes its utility [1.2] with respect to its effort e_i. This gives the following condition:

$$\chi e_i = U^D_{i\phi}\phi_{R_i}(1 + T_{ie_i}). \quad [1.7]$$

The condition in [1.7] simply states that the marginal cost of effort in terms of utility should be equal to its marginal benefit. Using the previous transfer results, from the point of view of an EDA, increasing funding through effort will also result in the reduction of the transfer by the central leadership. Therefore, even if the overall level of party funding is fixed, the strategic behavior between EDAs will lead to a sub-optimal level of effort.[7] Taking the total derivative of [1.7] with respect to C yields:

$$e_{iC} = \frac{U^D_{i\phi C}\phi_{R_i}}{2\chi - 2U^D_{i\phi\phi}\phi^2_{R_i} - U^D_{i\phi}\phi_{R_iR_i}}. \quad [1.8]$$

This expression shows how sensitive the effort level is to a centralization change. The right end side is negative and therefore centralizing is expensive. Indeed, if this was not the case, the party leadership would have no incentive to use decentralized fundraising.[8]

1.3.2.4 Centralization decision

In the first stage the central leadership defines the centralization level by maximizing [1.1] with respect to C while using the implicitly defined best response function $e_i(C)$. This gives the marginal rate of substitution between centralization and funding:

[7] It can also be noted that this problem will increase as the number of EDA increases. In this case, [1.6] becomes:

$$T_{ie_i} = -\frac{n-1}{n} \quad and \quad T_{ie_j} = \frac{1}{n}.$$

If fundraising activities are central to political involvement in local organizations, the free riding might be a threat to the survival of the grassroots organizations, particularly in large federal states such as Canada.

[8] The return of effort at the EDA could be taken more widely as any activities that impact the probability of winning the election.

$$-\frac{U_C^L}{2U_\phi^L\phi_R} = e_{iC}. \quad [1.9]$$

This equation shows the basic trade-off faced by the central leadership when establishing the level of centralization. Although high centralization is directly preferable, it also lowers the efforts to attract contributions at the EDA level, which has a negative impact on the expectation of winning the election.

1.3.3 Simulation

I now adopt more explicit functional forms in order to simulate the impact of public and private funding on the centralization level. The numerical solutions yield intuitive results that can be represented graphically, and are used to develop empirically testable hypotheses.[9] The strategy I use to find a solution for the centralization and the effort level is simple. First, I solve numerically to obtain the best response of the EDA, then I maximize the utility of the leadership using the numerical approximation of the best response function. For simplicity, I also limit the model to one EDA.

[9]The model presented so far seems rather simple; however, when studying variations in parameters such as public funding, the solutions of the general model become exhaustive and their study does not lead to notable payoffs. For instance, the maximization of [1.7] with respect to public funding, where $C(\kappa)$, $e_i(\kappa, C(\kappa))$ and $T_i(e_i(\kappa, C(\kappa)), e_j(\kappa, C(\kappa)), C(\kappa), \kappa)$, yields:

$$e_{i\kappa} = \frac{2C_\kappa\left[U_{i\phi C}^D\phi_{R_i} + e_{iC}\left[U_{i\phi\phi}^D\phi_{R_i}^2 + U_{i\phi}^D\phi_{R_iR_i} - \chi\right]\right] + U_{i\phi\phi}^D\phi_{R_i}^2 + U_{i\phi}^D\phi_{R_iR_i}}{2\chi - U_{i\phi\phi}^D\phi_{R_i}^2 - U_{i\phi}^D\phi_{R_iR_i}}.$$

Public funding impacts the level of effort directly due to the increase in overall funding and thus the decrease in the marginal benefit of funding through effort. It also impacts the level of effort indirectly due to the change in centralization following the increase in public funding. The sign of this part of the equation is undetermined. Furthermore, maximizing [1.9] with respect to public funding yields:

$$C_\kappa = \frac{2U_\phi^L\phi_{R_i}e_{iC\kappa} + \left[U_{\phi\phi}^L\phi_{R_i}^2e_{iC} + U_\phi^L\phi_{R_iR_i}e_{iC} - U_{C\phi}^L\phi_{R_i}\right][1 + 2e_{i\kappa}]}{U_{CC}^L - 2U_{\phi\phi}^L\phi_{R_i}^2e_{iC}^2 + 2U_{C\phi}^L\left[\phi_{R_i}e_{iC} - 1\right] - 2U_\phi^L\left[\phi_{R_i}e_{iCC} + \phi_{R_iR_i}e_{iC}^2\right]}.$$

In this case, assumptions on third derivatives would be necessary to fully characterize the solution because of $e_{iC\kappa}$ and e_{iCC}. The focus on the effect of marginal changes in public funding might also be misleading, because such changes may be less relevant in reality, especially if the focus is on the introduction of public funding. In this case, the magnitude of some of the indirect effects might be small and irrelevant. Therefore, the simulation of a change in public funding leads to more interesting results even if the functional solutions will lack the comprehensiveness of the general solutions.

Archambault and Semenov (2019) obtain similar hypotheses as those from the simulation assuming that the payoff of the central leadership is a Cobb-Douglas function and the payoff of the EDA is:

$$R_iv(C) - \chi\frac{e_i^2}{2}.$$

1.3.3.1 EDA utility function

For the EDA I use a function analogous to a Cobb-Douglas:

$$U^D = \frac{R^A}{C^B} - \chi\frac{e^2}{2}. \quad [1.10]$$

This function meets our previous assumptions. It is increasing in revenue and decreasing in centralization. Furthermore, I let $A, B \in [0, 1]$ so revenue and decentralization are submodular.

1.3.3.2 Central leadership utility functions

To solve the central leadership problem, I use two limiting cases of the CES function, the Cobb-Douglas, and the Leontief utility function:

$$U^L = C^Q * R^P \quad [1.11]$$

and

$$U^L = \min(C^Q, R^P), \quad [1.12]$$

where I let $Q,\ P \in [0, 1]$.

Both functions give interesting interpretations. The Cobb-Douglas leads to an equilibrium where either the effort level or the centralization level is at its maximum. Indeed, in these cases the central leadership prefers centralization or revenue.[10] For example, when effort is the only source of funding, I find that the central leadership prefers centralization if:

$$Q > P\frac{B}{2 - A}.^{11} \quad [1.13]$$

While it might seem unrealistic that the centralization level jumps when it reaches a certain threshold, a movement in centralization likely occurs when there is significant changes to the party structure such as an electoral defeat, a change in the party funding, a change in the central leadership, etc. In the context of the model, the parameters of the utility function could change at these specific times, which may induce a sudden shift of the centralization level. Also, different levels of centralization most likely co-exist between EDAs of a party. This forces the central leadership to opt for a tailored approach. For example, following an election, the EDAs where the incumbents lose may move towards centralization while other EDAs may not. Therefore, an increase in the centralization level of the party might equate to an increase in the number of EDAs that are centralized and not necessarily to an increase in the average centralization level of each EDAs.

[10] The free-riding problem has no impact on the threshold from relative centralization to relative decentralization. However, when the party is decentralized, more decentralization will be needed within the free-riding case in order to reach the maximum level of effort.

[11] In the case of equality, both a centralized and a decentralized equilibrium exist.

The Leontief function leads to an equilibrium where the central leadership does not strictly prefer centralization or decentralization, because centralization and funding are perfect complements. In that case, the transitions of centralization and effort are continuous. However, if $C^Q \geq R^P$ or $R^P \geq C^Q$, the marginal utility of centralization or the marginal utility of revenue is zero, which is unintuitive.[12]

1.3.3.3 Boundaries of effort and centralization

In order to obtain insightful solutions, I require both centralization and effort to have a superior bound and to be positive. Indeed, if centralization and effort could increase infinitely, then centralizing will never lead to the disappearance of effort and decentralizing will always bring more revenue.[13] Therefore, I let $C, e \in [0, 1]$. When the centralization level is close to 0, the party is considered to be relatively decentralized; when it is close to 1, the party is considered to be relatively centralized. The movement between relative centralization and relative decentralization is of particular interest within this paper.

1.3.3.4 Numerical solution

Solving the EDA utility maximization in the second step gives us the inverse of the best response function:

$$C = [\frac{A}{e\chi}[e + \kappa + \psi(\chi)]^{A-1}]^{\frac{1}{B}}. \qquad [1.14]$$

This equation give us the level of effort in function of the level of centralization but the function $e(C)$ cannot explicitly be obtained. It can directly be seen that since A<1, an increase in C lead to a decrease in e as in [1.8]. As expected we obtain the result that centralization reduces local fundraising.

Since there is only one mapping of e to C in the positive plane, an approximation of the best response function of the EDA can be recovered. Furthermore, when using these coordinates in the central leadership utility function, an approximation of the solution for the level of centralization can be computed by finding the coordinates that maximizes the utility function. Therefore, it is possible to see the impact of the changes in other parameters, such as public funding, on the optimal level of centralization and effort. For now I let $\psi(\chi) = 0$.

Figure 1.2 represents a particular best response function of the EDA. In this case when centralization is low, the effort level is at its maximum and it decreases according to the level of centralization. Without a limit to the level of effort, the effort can potentially go to infinity while centralization approaches zero. This supports the idea that when a party is relatively decentralized, centralizing becomes costly in terms of revenue. Simultaneously,

[12] In the Leontief case when there are two or more EDAs and $R_1^P + R_2^P \geq C^Q$, the transfer condition $R_1 = R_2$ is not necessarily true for the central leadership to maximize its utility. Therefore, more assumptions would be needed to analyze the free-riding case; but at the same time, making assumptions about transfers would impact the free riding problem.

[13] It must be noted that within the current democratic system, political parties are neither fully centralized or fully decentralized. Therefore, the solutions presented are not automatically relevant.

when a party is relatively centralized, decentralizing induces little effort. Therefore, this highlights that extreme positions could be more stable.[14]

Figure 1.2: Best response function of the EDA

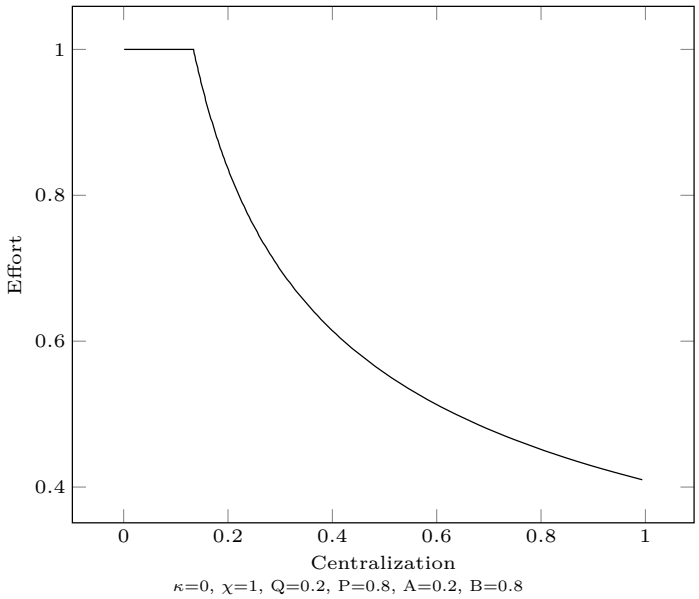


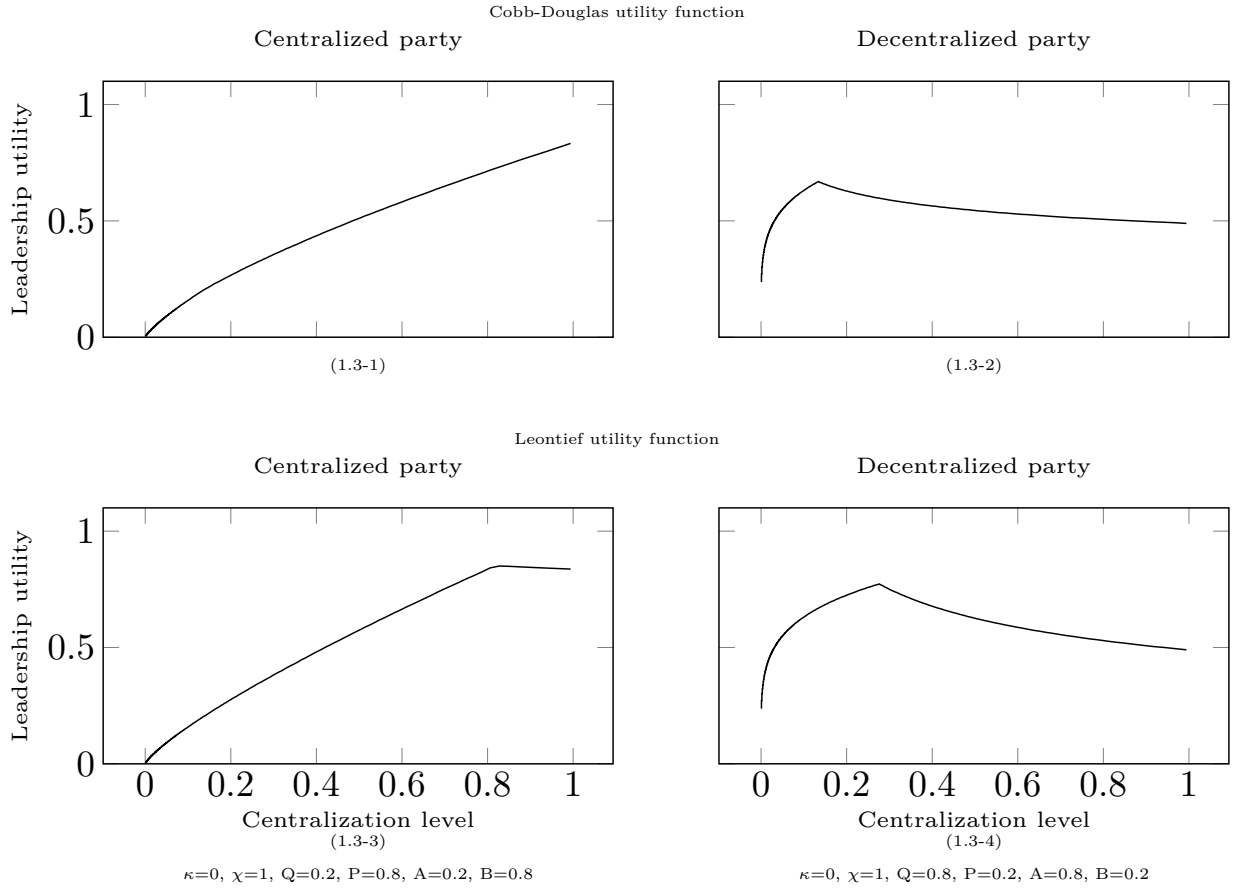
Figure 1.3-1 and 1.3-2 respectively show a centralized and a decentralized equilibrium in the Cobb-Douglas case. In Figure 1.3-1 the utility increases with centralization, and therefore the party's optimal decision is to be fully centralized. In Figure 1.3-2, when decentralization is high, the utility diminishes because effort is maximized, and therefore further decentralization does not bring more funding because of the boundary condition. Figure 1.3-3 and 1.3-4 show the results obtained when using a Leontief utility function. In these cases, an interior equilibrium is possible even without the bounds. A centralization level over the optimal solution leads to the decrease of effort and therefore to the decrease of utility. A centralization level under the optimal solution decreases utility despite inducing more effort because the centralization level becomes too low in relation to funding.

1.3.3.5 Impact of public funding

An increase in public funding impacts the level of effort of an EDA at two separate levels. Firstly, there is a direct negative impact due to the increase in overall funding and thus the decrease in the marginal benefit of funding through effort. Therefore, the best response function of the EDA decreases for each level of centralization when public funding increases. Secondly, there is an indirect impact due to the change of the centralization level following the increase of public funding. Indeed, when public funding increases, the optimal choice of centralization for the central leadership also experiences changes. The impact of the variation

[14]Important changes in the political environment could potentially lead to a "(de)centralization trap" where (de)centralization is never an optimal solution for the central leadership of a party.

Figure 1.3: Leadership utility as a function of the centralization level



in public funding on centralization depends on the EDA's best response function. Intuitively, if the overall funding increases for every level of centralization, the central party will choose to increase centralization. The Leontief function provides an easy interpretation of this solution: an increase in public funding allows the opportunity for the central leadership to centralize, since the marginal value of centralization becomes greater than zero. However, the central leadership does not want the EDA to completely crowd out the increases in public funding, because overall funding also becomes more appealing. Figure 1.4-1 and 1.4-3 show these results. When public funding increases, centralization increases whilst effort decreases. Once centralization is at its maximum, the effort will decrease at a faster pace.

Figure 1.4-2 and 1.4-4 show the results for the Cobb-Douglas function. When public funding increases and the party is already decentralized, further decentralization will occur to keep effort at its maximum. Without the maximum bound on the level of effort there would be no movement in decentralization, since $C \to 0$ would already be true due to $\lim_{C\to 0} e(C) = \infty$, thus the party would already be entirely decentralized. Therefore, this in-between movement is due to the simulation assumptions. When it comes to increases in public funding, centralization is an efficient strategy for the central leadership. At a certain threshold, the central leadership jumps to centralization while the effort level jumps from relatively high to relatively low.

For increases in public funding, solutions with both Cobb-Douglas and Leontief functions suggest a decrease of effort and an increase of the centralization level. However, in the Cobb-Douglas case, small increases may not lead to a jump from decentralization to centralization. Taking the simulation as a whole suggests the following testable hypotheses:

1. When the public funding of a central party increases (decreases), the EDAs decrease (increase) their effort level and raise less (more) funds.

2. When the public funding of a central party increases (decreases) the centralization level of the party increases (decreases).

1.3.3.6 Impact of a change in central party fundraising

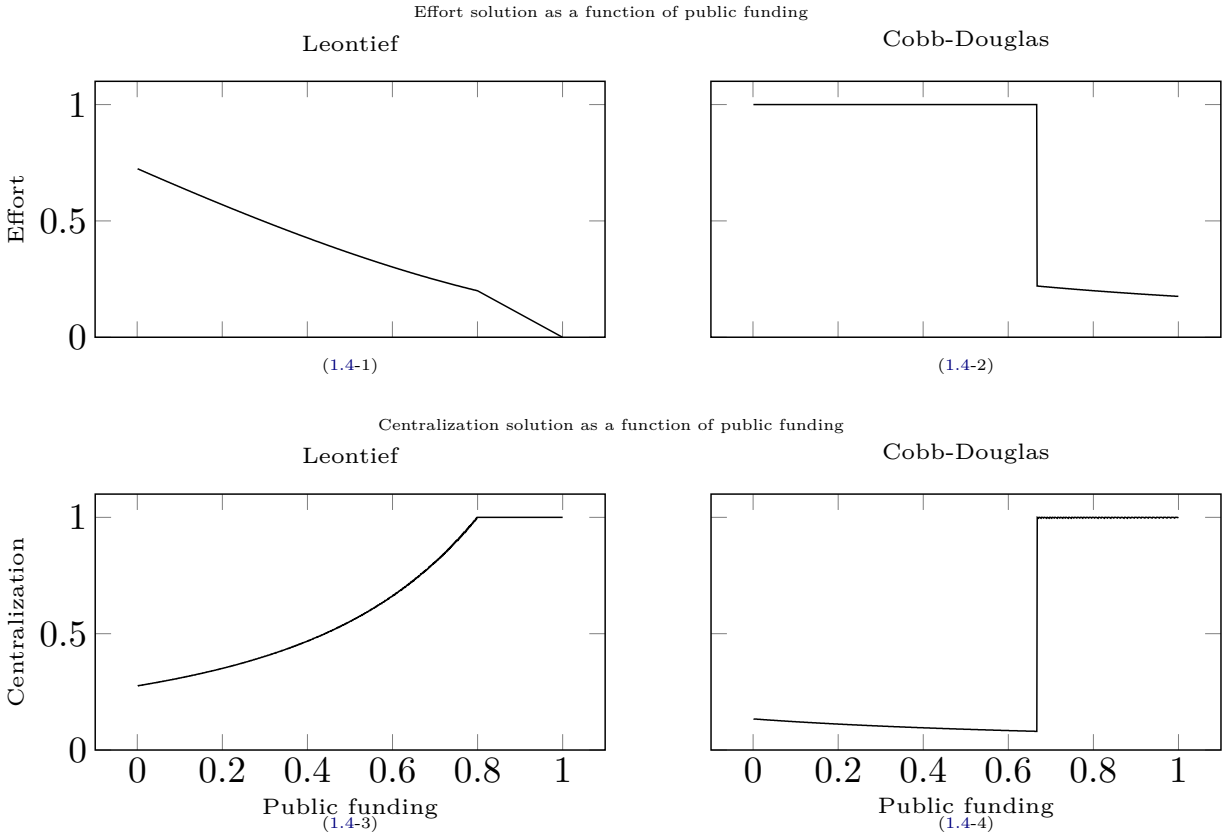
To discuss the impact of central party fundraising, I look at the relative cost of fundraising between the EDA and the central party.[15] I use the linear form $\psi(\chi) = S * \chi$ for private funding of the central party. However, the form of $\psi(\chi)$ does not have an important implication for the results as long as $\psi_\chi > 0$.[16]

Whenever the relative cost of fundraising at the EDA increases, the effort decreases. If the relative cost was already very low at the beginning, as it is increasing the party will eventually decentralize to keep funding high. However, the return of decentralization in funding will diminish as the relative cost continues to increase. At some stage, the marginal

[15] In the case where central party fundraising has no direct link to the EDA fundraising, the impact of a change in central party fundraising would be equivalent to the impact of a change in public funding and therefore the effect on centralization and effort can be associated with the discussion in section 1.3.3.5.

[16] Allowing fundraising at the party level to depend positively on the relative cost of effort will accelerate the movement towards centralization, as the need for decentralized fundraising will be diminished. However, if the change in χ leads to an important reduction in the overall level of funding, the party might never go back to centralization in the Leontief case.

Figure 1.4: The impact of public funding



χ=1, Q=0.2, P=0.8, A=0.2, B=0.8

return of centralizing will become higher than the marginal return of decentralizing and therefore centralization will increase. Figure 1.5 shows these results. In the Leontief case, the process is smooth while in the Cobb-Douglas case the party decentralizes to keep the value of effort at the optimal level. However, when the cost meets a certain threshold, centralization brings more utility than decentralization and the party will jump back to centralization.[17]

For increases in the relative cost of fundraising between the EDA and the central party, private funding solutions with both Cobb-Douglas and Leontief suggest a decrease of effort. However, for the centralization level the impact may lead to qualitatively different results. Taking the simulation as a whole suggests the following testable hypotheses:

3. When the private funding of a central party increases (decreases), the EDAs decrease (increase) their effort level and raise less (more) funds.

1.3.4 Testable hypotheses

Summarizing the testable hypotheses:

1. When the public funding or private funding of a central party increases (decreases), the EDAs decrease (increase) their effort level and raise less (more) funds.

2. When the public of a central party increases (decreases), the centralization level of the party increases (decreases).

The model remains agnostic about the impact of central party fundraising on centralization. However, following the results, a substantial increase would probably lead to an increase in the centralization level. In the next section, I test these hypothesis in the Canadian context.

1.4 Empirical evidence

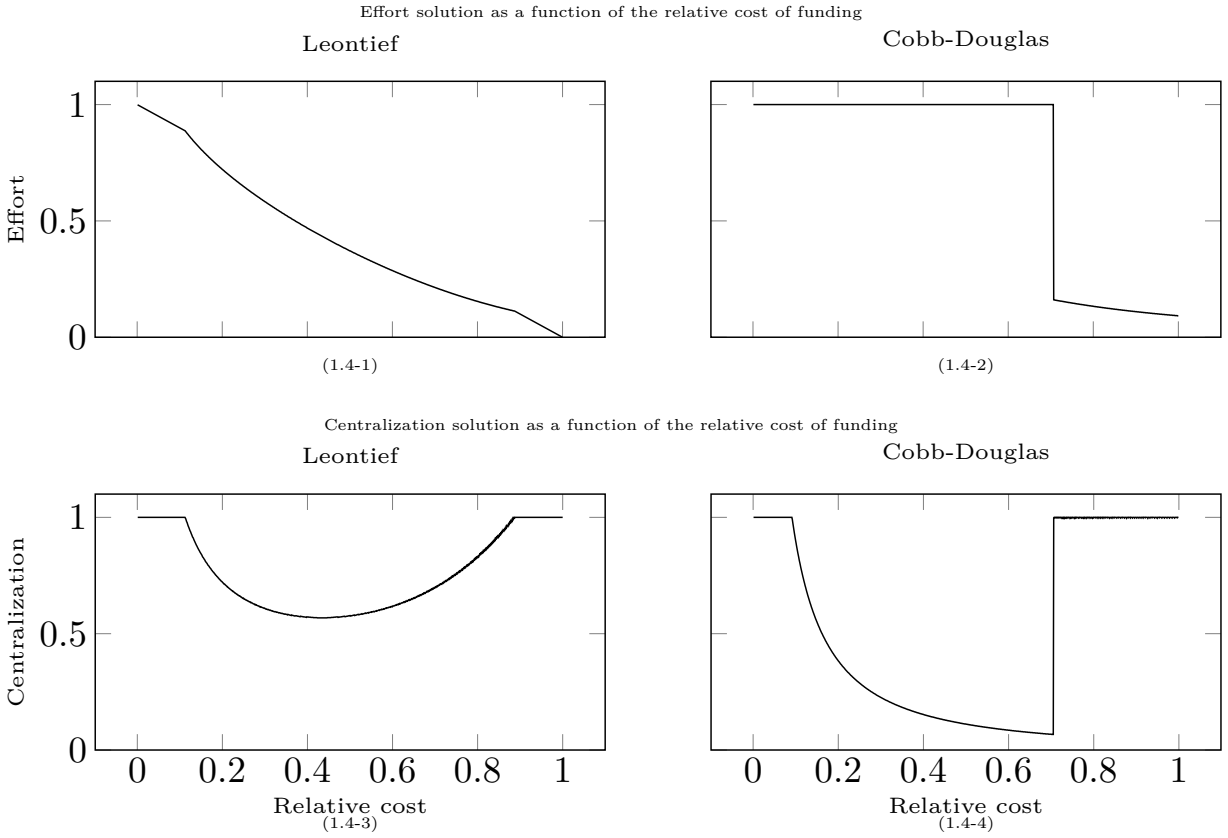
Between 2005 and 2013, Canadian political party financing experienced many fluctuations, partly due to the political turmoil brought by three consecutive minority governments. Indeed, during this 9-year span, three general elections, four different governments and five leadership elections within the main political parties took place.[18,19] These political variations, combined with the fact that constituencies geographic boundaries remained the same,

[17] In the same view, the centralization level might be an indicator for contributors who seek greater influence over the political platform. Thus, when the centralization level fluctuates, contributors might change where they allocate money. This effect would further decrease the negative impact of centralization on funding. Obviously, if the substitution between contributions at the EDA level and contributions at the central party level is perfect, there is no need to decentralize.

[18] See Table 1.10 in the appendix for a small summary of the general elections that took place from 2000 to 2015. Note that the 2015 election was the first election to be held on a fixed, publicly known date.

[19] The Liberal Party of Canada held a leadership election following each of its electoral defeats: on December 2nd, 2006, on April 30th, 2009, and on April 14th, 2013. The New Democratic Party held a leadership election on March 24th, 2012. The Bloc Quebecois held a leadership election on December 11th, 2011.

Figure 1.5: The impact of a change in the relative cost of funding at the EDA



κ=0, S=1, Q=0.2, P=0.8, A=0.1, B=0.9

provide a good setting to test the hypothesis discussed previously.[20] In this paper I focus on the four parties which retained at least one district seat during this entire period: the Bloc Quebecois (BQ), the Conservative party of Canada (CPC), the Liberal Party of Canada (LPC) and the New Democratic Party (NDP).[21]

1.4.1 The Canadian experience with party financing

In 2003, concerns over illegal financing pressured the LPC to amend the party financing legislation.[22] As such, EDAs were now required to register with Elections Canada in order to be able to perform most electoral tasks, such as accepting contributions or transferring assets to a party. Registered EDAs were mandated to produce an annual financial report as well as a detailed list of private contributors who donated $200 or more. The new amendments also introduced a contribution cap of $5,000 by individuals.[23] A yearly subsidy to the central parties of $1.75 per vote was also introduced at the same time to mitigate the negative impact of the new contribution cap.[24] The reimbursement of electoral expenses also increased from 22.5% to 50% for the central party level and from 50% to 60% for the EDA candidates.[25] Furthermore, in 2006, the CPC introduced the Federal Accountability Act, amending the party finance legislation again. At that time they notably prohibited completely political contributions from corporations, unions and other organizations and lowered the contribution

[20]The Canadian constitution requires a redistribution of the federal electoral districts every 10 years to reflect variations in population. Following the census results, a computation of the new number of seats among each provinces and territories is undertaken. When the results are known, an electoral boundaries commission is appointed provincially and the process of drawing the constituencies or readjusting the electoral boundaries begins. One redistribution took effect in the 2004 election, and another in the 2015 election. The number of constituencies increased from 301 to 308 in 2004, and from 308 to 338 in 2015. Since I use a fixed effect model by EDAs, where the goal is to control for unobserved EDA fixed effects, I omit the observations from 2004 because the boundaries were modified mid-year which resulted in many implications for the EDAs and their financing. Likewise, I also omit the observations from 2014 because many EDAs were altered during the redistribution that took effect during the 2015 redistribution. The financial statements of 2014 do not cover the entire year because the end of the year date was set on December 18th. Also, some EDAs changed their names following the Riding Name Change Act of 2014. Overall, more than a third of EDAs have two statements in 2014.

[21]The Green Party of Canada is the only other party who won a seat during this period. In the 2011 election, party leader, Elizabeth May, won the constituency of Saanich—Gulf Islands.

[22]See Law and Government Division (2003) for an extensive overview of the modifications.

[23]Individuals could donate $5,000 in total to each registered party and its electoral district associations, candidates and nomination contestants. Corporations, unions and other organizations were prohibited to donate to a registered party or to any leadership contestants, but could still donate up to $1,000 to a party's candidate, a nomination contestant, or an electoral district association.

[24]To be eligible for this subsidy, registered political parties had to receive either 2% of the number of valid votes or 5% of the number of valid votes cast within the electoral districts in which the party endorsed a candidate. The subsidy depended on the votes received during the previous general election and was adjusted to inflation. The payments were allocated quarterly.

[25]During election time, the constituency candidate becomes an entity of the party and can receive private contributions, transfers from other party entities, and take loans. All the constituencies electoral expenses must be made through the candidate. To be eligible for a reimbursement of his electoral expenses, a candidate must receive at least 10% of the valid vote while a party must receive either 2% of the number of valid votes or 5% of the number of valid votes cast in the electoral districts in which the party endorsed a candidate.

Table 1.1: Revenues for the main Canadian political parties (in thousands)

	Central Party[1]			Electoral District Associations	
	Membership	Contributions	Public Subsidy	Fundraising	Contributions
Year	Conservative Party of Canada				
2005	738	17,916	7,331	1,375	5,562
2006	628	18,273	9,208	1,390	3,892
2007	834	16,298	9,806	1,499	4,591
2008	1,374	19,860	9,790	1,249	5,976
2009	718	16,557	9,682	1,635	4,975
2010	1,091	15,989	9,580	1,254	4,639
2011	979	20,282	10,006	732	5,619
2012	941	15,168	8,502	1,103	3,793
2013	947	15,959	5,834	891	3,163
	Liberal Party of Canada[2]				
2005	572	9,122	9,087	2,479	5,243
2006	570	4,287	8,408	690	2,830
2007	163	5,179	8,172	879	3,277
2008	236	5,925	8,167	751	6,031
2009	665	8,500	6,749	1,414	3,807
2010	329	6,763	6,644	1,185	3,786
2011	244	8,826	5,809	401	5,325
2012	144	6,887	4,055	328	2,285
2013	458	10,092	2,783	254	2,274
	New Democratic Party				
2005	136	5,073	3,880	367	2,035
2006	75	3,878	4,522	156	1,072
2007	63	3,754	4,725	190	1,084
2008	94	5,078	4,717	141	1,531
2009	51	3,748	4,675	119	983
2010	26	4,006	4,626	182	1,339
2011	207	6,588	6,373	146	1,518
2012	375	6,964	6,575	178	980
2013	149	7,105	4,512	169	1,110
	Bloc Québécois[3]				
2005	-	965	3,065	310	1,073
2006	-	676	2,894	263	1,113
2007	-	569	2,834	154	760
2008	-	866	2,829	87	781
2009	-	803	2,565	174	722
2010	-	766	2,538	167	668
2011	-	907	2,056	45	465
2012	-	445	1,299	17	142
2013	-	429	891	10	109

Note: Values are in real dollars of 2005.
[1]We use the data adjusted from the statement in the following year.
[2]The contributions directed to a leadership contestant have to be made through the center, however they are very often separated from the contributions to the center. In 2006, directed leadership contributions were included in the overall level of contribution to the Liberal Party of Canada. In order to obtain the exact number of contributions made to the center for that year, the payments made to the leadership have to be removed.
[3]In the BQ financial statements, membership fees are already included within the party contributions.

cap to $1,000.[26]

According to Coletto, Jansen and Young (2011), political parties started moving towards centralization following the 2003 and 2006 reforms. These amendments meant that EDAs were no longer advantaged in terms of financing over the central party. Figure 1.1 shows that the share of contributions raised by EDAs in the overall level of private contributions decreased for the main parties.[27,28] In 2012 the CPC began a new reform phasing-out the per-vote subsidy to the central party by 25% until its complete removal in 2015. This had the inverse effect on the centralization of funding.[29,30]

Table 1.1 presents descriptive statistics of the main sources of funding from 2005 to 2013. It can be observed that contributions to EDAs decreased for all parties except for the NDP, which remained stable. However, their seats almost tripled following the 2011 election, which probably had a positive impact on EDA funding. Throughout this period, there was also an important increase in contributions at the party level for the LPC and the NDP, while for the CPC it remained mostly similar.

The BQ lost most of its seats following the 2011 election, and, as a consequence, their funding greatly decreased. As a whole, these variations support the increase of the centralization of private funding presented in Figure 1.1.[31]

1.4.1.1 Data

Elections Canada publicly discloses an extensive array of financial and electoral data from EDAs and their candidates. The dataset created for the following estimation includes every EDA of the four parties in each year from 2005 to 2013. For example, in a constituency such

[26] See Economics Division, Law and Government Division and Political and Social Affairs Division (2006) for an extensive overview of the modifications.

[27] The amount of contributions raised at the EDAs is the sum of contributions and fundraising activities for all the EDAs of a party. The cost paid for an activity minus its marketable value is considered a contribution. The fundraising activities represent around 20% of the total amount of the EDA fundraising. It includes contributions of individuals who are not reported by the EDAs. EDAs do not have to publicly report an individual publicly if the total amount of his yearly contributions is below $200.

[28] I did not include membership fees in private contributions to the central parties. They only represent a small fraction of overall party funding as shown in Table 1.1. In the BQ financial statements, these fees are already included within the party contributions. However, an internal agreement stipulates that the membership fees and the contributions must be transferred to the EDAs where the contributor reside. Therefore, Figure 1.1 does not accurately translate the BQ data and a better representation of the centralization of funding can be found when considering the share of contribution in the overall funding, including government subsidies. Nevertheless, in this case, a declining slope is also obtained.

[29] However, centralization in funding was higher than when the per-vote subsidy was established in 2004, since the level of centralization of private contributions increased during this period. According to Coletto and Eagles (2011), prior to 2004 EDAs could amass a high level of funding due to the lack of regulations. It can thus be argued that private funding was even more decentralized before 2004, but the EDAs were not mandated to produce public financial reports.

[30] Arguably, the introduction and the removal of the per-vote subsidy was also part of the political game between the parties. Indeed, the relative impact of the per-vote subsidy in party finance was higher for the LPC and lower for the CPC.

[31] Recall that for 2005 and 2006, the contribution cap was five times higher. Unexpectedly, the number of contributors stayed the same after 2006 and the average contributions of at least $200 remained constant despite the cap being lowered. (Source: Statement of Contributions Received from the Registered Party Financial Transactions Return available at http://www.elections.ca/WPAPPS/WPF/)

as Toronto Centre, the CPC, the LPC and the NDP each own an EDA which reports its financial activity in an annual report. Therefore for Toronto Centre there are three EDAs in each of the nine years which represents 27 observations in the dataset. The data appendix explains the detailed set of steps taken to create the dataset.

1.4.1.2 Net transfers

As discussed in the literature review, the net transfers by the central party to the EDAs is a measure of control over the resources. Following the ideas of the theoretical model, this change will ultimately relate to a variation in control over the political platform. Indeed, if control and funding are complementary goods, as the political leadership become wealthier they will be willing to trade funding for control. Likewise, as they become poorer, they will be willing to trade control for funding.[32] Therefore, the goal of the following estimation is to isolate the components that influence the net transfers to test the hypothesis of section 1.3.4.

Table 1.2: Average net transfer to EDAs from central parties

	CPC		LPC		NDP		BQ	
Year	Mean	S.d.	Mean	S.d.	Mean	S.d.	Mean	S.d.
2005	2,143	(6,327)	214	(10,147)	2,513	(3,749)	8,421	(11,172)
2006	4,360	(7,278)	1,210	(8,324)	2,708	(5,360)	5,496	(10,172)
2007	5,562	(8,239)	2,052	(5,368)	1,882	(3,833)	5,153	(6,408)
2008	3,295	(8,200)	1,455	(12,925)	904	(3,480)	-968	(9,221)
2009	6,668	(9,719)	1,233	(16,327)	2,821	(5,760)	7,707	(9,612)
2010	6,049	(7,573)	1,346	(4,055)	1,931	(4,880)	7,182	(9,741)
2011	3,938	(10,679)	1,671	(5,262)	2,514	(7,087)	6,839	(20,592)
2012	5,249	(9,250)	2,456	(12,072)	1,704	(4,950)	1,272	(6,467)
2013	-5,498	(26,909)	652	(5,098)	2,919	(7,105)	-897	(5,622)
Observations	2,772		2,772		2,772		675	

Notes: Values are in real dollars of 2005. The quantities in brackets are standard deviations.

Table 1.2 shows the average net transfer per EDA for each party from 2005 to 2013. Net transfers are usually low until 2007. This is due to an important decrease in transfers made by the EDAs to the party associated with the worsening of EDA finances.[33] In 2008, there was also an important decrease in net transfer for all parties, probably due to the 2008 election which was the third election in only four years.[34] In 2013, there was another that

[32] This implicit trade is effective by a change in the level of influence of EDAs within the organization.

[33] Since EDA finances strongly fluctuate during an election year, it is difficult to determine why transfers decreased after 2006, since three elections took place over five years. However, rationales discussed above, such as the large number of elections in a short period of time, the 2004 and 2006 amendments to the funding legislation which affected the EDA's ability to raise funding, and the depletion of the war chest gathered before 2004, all provide sensible explanations.

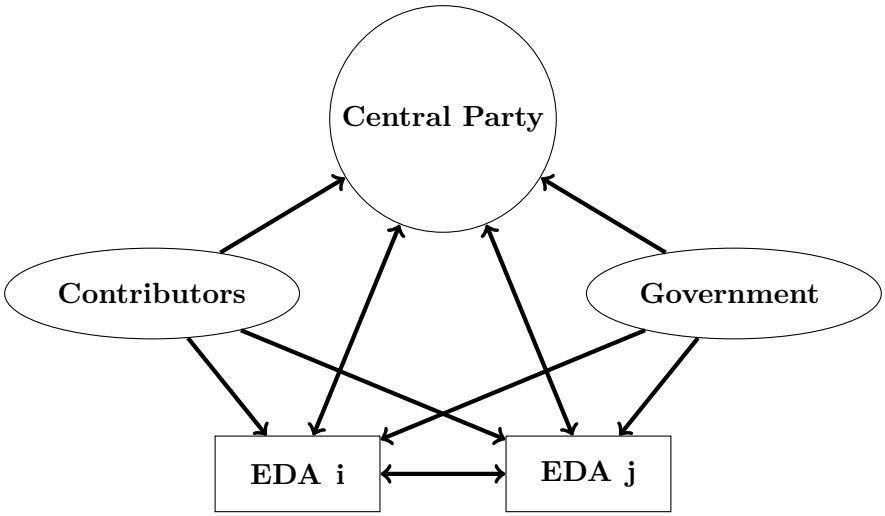
[34] During the election period the local candidate is the only one who is entitled to receive private contributions, accept transfers from other party entities, take loans, and make expenses. This explains why transfer to the EDAs might decrease during these years.

is principally due to the fading out of the per-vote subsidy.[35] The data in regards to the NDP net transfers differ slightly from other parties, as only a low level of contributions is raised by its EDAs. Indeed, EDAs transfers to the central party have little incidence on the net transfers. Also, in 2011 the central party increased its number of votes by two million, which had a positive impact on the per-vote subsidy that mitigated the negative effect of the phasing out of the subsidy in 2012 and 2013.

1.4.1.2.1 Flow of funding and internal agreements

The flow of funding for a party is shown in Figure 1.6. As previously discussed, donators give at the EDAs and at the central party. Public subsidies are mainly received at the central party but candidate's reimbursement of electoral expenses is usually transferred to the EDAs.[36] Finally transfers flow between the EDAs and the central party. Some funds are directly transfer between EDAs but this usually is a small part of the total transfer with the central party.

Figure 1.6: Flow of funding for a party with two EDAs



Internal agreements can impact on the flux of funds within a party. For instance, the BQ has an internal agreement which stipulates that membership fees and private contributions received at the central party level must be transferred to the EDA where the contributor resides.[37] This, therefore, provides an explanation as to why the mean net transfer is higher for the BQ. The LPC is the sole party that is clearly receiving direct payments from its EDAs. However, from 2011 onwards, the payment line was removed from financial statements.[38]

[35]The decrease of net transfers for the CPC is intensified because 24 EDAs transferred over $50,000 to the party. These funds were acquired in the previous 8 years. However, the exclusion of these observations have no significant impact on the results.

[36]During an electoral year candidate are also part of the flow of funding as they can received contributions and public funding. However, they usually have strong ties with the local EDAs.

[37]The central party charges an administrative fee to the EDAs for transferring these funds. However, a contributor can provide a written request if he wants the funds to be allocated otherwise.

[38]Likely, these direct transfers became insignificant. In 2005, the payments amounted to around $500,000,

1.4.2 Estimating equation

The starting point of the empirical model is:

$$y_{it} = x_{pt}\beta_1 + w_{pt}\beta_2 + x_{pt} * w_{pt}\beta_3 + z_{it}\rho + k_{pt}\alpha + h_{it}\delta + \gamma_t + \theta_i + \varepsilon_{it} \quad [1.15]$$

where y_{it} is the net transfer to EDA i in year t. x_{pt} is the vector of total per-vote subsidy, w_{pt} is the vector of private contributions received by party p and z_{it} is the vector of private contributions received by the EDA. Therefore, β_1, β_2, β_3 and ρ are the parameters of interest. k_{pt} is a matrix of the party time-varying controls, and h_{it} is a matrix of the EDA time-varying controls. γ_t is the time fixed effects, θ_i is the EDA fixed effect and ε_{it} is the error term.[39,40] Table 1.3 presents the summary statistics for the model variables classified in two categories: party time-varying and EDA time-varying. These variables will be discussed in the following sections.

The first hypothesis, stated in section 1.3.4, provides intuition for β_1, β_2 and β_3. I use an interaction term between the sources of funding at the central party because of the complementarity of these funds. Since private funding is costly I do not expect that the marginal impact of both funds is equal.[41]

The total per-vote subsidy depends on the votes received during the previous election and is adjusted during the year if an election is held. This type of funding can reasonably be expected and it is assumed to be exogenous. The coefficient of the interaction term, β_3, should be positive because when funding at the central party increases, the net transfers and thus the financial control over the EDAs increases. β_1 should be significantly higher than β_2 because fundraising is costly.[42] It can be expected that ρ will be negative, because when local fundraising increases, the central party should be able to reallocate funding between EDAs. However, disposing freely from EDA funding can prove challenging for the central party. For instance, an EDA might be unwilling to give funds if its utility mainly depends on its own electoral performance. Section 1.5.2 discusses the endogeneity problem related to EDAs private fundraising and provides an instrumental variable framework to address this problem.

1.4.2.1 Party time-varying

As shown in Table 1.3, the level of public and private funding at the central party is large and both amount are close. However, this is misleading as the CPC received more than two times the average amount as Table 1.1 shows. This explains the large standard variation for the contribution to the center.

whereas in 2010 the payments dropped sharply to $40,000. This may be linked to the worsening of the EDA financial situation, which was discussed previously.

[39] Recall that within a party there is a fixed number of EDAs, and within a constituency the number of EDAs is also fixed. Therefore, estimating the fixed effects prevents us from estimating party fixed effects or constituency fixed effects.

[40] EDA fixed effects are used to tackle the endogeneity problem caused by unobserved characteristics of the EDA such as its fundraising ability. These might impact transfers by the party as well as other financial variables related to the EDA. The fixed effects also tackle constituency and party unobserved effects, such as local competition and unobserved agreements between a party and its EDAs.

[41] Also, the EDAs can predict the amount of public funding that the party will receive, but could have imperfect knowledge about the amount of private funding. This could lead the central party to transfer a lower share of the private funding.

[42] Depending on the party, the fundraising expenses can reach 10% to 40% of total revenues.

The number of seats at the beginning of the year represents a measure of the size and district presence of the party.[43] The number of seats coefficient is expected to be negative because when a party expends, the transfer towards a specific EDA must diminish, since central funding has to be divided into additional local associations. The maximum number of seats shown in Table 1.3 is small when compared to the total number of constituencies (308). This translates the fact that parties who formed the government had a relatively small number of seats during the whole period.

The government status is a binary variable that is 1 when the party forms the government at the beginning of the year. This variable is used to verify if there is an impact between the government and its net transfer.

1.4.2.2 Electoral district association time-varying

1.4.2.2.1 Financial variable

The overall funding raised by an EDA can be computed by adding the amount of contributions to the amount of fundraising, which is the contributions of less than $200. Within these two categories, the maximums seen in Table 1.3 are much higher than the average. The two main EDAs which experienced abnormally high fundraising were featured in the press and were classified as potentially illegal. For instance, in both cases many employees from the same engineering firms contributed to a party.[44] These funds raised by the EDAs were transferred to other EDAs afterwards. It has to be noted that singling out these EDAs has no impact on the results in part because of the fixed effects.

Expenses and disposable funds at the beginning of the year have high maximums, but this is mainly due to wealth acquired before the new finance regulations were applicable.[45] I expect the coefficient of the disposable funds to be negative as the party might play a redistributive role by transferring out of wealthier EDAs. This could be explained if being represented in each EDA is valuable for the party.[46] Also, EDAs that had a sure seat where their previous winning margin was high are generally better funded than others. However, during an election, the candidates associated to these EDAs spend less on average than candidates in close races. Therefore, transferring out funds from richer EDAs is probably an efficient strategy since the marginal impact of spending is likely lower.

[43] Alternative definitions for the timing of the variables that changes over the year have little no significant impact on the main results.

[44] The conservative EDA of Laurier—Sainte-Marie received $267,231 in 2006, $94,909 in 2007, $38,300 in 2008 and $377,649 in 2009, whilst the liberal district association of Chambly—Borduas received $391,781 in 2008, $492,686 in 2009 and $322,745 in 2010. They both received small amounts of contributions over the other years. Surprisingly, the CPC candidate of Laurier—Sainte-Marie received at most 6.4% of the votes and the LPC candidate of Chambly—Borduas lost to the winner by more than 30% of the vote in the four elections from 2004 to 2011. As a comparison, the 2008 mean contribution for other registered EDAs that received less than 10% of the vote in the 2008 election year was $2,632. Both parties denied receiving illegal contributions and stated that the high level of contributions received were due to important fundraising activities attended by high ranking party officials. In contrast, the conservative EDA of Calgary Southest, where the prime minister of Canada was elected eight of the nine years, received an average of $126,707 with a peak of $150,378.

[45] The current assets minus the current liabilities were also used as a measure of disposable funds without qualitative impact on the results.

[46] The three national parties all had more than 300 candidates during each election.

Table 1.3: Summary statistics

VARIABLES	Mean	Standard deviation	Minimum	Maximum
Party time-varying				
Contributions to the center	7.6e+06	(6.3e+06)	4.3e+05	2.0e+07
Per-vote subsidy	6.5e+06	(2.4e+06)	8.9e+05	1.0e+07
Number of seats	76.032	(49.49)	4	166
Government status	0.25	(0.439)	0	1
Electoral District Association time-varying				
Fundraising activities	2,490	(8,961)	-569	417,150
Contributions to the EDA	10,517	(17,871)	-4,619	352,776
Disposable funds	19,033	(32,875)	-74,553	356,685
Expenses	21,961	(33,494)	-20,063	487,846
By-election	0.009	(0.097)	0	1
Unregistered EDA status	.0268	(.1615)	0	1
Incumbency status	0.307	(0.461)	0	1
Vote margin difference with the incumbent	0.273	(0.167)	0.0002	0.817
Transfers				
Transfers from the party to the EDA	3,746	(7,200)	-11,484	176,718
Transfers from the EDA to the party	1,220	(7,612)	-949.9	273,822
Net transfers to the EDA	2,526	(9,828)	-261,335	173,970
Observations	8,991			

Notes: Financial values are in real dollars of 2005. The quantities in brackets are standard deviations.

The coefficient of correlation between EDA expenses and EDA private contributions is high. The expenses variable is therefore omitted from the estimating equation. However, some expenses might be financed through net transfers and could also impact upon EDA fundraising. In section 1.5.2, an instrumental variable framework is used to tackle the more general problem of time varying unobservables and their impact on net transfers and EDA fundraising.

1.4.2.2.2 Electoral variables

The by-election variable is a binary variable that is 1 if there is a by-election in the constituency during the year.[47] A by-election occurred for less than 1% of the observations. It is expected that transfers towards the EDA will increase during a by-election years. However, as discussed before, the EDA cannot make expenses or receives transfers during the election.

The unregistered EDA variable is a binary variable that is 1 if the EDA is unregistered during the year. An unregistered EDA is not required to produce a financial report. However, most electoral tasks, such as accepting contributions or transferring assets to a party, can only be performed by a registered EDA.[48]

The incumbency status is a binary variable that is 1 if the EDA candidate is the incumbent at the beginning of the year or following the election during an election year.[49]

I use the vote margin difference with the incumbent and its square as a measure of competitiveness between the parties within the constituency.[50] The incumbent has a margin of 0, although winning a seat does not mean that it was necessarily competitive or not. Therefore, I use the margin difference with the second place candidate in these cases. As the margin increases, it is expected that net transfers will decrease at a lower rate. Table 1.3 shows that in one constituency a candidate won with more than 81% of the vote share while the lowest vote share received by a candidate of the main parties was 0.02%.

[47] Because Parliament was dissolved on September 7th, 2008 due to the 38th general election held on October 14th, four by-elections were cancelled. I have included these by-elections because when a seat becomes vacant a by-election must be held within the 180 following days. The exact day of the election is decided by the Prime Minister who advises the Governor General accordingly. Recall that during the election time, funds are transferred to the candidates since by law any electoral expenses must be made through them. Therefore, since by-election are announced beforehand, it can be expected that funds will be transferred to the EDAs prior the electoral period. In the case of the cancelled by-elections, the electoral period had started. However, excluding them has no significant impact on the results. See Table 1.11 in the appendix for the by-election that occurred from 2005 to 2013.

[48] The three main political parties all had EDAs registered at least during one year. Around 50 EDAs are registered for the BQ each year whilst 75 constituencies are registered in the province of Quebec. However, during the election, the party has 75 candidates. Indeed, a party is not required to have a registered EDA to present a candidate in a constituency. In the database, I kept the observations for all the EDAs but I replaced the value of the financial variables by 0 when an EDA was unregistered. In the following estimation, the exclusion of unregistered EDAs has no significant impact on the overall results. See Table 1.9 in the appendix for the number of registered EDAs per year by party.

[49] Over the nine year span, three independent candidates and one candidate from the Green Party of Canada won an election. Therefore, over certain years no incumbent were recorded in the dataset. See the data appendix for further discussion on this matter. It must also be noted that the incumbency status is not modified if the candidate changes its party affiliation. In these situations the relation between the EDA and its candidate is complex and it is a rare occurrence.

[50] The vote margin has been used in many other studies (e.g. Theilmann and Wilhite, 1987; Blais, Lago and Singh, 2011).

1.4.2.2.3 Transfers

Finally, Table 1.3 shows that on average, the transfer from the party to the EDA is about three times more than the transfer from the EDA to the party. Also, over 70% of the observations have no transfer to the party and around 20% have no transfer from the party. As expected by the other EDA variables, the maximums for both type of transfers are much larger. Overall the net transfers represent an average of what we have seen in Table 1.2.

1.5 Results

Table 1.4 presents the main results for the fixed effects model.

1.5.1 Main specifications

Specification (1) and (2) show the results whether the interaction term is included. Specification (3) and (4) subsequently add the EDA and the central party time-varying controls. As expected, the coefficients for the interaction term, β_3 are positive and significant. The fact that β_1 and β_2 are negative or insignificant in specification (2), (3) and (4) indicates that when central funding is low, net transfers are negative, or that the EDAs are funding the central party.

When we factor in party time-varying controls, the contributions received by the party have a significantly lower impact on net transfer than the per-vote subsidy. This is expected because of the cost of private fundraising to the central party. Specification (4) suggests that a party receiving \$10,000,000 in private contributions will see its net transfers increase by around \$0.34 for each dollar of public funding.[51] Likewise, a party that receives \$10,000,000 in public contributions will see its net transfers increase by around \$0.06 for each dollar of private contributions.

The coefficient for the contributions to the EDA ρ is negative but not significant in each specification. The coefficients of the control variables are as expected and seem to indicate that transfers are made strategically. Disposable funds, the number of seats, and unregistered EDAs have a negative and significant impact on net transfers. By-election and incumbency status have a positive impact on net transfers. As expected, the net transfers decreases when the vote margin increases but at a slower pace. However, the vote margin coefficients are insignificant.

1.5.2 Endogeneity problem

Endogeneity may arise when estimating [1.15] because net transfers and EDA fundraising could be correlated with unobserved time-varying variables. For instance, a local political activity could be sponsored by the central party, whilst also impacting local fundraising. I use an instrumental variable framework to tackle this problem. The first stage coefficients will also give information about the second hypothesis: the impact of central funding on fundraising effort at the EDA. Following the second hypothesis, central funding is expected to crowd out EDA fundraising.

I use a novel instrumental variable: the by-elections at the provincial level. The main assumption is that by-elections at the provincial level are exogenous to net transfers to EDAs at the federal level. However, they increase the competition for political funding within a given region and thus have a negative impact on the funding of federal EDAs. For the purpose of this estimation, I only

[51] This is obtained by multiplying the interaction coefficients by the total number of EDAs (308) and treating β_1 as 0.

Table 1.4: Fixed effects model

VARIABLES	(1)	(2)	(3)	(4)
	y = Net transfer from the center			
Per-vote subsidy	0.0263***	-0.0428***	-0.0827***	0.0093
	(0.0096)	(0.0182)	(0.0199)	(0.0333)
Contributions to the party	0.0367***	-0.0447***	-0.0970***	-0.0814***
	(0.0109)	(0.00159)	(0.0191)	(0.0222)
Per-vote subsidy*Contributions		0.0839***	0.1259***	0.1053***
to the party / 10,000,000		(0.0206)	(0.0240)	(0.0277)
Contributions to the EDA	-0.0581	-0.0575	-0.0678	-0.0685
	(0.0563)	(0.0563)	(0.0564)	(0.0565)
Disposable funds			-0.0918***	-0.0891***
			(0.0178)	(0.0176)
By-election			8,847***	8,867***
			(2,433)	(2,440)
Unregistered EDA status			-2,996***	-3,135***
			(832.9)	(847.9)
Incumbency status			2,059***	2,420***
			(714.0)	(735.6)
Vote margin			-4,498	-4,402
			(3,207)	(3,223)
Vote margin ^ 2			7,102	7,298
			(4,927)	(4,949)
Number of seats				-30.32***
				(10.07)
Government status				-553.0
				(581.6)
Time fixed effects	Y	Y	Y	Y
EDA fixed effects	Y	Y	Y	Y
Adjusted R-squared	.11	.12	.15	.15
Observations	8,983	8,983	8,983	8,983
Number of EDAs	999	999	999	999

Notes : Robust to arbitrary within-EDA correlation standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

use observations from Ontario since, for most of the province, the constituencies were co-determined with the federal constituencies starting in the 2007 Ontario general election.[52,53]

1.5.2.1 Validity of the instrumental variable

By-elections are relatively rare. At the federal level, only 30 by-elections occurred over the 2005-2013 period whilst 21 took place in Ontario. By-elections only take place if a Member of Provincial Parliament (MPP) resigns, dies, or is excluded from Parliament. Table 1.12 in the appendix shows each Ontario by-election, the public day of resignation, the day of the by-election and the reason of resignation.[54]

There are two main threats to the validity of the instrument. The first one is associated with the individual nature of each by-election. A clear contradiction of the exogeneity assumption is when a MPP resigns to run in the federal election. In these cases, the candidates probably impact net transfers to the federal EDAs.[55] Likewise, resignations due to a federal nomination might have been known in advance by the federal parties. The main specification will exclude all these by-elections.

The second threat to the validity of the instrument is that federal parties may attempt to support their affiliated provincial party by transferring funds to their local EDA. Under the legislation, a provincial party, candidate or local association, cannot receive funds from a federal party or its EDAs.[56] A federal EDA could also receive transfers in order to increase its own expenses to help the provincial party. During an electoral period, expenses have to be made by the provincial party and strict laws prohibit third party expenses. Also, the period between the vacation of a seat and the beginning of the by-election is usually short since the Prime Minister only has six months to write the writ.[57] As a robustness check, I also excluded by-elections which took place more than two months after public resignation since the election period must be at least 36 days. This limits the time that the federal EDA could have spent in the district.

1.5.2.2 2SLS Results

Table 1.6 shows the 2SLS results. The first specification is the Ontario fixed effect model and the results are mostly similar from the previous fixed effects model. The EDA fundraising coefficient is now positive but still non-significant. Specification (2) shows the results for the main exclusion of the by-elections discussed in section 1.5.2.1. In specification (3) only the by-elections from the same geographical boundaries as the one in the federal districts were used. Specification (4) restricts to

[52]Constituencies from Northern Ontario remained the same after 2007, as the Ontario parliament decided not to reduce the number of seats to match federal constituencies.

[53]I use the by-elections which occurred between 2005 and 2007, when the new constituency boundaries are close to the old ones. The provincial constituency of Markham overlapped two federal constituencies. Therefore, I exclude the Markham by-election. As a robustness check, I also exclude all by-elections before 2007.

[54]MPPs usually complete their last day shortly after the public announcement has been made. However, this did not occur in Toronto Centre and Ottawa South where, respectively, five and four months separated public announcement from the resignation in Parliament. For the exact dates of services of MPPs see: Past & Present MPPs. Available at : http://www.ontla.on.ca/web/members/members_all.do?locale=en.

[55]Indeed, two out of three MPPs who ran federally were elected in 2006 and became minister afterwards.

[56]See the Election Finance Act of Ontario. Before 2008, the law did not included candidates and associations. This is another reason why the estimation for the 2008-2013 period is also provided. However, a party, candidate or local association can receive at most $100 per candidate by a federal party during election time.

[57]If a general election is scheduled to take place when a seat is vacated no by-election has to be called.

Table 1.5: 2SLS reduced form

VARIABLES	(1)	(2)	(3)	(4)
	y = Contributions to the EDA			
Per-vote subsidy	0.5922***	0.6428***	0.5920***	0.5957***
	(0.1088)	(0.1221)	(0.1152)	(0.1090)
Contributions to the party	0.1448**	0.0405	0.1448**	0.1444**
	(0.0643)	(0.0682)	(0.0703)	(0.0664)
Per-vote subsidy*Contributions	-0.1805***	-0.1287**	-0.1805***	-0.1814***
to the party / 10,000,000	(0.0634)	(0.0671)	(0.0713)	(0.0674)
Disposable funds	-0.0424*	-0.0574**	-0.0424*	-0.0418
	(0.0241)	(0.0290)	(0.0241)	(0.0240)
By-election	17,237**	22,589***	17,150**	17,264**
	(7,766)	(8,601)	(7,765)	(7,794)
Unregistered EDA status	-18,558	1,084	-18,590	-18,594
	(11,379)	(892.9)	(11,341)	(11,395)
Incumbency status	9,447***	9,404***	9,449***	9,469***
	(1,877)	(2,772)	(1,875)	(1,880)
Vote margin	-57,125***	-58,413***	-57,351***	-56,472***
	(13,612)	(19,731)	(13,643)	(13,572)
Vote margin^ 2	98,260***	89,525**	98,540***	97,285***
	(29,493)	(38,388)	(29,516)	(29,453)
Number of seats	-187.4***	-177.5***	-187.4***	-188.3***
	(35.03)	(37.70)	(34.95)	(35.12)
Government status	5,013**	-	5,014**	5,015**
	(2,127)	-	(2,126)	(2,130)
Provincial by-election	-6,087***	-6,567***	-8,463***	-4,896***
	(1,766)	(1,963)	(2,647)	(1,754)
Time fixed effects	Y	Y	Y	Y
EDA fixed effects	Y	Y	Y	Y
F statistic	11.88	11.20	10.22	7.79
Observations	2,862	1,908	2,862	2,862
Number of by-elections	13	10	6	17

Notes : Robust to arbitrary within-EDA correlation standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 1.6: 2SLS model

	(1) FE	(2) 2SLS	(3) 2SLS	(4) 2SLS	(5) 2SLS
VARIABLES	y = Net transfer from the center				
Per-vote subsidy	0.0029	0.0615	0.2025	0.0386	0.1000
	(0.0479)	(0.1107)	(0.1615)	(0.1098)	(0.1637)
Contributions to the party	-0.2494***	-0.2351***	-0.1874***	-0.2445***	-0.2257***
	(0.0497)	(0.0485)	(0.0490)	(0.0514)	(0.0555)
Per-vote subsidy*Contributions	0.2554***	0.2375***	0.1798***	0.2445***	0.2258***
to the party / 10,000,000	(0.0587)	(0.0575)	(0.0573)	(0.0614)	(0.0647)
Contributions to the EDA	0.0238	-0.0752	-0.2068	-0.0365	-0.1402
	(0.0157)	(0.1632)	(0.2214)	(0.1575)	(0.2580)
Disposable funds	-0.0762**	-0.0805**	-0.1379***	-0.0788**	-0.0832**
	(0.0337)	(0.0367)	(0.0533)	(0.0358)	(0.0392)
By-election	10,538	12,265*	18,836**	11,589*	13,398*
	(6,763)	(6,435)	(7,966)	(6,047)	(7,206)
Unregistered EDA status	1,831***	3,671	1,204*	2,951	4,878
	(517.0)	(3,453)	(659.9)	(3,185)	(5,317)
Incumbency status	-102.7	832.7	2,116	466.6	1,446
	(782.8)	(1,834)	(2,446)	(1,730)	(2,716)
Vote margin	523.2	-5,059	-11,642	-2,874	-8,721
	(5,380)	(9,974)	(14,799)	(9,492)	(15,268)
Vote margin ^ 2	-121.3	9,504	19,372	5,736	15,818
	(10,325)	(18,799)	(27,590)	(18,357)	(27,593)
Number of seats	-57.21***	-75.77*	-97.35*	-68.51*	-87.94
	(20.38)	(40.40)	(50.77)	(38.64)	(57.55)
Government status	-2,558***	-2,062*	-	-2,256*	-1,736
	(962.2)	(1,123)	-	(1,224)	(1,449)
Time fixed effects	Y	Y	Y	Y	Y
EDA fixed effects	Y	Y	Y	Y	Y
Observations	2,862	2,862	1,908	2,862	2,862
Number of EDAs	318	318	318	318	318

Notes : Robust to arbitrary within-EDA correlation standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

by-elections that took place less than two months after the public resignation of the MPPs. The F-statistics for the 2SLS specifications are present in Table 1.5. The F-statistic is higher than the critical value of 10 in the three first specifications. The last specification includes by-elections previously omitted. The fact that by-elections occurred rarely could be an important reason why the instrument is relatively weak. At most, there are 63 EDA by-elections and, when excluding a by-election, 3 observations are lost.[58]

1.5.2.3 Impact of central funding on effort

The impact of central funding on EDA fundraising effort can be seen in the reduced form coefficient shown in Table 1.5. Funding to the party increases fundraising to the EDA but the marginal return is decreasing. This result could translate an important trade-off when implementing public subsidies to the political parties. Local organizations might survive on central party transfers. However, when transfers are too high, local fundraising activity might be at risk of decreasing. Allocating the per-vote subsidy directly to EDAs could be a way to favour the grassroots organizations as long as the central party does not have full control over net transfers.

1.5.3 Disaggregating the net transfers

As discussed before, the net transfers can be disaggregated into transfers from the party to the EDA, and transfers from the EDA to the party. Both types of transfers may not be perfectly linked, and this provides further insights on intra-party relationships. For instance, in Ontario, transfers from the EDAs to the party are non-zero for 27.4% of the observations, while transfers from the party to the EDAs are non-zero for 76.8% of the observations. Therefore, the fixed effects model produces biased estimates, especially when using the transfer from the EDA to the party as the dependent variable. However, the incidental parameter problem leads to inconsistent results in the case of the Tobit with fixed effects model.[59]

We show the fixed effects and the instrumental variable results for transfers from the party to the EDA in Table 1.7 , and transfers from the EDA to the party in Table 1.8. Both tables show results in line with the previous impact of central funding on transfers: party funding increases transfers towards EDAs and decreases transfers towards the party. Likewise, public funding has a greater impact on transfers than private contributions.

The instrumental variable framework provides interesting results in regards to the impact of private contributions at the EDA level. In both tables, the impact of local fundraising on transfers is positive but mostly insignificant. This indicates that both transfers would likely increase along with local contributions. Although the positive impact on transfers to the party is expected, the positive impact of transfers to the EDA is inexpected. Such results might indicate that the center internalized the free-riding problem, and may elect to provide an incentive to local fundraising to increase local political activities. Another possibility is that local fundraising signals electoral opportunities to the center, and this trigger transfers.

[58] The first specification has 39 EDA by-elections, the second 30, the third 18, the fourth 28.
[59] See (Greene, 2004).

Table 1.7: Transfer from the party to the EDA

	(1) FE	(2) 2SLS	(3) 2SLS	(4) 2SLS	(5) 2SLS
VARIABLES	y = Transfers to the EDA				
Per-vote subsidy	-0.0174	-0.1135*	-0.0456	-0.0579	-0.1242
	(0.0388)	(0.0685)	(0.0896)	(0.0715)	(0.0891)
Contributions to the party	-0.1095***	-0.1329***	-0.0809***	-0.1193***	-0.1355***
	(0.0245)	(0.0281)	(0.0311)	(0.0290)	(0.0318)
Per-vote subsidy*Contributions	0.0706***	0.0998***	0.0525	0.0829***	0.1031***
to the party / 10,000,000	(0.0238)	(0.0305)	(0.0326)	(0.0318)	(0.0355)
Contributions to the EDA	0.0206	0.1828*	0.1055	0.0889	0.2008
	(0.0125)	(0.0937)	(0.1199)	(0.0951)	(0.1326)
Disposable funds	-0.0059	0.0011	-0.0217*	-0.0030	0.0018
	(0.0062)	(0.0083)	(0.0119)	(0.0078)	(0.0091)
By-election	13,294**	10,464*	14,389**	12,102**	10,150*
	(5,384)	(5,351)	(6,394)	(5,149)	(5,696)
Unregistered EDA status	1,100***	-1,915	220.3	-169.3	-2,248
	(413.0)	(2,411)	(371.8)	(1,899)	(3,064)
Incumbency status	34.18	-1,498	-517.0	-611.0	-1,668
	(511.3)	(1,059)	(1,377)	(1,069)	(1,378)
Vote margin	-4,877	4,269	-473.4	-1,026	5,282
	(3,680)	(6,230)	(8,305)	(5,826)	(8,491)
Vote margin^ 2	8,323	-7,447	-1,039	1,684	-9,194
	(7,000)	(11,610)	(15,461)	(11,442)	(15,312)
Number of seats	-5.437	24.96	16.92	7.361	28.33
	(12.15)	(21.60)	(25.31)	(22.16)	(28.47)
Government status	944.7	131.2	-	602.2	41.07
	(627.0)	(902.0)	-	(876.1)	(1,050)
Time fixed effects	Y	Y	Y	Y	Y
EDA fixed effects	Y	Y	Y	Y	Y
Observations	2,862	2,862	1,908	2,862	2,862
Number of EDAs	318	318	318	318	318

Notes : Robust to arbitrary within-EDA correlation standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 1.8: Transfer from the EDA to the party

	(1) FE	(2) 2SLS	(3) 2SLS	(4) 2SLS	(5) 2SLS
VARIABLES	y = Transfers to the party				
Per-vote subsidy	-0.0203	-0.1751*	-0.2480**	-0.0965	-0.2242
	(0.0289)	(0.0929)	(0.1263)	(0.0657)	(0.1485)
Contributions to the party	0.1400***	0.1022**	0.1065***	0.1214***	0.0902*
	(0.0440)	(0.0420)	(0.0378)	(0.0399)	(0.0479)
Per-vote subsidy*Contributions	-0.1848***	-0.1377***	-0.1273***	-0.1616***	-0.1227**
to the party / 10,000,000	(0.0549)	(0.0514)	(0.0456)	(0.0497)	(0.0570)
Contributions to the EDA	-0.0032	0.2581*	0.3122*	0.1254	0.3410
	(0.0093)	(0.1380)	(0.1806)	(0.0968)	(0.2354)
Disposable funds	0.0704**	0.0815**	0.1162**	0.0759**	0.0851**
	(0.0342)	(0.0377)	(0.0533)	(0.0362)	(0.0405)
By-election	2,756	-1,802	-4,448	513.3	-3,248
	(2,928)	(3,623)	(5,664)	(2,836)	(5,067)
Unregistered EDA status	731.2*	5,585	983.7*	3,120	7,126
	(412.3)	(3,975)	(589.0)	(2,393)	(5,921)
Incumbency status	136.8	-2,331	-2,633	-1,078	-3,115
	(638.6)	(1,629)	(2,120)	(1,232)	(2,556)
Vote margin	-5,400	9,328	11,169	1,848	14,003
	(4,414)	(8,937)	(13,291)	(6,567)	(14,264)
Vote margin ^ 2	8,444	-16,950	-20,412	-4,053	-25,012
	(8,415)	(16,530)	(23,356)	(12,366)	(25,312)
Number of seats	51.78***	100.7***	114.3***	75.87***	116.27**
	(16.31)	(36.75)	(43.50)	(28.60)	(54.38)
Government status	3,503***	2,193**	-	2,858***	1,777
	(802.6)	(994.4)	-	(790.2)	(1,367)
Time fixed effects	Y	Y	Y	Y	Y
EDA fixed effects	Y	Y	Y	Y	Y
Observations	2,862	2,862	1,908	2,862	2,862
Number of EDAs	318	318	318	318	318

Notes : Robust to arbitrary within-EDA correlation standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

1.5.4 Impact of winning a new seat

When a party wins a seat, the winning EDA experiences an increase in funding. Following the 2011 election, no such increase of overall funding was recorded for the NDP and the CPC. However, the LPC and the BQ, which both lost many seats, did experience a decrease in their EDAs contributions. It can be expected that a long term incumbent has a greater influence within a given party than a new candidate. Therefore, when an incumbent loses, the party might have the opportunity to centralize. For example, following their historical loss in 2011, the LPC announced an opening of nominations in each constituency, even the ones where a liberal incumbent was already elected. This decision, although disapproved by many MPs and EDAs, indicated an increase in the centralization level. It must also be acknowledged that in the past, the LPC did give its MPs free vote choice on more controversial issues such as abortion and marijuana legalization. Such initiatives enabled MPs from more conservative regions to vote differently than other liberals MPs. However, being pro-choice was one of the requirement to be appointed as a liberal candidate in 2015. These anecdotal changes all seem to indicate an increases in centralization within this political party following its significant loss of seats. In a sense, local political uncertainty could therefore be favourable to centralization.

1.6 Conclusion

In this study, I develop a model explaining the centralization level of a political party that can be used to explain the recent decline in grassroots organization. The concept underpinning this model is that decentralization induces grassroots fundraising efforts. The central leadership must then determine the optimal level of centralization in order to acquire sufficient funds. Grassroots organizations also compete for transfers from the central party by reducing their effort to attract funds. This collective action problem incentivizes the central leadership to remain centralized.

I simulate the model using functional forms to elaborate testable hypothesis. The simulation indicates that public and private funding to the central party crowds out fundraising effort at the grassroot level and can increase the centralization level. This effect becomes more prominent if the central party and the grassroots organizations compete over private funding.

In Canada, the share of the funds raised by grassroots organizations significantly decreased from 2005 up until 2013. In 2012, a new reform initiated the phasing-out of the per-vote subsidy. This period therefore represents a suitable setting for the estimation of the impact of sources of funds on centralization. I use net transfers from the central party to the EDAs as a measure of party centralization in a fixed effect model by EDA. The results indicate that an increase in private and public funding at the central party level will increase overall net transfers to EDAs. In a context where the share of the funds raised at the EDA level significantly decreases, this provides evidence of an ongoing centralization of control. Furthermore, I find that an increase of central party funding reduces EDA fundraising. However, low central party funding might also impact negatively on EDA fundraising effort. As such, the removal of the per-vote subsidy may increase centralization, seeing that amendments to the legislation have limited EDAs' ability to raise funds.

1.7 References

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1.8 Table appendix

Table 1.9: Number of registered EDAs

Years	CPC	LPC	NDP	BQ
2005	306	308	287	55
2006	307	306	301	56
2007	307	306	305	58
2008	306	308	304	58
2009	308	308	304	57
2010	306	308	305	56
2011	307	307	307	54
2012	307	306	308	54
2013	307	306	308	49
Total	2761	2763	2728	497
Maximum	2772	2772	2772	675

Table 1.10: Descriptive summary of the Canadian elections from 2000 to 2016

Election	**Day of election**	**Campaign duration**[1]	**Government elected**	**Type of government**	**Constituencies**
37th	27-Nov-00	36-day calendar	Liberal Party of Canada	Majority Government	301
38th	28-Jun-04	36-day calendar	Liberal Party of Canada	Minority Government	308
39th	23-Jan-06	55-day calendar	Conservative Party of Canada	Minority Government	308
40th	14-Oct-08	37-day calendar	Conservative Party of Canada	Minority Government	308
41st	2-May-11	37-day calendar	Conservative Party of Canada	Majority Government	308
42th	19-Oct-2015	78-day calendar	Liberal Party of Canada	Majority Government	338

[1]Includes the day the election is called and excludes the day of the election.

Table 1.11: Canadian federal by-elections

2005	2006	2007	2008	2009	2010	2012	2013
Labrador May 24	Repentigny November 27	Outremont September 17	Desnethé March 17	Cumberland November 9	Dauphin—Swan River November 29	Toronto—Danforth March 19	Labrador May 13
	London North-Centre November 27	Roberval September 17	Toronto Centre March 17	Hochelaga sx fcer fcer vcre 9	Vaughan November 29	Calgary Centre November 26	Bourassa November 25
		Saint-Hyacinthe September 17	Vancouver Quadra March 17	Montmagny November 9	Winnipeg North November 29	Durham November 26	Brandon—Souris November 25
			Willowdale March 17	New Westminster November 9		Victoria November 26	Provencher November 26
			Guelph* September 8				Toronto Centre November 25
			Westmount—Ville-Marie* September 8 September 8				
			Don Valley West* September 22				

Notes: There was no by-election in 2011. For the sake of the presentation, Desnethé is Desnethé—Missinippi—Churchill River, Roberval is Roberval—Lac-Saint-Jean, Saint-Hyacinte is Saint-Hyacinthe—Bagot, Cumberland is Cumberland—Colchester—Musquodoboit Valley, New Westminster is New Westminster—Coquitlam, Dauphin—Swan River is Dauphin—Swan River—Marquette, Montmagny is Montmagny—L'Islet—Kamouraska—Rivière-du-Loup. * Were canceled because the parliament was dissolved on September 7th and the 38th general election was held on October 14th.

Table 1.12: Ontario by-elections, day of resignation, day of election and resignation reason

2005	2006	2007	2009	2010	2012	2013
Dufferin—Peel Jan 31th - Mar 17th	Nepean—Carleton Nov 29th - Mar 26th Run federally	York South—Weston Sep 18th - Feb 8th	Haliburton Jan 8th - Mar 5th	Toronto Centre Nov 8th - Feb 4th Run for mayor	Kitchener—Waterloo Apr 27th - Sep 6th	Ottawa South Feb 11th - Aug 1st
Scarborough Aug 19th - Nov 24th Diplomatic position	Toronto—Danforth Nov 29th - Mar 26th Run federally	Markham Sep 25th - Feb 8th Run municipally	St. Paul's May 23th - Sep 17th	Ottawa West—Nepean Jan 12th - Mar 4th Run for mayor	Vaughan Aug 1st - Sep 6th Campaign chair	Windsor—Tecumseh Feb 14th - Aug 1st
	Whitby—Ajax Nov 29th - Mar 30th Run federally	Burlington Sep 28th - Feb 8th Run for mayor		Leeds—Grenville Jan 29th - Mar 4th Senate appointment		London West Feb 14th - Aug 1st
	Parkdale—High Park May 18th - Sep 14th Federal leadership					Scarborough Jun 27th - Aug 1st
						Etobicoke Jul 2nd - Aug 1st

Notes: The reason for resignation only appears when the MPP accepted a position from the federal government, the MP resigned to run in another election or the MP accepted a position related to campaign fundraising. No by-elections occurred in 2008 and 2011. The day of resignation is the day where the resignation is made public. It may differ from the official date listed by the parliament. In most cases, less than 2 weeks separate both dates except for George Smitherman in Toronto Centre who resign from parliament on January 3rd and Dalton McGuinty in Ottawa South on June 12th. For the sake of the presentation, Scarborough in 2005 is Scarborough—Rouge River, Scarborough in 2013 is Scarborough—Guildwood, Dufferin—Peel is Dufferin—Peel—Wellington—Grey, Haliburton is Haliburton—Kawartha Lakes—Brock and Etobicoke is Etobicoke—Lakeshore.

1.9 Mathematical appendix

Section 1.3.2.2

We maximize the utility of the central leadership, assuming there is two EDAs i and j.

$$\max_{T_i,T_j} U^L(C, \phi(R_i) + \phi(R_j)),$$

such that

$$R_i = e_i + T_i$$

and

$$T_i = \kappa + \psi(\chi) - T_j.$$

Therefore we find

$$\max_{T_i,T_j} U^L(C, \phi(e_i + T_i) + \phi(e_j + T_j)),$$

$$U^L_\phi \phi_{R_i} - U^L_\phi \phi_{R_j} = 0.$$

Thus

$$\phi_{R_i} = \phi_{R_j},$$

$$R_i = R_j.$$

The previous equation implicitly determine the transfers $T_i(e_i, e_j, C)$ and $T_i(e_i, e_j, C)$. Rewriting the previous equation

$$e_i + T_i(e_i, e_j, C) = e_j + \kappa + w(\chi) - T_i(e_i, e_j, C).$$

Taking the total derivative with respect to e_i:

$$1 + T_{ie_i} = -T_{ie_i}.$$

By the symmetry of both EDAs:

$$T_{ie_i} = -\frac{1}{2},$$

$$T_{ie_i} = -T_{je_i},$$

$$T_{ie_j} = \frac{1}{2}.$$

The total derivative with respect to e_j also yields

$$T_{je_j} = -\frac{1}{2}, T_{je_i} = \frac{1}{2}$$

Transfers with n EDAs

We maximize the utility of the central leadership, assuming there is n EDAs.

$$\max_{T_1,\ldots,T_n} U^L(C, \sum_{i=1}^{n} \phi(R_i),$$

such that

$$R_i = e_i(C) + T_i$$

and

$$T_i = \kappa - \sum_{j=1 \ \& \ j \neq i}^{n} T_j.$$

The Lagrangian is

$$L = U^L(C, \sum_{i=1}^{n} \phi(e_i(C) + T_i)) + \lambda(\kappa - T_i - \sum_{j=1 \ \& \ j \neq i}^{n} T_j),$$

where λ is the Lagrange multiplier. We obtain

$$\frac{dU^L}{dT_i} \rightarrow U^L_\phi \phi_{R_i} - \lambda = 0.$$

Thus

$$U^L_\phi \phi_{R_i} = U^L_\phi \phi_{R_j} \rightarrow \phi_{R_i} = \phi_{R_j}.$$

This determine $T_1(e_1, \ldots e_n, C), \ldots, T_n(e_1, \ldots e_n, C)$.

Taking the total derivative of the optimal condition with respect to e_i:

$$\phi_{R_i R_i}(T_{ie_i} + 1) = \phi_{R_j R_j} T_{je_i},$$

$$T_{je_i} = \frac{\phi_{R_i R_i}(T_{ie_i} + 1)}{\phi_{R_j R_j}}.$$

By the symmetry between EDAs:

$$T_{je_i} = T_{ie_i} + 1.$$

Using the transfer condition

$$T_{ie_i} = -\sum_{j=1 \ \& \ j\neq i}^{n} T_{je_i}.$$

Again by symmetry:

$$\sum_{j=1 \ \& \ j\neq i}^{n} T_{je_i} = T_{je_i}(n-1).$$

Thus

$$T_{ie_i} = -T_{je_i}(n-1),$$

$$T_{je_i} = -\frac{T_{ie_i}}{n-1},$$

$$-\frac{T_{ie_i}}{n-1} - T_{ie_i} = 1.$$

We obtain that

$$T_{ie_i} = \frac{n-1}{n} \quad and \quad T_{ie_j} = \frac{1}{n}.$$

Section 1.3.2.3

We maximize the utility of EDA i in function of its level of effort e_i

$$\max_{e_i} U_i^D\left(C, \phi\left(R_i\right)\right) - \chi\frac{{e_i}^2}{2}.$$

The first order condition is:

$$\chi e_i = U_{i\phi}^D \phi_{R_i}(1 + T_{ie_i}).$$

Taking the total derivative of the transfer condition with respect to C:

$$e_{iC} + T_{ie_i}e_{iC} + T_{ie_j}e_{jC} + T_{iC} = e_{iC} - T_{ie_i}e_{iC} - T_{ie_j}e_{jC} - T_{iC},$$

$$e_{iC} - \frac{1}{2}e_{iC} + \frac{1}{2}e_{jC} + T_{iC} = e_{jC} + \frac{1}{2}e_{iC} - \frac{1}{2}e_{jC} - T_{iC},$$

$$T_{iC} = -T_{iC},$$

$$T_{iC} = 0.$$

Taking the total derivative of [7] with respect to C:

$$2\chi e_{iC} =$$

$$\phi_{R_i}\left[U^D_{i\phi C}+U^D_{i\phi\phi}\left[\phi_{R_i}\left[e_{iC}+T_{ie_i}e_{iC}+T_{ie_j}e_{jC}+T_{iC}\right]+\phi_{R_j}\left[e_{jC}+T_{je_i}e_{iC}+T_{je_j}e_{jC}+T_{jC}\right]\right]\right]+$$
$$U^D_{i\phi}\phi_{R_iR_i}[e_{iC}+T_{ie_i}e_{iC}+T_{ie_j}e_{jC}+T_{iC}].$$

Simplifying:

$$2\chi e_{iC}=\phi_{R_i}\left[U^D_{i\phi C}+U^D_{i\phi\phi}\phi_{R_i}\left[\left[e_{iC}-\frac{1}{2}e_{iC}+\frac{1}{2}e_{jC}\right]+\left[e_{jC}+\frac{1}{2}e_{iC}-\frac{1}{2}e_{jC}\right]\right]\right]+$$
$$U^D_{i\phi}\phi_{R_iR_i}\left[e_{iC}-\frac{1}{2}e_{iC}+\frac{1}{2}e_{jC}\right].$$

Using the symmetry between EDAs:

$$2\chi e_{iC}=U^D_{i\phi C}\phi_{R_i}+2U^D_{i\phi\phi}\phi^2_{R_i}e_{iC}+U^D_{i\phi}\phi_{R_iR_i}e_{iC}.$$

Thus

$$e_{iC}=\frac{U^D_{i\phi C}\phi_{R_i}}{2\chi-2U^D_{i\phi\phi}\phi^2_{R_i}-U^D_{i\phi}\phi_{R_iR_i}}.$$

Section 1.3.2.4

We maximize the utility of the central leadership, with respect to C.

$$\max_C U^L(C,\phi(R_i)+\phi(R_j))$$

$$U^L_C+U^L_\phi(\phi_{R_i}\left[e_{iC}+T_{ie_i}e_{iC}+T_{ie_j}e_{jC}+T_{iC}\right]+\phi_{R_j}\left[e_{jC}+T_{je_i}e_{iC}+T_{je_j}e_{jC}+T_{jC}\right])=0$$

Simplifying:

$$-\frac{U^L_C}{2U^L_\phi\phi_{R_i}}=e_{iC}$$

Section 1.3.3

Taking the total derivative of [7] with respect to κ

$$2\chi\left[e_{i\kappa}+e_{iC}C_\kappa\right]=U^D_{i\phi C}\phi_{R_i}C_\kappa$$
$$+U^D_{i\phi\phi}\phi^2_{R_i}\left[e_{i\kappa}+e_{iC}C_\kappa+T_{ie_i}(e_{i\kappa}+e_{iC}C_\kappa)+T_{ie_j}(e_{j\kappa}+e_{jC}C_\kappa)+T_{iC}C_\kappa+T_{i\kappa}\right]$$
$$+U^D_{i\phi}\phi_{R_iR_i}\left[e_{i\kappa}+e_{iC}C_\kappa+T_{ie_i}(e_{i\kappa}+e_{iC}C_\kappa)+T_{ie_j}(e_{j\kappa}+e_{jC}C_\kappa)+T_{iC}C_\kappa+T_{i\kappa}.\right].$$

Now, the derivative of $T_i=w(\chi)+\kappa-T_j$ with respect to κ:

$$T_{i\kappa}=1-T_{j\kappa},$$

$$T_{i\kappa} = \frac{1}{2}.$$

Simplifying the first expression:

$$2\chi\left[e_{i\kappa} + e_{iC}C_\kappa\right] = U^D_{i\phi C}\phi_{R_i}C_\kappa + U^D_{i\phi\phi}\phi^2_{R_i}\left[e_{i\kappa} + e_{iC}C_\kappa + \frac{1}{2}\right] + U^D_{i\phi}\phi_{R_iR_i}\left[e_{i\kappa} + e_{iC}C_\kappa + \frac{1}{2}\right],$$

$$e_{i\kappa}\left[2\chi - U^D_{i\phi\phi}\phi^2_{R_i} - U^D_{i\phi}\phi_{R_iR_i}\right] = U^D_{i\phi C}\phi_{R_i}C_\kappa + U^D_{i\phi\phi}\phi^2_{R_i}\frac{1}{2}$$

$$+e_{iC}C_\kappa] + U^D_{i\phi}\phi_{R_iR_i}\left[\frac{1}{2} + e_{iC}C_\kappa\right] - e_{iC}C_\kappa\chi,$$

$$e_{i\kappa} = \frac{2C_\kappa\left[U^D_{i\phi C}\phi_{R_i} + e_{iC}\left[U^D_{i\phi\phi}\phi^2_{R_i} + U^D_{i\phi}\phi_{R_iR_i} - \chi\right]\right] + U^D_{i\phi\phi}\phi^2_{R_i} + U^D_{i\phi}\phi_{R_iR_i}}{2\chi - U^D_{i\phi\phi}\phi^2_{R_i} - U^D_{i\phi}\phi_{R_iR_i}}.$$

Taking the total derivative of [9] with respect to κ:

$$U^L_{CC}C_\kappa + 2U^L_{C\phi}\phi_{R_i}\left[e_{i\kappa} + e_{iC}C_\kappa + \frac{1}{2}\right]$$

$$= 2U^L_\phi\phi_{R_i}\left[e_{iC\kappa} + e_{iCC}C_\kappa\right] + \left[2U^L_{\phi C}C_\kappa + 2U^L_{\phi\phi}\phi_{R_i}\left[e_{i\kappa} + e_{iC}C_\kappa + \frac{1}{2}\right]\right]\phi_{R_i}e_{iC}$$

$$+2U^L_\phi\phi_{R_iR_i}\left[e_{i\kappa} + e_{iC}C_\kappa + \frac{1}{2}\right]e_{iC}.$$

Simplifying the expression:

$$C_\kappa\left[U^L_{CC} + 2U^L_{C\phi}\phi_{R_i}e_{iC} - 2U^L_\phi\phi_{R_i}e_{iCC} - 2U^L_{\phi C} - 2U^L_{\phi\phi}\phi^2_{R_i}e^2_{iC} - 2U^L_\phi\phi_{R_iR_i}e^2_{iC}\right]$$

$$= 2U^L_\phi\phi_{R_i}e_{iC\kappa} + 2U^L_{\phi\phi}\phi^2_{R_i}e_{iC}e_{i\kappa} + U^L_{\phi\phi}\phi^2_{R_i}e_{iC} + 2U^L_\phi\phi_{R_iR_i}e_{i\kappa}e_{iC} + U^L_\phi\phi_{R_iR_i}e_{iC} - 2U^L_{C\phi}\phi_{R_i}e_{i\kappa} - U^L_{C\phi}\phi_{R_i},$$

$$C_\kappa = \frac{2U^L_\phi\phi_{R_i}e_{iC\kappa} + \left[U^L_{\phi\phi}\phi^2_{R_i}e_{iC} + U^L_\phi\phi_{R_iR_i}e_{iC} - U^L_{C\phi}\phi_{R_i}\right]\left[1 + 2e_{i\kappa}\right]}{U^L_{CC} - 2U^L_{\phi\phi}\phi^2_{R_i}e^2_{iC} + 2U^L_{C\phi}\left[\phi_{R_i}e_{iC} - 1\right] - 2U^L_\phi\left[\phi_{R_i}e_{iCC} + \phi_{R_iR_i}e^2_{iC}\right]}.$$

Section 1.3.3.2

Maximizing the EDA utility function with respect to effort:

$$\max_e \quad \frac{R^A}{C^B} - \chi[\frac{e}{2}]^2,$$

$$e = \frac{A}{R^{1-A}C^B\chi},$$

$$e * e^{1-A} = \frac{A}{C^B \chi},$$

$$e = \frac{A}{C^B \chi}^{\frac{1}{2-A}}.$$

Taking the derivative of the effort solution with respect to centralization:

$$e_C = -[\frac{B}{2-A}][\frac{A}{\chi}]^{\frac{1}{2-A}} C^{\frac{A-B-2}{2-A}}.$$

Maximizing the central leadership utility function with respect to centralization:

$$\max_C \quad C^Q * R^P$$

$$\frac{Q}{C^{1-Q}} R^P + \frac{P}{R^{1-P}} C^Q e_{1C} = 0$$

Therefore, assuming R=e, C is preferred if

$$Qe > -PCe_C$$

$$Q[\frac{A}{\chi}]^{\frac{1}{2-A}} C^{-\frac{B}{2-A}} > P[\frac{B}{2-A}][\frac{A}{\chi}]^{\frac{1}{2-A}} C^{-\frac{B}{2-A}}$$

$$Q > P[\frac{B}{2-A}]$$

Section 1.3.3.4

Maximizing $\frac{[e+\kappa+F\chi]^A}{C^B} - \chi\frac{e^2}{2}$ with respect to effort:

$$A\frac{[e+\kappa+F\chi]^{A-1}}{C^B} - e\chi = 0,$$

$$C = \left[\frac{A}{e\chi}[e+\kappa+F\chi]^{A-1}\right]^{\frac{1}{B}}.$$

1.10 Data appendix

The dataset is available upon request. This section outlines the steps involved when creating the dataset from publicly available data for the sake of replication.

1 - Download the *Annual financial returns, the Statement of Transfers Received, the Statement of Transfers to a Registered Party, Another Registered Association, a Candidate, a Leadership Contestant or a Nomination Contestant* and the *Association's Financial Statements* for every EDA from Elections Canada.[60,61] The data from the 2004-2006 period has been separated from the 2007-2013 data. A slight discrepancy between these two datasets is that the *Research and Polling Expenses* are pooled together from 2007 onward. These statements then have to be matched with their respective EDAs using their titles. In some cases, the name of the district has been altered within the period. The *History of Federal Ridings since 1867* was used to match these EDAs.[62] It must also be noted that in 2007 two EDAs had multiple entries: the New Democratic Party EDA of Saint-Lambert and the Liberal Party of Canada EDA of Beaches—East York. In both cases, the EDAs were unregistered and registered over the same year which required two separate statements. The registered statement was used in both cases. The financial variables for each registered EDAs of the main political parties from 2005 to 2013 were obtained from these statements.

2 - Download the summary table *List of Candidates by Electoral District and Individual Results* from the *Official Voting Results (raw data)* for 2004, 2006, 2008 and 2011 elections.[63] The number of votes by constituency candidates is used to obtain the votes' shares by EDAs for each party and the margin difference with the incumbent is computed. Note that the Conservative Party of Canada did not appoint a candidate in Portneuf—Jacques-Cartier for the 2008 and 2011 elections and the Liberal Party of Canada did not appoint a candidate in Central Nova for the 2008 election.[64] Therefore, over these years and until the next election these two EDAs lacked vote margin differences with the incumbent. In addition, three independent candidates and the leader of the Green Party won a seat during a general election Chuck Cadman in Surrey North in 2004, Andre Arthur in Portneuf—Jacques-Cartier in 2006 and 2008, Bill Casey in 2008 and Elizabeth May in Saanich—Gulf Islands in 2011.[65] The incumbency variable and the number of seats for the party variable can now be created.

3 - Download the annual *Financial Statements* of the four political parties over the 2006 to 2014 period which provides the private contributions received by the party using the data revised

[60] Each financial data is available publicly from http://www.elections.ca/.

[61] The original returns as submitted to Elections Canada are used instead of the data reviewed by Elections Canada. These reviewed files may include updates to the original return by the agent and minor corrections made by Elections Canada. However, thirty-six modified statements were missing at the time. According to Elections Canada, these modified statements are missing because their original statements were never verified. In most cases, the differences between modified statements for financial variables are negligible. Furthermore, the discrepancies occurred in a small number of EDAs. For these reasons, we used the original returns.

[62] Available at http://www.lop.parl.gc.ca/.

[63] Available at http://www.elections.ca/.

[64] In both cases, this was a strategic decision made in order to benefit another candidate.

[65] The share of the votes of these elected candidates was used as the incumbent vote share in these EDAs.

from the following year.[66,67] The amount of per-vote subsidies received by the parties must be taken from *Quarterly Allowances to the Registered Political Parties*.[68] They are not provided by the financial statements because they are often combined with other types of government subsidies such as electoral reimbursement.

4 - Create a frame that contains each EDAs in each year or 308*9*3 +75*9 lines. The candidates' electoral variables, the financial variables of the EDAs and of the political parties can then be matched on the frame. When an EDA is not registered in a given year the financial variables are normalized to 0 as discussed previously. The federal and provincial by-election binary variables are implemented manually using Table 1.11 and 1.12.

Four groups of by-elections at the provincial level were proposed as exogenous to net transfers to the EDA. All groups exclude by-elections in 2006 because of their link to the federal election and Markham in 2007 because provincial and federal district boundaries were much different. The first group also excludes by-elections in Scarborough—Rouge River and Leeds—Grenville because resigning MPPs received federal appointments and Vaughan because the MPPs remained campaign chair for the party. The second group is the same as the first but limited to by-elections after 2007 where provincial and federal districts boundaries were exactly the same. The third group includes only by-elections that took place less than 3 months after public resignation. The fourth group includes only EDAs not affiliated to the party in power (Liberal during the whole period) or to the resigning MPP.

5 - The incumbency status, the vote margin and the number of seats by the party can now be created.[69]

From these datasets, each variable used in this paper can be created. It must be noted that to our knowledge, the adjustments and arbitrary decisions taken in regards to the data did not impact the general results presented in this paper.

[66] Available at http://www.elections.ca.

[67] The contributions made to a leadership contestant have to go through the center although they are separated from normal contributions. However, in 2006, these were included in the overall level of contributions in the statement of the Liberal Party of Canada. In order to obtain the exact number of contributions made to the center over that year, payments made to the leadership have to be omitted. Over the following years, the payments to the leadership candidates are indeed equal to contributions made directly to the leadership.

[68] Available at http://www.elections.ca/.

[69] When no general election occurred, the number of seats at the beginning of the year is used. Available at http://www.lop.parl.gc.ca/.

Chapter 2

The Effect of Public Subsidies on Political Organization Fundraising

Abstract

In this paper, I develop a methodology to deal with continuous treatment levels within a regression discontinuity design, and I apply this to study the effect of public subsidies on fundraising. Introducing continuous treatment allows the estimation of a dose response function for outcomes conditional on the level of treatment. Using this framework, I study empirically how public subsidies in Canada allocated to grassroots political organizations impact their private fundraising: in the Canadian case I explore, a local candidate who wins over 10% of the vote was eligible for reimbursement of 60% of his electoral expenses. The results uncover a crowding out effect. Wealthier grassroots organizations exhibit a decrease in fundraising after receiving the reimbursement. A survival effect also appears, as the poorer grassroots organizations are found to increase their fundraising activities following reimbursement.

2.1 Introduction

In most experiments where the level of treatment varies, the estimation of the relationship between the level of the treatment and the outcome, namely the dose response function, is of importance. This research extends the regression discontinuity design (RDD) methodology to include the estimation of a continuous treatment. To illustrate such framework, I use Rosenbaum and Rubin (1983) potential outcome framework and separate the assignments between the treatment assignment and the treatment level assignment as in Imbens (2000) and Adorno (2007).

The first section of this paper introduces the methodology to deal with continuous treatment level within a RDD. I use a simulation to illustrate how discontinuities can be used to estimate a dose response function. I also provide a discussion on how graphical representations commonly used within the RDD can be adapted in the continuous treatment context.

The second section of this paper uses the developed methodology to provide quasi-experimental estimates of the impact of public subsidies on political organization fundraising. Conventional estimations of the impact of public subsidies to political parties on private fundraising are challenging because both public and private funding may depend on the organization's ability, since public funding schemes generally depend upon electoral outcomes. I use the federal Canadian electoral system because a local candidate is entitled to a 60% reimbursement of his electoral expenses if he received at least 10% of the vote. As such, following the footsteps of Lee's (2008) seminal paper on the regression discontinuity within an electoral context, I argue that local organizations where candidates received around 10% of the votes are subject to a quasi-experimental variation in public funding. Using this framework, I observe the effect of public funding on grassroots fundraising over the first year following the election.

The reimbursement of electoral expenses within continuous treatment methodology requires greater attention since grassroots organizations self-select a potential treatment level by making an expense decision. This is discussed thoroughly in the second section of this paper. To circumvent the problem, I estimate a treatment effect by block defined over fixed levels of reimbursement, where I assume that grassroots organizations within a block have similar outcomes. To estimate the treatment effect, I use both a regression with a fixed bandwidth around 10% of the votes and a local polynomial regression with a data-driven bandwidth and corrected confidence intervals for large bandwidth as proposed by Calonico, Cattaneo and Titiunik (2014b). I also estimate a dose response function allowing for the stronger assumption that the dose assignment is independent of the potential outcomes when conditioning on covariates.

The empirical findings suggest that the reimbursement of electoral expenses crowds out private fundraising for sufficiently large reimbursements. The results indicate a crowding out between 10% to 20% of the amount reimbursed, which is an overall reduction of as much as 40% of the following fundraising year. However, a survival effect might also prevail for grassroots organizations receiving small reimbursements because it would increase fundraising ability. This can be explained by the fact that smaller grassroots organization failing to receive a reimbursement may become inactive following the election due to lack of resources.

The remainder of this paper is structured in three sections. The first section introduces the RDD with continuous treatment methodology, simulates the model, and illustrates the results through graphical presentation. The second section discusses the impact of public subsidies on grassroots organizations fundraising, provides a literature review, and defines the Canadian experience. Results and findings are also presented within section two. The final section concludes.

2.2 RDD with continuous treatment

In this section, I propose a methodology to examine a continuous treatment within a regression discontinuity design. I use a simulation to illustrate the framework and I discuss how graphical presentation can be adapted to this methodology.

2.2.1 Methodology

I divide the methodology into the assignment to the treatment status and the assignment to the treatment level as in Adorno (2007) and Imbens (2000). My contribution is the use of the regression discontinuity as the assignment to the treatment status in the continuous treatment context.

2.2.1.1 The regression discontinuity

When discussing the RDD I follow Hahn, Todd and Van der Klaauw (2001) and the framework redefined in Lee and Lemieux (2010). Let y_i be the outcome or the amount of private contributions received by subject i in the year following the election. R_i is the treatment indicator that is 1 if the subject is treated and 0 if not. Let D_i be the potential dose indicator and δ_i the level of potential treatment. The two potential outcomes are:

$$y_i|(R_i = 1, D_i = \delta_i) = y_i(1) \quad \text{and} \quad y_i|(R_i = 0, D_i = \delta_i) = y_i(0). \tag{2.1}$$

In an observational study, the identification of the treatment would rely on the ignorability or unconfoundedness assumption where X_i is the set of covariates:

$$R_i \perp (y_i(1), y_i(0))|X_i. \tag{2.2}$$

In the regression discontinuity, the assignment mechanism can be seen as quasi-random but not entirely random because the running variable effectively differs for observations on both sides of the discontinuity. Let define V_i as the running variable and $\overline{v}$ is the value at the discontinuity. Let R_i=1 if the subject is assigned a value $V_i > \overline{v}$ and R_i=0 if $V_i < \overline{v}$ or:

$$R_i = \mathbf{1}\{\mathbf{V_i} > \overline{\mathbf{v}}\}, \tag{2.3}$$

The continuity assumption explicitly defined in de la Cuesta and Imai (2016) allows us to identify the average treatment at the discontinuity:

$$E[y_i(1)|V_i = \overline{v}] = \lim_{V \downarrow \overline{v}} E[y_i|V_i] \tag{2.4}$$

and

$$E[y_i(0)|V_i = \overline{v}] = \lim_{V \uparrow \overline{v}} E[y_i|V_i] \quad [2.5]$$

The average treatment effect at the threshold $\overline{v}$ is thus:

$$\tau = \lim_{V \downarrow \overline{v}} E[y_i|V_i] - \lim_{V \uparrow \overline{v}} E[y_i|V_i]. \quad [2.6]$$

2.2.1.2 Continuous treatment

The treatment effect in [2.6] can be estimated without further assumption. However, when the treatment is continuous this represents a weighted average treatment effect over all the possible treatment levels and thus will also depends on the distribution of doses. This provides an explanation as to why the dose response relationship is often of importance within studies of continuous treatment.

Dose-testing trials are used to determine the adequate level of a drug dosage. In this study, I use the regression discontinuity design to replicate the assignment to a dose testing trial. Beal, Hashimoto and Sheiner (1991) discuss three different trial designs in the context of dose ranging drugs: the parallel-dose design where each patient receives one dose for a single period, the cross-over design where each subject receives all doses and the dose-escalation design where patients see their dosage increase until the outcome is close to an identified threshold. The dose assignment in the RDD with continuous treatment level relates to the parallel-dose design as subjects are usually assigned once through the discontinuity. This highlights the fact that, at best, the dose response function might inform us about the population response distribution, allowing that the dose assignment is random. This leads to the analog of the unconfoundedness assumption [2.2] in the continuous treatment case :

$$R_i \perp (y(\delta), X_i) \quad \forall \delta \in [0, l] \quad [2.7]$$

Imbens (2000) and Imai and van Dyk (2004) base the independence on the covariates and use the propensity score as a function of both the covariates and the continuous treatment.[1]

Now assuming unconfoundedness of the potential dose assignment to be true:

$$D_i \perp (y_i(\delta_i), y_i(0)) \forall \delta_i \in [0, l]. \quad [2.9]$$

In other words, the potential dose assignment does not impact on the outcome or if for subject i and j, $\delta_i \neq \delta_j$, $y_i(\delta_i) = y_j(\delta_i)$ and $y_i(\delta_j) = y_j(\delta_j)$. Therefore, $y(\delta) = y_i(\delta) = y_j(\delta)$ would be the function of the treatment effect depending on the dose.[2] The RDD offers

[1] They also use the notion of weak unconfoundedness:

$$R_i(\delta) \perp (y(\delta), X_i) \quad \forall \delta \in [0, l]. \quad [2.8]$$

That is, the treatment assignment only requires pairwise independence. Weak unconfoundedness is not required here when the assignment mechanism is independent of the level of treatment.

[2] Note that receiving a dose of zero and assignment to the control group may lead to different outcomes. This is important in the case where there exist a placebo effect of being assigned to the treatment. Accordingly, receiving a dose of zero would have a different outcome than being assigned to the control group and thus also receiving a dose of zero.

the advantage of not requiring the use of covariates besides the running variable and the potential treatment level to assume that the continuity assumption holds:

$$E[y_i(1)|V_i = \overline{v}, \delta_i] = \lim_{V \downarrow \overline{v}} E[y_i|V_i, \delta_i] \quad \forall \delta_i \in [0, l] \tag{2.10}$$

and

$$E[y_i(0)|V_i = \overline{v}, \delta_i] = \lim_{V \uparrow \overline{v}} E[y_i|V_i, \delta_i] \quad \forall \delta_i \in [0, l]. \tag{2.11}$$

We can define the average treatment effect for subjects receiving a dose δ_i:

$$\tau_i = \lim_{V \downarrow \overline{v}} E[y_i|V_i, \delta_i] - \lim_{V \uparrow \overline{v}} E[y_i|V_i, \delta_i]. \tag{2.12}$$

Therefore estimating the average treatment effect as in [2.6] in the continuous treatment context under the simplifying assumptions that there is a finite amount of doses q and the number of subject for each potential dose m_i is equally divided between treated and control, leads to:

$$\tau = \sum_{n=1}^{q} w_i \tau_i. \tag{2.13}$$

where $w_i = \frac{m_i}{\sum_{n=1}^{q} m_i}$. Two issues must be considered. The first is that the average treatment effect is an average of the treatment effect at different dose levels. This may be particularly problematic if we expect an income and a substitution effect at different dosages to dominate. The second is that the effect depends on the number of observations at each treatment level. This may be of importance when the assignment to each dose is unequal. For example, if each subject was to receive a lottery ticket where the probability of winning a small price is higher. In this case, the treatment effect would overrepresent the impact of winning a small price on the outcome. This is more likely to occur within the RDD context because we are looking at randomness that did not emerge from stratification as in a randomized control trial.

Alternatively, the RDD dose response function can now be defined as:

$$E[y(\delta)|V = \overline{v}, \delta] = \lim_{V \downarrow \overline{v}} E[y(\delta)|V, \delta] - \lim_{V \uparrow \overline{v}} E[y(\delta)|V, \delta] \tag{2.14}$$

When there exist a few treatment levels and there is enough observations, it might be more useful to estimate the treatment effect by dose. Otherwise, when the treatment is continuous, a dose response function or an average treatment effect over a smaller dose bandwidth could be estimated.

2.2.2 Simulating a dose response function

In this section I simulate the assignment to a continuous treatment level through a discontinuity and provide a graphical intuition to examine a discontinuity when the treatment is

continuous. I use the Sigmoid Emax model to simulate potential outcomes depending on the potential dose level.[3]

2.2.2.1 Sigmoid Emax model

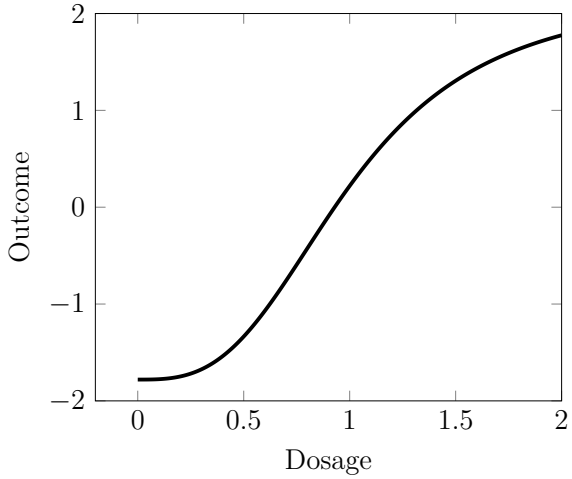
The Sigmoid Emax model is commonly used in biostatistics to estimate a dose response functions and is defined as follows:

$$y(\delta) = E_0 + \frac{E_{max} * \delta^{\gamma}}{ED_{50}^{\gamma} + \delta^{\gamma}} \quad [2.15]$$

where $y(\delta)$ is the dose response for dose δ, E_0 is the placebo effect, E_{max} is the maximum effect possible, ED_{50} is the dose at which 50% of the effect is observed and γ is the Hill parameter that determine the steepness of the curve. The Sigmoid Emax model is monotonically increasing and thus may not represent every dose response function that exist.[4]

In this simulation we use the following parameters: $E_0 = -1.78, E_{max} = 4, ED_{50} = 1$ and $\gamma = 3$ on the dose domain $[0, 2]$. The resulting function is presented in figure 2.1.

Figure 2.1: Sigmoid Emax dose-response function



In the following simulation, I generate a potential dose assignment for 2,500 observations using a uniform distribution over the dose domain $[0, 2]$.[5] I then generate a random running variable for each observation from a normal distribution N(0,1) where I assume that observations greater than 0 are assigned to the treatment. I finally compute the outcome where observations from the control group received an outcome randomly drawn from a

[3]To simplify the presentation, I assume that a potential treatment level is assigned to a subject at the same time as the treatment assignment occurs. However, in many empirical situation, only subjects assigned to the treatment may receive a treatment level assignment.

[4]For more information on the Sigmoid Emax model, see Macdougall (2006).

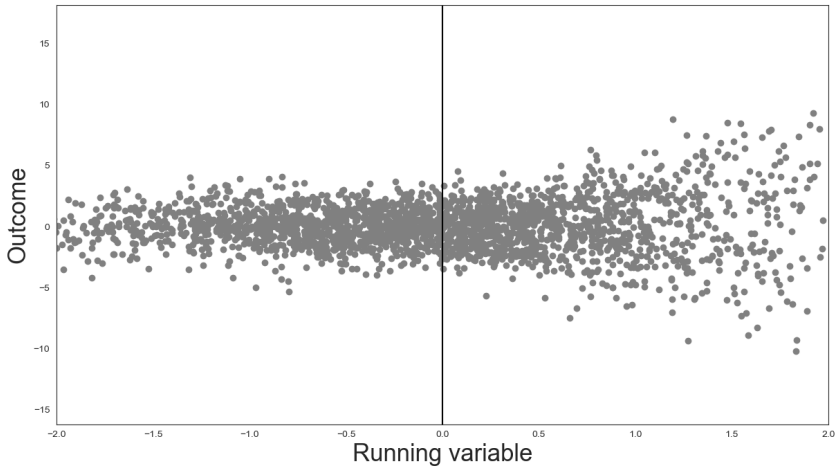
[5]Python code is available upon request. I used a fixed seed to complete the simulation therefore the graphical presentation in the next section can be exactly replicated.

N(0,1), while the outcome for observations in the treatment group is randomly drawn from a $N(y(\delta), 1)$ where $y(\delta)$ is the Emax model with the previously discussed parameters. Additionally, the outcome is correlated with the distance to the discontinuity for observations in the treatment group.[6]

2.2.3 Graphical representation

Graphical presentations are a useful tool to illustrate changes in the outcome at the discontinuity, as discussed in Lee and Lemieux (2010). However, when the treatment is continuous, it may be difficult to observe a significant jump in the outcome at the discontinuity. This is highlighted in Figure 2.2 where I present an iteration of the previously discussed simulation.

Figure 2.2: Simulation of a regression discontinuity with continuous treatment



Since the dose level is uniformly distributed, the outcome is zero and symmetric on both sides of the 50% dose, and the average treatment is zero. Figure 2.3 provides a similar presentation although observations are divided over the potential dosage. In this case, a discontinuity in the outcome appears for relatively low and high dosages.[7]

Empirically, finding an appropriate bandwidth over the dose level may prove challenging. Plotting the relationship between the potential dose level and the outcome over the treatment

[6]Denoting r as the running variable. When $r > 0.5$, the variance of the outcome increases by r. When $r > 0.75$ and if $\delta > 1$, the outcome increases by $0.75r^2$. When $r > 0.75$ and if $\delta \leq 1$ the outcome decreases by $0.75r^2$. Similarly to the RDD with a single treatment level, the dose response function must be estimated over a bandwidth of observations close to the discontinuity to obtain the correct result.

[7]Each of the three bin plots present 30 bins (15 on each side of the discontinuity) and the jump at the discontinuity approximately equates to the average outcome over the dosage domain of the Emax model used to simulate the outcomes. The red line is a Robust Locally Weighted Regression (Lowees). This function fits a nonparametric regression curve using all the observations simulated over the dosage domain. For more information see Cleveland (1979). In this case, we used f=.3, 3 iterations and a local linear regression.

assignment could provide some guideline. When the potential dose is given, unconfoundedness of the treatment level can be tested because the outcome should be similar for all the observations in the control group regardless of the potential dose. For observations close to the discontinuity, the dose response function can be illustrated. Figure 2.4 shows the dose response for both the treatment and the control group for a bandwidth around the discontinuity of 0.5.[8] As expected, we find that the Lowess smoother gives a good approximation of the actual Sigmoid dose response function.

2.3 The impact of public subsidies

One of the main challenges faced by researchers when estimating the impact of public subsidies to political parties on private fundraising is that public and private funding may depend on the same unobservables. In the case of political funding, the ability and activity of local political organizations will determine both types of funding. Indeed, public funding schemes generally depend upon electoral outcomes such as per-vote subsidies or the reimbursement of electoral expenses. To mitigate this problem, I use the reimbursement of electoral expenses scheme in the federal Canadian electoral system because it allows the use of a regression discontinuity design. As such, a local candidate is entitled to a 60% reimbursement of his electoral expenses if he received at least 10% of the vote. I argue that local candidates that received around 10% of the votes are subjected to a quasi-experimental variation in public funding and estimate the effect of the reimbursement on grassroots fundraising in the year following the election.

This section provides the first quasi-experimental results of the impact of public subsidies on the fundraising activities of political organizations. I use the methodology developed in section 2.2, as the reimbursement is continuous because it linearly depends upon the level of electoral expenses. This justifies the estimation of a dose response function because the reimbursement amount could impact fundraising differently.[9] However, the unconfoundedness of the treatment level assumption cannot necessarily be maintained since the level of potential reimbursement depends on the expense decision. Particularly, we see that fundraising is increasing with the level of potential reimbursement for observations in the control group. Therefore, alternative assumptions are discussed in order to identify a treatment effect at different levels of reimbursement.

Empirical findings suggest that the reimbursement crowds out private fundraising for sufficiently large reimbursements. The results show a crowding out between 10% to 20% of the amount reimbursed, which is an overall reduction of as much as 40% of the following fundraising year. However, a survival effect might also prevail for grassroots organizations receiving small reimbursements, since it would increase fundraising ability. This can be explained by the fact that smaller grassroots organizations that fail to receive a reimbursement may become inactive following the election due to lack of resources.

[8] Empirically, the correct bandwidth is complex to determine because an optimal bandwidth cannot be computed for each dose level when the treatment level is continuous.

[9] Archambault and Semenov (2019) found that low public funding might encourage the fundraising of grassroots organizations, while high funding could lead to a crowding out of fundraising.

Figure 2.3: Discontinuity depending on the dose level (30 bins)

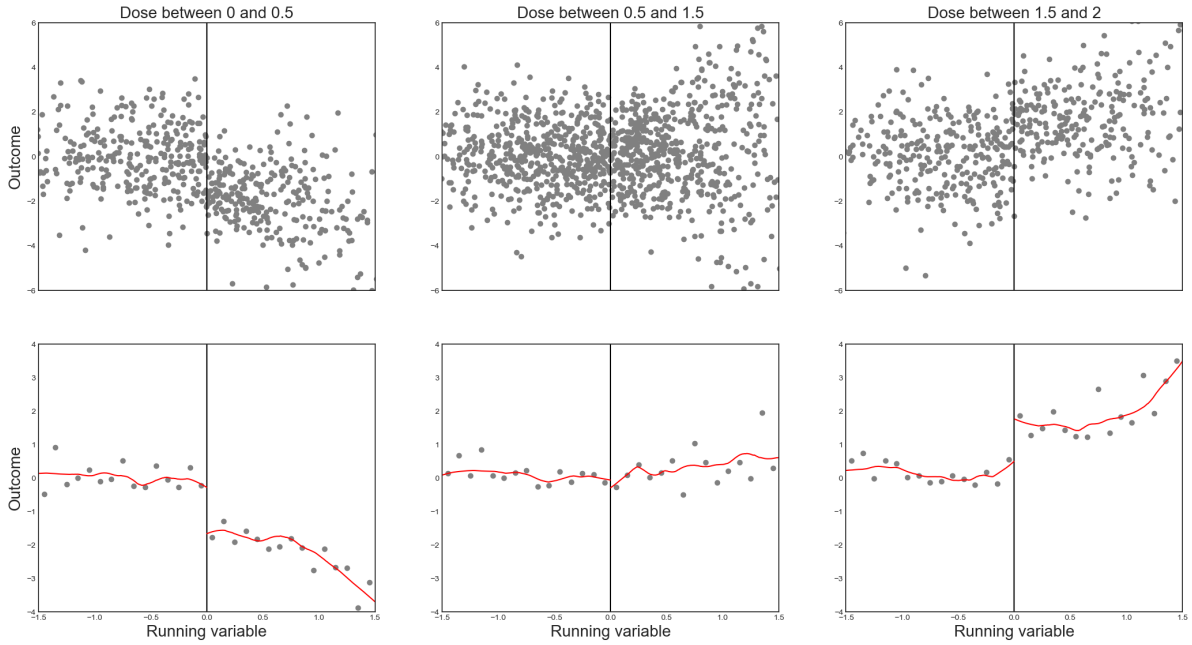
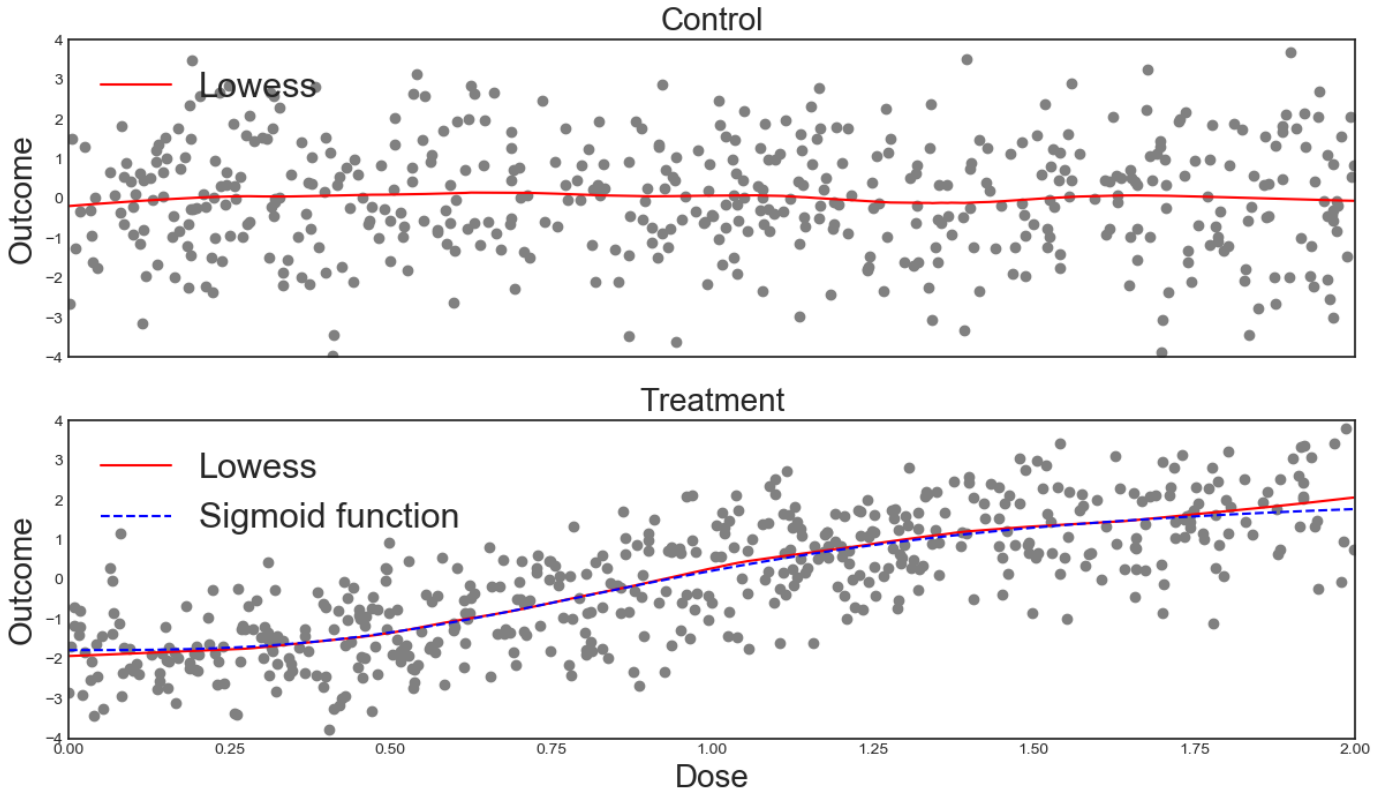


Figure 2.4: Simulation of a regression discontinuity with continuous treatment



2.3.1 Literature review

Within advanced democracies, it is common practice to allocate public subsidies to political parties. These subsidies have been introduced in most Western countries to prevent private interest from undermining the "one man one vote" core principle.[10] However, political contributions can also be part of an healthy democratic debate, as stated by the Royal Commission on Electoral Reform and Party Financing (1991): "Contributors, through their financial support, may help influence the course of public debate and public policy - but such influence is both indirect and legitimate". Several studies highlight how public subsidies may be crowding out private contributions, which in turn impacts negatively upon local political participation. (e.g. Paltiel, 1981; Mendilow, 1992; Katz and Mair, 1995) This may have major implications for the democratic system in regards to efficiency and competitiveness.

In the United States, public funding is still absent at the federal level. However, some public funding schemes have recently been implemented at the state level and the municipal level under clean election legislation. In 2013, as many as 15 states provided some sort of funding to different types of candidates.[11] Contributions matching grants has been one of the preferred methods to allocate funds to candidates, since it incentivizes small grassroots contributions. For example, New York City implemented a public matching fund program as early as 1989. When the scheme was introduced, contributions lower than $250 were matched on a 1 to 1 basis. Now, the ratio is 6 to 1 and 8 to 1 depending on the type of candidate.[12]

Studies of the impact of clean election laws are still in their infancy and they focus more on campaign funding than on overall political fundraising. Much interest has been shown to their impact on electoral competitiveness, but results are still inconclusive. For instance, Malhotra (2008) found that in Arizona and Maine, public funding had a positive impact on competition, while Brogan (2009) found no long term impact of clean election laws on long term inter-party competition. Brogan and Mendilow (2012) determined that the legislation is enhancing the already-existing trend. Fortier and Malbin (2013) discussed an agenda for future research on money in politics following the recommendations from a working group of scholars. At this time, building and updating databases across jurisdictions is a priority for future research in the United States. They also highlight the need for better knowledge on what determines becoming a donor, and if political contributions can be related to participation. In the context of this study, the link between contributions and participation is important since, if public funding impact fundraising, it might also affect participation.

The literature around the impact of public funding on local political organizations fundraising is limited. Katz and Mair (1995) discussed the emergence of the cartel party model: a party that uses state subsidies to survive. In this case, the party ties to grassroots organizations diminishes because less fundraising is required. This concern is also recognized by Paltiel (1981), particularly in regards to the impact on grassroots organizations fundraising incentives.

[10] See Nassmacher (2009) for an extensive review of public subsidies to political parties.

[11] See Fortier and Malbin (2013) and Mayer (2013).

[12] Note that the maximum available for matching also depend on the type office. See Malbin, Brusoe and Glavin (2012) for a discussion of New York city public subsidy system.

Empirically, cross-national comparisons by Nassmacher (2009) and Pierre, Svåsand and Widfeldt (2000) found no direct evidence of a crowding-out effect generated by public subsidies. However, the authors' main argument relies upon observations of broad trends at a time of rapid political change, such as the advent of mass media campaigns. Also, cross-national comparisons are challenging because there are strong differences between political systems and party finance laws. Archambault and Semenov (2019) proposed a model of party centralization where incentives for local organizations are decreasing along with central party power and public subsidies. They also provide some evidence through a fixed effect model that public funding at the central party may have an adverse effect on local fundraising. My main contribution to this literature is the quasi-experimental estimation of the impact of public subsidies to grassroots organizations on their private fundraising.

2.3.2 Methodology

The reimbursement of electoral expenses is a special case of the RDD with continuous treatment methodology because grassroots organizations self-select into a potential treatment level by choosing their level of expense. Therefore, only two points on the dose response function might be identified for grassroots organizations with the same level of expenses. To circumvent this problem, I estimate an average treatment effect by block, defined over different reimbursement levels, where I assume that grassroots organizations within a block are similar. I use both a regression with a fixed bandwidth around 10% of the votes and a local polynomial regression with a data-driven bandwidth and corrected confidence intervals for large bandwidth as proposed by Calonico, Cattaneo and Titiunik (2014b). I also estimate a dose response function allowing for the stronger assumption that the dose assignment is independent of the potential outcomes when conditioning on covariates.

2.3.2.1 The expenditure decision

When a reimbursement of electoral expenses subsidy exists, the electoral expenditures decision is affected because it directly impacts assignment to the reimbursement. Assuming that expenses are correlated with the vote share, the probability of receiving a reimbursement depends upon the expenses.[13] Therefore, the treatment level is not randomly assigned since the potential reimbursements depend upon the level of expenses.[14]

The reimbursement of electoral expense could be related to randomized control trials where patients with different covariates select their trial. As discussed previously, the exact dose of the treatment in each trial is part of a maximizing decision that might also impact the outcome. In that respect, the average treatment effects for different levels of treatment

[13]For empirical justifications about the role of spending on election outcomes, see Jacobson (1990), Levitt (1994) and Erikson and Palfrey (2000). The reimbursement represents 60% of the expenses, and thus spending must have an inherent value for the political organization.

[14]A similar situation can be observed when looking at lottery decisions where the cost of entry depends on the choice of the lottery. Allowing that the choice is continuous, in the sense that winning the lottery gives a fixed percentage of the cost paid and that the probability of winning increases with the payment. Lottery decisions have been widely studied in behavioural economics, see Holt and Laury (2002) and Masclet et al. (2009). In the continuous treatment literature, Hirano and Imbens (2004) studies a lottery where claiming a particular price is a self-selection process that depends on observables.

are not necessarily comparable. For example, let two trials exist, A and B, where a different dosage δ_G of a same treatment is given to each groups G. Also, let the patients choose their groups and therefore their potential outcomes. In this case, the treatment assignment is confounded but not the dose assignment. That is, patients in group A are expected to be different than patients in group B because of self-selection into the experiment. However, within each group, subjects are similar whether receiving the treatment or not. Therefore, the outcome of a patient in group A with the dose δ_A is not applicable to patients in group B unless the group decision is independent of the outcome.

2.3.2.2 The regression discontinuity in electoral context

Redefining the previous variable y_i to be the amount of private contributions received by the grassroots organization i in the year following the election. R_i, the treatment indicator that is 1 if the reimbursement is received and 0 if not. D_i the potential reimbursement indicator; δ_i the level of potential reimbursement where $\delta_i \in [0, l]$ and l is the reimbursement limit.[15] The potential dose indicator can be regarded as the level of expense because it is a linear function of the expenses or 0. As in [2.1], the two potential outcomes of a grassroots organizations are:

$$y_i|(R_i = 1, D_i = \delta_i) = y_i(1) \quad \text{and} \quad y_i|(R_i = 0, D_i = \delta_i) = y_i(0).$$

In this case, the vote share of the local candidate during the election V_i is the running variable. Particularly, R_i=1 if the EDA receives $V_i \geq 10\%$ and R_i=0 if $V_i < 10\%$ or:

$$R_i = 1\{V_i \geq 10\%\}, \tag{2.16}$$

The average treatment effect at dose i can therefore be defined as:

$$\tau_i = \lim_{V \downarrow 10\%} E[y_i|V_i, \delta_i] - \lim_{V \uparrow 10\%} E[y_i|V_i, \delta_i]. \tag{2.17}$$

Lee (2008) was the first to use the regression discontinuity design in an electoral context to estimate the party incumbency effect. In recent times, the question of sorting around the discontinuity has been the focus of many studies. Indeed, if a candidate can accurately determine the number of votes, the continuity assumption would be invalidated.[16] Within this study, the design does not rely on winners and losers since the reimbursement can be received by more than one EDA within a constituency. Also, 10% is a fairly low threshold. Manipulation by candidates is improbable because these candidates were marginal players in their constituencies and sorting is not observed around the threshold.[17] However, the resulting treatment effect may not be representative for local organizations with high vote share.

[15] In this case the reimbursement is limited since there is a limit to the expense level. However, no grassroots organizations receiving around 10% of the vote reached the limit.

[16] Caughey and Sekhon (2011) found that in the U.S h House of Representatives, incumbents disproportionally win close elections while close winners and close losers covariates differ significantly. However, after studying more than 40,000 close elections (including the Canadian federal elections), Eggers et al. (2015) found no tangible threat to the assumption.

[17] They finished in third, fourth and fifth place in their constituencies.

2.3.2.3 The potential reimbursement assignment

As discussed previously, the treatment assignment might be seen as close to random, but not the potential dose assignment. Indeed, for a local organization with potential reimbursement δ_i only two points can be observed on the dose response function, $y_i(0)$ and $y_i(\delta_i)$. Therefore, the dose response function cannot be interpreted as the impact of receiving different reimbursements for an EDA, but rather that each point represents the impact of receiving the reimbursement or not, knowing the expense decision of the local organization. In this case, the dose response function has little meaning when isolated. Unconfoundedness of the potential dose assignment, [2.9], must be imposed to evaluate the dose function.

Let Z_i be the matrix of covariates on which the potential dose decision of the local organization i depends upon. The unconfoundedness assumption can be rewritten as:

$$Z_i \perp (y_i(\delta_i), y_i(0)) \forall \delta_i \in [0, l] \tag{2.18}$$

The dose decision has no correlation with the potential outcome. Allowing this assumption to be true would mean that all the controls have equal outcome:

$$y_i(\delta_i | R_i = 0) = y_i(0) \forall \delta_i \in [0, l] \tag{2.19}$$

Therefore, grassroots organizations that received no treatment are similar in their outcomes, no matter their expense decisions. Furthermore, all grassroots organizations that had no expense but were assigned to a reimbursement would be similar to the controls since the reimbursement was 0. This assumption might be too strong in view of the fact that grassroots organizations that did not spend most likely differ from the ones that did. This will be observed when plotting the fundraising observations in the control group as a function of their potential reimbursement. Therefore, unconfoundedness of the treatment level must at least rely on covariates for the estimation of the dose response function:

$$D_i \perp (y_i(\delta_i), y_i(0), Z_i) \forall \delta_i \in [0, l] \tag{2.20}$$

2.3.2.4 Empirical strategies

The previous analysis leads us to consider two different empirical strategies. The first strategy is to estimate an average treatment effect by block, defined over different bandwidths of reimbursement. Indeed, since the spending decision is continuous, there is no exact spending level that can be used to estimate an average treatment effect. However, it is expected that for close expenses, grassroots organizations are similar; or, more specifically, that the effect of reimbursement on the outcome is similar. This strategy can be written as:

$$E[y_i(1) | V_i = 10\%, \delta_i \in [\delta_1, \delta_2]] = \lim_{V \downarrow 10\%} E[y_i | V_i, \delta_i \in [\delta_1, \delta_2]] \tag{2.21}$$

and

$$E[y_i(0) | V_i = 10\%, \delta_i \in [\delta_1, \delta_2]] = \lim_{V \uparrow 10\%} E[y_i | V_i, \delta_i \in [\delta_1, \delta_2]] \tag{2.22}$$

where, δ_1 and δ_2 are two sufficiently-close levels of expenses. Now let B be the block indicator and b the block where $\delta_i \in [\delta_1, \delta_2]$. The RD average treatment effect by block can be defined as:

$$\tau_b = \lim_{V \downarrow 10\%} E[y_i|V_i, B = b] - \lim_{V \uparrow 10\%} E[y_i|V_i, B = b]. \quad [2.23]$$

Using the fact that expenses on both sides of the threshold should be similar for a given block of reimbursement, τ_b can be redefined as:

$$\tau_b = E[[\lim_{V \downarrow 10\%} E[y_i|V_i] - \lim_{V \uparrow 10\%} E[y_i|V_i]]|B = b]. \quad [2.24]$$

In other words, the expectation of the average treatment effect over a block is equal to the average treatment estimated by assignment within a block.

2.3.2.5 Local polynomial regression

The regression discontinuity can be estimated by kernel regression since it involves estimating weighted local averages at two boundary points. However, kernel regressions are known to be biased at the boundaries. Following Fan (1992) and Fan and Gijbels (1996), Hahn, Todd and Van der Klaauw (2001) proposed a local linear nonparametric regression which improves on other nonparametric smoother such as the Nadaraya-Watson estimator. Porter (2003) goes a step further showing that a local polynomial nonparametric regression achieves an improved bias behavior compared to both the Nadaraya-Watson and the local-linear regression.[18] The solution to the following minimization problem for both limiting points leads to the semiparametric estimation of the RDD treatment effect by second order local polynomial regression:

$$\min_{\alpha,\beta_1,\beta_2} \frac{1}{n} \sum_{i=1}^{n} K_h(x_i - \bar{x}) w_i [y_i - \alpha - \beta_1(x_i - \bar{x}) - \beta_2(x_i - \bar{x})^2]^2,$$

where x_i is the vote share and $\bar{x}$ is the 10% discontinuity point. K_h is a kernel function defined over the bandwidth h, $w_i = 1\{x_i < \bar{x}\}$ when estimating the point to the left of the bound and $w_i = 1\{x_i > \bar{x}\}$ when estimating the point to the right of the bound. The parameter of interest is α and β_1 and β_2 are treated as nuisance parameters. I used the triangular kernel function as it is commonly utilized in RDD to reduce the weight of observations away from the discontinuity. I use a data-driven bandwidth for the local polynomial parametric regression. The optimal bandwidth is defined from the minimization of the asymptotic approximation of the mean square error (MSE):

$$h^{opt} = \min_h E[(\tau - \hat{\tau})^2].^{19}$$

[18] See Ghosh (2018) for further comparison between these parametric models. Note that the Nadaraya-Watson estimator remains a special case of the local polynomial regression where p=0 and the local linear estimator is obtained when p=1.

[19] See Imbens and Kalyanaraman (2012) for a detail explanation of data-driven bandwidth in the RDD context.

To estimate the local polynomial regression and the data-driven bandwidth, I follow Calonico, Cattaneo and Titiunik (2014b) methodology and its implementation through Calonico, Cattaneo and Titiunik (2014a) who also estimates robust confidence interval because data-driven bandwidths are too large.

I also estimate the average treatment effect using a regression for a small bandwidth around the discontinuity. In this case, I estimate the following equation:

$$F_{i,t+1} = \beta_1 R_{i,t} + \beta_2 X_{i,t} + \chi_t + \phi_i + \alpha_1 V_{i,t} + \alpha_2 V_{i,t}^2 + \alpha_3 V_{i,t}^3 + \epsilon_{it}, \quad [2.25]$$

where $F_{i,t+1}$ is the level of fundraising for the local organization i during the year following the election. $R_{i,t}$ is the reimbursement indicator variable that =1 if the grassroots organizations received the reimbursement, and =0 otherwise. β_1 is therefore the coefficient of interest. $X_{i,t}$ is a matrix of financial covariates for the local organization and χ and ϕ are election and province fixed effects. For simplicity, $V_{i,t} = Vote\ share - 10\%$ and the use of different exponents accounts for departures from the discontinuity threshold. I also allow for nuisance parameters related to the level of reimbursement and ϵ_{it} is the error term.

2.3.2.6 Dose response estimation

The second strategy is to estimate the dose response function using the assumption that the function is similar for different grassroots organizations conditioning on observables. The empirical specification of the model is:

$$F_{i,t+1} = \beta_1 T_{i,t} + \beta_1 T_{i,t}^2 + \beta_2 X_{i,t} + \chi_t + \phi_i + \alpha_1 V_{i,t} + \alpha_2 V_{i,t}^2 + \alpha_3 V_{i,t}^3 + \epsilon_{it}$$

where $T_{i,t}$ is the amount reimburse.

2.3.3 Evidence from the Canadian data

In Canada, an electoral candidate is entitled to 60% of his electoral expenses if he attracts at least 10% of the valid vote in his district.[20] Figure 2.5 gives an overview of the current reimbursement scheme. Following the previous methodology, I estimate the impact of the reimbursement of electoral expenses on ensuing fundraising using Canadian federal elections

[20]The Royal Commission on Electoral Reform and Party Financing (1991) provides this rationale for the reimbursement, of electoral expenses:

> 'At the heart of this reimbursement system lies the belief that candidates and parties perform important and necessary functions during elections in a democratic system ; it is therefore in the public interest for the state to provide public funds to support these functions. Reimbursement also lessens candidates' and parties' reliance on large donations from a few donors and helps ensure that candidates and parties are able to conduct effective campaigns. Finally, reimbursement lowers the cost of running for office, thereby facilitating access to the system.'

After reassessing the role of the reimbursement, the commission recommended to lower the reimbursement threshold to 1% because the high threshold (15% at the time) was disproportionally compensating the larger parties.

Figure 2.5: Reimbursement of electoral expenses

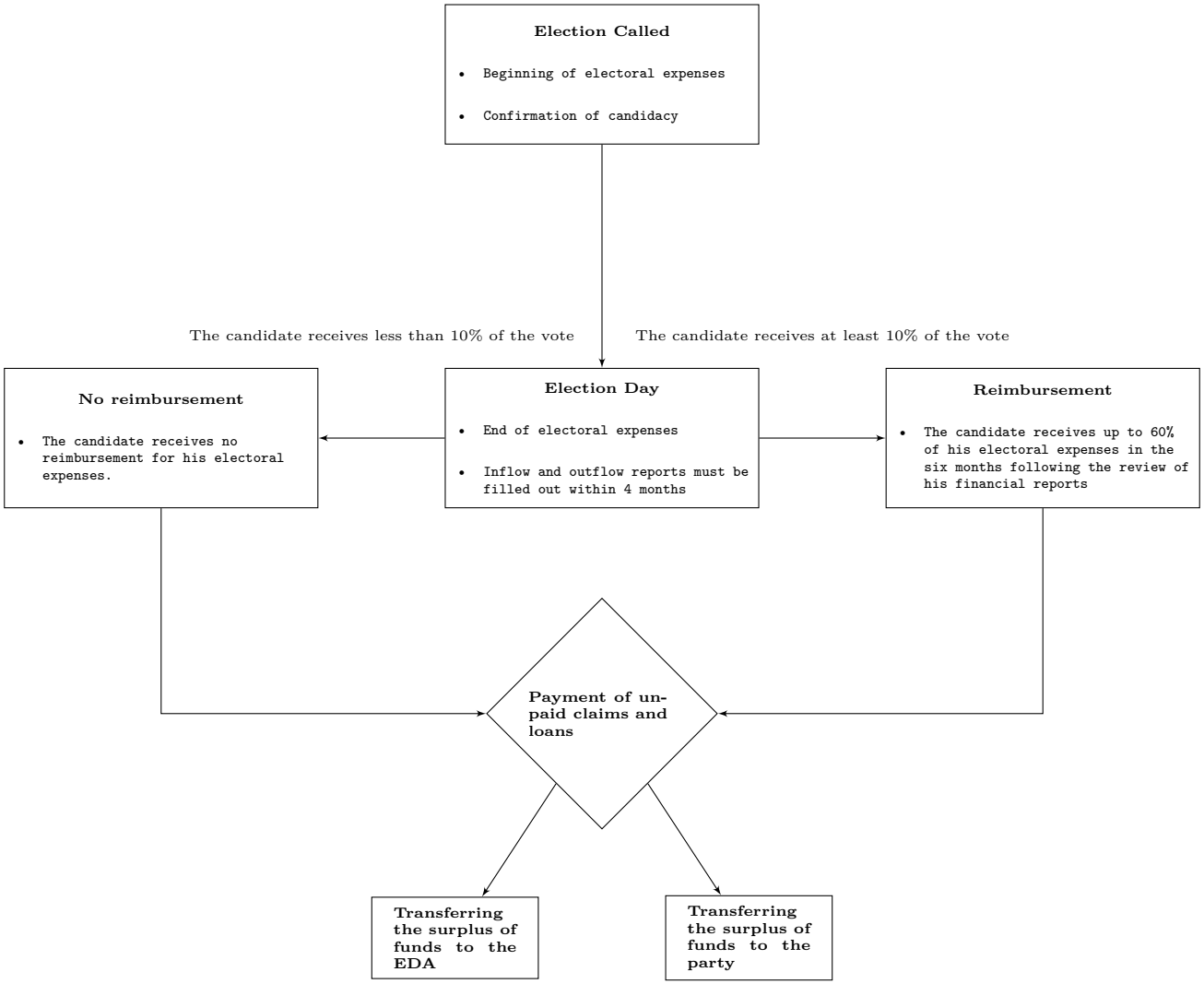


Table 2.1: Descriptive summary of the Canadian elections from 2000 to 2016

Election	**Day of election**	**Campaign duration**[1]	**Government elected**	**Type of government**	**Constituencies**
38th	28-Jun-04	36-day calendar	Liberal Party of Canada	Minority Government	308
39th	23-Jan-06	55-day calendar	Conservative Party of Canada	Minority Government	308
40th	14-Oct-08	37-day calendar	Conservative Party of Canada	Minority Government	308
41st	2-May-11	37-day calendar	Conservative Party of Canada	Majority Government	308
42th	19-Oct-15	78-day calendar	Liberal Party of Canada	Majority Government	338

[1] Includes the day the election is called and excludes the day of the election.

that occurred from 2004 to 2015.[21,22] Table 2.1 gives a brief overview of these elections.[23] From 2004 to 2011, the constituencies had the same boundaries but redistricting was enacted during the 2015 election, which added 30 seats. Also, the 2015 campaign was by far the longest in the post-war period.

2.3.3.1 Electoral district associations

In Canada, the local organization of a political party is called an electoral district association (EDA). Political parties can have one EDA per electoral district.[24] EDAs have three main functions: to participate in the selection of the riding candidate, to support the riding candidate, and, between elections, to regulate party life locally. They also play a role nationally by attending party conventions and voting on different party resolutions. Between elections, EDAs receive local private contributions. However, during an electoral campaign, only the local candidate is entitled to receive private contributions, accept transfers from other party entities, take loans, and make expenses. In a sense, candidates replace EDAs during the electoral period as they must report inflows and expenses made during the campaign. Since 2004, EDAs have to publicly report extensive yearly financial statements in which they must list all private contributions amounting to $200 or more. Since 2007, only individuals are allowed to contribute and the limit is fixed at $1,000.[25]

2.3.3.2 Electoral campaign expenses

There are three types of electoral campaign expenses: the election expenses, the candidate's personal expenses, and the other electoral expenses.

2.3.3.2.1 Election expenses

Election expenses account for the lion's share of electoral expenditures and include all of the properties and/or services reasonably incurred over the electoral period. These expenses can only be made from the day the election is called up until election day. There is an election expense limit based upon the preliminary list of electors. This limit is also adjusted for low populations, large districts and longer campaigns.[26] These expenses are considered eligible for the reimbursement of electoral expenses.

[21] Since 2004 detailed financial data from EDAs are publicly available from Election Canada.

[22] The important number of elections within the 11-year period is due to three consecutive minority governments.

[23] I choose to only analyze the outcomes from the year following an election in order to prevent overlap between elections. Indeed, minority government elections generally occurred over a shorter period of time as seen in Table 2.1.

[24] See Carty (2002) and Coletto and Eagles (2011) for discussions related to Canadian EDAs.

[25] This amount was adjusted in the subsequent years and reached $1,575 in 2018. Before 2007, individuals could donate $5,000 and corporations, unions and other organizations could donate as much as $1,000. For more details see Archambault and Semenov (2019).

[26] Such threshold is also adjusted to reflect the list of electors on the last week of the campaign.

2.3.3.2.2 Candidate's personal expenses

The candidate's personal expenses are the costs of running the campaign incurred by a candidate. These may include traveling, food, and childcare expenses incurred by the candidate and they are considered eligible for the reimbursement of electoral expenses. These are not subject to a fixed limit.

2.3.3.2.3 Other electoral expenses

Other electoral expenses are generally not subjected to the set limit amount and differ from the candidate's personal expenses. These may include expenses made prior to or after the election period, fundraising expenses, compensations paid to a candidate to cover its loss of revenue, etc. These expenses are not considered eligible for the reimbursement of electoral expenses.

2.3.3.2.4 The reimbursement of electoral expenses

As shown in Figure 2.5, following an election, a candidate must provide a financial report in order to be eligible for a 60% reimbursement of his election expenses and his candidate's personal expenses. However, this is only applicable if he received at least 10% of the valid vote in his district. At most, the reimbursement makes up to 60% of the election expense limit. The reimbursement is paid in two installments. An initial reimbursement of 15% is directly issued following an election if the candidate has attracted 10% of the vote criterion. Once every financial report has been reviewed and approved by Elections Canada, the final installment is paid. The reimbursements can be used to pay a candidate's outstanding debts and the remaining funds must be transferred.[27] The reimbursement is usually paid during the election year or in the two years following the election, according to when the financial report is received by Election Canada.

2.3.3.3 EDA summary statistics

This study focuses on the five main Canadian political parties: the Bloc Quebecois (BQ), the Conservative Party of Canada (CPC), the Liberal Party of Canada (LPC), the New Democratic Party (NDP) and the Green Party of Canada (GPC). Each party uses different fundraising strategies when it comes to local fundraising. The CPC, the LPC and the BQ rely on fundraising at the EDA level. For the NDP and the GPC, a greater share of fundraising occurs during the election period.

Table 2.2 shows summary statistics for all the EDAs. In most elections, 4 of the main parties were competing and about 23.6% of the candidates won the election. As expected, there are important differences between organizations in regard to the expenses subject to

[27] Over the five campaigns studied, 0.1% of all candidates exceeded the electoral expense limit. These candidates were penalized by a reduction to the reimbursement that depended on the exceeding amount. When adding the candidate's personal expenses to the electoral expenses, about 15% exceeded the electoral expense limit. However, only one candidate in a bandwidth of 3% around the 10% threshold had expenses exceeding the limit.

Table 2.2: Summary statistics for all observations

VARIABLES	Mean	Sd	Max
Candidate (at t)			
Vote percentage	23.38	18.18	83.99
Win	0.236	0.424	1
Treated	0.676	0.468	1
Expenses subject to reimbursement	36,228	33,387	185,394
EDA (at t+1)			
Opening balance	12,319	27,087	362,160
Transfer from candidate	4,608	11,902	100,902
Fundraising	12,277	24,019	481,686
Party			
Liberal Party of Canada	0.236	0.425	1
Conservative Party of Canada	0.236	0.425	1
New Democratic Party	0.236	0.425	1
Bloc Quebecois	0.057	0.232	1
Green Party of Canada	0.235	0.424	1
Election (t)			
2004	0.197	0.398	1
2006	0.197	0.398	1
2008	0.196	0.397	1
2011	0.196	0.397	1
2015	0.215	0.411	1
Observations	6644		
Observations with a candidate report	6615		
Fundraising cornered at 0	1988		

Notes: Monetary values are in 2004 dollars. Time t is the election year.

the reimbursement, their opening balances and their transfers from the candidate to the EDA. This can be related to different political support depending on the constituencies. Note that transfers from the candidate to the EDA include any transfers due to reimbursements received during the year following the election. Therefore, this variable is used to determine how the timing of the reimbursement impacts fundraising.

Table 2.3 shows summary statistics for EDAs in close margin elections with a bandwidth of 3% around the 10% vote share threshold.[28] The average level of expenses subjected to the reimbursement is $20,000 lower for EDAs close to the 10% threshold.[29] The net opening balance of assets indicates that EDAs that received relatively low support in the elections are, on average, poorer than other EDAs. Overall, 67% of EDAs received a reimbursement and, as expected, about 50% of EDAs in close margin elections received a reimbursement. A third of EDAs close to 10% did not raise private funding in the year following the election. Some of the small grassroots organizations therefore stayed inactive in term of fundraising, but almost every EDA remained open, even if they had no fundraising. Consequently, Tobit estimates will also be provided for the estimation of the dose response function, and the probability of fundraising will also be used as an outcome variable to see if the reimbursement determines activity. Overall the financial variables indicate that EDAs close to 10% of the vote are considerably less wealthy than other EDAs. A possible explanation is that they also have limited chances of winning the election. When comparing parties, the NDP is overrepresented near the threshold. Also, more observations are recorded in 2015 due to a considerable increase in the number of seats.

Figure 2.6 shows the distribution of expenses for all candidates and for candidates 3% around the threshold. The distribution for all candidates is bimodal because expenses are either relatively low or around the limit. For EDAs close to 10%, the level of expense is lower and for the most part, less than $25,000.

Table 2.4 provides additional information in regard to the difference between blocks when looking at observations around 3% of the discontinuity.[30] The block with the lowest potential reimbursement consist of EDAs with minimal financial resources, while the block with the highest potential reimbursement is the one where the financial variable varies the most.

Table 2.5 shows the summary statistics for treated and control EDAs. As expected, treated EDAs are generally wealthier, receive more funding, and make more transfers. However, testing for the difference of covariates between control and treated EDAs were rejected. This provides some evidence that, within blocks, the continuity assumption holds. However, between blocks, there are important differences in covariates as seen in Table 2.4. This indicates that observations that did not received a reimbursement are bad counterfactuals for observations that did receive a reimbursement but are in a different group.

[28] Table 2.14 and 2.15 in the appendix show summary statistics for EDAs in close margin elections with a bandwidth of 2% and 1%.

[29] Candidates without expenses are relatively rare as only 3% of the observations around the 10% threshold had no expense. More than half of these were representatives of the NDP.

[30] The 3% bandwidth is also used because it provides an important number of observations while remaining near the discontinuity. A wider bandwidth may be too large as few EDAs received around 5% of the vote and this represents half of the total votes required to receive the reimbursement. The regression results for different bandwidths and numbers of block are also provided.

Table 2.3: Summary statistics for observations 3% around the discontinuity

VARIABLES	Mean	Sd	Max
Candidate (at t)			
Vote percentage	9.909	1.680	12.98
Win	0	0	0
Treated	0.476	0.500	1
Expenses subject to reimbursement	14,663	16,841	185,394
EDA (at t+1)			
Opening balance	2,159	5,121	62,752
Transfer from candidate	815.2	3,133	38,148
Fundraising	2,794	5,878	59,913
Party			
Liberal Party of Canada	0.177	0.382	1
Conservative Party of Canada	0.163	0.369	1
New Democratic Party	0.444	0.497	1
Bloc Quebecois	0.033	0.178	1
Green Party of Canada	0.183	0.387	1
Election (t)			
2004	0.152	0.359	1
2006	0.199	0.399	1
2008	0.299	0.458	1
2011	0.154	0.361	1
2015	0.197	0.398	1
Observations	921		
Observations with a candidate report	916		
Fundraising cornered at 0	343		

Notes: Monetary values are in 2004 dollars. Time t is the election year.

Figure 2.6:
Distribution of expenses by local candidates in Canada for the 37th to the 42th elections (in 2004 dollars)

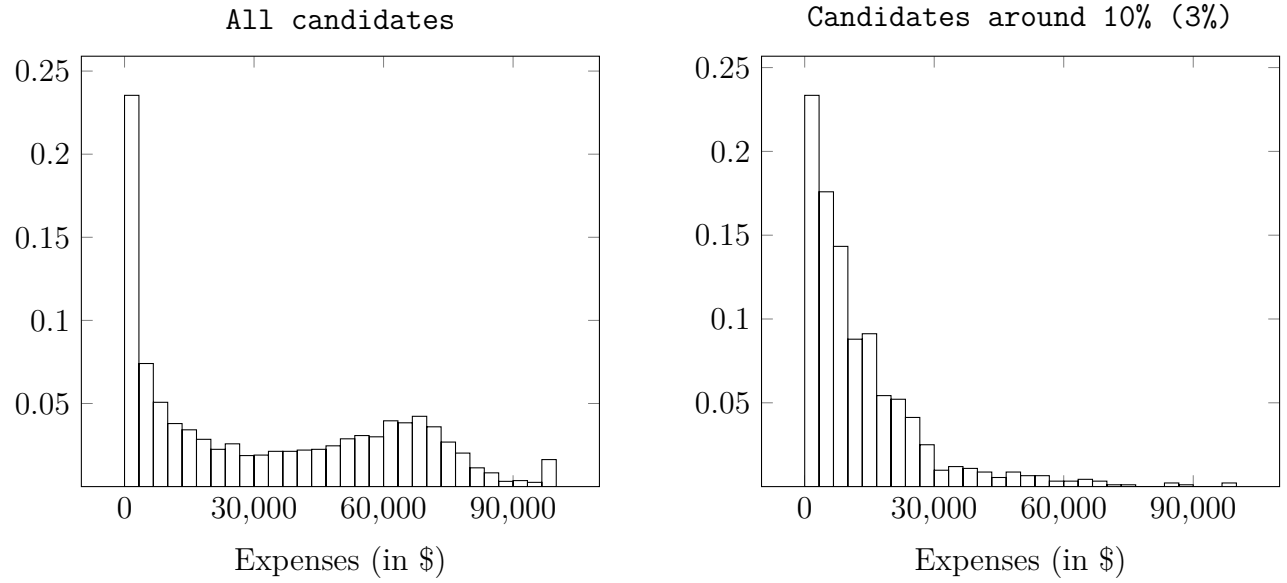


Table 2.4: Summary statistics for observations 3% around the discontinuity by expense block

	1 block			2 block			3 block		
VARIABLES	Mean	Sd	Max	Mean	Sd	Max	Mean	Sd	Max
Candidate (at t)									
Treated	0.358	0.480	1	0.436	0.497	1	0.632	0.483	1
Expenses subject to reimbursement	2,422	1,488	5,151	9,043	2,567	14,071	28,351	16,826	151,094
EDA (at t+1)									
Opening balance	833.6	1,611	12,428	1,643	3,106	16,970	4,030	7,855	62,752
Transfer from candidate	181.3	568.6	4,477	523.8	1,959	24,506	1,756	4,922	38,148
Fundraising	744.4	2,134	23,665	2,125	3,965	35,009	5,559	8,486	59,913
Party									
Liberal Party of Canada	0.052	0.223	1	0.176	0.381	1	0.303	0.460	1
Conservative Party of Canada	0.091	0.288	1	0.127	0.334	1	0.270	0.445	1
New Democratic Party	0.603	0.490	1	0.489	0.501	1	0.241	0.428	1
Bloc Quebecois	0.023	0.150	1	0.055	0.229	1	0.020	0.139	1
Green Party of Canada	0.231	0.422	1	0.153	0.361	1	0.166	0.373	1
Election (t)									
2004	0.130	0.337	1	0.156	0.364	1	0.169	0.376	1
2006	0.212	0.409	1	0.208	0.407	1	0.176	0.381	1
2008	0.404	0.491	1	0.293	0.456	1	0.199	0.400	1
2011	0.104	0.306	1	0.124	0.330	1	0.235	0.424	1
2015	0.150	0.357	1	0.218	0.414	1	0.221	0.416	1
Observations		307			307			307	

Notes: Monetary values are in 2004 dollars. Time t is the election year.

Table 2.5: Summary statistics for observations 3% around the discontinuity by expense block and treatment status

	Treatment						Control					
	1 block		2 block		3 block		1 block		2 block		3 block	
VARIABLES	Mean	Sd	Mean	Sd	Mean	Sd	Mean	Sd	Mean	Sd	Mean	Sd
Candidate (at t)												
Expenses subject to reimbursement	2,405	1,644	9,194	2,578	28,255	17,177	2,432	1,398	8,926	2,559	28,519	16,262
EDA (at t+1)												
Opening balance	1,014	1,547	1,701	3,341	4,623	8,249	732.8	1,641	1,598	2,919	2,981	7,017
Transfer from candidate	183.3	624.2	709.7	2,592	2,263	5,622	180.2	536.6	379.9	1,258	858.7	3,172
Fundraising	1,038	3,225	1,854	3,336	5,014	8,561	580.5	1,119	2,335	4,390	6,522	8,303
Party												
Liberal Party of Canada	0.046	0.209	0.134	0.342	0.351	0.478	0.056	0.230	0.208	0.407	0.221	0.417
Conservative Party of Canada	0.136	0.345	0.112	0.316	0.278	0.449	0.066	0.249	0.139	0.347	0.257	0.439
New Democratic Party	0.727	0.447	0.575	0.496	0.247	0.433	0.533	0.500	0.422	0.495	0.230	0.423
Bloc Quebecois	0.009	0.095	0.090	0.287	0.016	0.124	0.031	0.172	0.030	0.168	0.027	0.161
Green Party of Canada	0.082	0.275	0.090	0.287	0.108	0.311	0.315	0.466	0.202	0.403	0.265	0.444
Election (t)												
2004	0.118	0.324	0.157	0.365	0.155	0.362	0.137	0.345	0.156	0.364	0.195	0.398
2006	0.145	0.354	0.224	0.418	0.196	0.398	0.249	0.433	0.197	0.399	0.142	0.350
2008	0.373	0.486	0.299	0.459	0.191	0.394	0.421	0.495	0.289	0.455	0.212	0.411
2011	0.164	0.372	0.060	0.238	0.247	0.433	0.071	0.258	0.173	0.380	0.212	0.411
2015	0.200	0.402	0.261	0.441	0.211	0.409	0.122	0.328	0.185	0.389	0.239	0.428

Notes: Monetary values are in 2004 dollars. Time t is the election year.

2.3.3.4 Other sources of public funding

In Canada, there are two other sources of public funding for political parties: the per-vote subsidies and the reimbursement of electoral expenses to the central party. Per-vote subsidies are allocated if the central party attracts more than 2% of the vote nationally or 5% in ridings where candidates are running. This subsidy provides around $2 per vote per year.[31] The electoral reimbursements are given to central parties for the national campaign following the same legislation as the per vote subsidies. The amount reimbursed represents 50% of all expenses. Also, it should be noted that private contributions to political parties are subjected to a tax rebate depending on the amount donated. This rebate represents more than 50% of the donation when the contribution limit is provided.

2.3.4 Manipulation of the running variable

The regression discontinuity design is an effective technique to estimate a treatment effect at the cutoff assuming that no manipulation is possible to receive the treatment. In the case of the reimbursement of electoral expenses, manipulation would require that local organizations can precisely predict or manipulate to receive more than 10% of the votes shares. While the reimbursement is in fact non-rival, the vote share is, since it depends on the number of votes received by each party. Other studies have shown that incumbents were not disproportionally winning races in the Canadian case. Therefore, it seems improbable that candidates close to 10% could predict or manipulate their vote share.

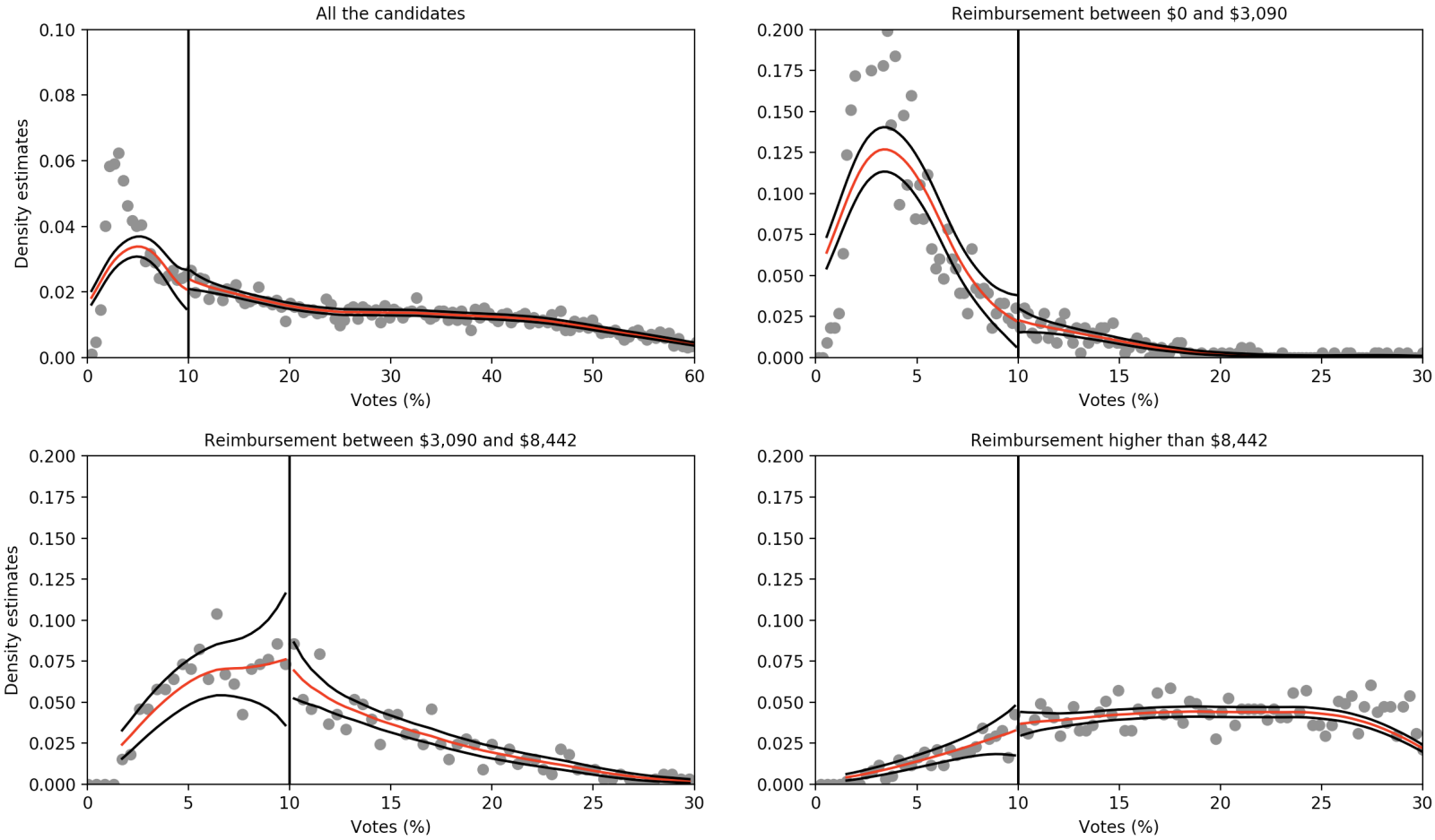
Manipulation of the recounting process could explain why local candidates meet the 10% threshold. However, strict rules overview the recounting process, which make it unlikely to be use by candidates with relatively low vote count. An automatic judicial recount is only conducted if the difference in votes between the winning candidate and the second place candidate is less than .1% of the total valid vote count. A judicial recount can also be conducted on application if there is proof of incorrect count during the voting process or an incorrect ballot rejection. However, fringe candidates are unlikely to be able to provide proof as their representation is usually minimal during the vote count. For instance, there were four judicial recounts during the 2011 election and only one of these came from an application. It was also due to a small difference in vote between the winning and the second place candidate that was not within the .1% rule.

To test for possible manipulation, I look for a discontinuity in the density of observations at the 10% cutoff following McCrary (2007) procedure. This procedure tests if the density function of the running variable is continuous at the discontinuity. I also provide this test by level of expense as it can be expect that the density function is different depending the level of potential reimbursement. As seen in Figure 2.7, we find no discontinuity in the density at 10% and this is reflected in the estimated log discontinuity in the density.[32]

[31] Starting in 2012, the per-vote subsidy was phased out by 25% per year until its complete removal in 2015.

[32] These test were performed using McCrary implementation of his test in Stata (DCdensity). The bandwidth h, and the binsize b, were define from the default calculation. However, subjective choice with h/b>10 did not seem to alter the results.

Figure 2.7: McCrary test by level of potential reimbursement



2.3.5 Graphical presentation

In this section, I use the data of grassroots organizations to generate the plots discussed in the simulation section.[33] Figure 2.8 shows the amount of local fundraising depending on the vote share received. I use 25 bins each covering .2% of the vote share. Candidates that received more than 10% of the votes received a partial reimbursement of their electoral expenses. When pooling all the observations we see no particular jump in fundraising at the discontinuity.

Figure 2.9 shows the discontinuity when dividing observations in three blocks that depends on the level of expense. The low number of observations, combined with the high level of fundraising cornered at 0, leads to choosing a relatively low number of bins. Figure 2.10 shows the level of fundraising relative to the level of potential reimbursement.[34] The level of fundraising is increasing faster for observations in the control group than for observations in the treatment group. Also, no particular sorting along the level of expense appears before $30,000. It is expected that grassroots organizations with very high expenses have a high probability of receiving a reimbursement. This phenomenon is not observed with lower bandwidths around 10%. Due to this, I choose lower than 5% bandwidth when possible. Few candidates had a potential reimbursement of more than $30,000 and received between 5% to 15% of the vote. This is because the vote share is correlated with expenses.[35]

Figure 2.10 provides some evidence against the unconfoundedness of the treatment level assumption, since grassroots organizations that did not receive the reimbursement have increasing fundraising with the level of potential reimbursement. Plot A) in Figure 2.11 shows the difference between the treatment group and the control group. The difference cannot be interpreted as a dose response function, since unconfoundedness of the dose is not maintained. However, this shows that for grassroots organizations with low expense, the reimbursement might positively impact fundraising while grassroots organizations with higher expense sees a negative impact on fundraising. Plot B) shows the difference for smaller bandwidth and plot C) shows the impact of fundraising relative to the potential reimbursement.

2.3.6 Results

I begin by discussing the regression discontinuity results without discrimination on the level of expenses. Table 2.6 shows the results when including all the observations within different bandwidths around 10% of the vote share. The treatment coefficient is insignificant for all the specifications except for the 1% bandwidth. The data-driven bandwidth is 2.7%, which is close to the larger fixed bandwidth.

[33] For the sake of presentation I use a bandwidth of 5% around the discontinuity, as it allows a clearer representation in term of the number of observations and bin size. However, I obtain similar plots for a fixed bandwidth of 3%.

[34] The red line is the Lowees. I did not smooth the fit over the y values since it produces over-smoothing toward 0, as fundraising is 0 in many cases. In other words, I only use one iteration.

[35] For example, expecting the reimbursement with high probability should impact expenses.

Figure 2.8: Impact of reimbursement on fundraising at t+1 (50 bins)

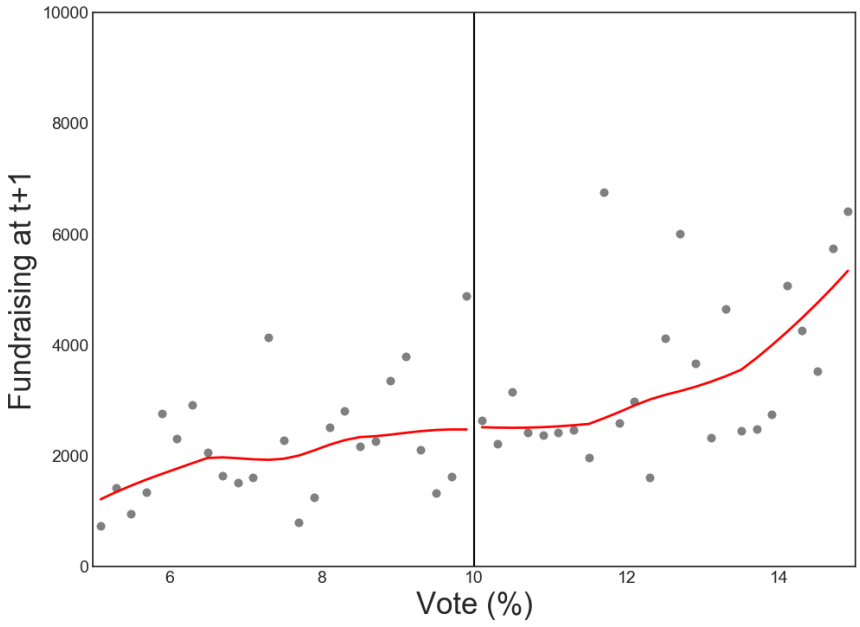


Figure 2.9: Impact of reimbursement on fundraising at t+1 by reimbursement blocks

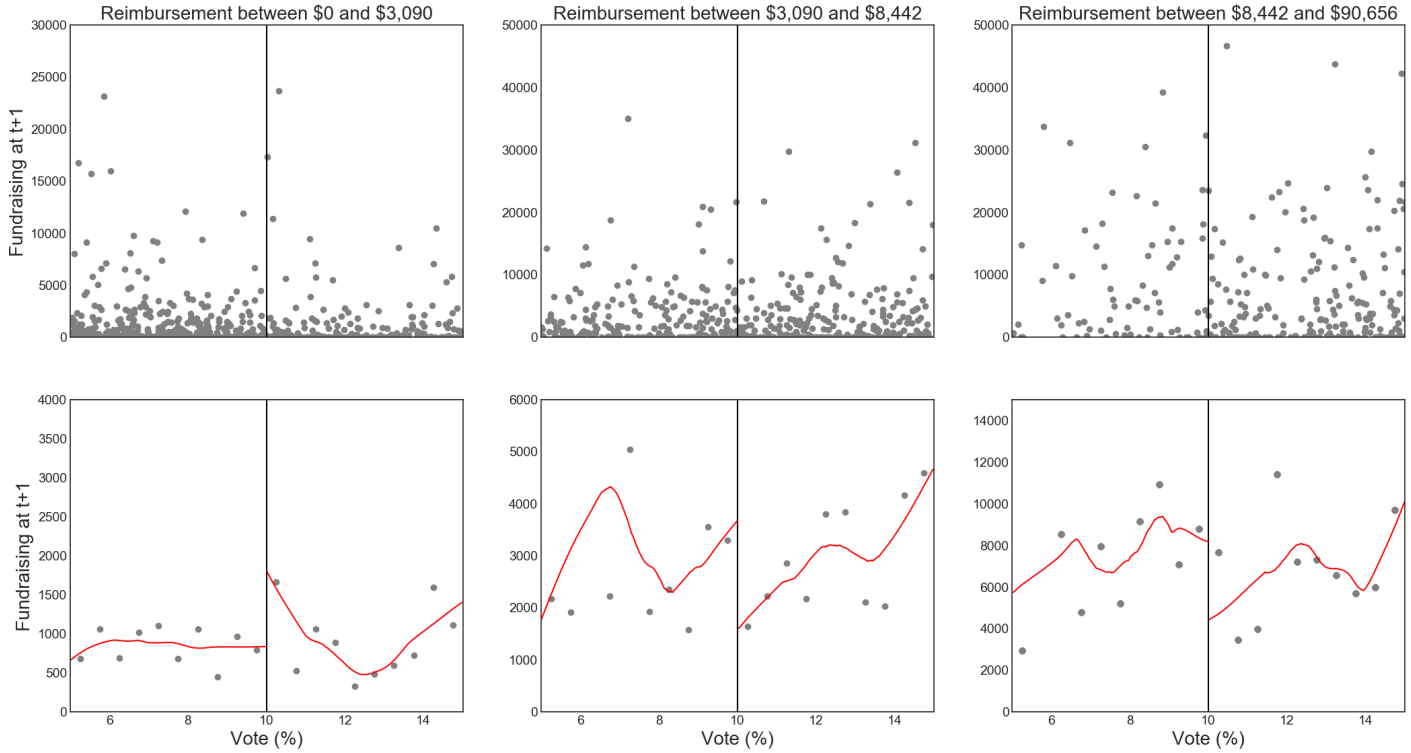


Figure 2.10: Relation between the reimbursement level and fundraising at t+1 (5% bandwidth)

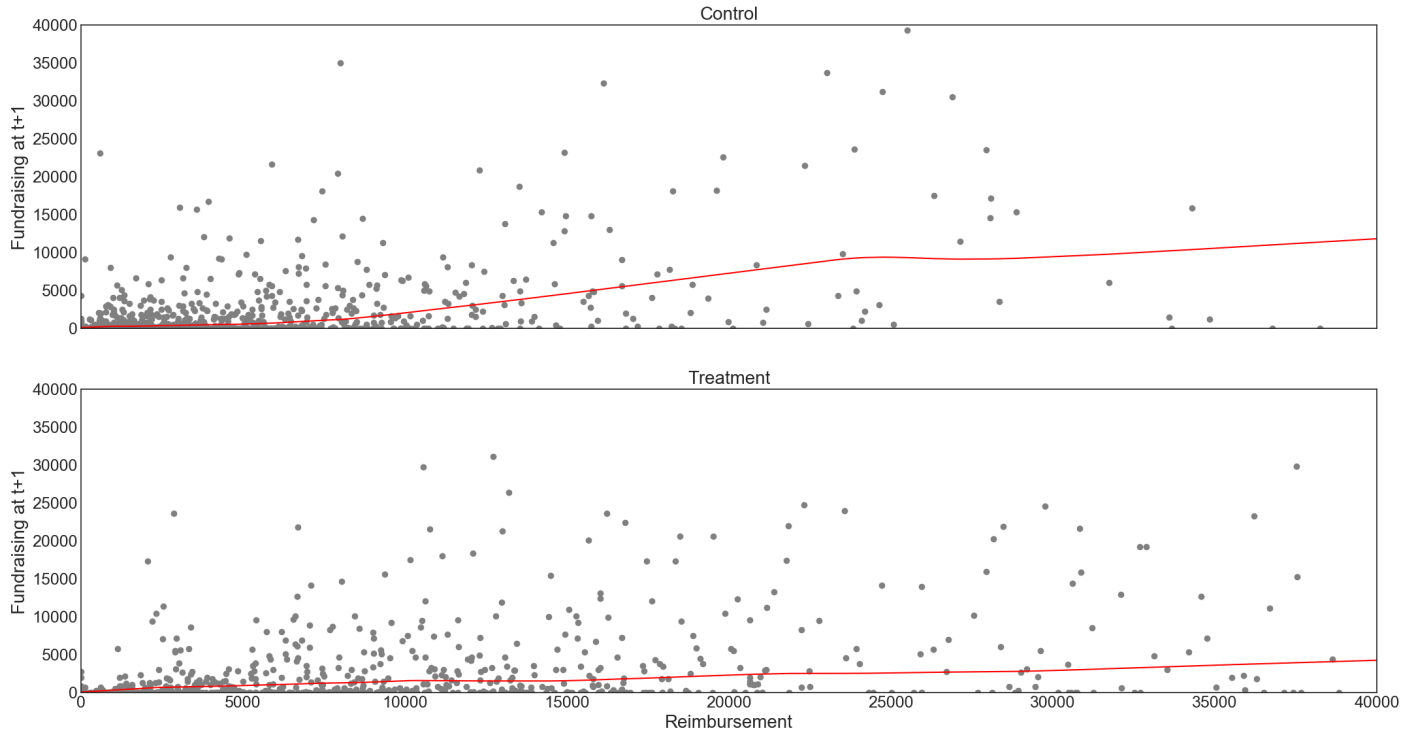
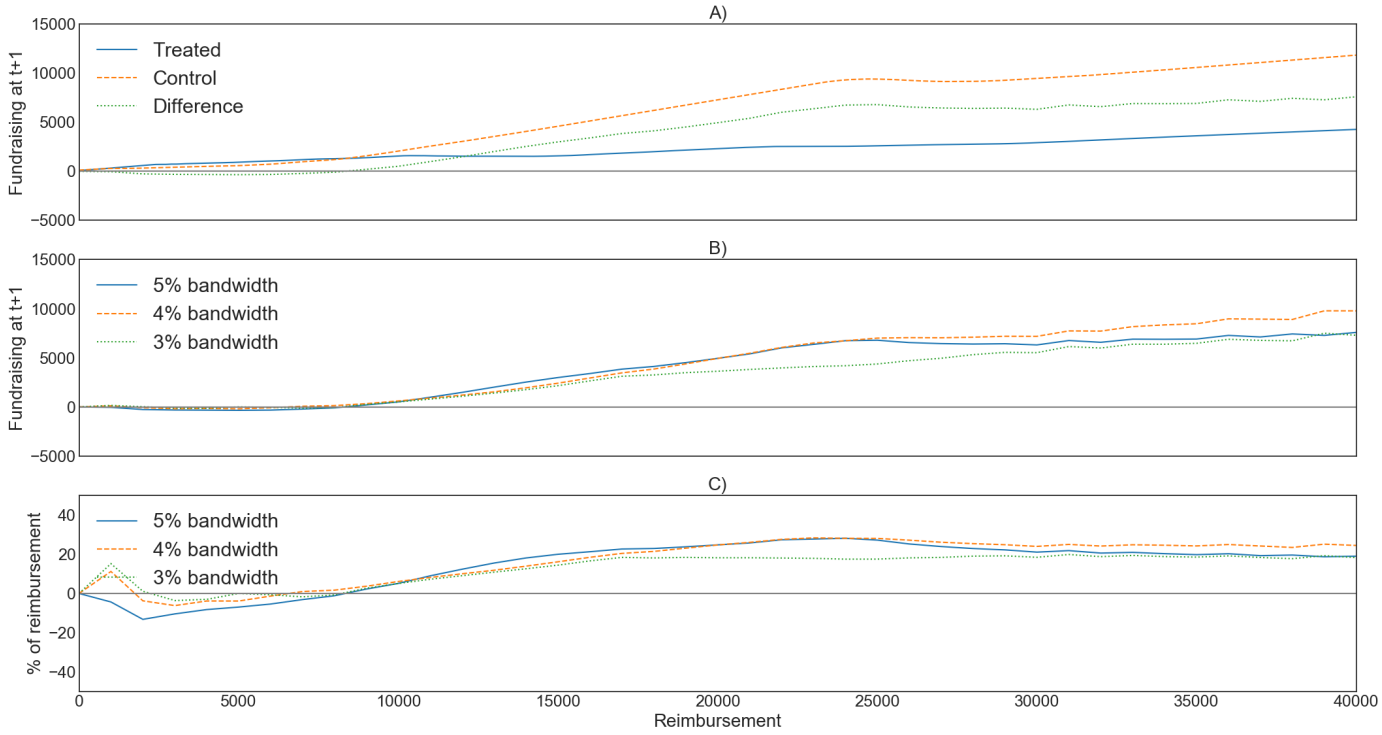


Figure 2.11: Relation between the reimbursement level and fundraising at t+1 for different bandwidth



The opening balance and the transfer from the candidate are positive and mostly insignificant. This remains true in most of the other specifications, and overall the impact of these variables on the treatment coefficients is insignificant. This could indicate that the timing of reimbursement does not impact fundraising. Indeed, as soon as the election ends, eligibility for a reimbursement is of common knowledge. More so, it enables EDAs to expect an upcoming impact on funding.

All regression specifications also have party and election fixed effects, and these are significant. This is likely to be related to the different fundraising schemes by party. The third degree polynomial term for expenses is used to control for similar EDAs in term of expenses or potential reimbursements. The polynomial vote share terms are used as a correction for observations away from the discontinuity.[36]

2.3.6.1 Continuous treatment by blocks

The primary results focus on the 3% bandwidth around the discontinuity and a proportional division between three blocks. Note that modifying the bandwidth at the marginal level has little impact on the results. However, decreasing the bandwidth leads to a reduction of the number of observations by block, which becomes an issue when using many blocks. When estimating the data-driven bandwidth, I use the same expense threshold used for the 3% bandwidth.

Table 2.7 and 2.8 show the results by blocks for the local polynomial regression with a fixed and a data-driven bandwidth.[37] The coefficient for the treatment in the first block is positive and significant; in the second, the coefficient is negative and significant; and in the final block, the coefficient is negative but not significant. In the final block, the difference in potential reimbursement is by far the highest, and this might explain the high variance of the coefficient. For instance, in this block observations in the treatment group have higher potential reimbursement in comparison to the control group. This is problematic, as fundraising is positively correlated with the potential reimbursement as seen in Figure 2.10. It would create an upward bias and may explain why the treatment effect is close to significant. This emphasizes the need for a large number of observations close to the discontinuity along the treatment level. Table 2.9 and 2.10 present similar results, but using the log of fundraising and replacing the 0 by 1. In this case, similar results are obtained in terms of sign and significance. However, the coefficients in the first and last blocks show that some of the results may be driven by extreme values in terms of fundraising. However, omitting these extreme values leads to similar results.[38]

Note that the data-driven bandwidth leads to lower than 3% bandwidth. Table 2.11 presents the results for observations divided equally into blocks, and they are similar to the local polynomial regression results. The impact of the covariates on the treatment is limited when the regression estimates are compared to those of the local polynomial regression.

[36] Different orders and the interaction between votes and expenses were tried without notable differences on the treatment coefficient.

[37] For the data-driven bandwidth, all the observations with potential reimbursement between the set levels were used.

[38] These high fundraising values usually happen if national political activities occur in the constituency.

Table 2.6: Regression discontinuity for observations around the threshold

y= fundraising in the year following the election							
	Bandwidth around the threshold						Local polynomial
VARIABLES	3%	2%	1%	3%	2%	1%	2.7%
Treatment	-866	-886	-3,092*	-1,043	-724	-2,556*	-1,048
	(961)	(1,172)	(1,646)	(904)	(1,106)	(1,548)	(924)
Opening balance	0.1488**	0.1100	0.1403	0.0844	0.0413	0.0552	-
	(0.0697)	(0.0937)	(0.0973)	(0.0641)	(0.0852)	(0.0901)	-
Transfer from candidate	0.1562	0.1866	0.2241	0.0526	0.0774	0.1354	-
	(0.1056)	(0.1234)	(0.1600)	(0.0960)	(0.1142)	(0.1454)	-
Party fixed effects	Y	Y	Y	Y	Y	Y	-
Election fixed effects	Y	Y	Y	Y	Y	Y	-
Vote polynomial	Y	Y	Y	Y	Y	Y	-
Reimbursement polynomial	N	N	N	Y	Y	Y	-
Observations	911	632	318	911	632	318	836
R-squared	0.1047	0.0877	0.1474	0.2304	0.2257	0.2377	-

Notes: Robust standard errors in parenthese. *** p<0.01, ** p<0.05, * p<0.1.

Table 2.7: Local polynomial regression by block with fixed bandwidth

y= fundraising in the year following the election			
	Block by reimbursement		
	$0 - $3,091	$3,091 - $8,443	$8,443 - $53,971
Treatment	1,932*	-1,723**	- 3,423
	(1,103)	(932)	(1,874)
Bandwidth	3%	3%	3%
Observations	307	307	307

Notes: Robust standard errors in parenthese. *** p<0.01, ** p<0.05, * p<0.1.

Table 2.8: Local polynomial regression by block

y= fundraising in the year following the election			
	Block by reimbursement		
	$0 - $3,091	$3,091 - $8,443	$8,443 - $53,971
Treatment	2,395*	-2,202*	- 2,868
	(1,260)	(1,128)	(1,984)
Data-driven bandwidth	2.8%	2.0%	2.4%
Observations	261	221	272

Notes: Robust standard errors in parenthese. *** p<0.01, ** p<0.05, * p<0.1.

Table 2.9: Local polynomial regression by block with fixed bandwidth

y= log(private funding at t+1)			
	Block by reimbursement		
	$0 - $3,091	$3,091 - $8,443	$8,443 - $53,971
Treatment	1.0405	-2.0656**	-0.6204
	(0.8842)	(0.8179)	(0.8398)
Data-driven bandwidth	3%	3%	3%
Observations	307	307	307

Notes: Robust standard errors in parenthese. *** p<0.01, ** p<0.05, * p<0.1.

Table 2.10: Local polynomial regression by block

y= log(private funding at t+1)			
	Block by reimbursement		
	$0 - $3,091	$3,091 - $8,443	$8,443 - $53,971
Treatment	1.4646*	-2.2462**	-0.0212
	(0.9429)	(0.9140)	(0.1125)
Data-driven bandwidth	3.1%	2.3%	2.4%
Observations	321	240	268

Notes: Robust standard errors in parenthese. *** p<0.01, ** p<0.05, * p<0.1.

Overall, the results indicate that a small reimbursement may positively impact fundraising, while a high reimbursement may lead to a crowding-out of fundraising. The first effect could be due to a survival effect, because EDAs that received a small amount of funding will remain active which will have a positive impact on their fundraising. The second effect is likely to be a crowding-out of fundraising. Wealthy EDAs that received a higher reimbursement will crowd-out their private fundraising.[39] These results follow the one obtained in the graphical presentation.

The results may also be due to the change in the probability of undertaking fundraising rather than to an increase in the amount fundraised. Table 2.16 and 2.17 in the appendix show the local polynomial regression results with the probability of receiving at least one dollar in fundraising as the dependant variable for the same three blocks of potential reimbursement. Only the second block has a significant decrease in the probability of fundraising. While the probability of funding follows the impact on the fundraising amount (increasing for low reimbursement and decreasing for high reimbursement), it does not solely cover the impact on the probability of winning the election.

Another issue to consider is the number of blocks, since dividing the reimbursement in three may be seen as arbitrary. Table 2.18 in the appendix presents regression results when using two, four and five proportional blocks. The pattern of positive to negative treatment effect when the potential reimbursement increases can also be observed for different numbers of blocks. However, only one block is significant and negative in each of the other cases. In the case of five blocks, the potential reimbursement for the first block is close to 0 and insignificant. This can be explained by the fact that for very low or no reimbursement, observations in the control or the treatment group should be the same including in their potential reimbursement. Finally, the only significant effect in each table remains the crowding-out effect. As a whole, the results highlight the relevance of estimating a dose-response function because, when the reimbursement increases, fundraising seems to be gradually decreasing.

2.3.6.2 Dose response function

Table 2.12 and 2.13 present the linear regression and the Tobit regression for the dose response function using quadratic and third degree polynomial terms. In both cases, the polynomial terms are not significant for the 1% bandwidth. Such results can be expected, seeing as there are few observations for each level of expense. Figure 2.12 and 2.13 plot the dose response function of the 3rd polynomial order for the 2% and 3% bandwidths. When comparing the results of the Tobit model to the linear regression, the Tobit line is higher for low reimbursements and lower for high reimbursements. This observation may be explained by the fact that small EDAs that did not receive a reimbursement had no fundraising in the following year because they ceased to be active. However, other larger EDAs that missed out on receiving a reimbursement might also have to increase their fundraising activities. Nevertheless the differences between both models remain insignificant.

[39] It is important to note that the reimbursement status is publicly available. Therefore, private contributors may choose to donate a lesser amount to EDAs that received an important reimbursement.

Table 2.11: Regression discontinuity by block around 3% of the threshold

y= fundraising in the year following the election						
	Block by reimbursement					
VARIABLES	$0 - $3,091		$3,091 - $8,443		$8,443 - $53,971	
Treatment	2,211**	2,162**	-2,638**	-2,301**	-1,913	-2,796
	(1,099)	(1,067)	(1,147)	(1,122)	(2,266)	(2,241)
Opening balance	-0.0782	-0.0771	0.1835*	0.1746*	0.0898	0.0633
	(0.0809)	(0.0834)	(0.0989)	(0.0981)	(0.0828)	(0.0808)
Transfer from candidate	0.3713	0.3095	0.1328	0.1182	0.1182	0.0572
	(0.2341)	(0.2396)	(0.0960)	(0.0889)	(0.1178)	(0.1208)
Party fixed effects	Y	Y	Y	Y	Y	Y
Election fixed effects	Y	Y	Y	Y	Y	Y
Vote polynomial	Y	Y	Y	Y	Y	Y
Reimbursement polynomial	N	Y	N	Y	N	Y
Observations	307	307	307	307	302	302
R-squared	0.1757	0.2127	0.1252	0.1645	0.1583	0.2181

Notes: Robust standard errors in parenthese. *** p<0.01, ** p<0.05, * p<0.1.

Table 2.12: Regression discontinuity with continuous reimbursement

	y= fundraising in the year following the election					
	OLS			Tobit		
	Bandwidth around the threshold					
VARIABLES	3%	2%	1%	3%	2%	1%
Reimbursement	-0.2530**	-0.2078	-0.1926	-0.2464*	-0.1777	-0.2288
	(0.1101)	(0.1284)	(0.1711)	(0.1405)	(0.1671)	(0.2096)
Reimbursement^ 2	3.90e-06	4.18e-08	3.49e-07	3.57-e06	-2.58-e06	4.11e-07
	(2.98e-06)	(3.71-e06)	(4.49e-06)	(3.95e-06)	(5.16e-06)	(5.91e-06)
Opening balance	0.0918	0.0495	0.0353	0.1607**	0.0960	0.0810
	(0.0613)	(0.0817)	(0.0884)	(0.0673)	(0.0881)	(0.0979)
Transfer from candidate	0.0707	0.1075	0.1587	0.1128	0.1616	0.2300
	(0.0924)	(0.1039)	(0.1363)	(0.1139)	(0.1201)	(0.1603)
Party fixed effects	Y	Y	Y	Y	Y	Y
Election fixed effects	Y	Y	Y	Y	Y	Y
Vote polynomial	Y	Y	Y	Y	Y	Y
Observations	911	632	318	911	632	318
Left-cornered observations	344	236	113	344	236	113
R-squared	0.2422	0.2534	0.2533			

Notes: Robust standard errors in parenthese. *** p<0.01, ** p<0.05, * p<0.1.

Table 2.13: Regression discontinuity with continuous reimbursement

	y= fundraising in the year following the election					
	OLS			Tobit		
	Bandwidth around the threshold					
VARIABLES	3%	2%	1%	3%	2%	1%
Reimbursement	0.0256	0.2990	-0.3727	0.2914	0.5829*	-0.4667
	(0.2159)	(0.2492)	(0.3032)	(0.2800)	(0.3270)	(0.4097)
Reimbursement^2	-1.94e-05	-4.31e-05**	1.54e-05	-4.07e-05*	-6.64e-05**	2.01e-05
	(1.91e-05)	(1.92e-05)	(2.61e-05)	(2.29e-05)	(2.66e-05)	(3.31e-05)
Reimbursement^3	4.22e-10	7.98e-10*	-2.76e-10	8.02e-10*	1.18e-09**	-3.62e-10
	(3.47e-10)	(3.35e-10)	(4.84e-10)	(4.11e-10)	(4.70e-10)	(6.11e-10)
Opening balance	0.0894	0.0551	0.0369	0.1574**	0.1054	0.0820
	(0.0611)	(0.0786)	(0.0885)	(0.0661)	(0.0833)	(0.0982)
Transfer from candidates	0.0742	0.1072	0.1589	0.1185	0.1582	0.2311
	(0.0915)	(0.1014)	(0.1377)	(0.1123)	(0.1171)	(0.1614)
Party fixed effects	Y	Y	Y	Y	Y	Y
Election fixed effects	Y	Y	Y	Y	Y	Y
Vote polynomial	Y	Y	Y	Y	Y	Y
Reimbursement polynomial	Y	Y	Y	Y	Y	Y
Observations	911	632	318	911	632	318
Left-cornered observations	343	235	113	343	235	113
R-squared	0.2451	0.2624	0.2542			

Notes: Robust standard errors in parenthese. *** p<0.01, ** p<0.05, * p<0.1.

Figure 2.12: Dose-response function, 3% bandwidth

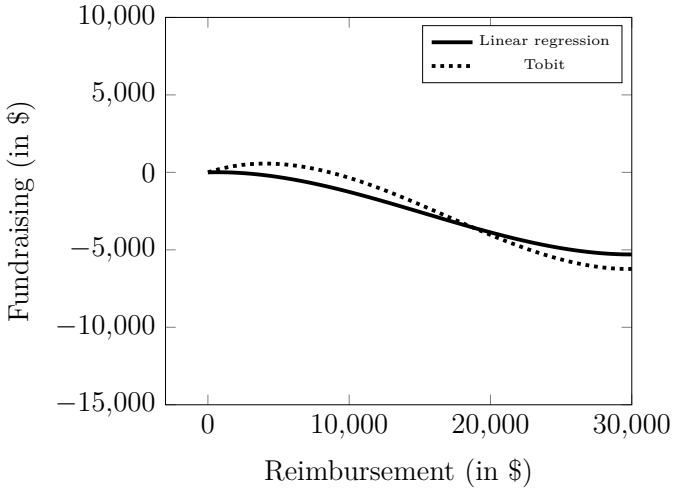


Figure 2.13: Dose-response function, 2% bandwidth

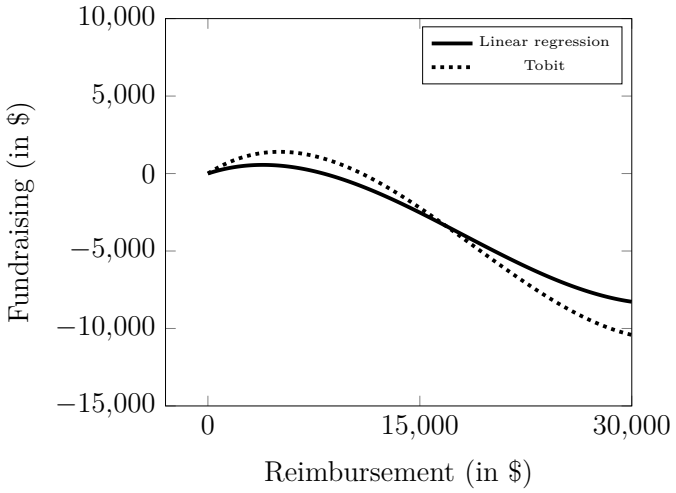


Figure 2.14 and 2.15 plot the impact on fundraising relative to the reimbursement. For the average level of expenses, 13% of the reimbursement is crowded out. In terms of average fundraising, this represents a reduction of 40%. At most, the crowding out amounts to around 20% of the reimbursement. However, few candidates in this subsample received more than $30,000 in reimbursement. Thus, these results stand for grassroots organizations with relatively low expenses.

2.3.6.3 Fixed effects

In the appendix, Table 2.19, Figure 2.16 and 2.17 show the results from a fixed effect model where all the observations are used, but the reimbursement term is interacted with a binary variable that is 1 for observations in a close bandwidth around 10%.[40] Furthermore, I show the results restricting up to the 2011 election as it allows the introduction of an EDA fixed effects, since electoral boundaries remained similar during the period. The results in Table 2.19 particularly emphasize the negative impact of the reimbursement on fundraising.

2.3.6.4 Limitations

As discussed previously, the empirical strategies may be biased because unconfoundedness of the dose cannot be maintained by design. Indeed, since the level of expenses is continuous, no EDA can be classified as having the exact same potential treatment and thus as being the perfect counterfactual for one another. In computing the average treatment by block, a bandwidth of reimbursement must be selected and it is assumed that within a block EDAs are the same. The outcome could be different as long as this is driven by different treatments. Therefore, the average treatment by block would simply be the average treatment over the bandwidth of a block. This assumption relies on the size of the bandwidth and on how similar grassroots organizations self-select into similar expenses. The first point depends on the availability of the data, which is already an issue within the regression discontinuity design. The second is more subjective. Summary statistics showed that closer EDAs in term of expenses also have other similar covariates. However, while the EDAs choose their potential reimbursement, the spending decisions are not necessarily closely related to the reimbursement. As such, it may limit the link between the choice of spending and the impact of the reimbursement on future fundraising. Thus, for a small bandwidth it can be expected that observations on both sides of the discontinuity are similar and that although the exact potential reimbursement is a choice, the average treatment effect may be estimated within blocks. It must be noted that the results apply only to an already narrow number of observations around the 10% discontinuity. Finally, these results capture the short term impact of public funding, since I only used fundraising in the year following the election.

The significance of these limitations is still to be established. However, the overarching goal of this paper was to observe how grassroots organizations react strategically to public funding and thereby to contribute to the limited existing literature around the impact of public subsidies to political parties on private fundraising. In that regard, the overall results that demonstrate a crowding out effect and possibly a survival effect are probably more interesting than the exact point estimates.

[40] Therefore, only observations close but over the bandwidth have reimbursement value different than 0.

Figure 2.14: Impact on fundraising relative to the reimbursement, 3% bandwidth

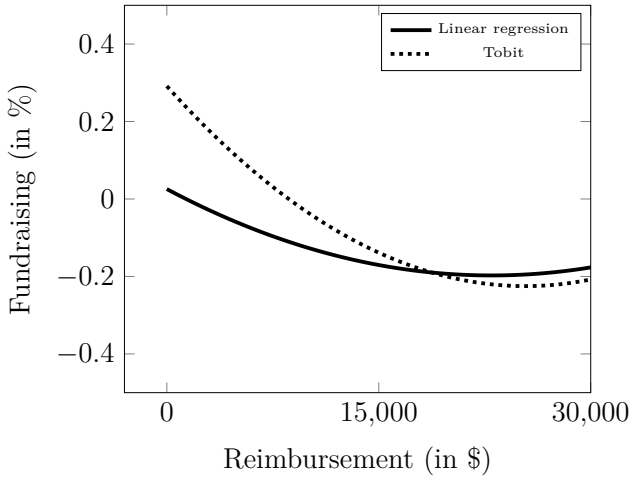
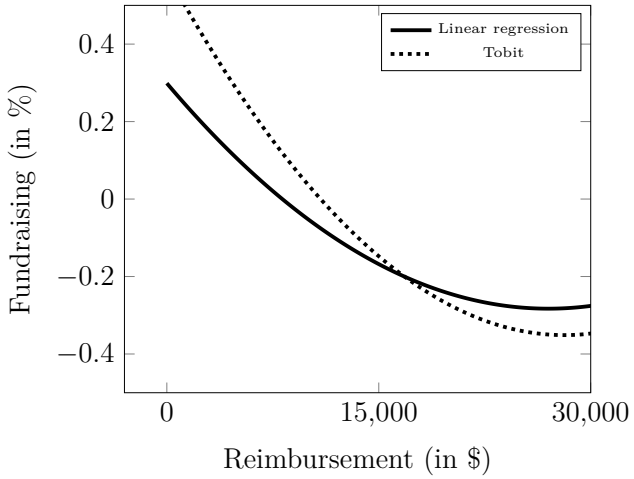


Figure 2.15: Impact on fundraising relative to the reimbursement, 2% bandwidth



Caveat to these findings are important. Self-selection into the potential reimbursement may lead to a dose response function that highlights the relation between the different outcomes of various grassroots organizations. However, the expense decision purpose is not limited to receiving a reimbursement, otherwise candidates would refrain from spending anything. Also, while the estimation by block defined over the level of reimbursement shows a movement from a positive impact on fundraising to a negative impact (when looking from low reimbursement blocks to high reimbursement blocks), the coefficients are not always significant. Overall, only the crowding out effect remains significant in at least one block for all the different estimations. This highlights the fact that using the regression discontinuity with a continuous treatment requires an important number of observations. Indeed, not only observations near the 10% threshold are necessary but sufficient observations with similar treatment levels are also required. Finally, because this study only analyses the data for candidates who received around 10% of the vote, the grassroots organizations that were not particularly successful are considered. Therefore, these results may not be applicable to other organizations. Nevertheless, the findings do provide some information about the strategic behaviour of political organizations, which is an important step forward in the existing debate around political party funding.

2.4 Conclusion

This study is divided in two sections. In the first section, I develop a framework to estimate the impact of a continuous treatment where the assignment to the treatment is discontinuous. I explain the hypotheses of the model through simulations, and provide graphical representations of the data that should be investigated when the treatment is continuous. In the second section, I use this framework in the Canadian context where local candidates are eligible for a 60% reimbursement of election expenses if they received at least 10% of the votes. This allows me to provide the first quasi-experimental investigation of the impact of public subsidies to political grassroots organizations on their private fundraising.

I estimated an average treatment effect by blocks defined over the level of reimbursement. It is therefore assumed that EDAs receiving an amount of reimbursement that is close should be similar. The number of available observations is crucial when selecting the amount of blocks, since the number of observations within each block is decreasing along with the spending bandwidth. When considering the regression discontinuity, the selection of the bandwidth around the discontinuity is also relevant. I also estimate a dose response function using the stronger assumption that EDAs close to the discontinuity have the same dose-response function when controlling for observables.

The results for the average treatment effect by block and the dose response function show a significant crowding out of private fundraising following a reimbursement. For low reimbursement, a positive and most often significant impact on private fundraising was found. This is akin to a survival effect where grassroots organizations used the reimbursement to stay afloat and fundraise in the following year. However, it is difficult to estimate this effect, because grassroots organizations with little or no electoral expenses will have no reimbursement impact, which in turn makes it challenging to separate the blocks accordingly.

It is impossible to determine which proportion of the crowding-out of funding observed

is due to contributors, and which proportion is due to a reduction in funding effort by local EDAs. Nevertheless, it is clear that public subsidization of local grassroots organizations leads to a substantial crowding out of private financing. This crowding out may reflects a decrease of local participation in the political life of democracies. The survival effect may be seen as worthy if it can be translated into valuable political activities. Public funding supporters usually frame the funding debate around the need to protect political parties from large private interest groups. However, reducing local political fundraising may not be the answer, since large private interest groups are very likely to simply revert to other means in order to maintain their influence over party officials.

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2.6 Table and figure appendix

Table 2.14: Summary statistics for observations 2% around the discontinuity

VARIABLES	Mean	Sd	Max
Candidate (at t)			
Vote percentage	9.942	1.148	11.99
Win	0	0	0
Treated	0.480	0.500	1
Expenses subject to reimbursement	14,825	16,760	185,394
EDA (at t+1)			
Opening balance	2,305	5,308	62,752
Transfer from candidate	887.4	3,381	38,148
Fundraising	2,795	5,878	59,913
Party			
Liberal Party of Canada	0.183	0.387	1
Conservative Party of Canada	0.167	0.374	1
New Democratic Party	0.452	0.498	1
Bloc Quebecois	0.027	0.161	1
Green Party of Canada	0.171	0.376	1
Election (t)			
2004	0.163	0.369	1
2006	0.174	0.379	1
2008	0.299	0.458	1
2011	0.163	0.369	1
2015	0.202	0.402	1
Observations	638		
Observations with a candidate report	636		
Fundraising cornered at 0	235		

Notes: Monetary values are in 2004 dollars. Time t is the election year.

Table 2.15: Summary statistics for observations 1% around the discontinuity

VARIABLES	Mean	Sd	Max
Candidate (at t)			
Vote percentage	9.949	0.568	10.98
Win	0	0	0
Treated	0.472	0.500	1
Expenses subject to reimbursement	14,782	15,004	73,352
EDA (at t+1)			
Opening balance	2,430	4,691	30,642
Transfer from candidate	1,008	3,828	38,148
Fundraising	2,788	5,587	46,687
Party			
Liberal Party of Canada	0.192	0.394	1
Conservative Party of Canada	0.179	0.384	1
New Democratic Party	0.453	0.499	1
Bloc Quebecois	0.028	0.166	1
Green Party of Canada	0.148	0.355	1
Election (t)			
2004	0.157	0.365	1
2006	0.170	0.376	1
2008	0.296	0.457	1
2011	0.170	0.376	1
2015	0.208	0.406	1
Observations	318		
Observations with a candidate report	318		
Fundraising cornered at 0	113		

Notes: Monetary values are in 2004 dollars. Time t is the election year.

Table 2.16: Local polynomial regression by block with fixed bandwidth

y= received private funding at t+1 (1 if yes)			
	Block by reimbursement		
	\$0- \$3,091	\$3,091 - \$8,443	\$8,443 - \$53,971
Treatment	0.0866	-0.1731	-0.0012
	(0.1290)	(0.1084)	(0.1011)
Data-driven bandwidth	3%	3%	3%
Observations	307	307	307

Notes: Robust standard errors in parenthese. *** p<0.01, ** p<0.05, * p<0.1.

Table 2.17: Local polynomial regression by block

y= received private funding at t+1 (1 if yes)			
	Block by reimbursement		
	\$0- \$3,091	\$3,091 - \$8,443	\$8,443 - \$53,971
Treatment	0.1233	-0.1927*	-0.0212
	(0.1296)	(0.1128)	(0.1125)
Data-driven bandwidth	3.3%	2.9%	2.4%
Observations	321	298	273

Notes: Robust standard errors in parenthese. *** p<0.01, ** p<0.05, * p<0.1.

Table 2.18: Regression discontinuity by block around 3% of the threshold

	y= fundraising in the year following the election										
VARIABLES	2 blocks		4 blocks				5 blocks				
Treatment	631	-2,987*	1,592	-198	-3,327*	-2,143	304	2,162	-2,877*	-1,587	-2,962
	(767)	(1,623)	(1,187)	(1,012)	(1,807)	(2,509)	(197)	(1,521)	(1,694)	(1,308)	(3,200)
Opening balance	0.0186	0.0644	0.0100	0.0231	0.1610	0.0461	-0.0307	-0.0007	0.1920	0.0724	0.0523
	(0.0502)	(0.0784)	(0.0577)	(0.0736)	(0.1103)	(0.0880)	(0.0316)	(0.1258)	(0.1228)	(0.0758)	(0.0998)
Transfer from candidate	0.1122*	0.0922	0.4022	-0.0343	0.0949	0.1303	0.1567	0.1543	0.2028*	-0.1195	0.1514
	(0.0627)	(0.1149)	(0.2894)	(0.1031)	(0.1205)	(0.1180)	(0.1120)	(0.1483)	(0.1039)	(0.1103)	(0.1391)
Party fixed effects	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Election fixed effects	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Vote polynomial	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Reimbursement polynomial	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Observations	457	457	230	202	231	251	185	185	185	185	174
R-squared	0.1261	0.2215	0.1914	0.1200	0.1258	0.2832	0.2560	0.1605	0.1773	0.1726	0.2967

Notes: Robust standard errors in parenthese. *** p<0.01, ** p<0.05, * p<0.1.

Table 2.19: Continuous reimbursement in fixed effect model

	y= fundraising in the year following the election								
	OLS			Tobit			EDA fixed effect		
	Bandwidth around the threshold								
VARIABLES	3%	2%	1%	3%	2%	1%	3%	2%	1%
Reimbursement	-0.3600**	-0.4492**	-0.4574**	-1.9988***	-1.9663***	-1.3352***	0.1860	-0.0551	0.3460
	(0.1446)	(0.1888)	(0.1936)	(0.2711)	(0.3376)	(0.4836)	(0.2570)	(0.3219)	(0.3559)
Reimbursement ^ 2	1.02e-05	1.43e-05	2.5e-05	9.06e-05***	8.96e-05***	5.7e-05	-2.95e-05	-1.46e-05	-4.89e-05
	(1.12e-05)	(1.34e-05)	(1.84e-05)	(1.64e-05)	(2.04e-05)	(4.32e-05)	(2.41e-05)	(3.49e-05)	(3.74e-05)
Reimbursement ^ 3	-2.87e-11	-5.63e-11	-4.49e-10	-9.49e-10***	-9.39e-10***	-7.29e-10	5.01e-10	3.20e-10	9.48e-10
	(1.59e-10)	(1.63e-10)	(3.45e-10)	(1.96e-10)	(2.15e-10)	(8.24e-10)	(4.58e-10)	(6.92e-10)	(7.41e-10)
Opening balance	0.1645***	0.1648***	0.1667***	0.1915***	0.1916***	0.1933***	-0.0210	-0.0209	-0.0212
	(0.0225)	(0.0225)	(0.0224)	(0.0239)	(0.0239)	(0.0239)	(0.0395)	(0.0395)	(0.0395)
Transfer from candidates	0.0511	0.0518	0.0534	0.0782*	0.0786*	0.0803*	0.0194	0.0199	0.0199
	(0.0407)	(0.0407)	(0.0407)	(0.0425)	(0.0425)	(0.0425)	(0.0436)	(0.0436)	(0.0436)
Party fixed effects	Y	Y	Y	Y	Y	Y	N	N	N
Election fixed effects	Y	Y	Y	Y	Y	Y	Y	Y	Y
Vote polynomial	Y	Y	Y	Y	Y	Y	Y	Y	Y
Expenses polynomial	Y	Y	Y	Y	Y	Y	Y	Y	Y
Reimbursement for all EDAs	Y	Y	Y	Y	Y	Y	Y	Y	Y
EDA fixed effect	N	N	N	N	N	N	Y	Y	Y
Observations	6,615	6,615	6,615	6,615	6,615	6,615	3,975	3,975	3,975
Left-cornered observations	1988	1988	1988	1988	1988	1988	665	665	665
R-squared	0.3960	0.3957	0.3939				0.2362	0.2362	0.2361

Notes: Robust standard errors in parenthese. *** p<0.01, ** p<0.05, * p<0.1.

Figure 2.16: Dose-response function, 3% bandwidth

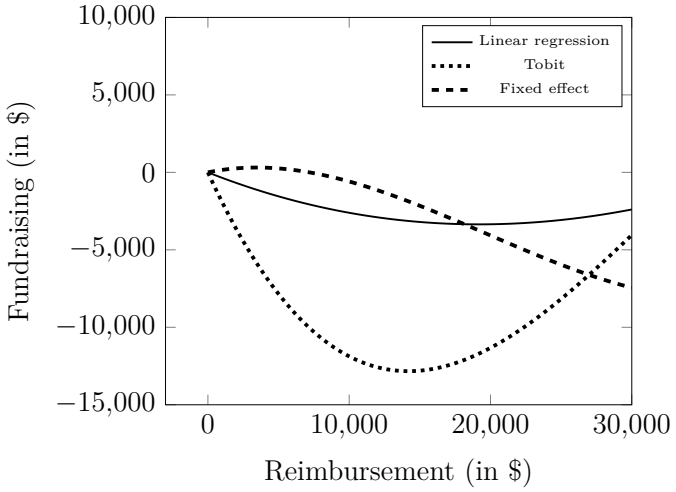
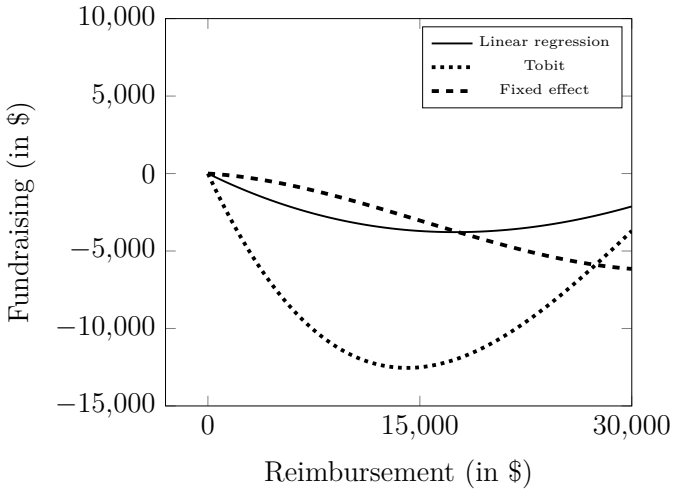


Figure 2.17: Dose-response function, 2% bandwidth



2.7 Data appendix

The dataset is available upon request. This section outlines the steps involved when creating the dataset from publicly available data for the sake of replication.

1 - Download the *Complete financial returns* for candidates in 2004, 2006, 2008, 2011, and 2015 from Election Canada.[41]

2 - Follow the data appendix from chapter, 1.10, to download and format the EDA financial variables and the vote share by candidates during general elections. Additionally, download the data for the Green Party of Canada and its candidates, the 2015 election, and 2016 EDA financial statements.

3 - Merge the election data with the candidates' financial returns. Finally, merge these with the EDA financial variables from the year following the election. To create the potential reimbursement variable, add the election expenses to the candidate's personal expenses and multiply by 60%.

[41] Each financial data is available publicly from http://www.elections.ca/

Chapter 3

Political Competitiveness, Regression Discontinuity Design & the Incumbency Effect

Co-author: Stanley L. Winer

Abstract

This paper considers issues of randomness and unobserved heterogeneity that typically arise when using a regression discontinuity design (RDD) to study the incumbency effect, or indeed in any controlled experiment. In studies of incumbency, randomness depends on the selection of 'close' elections as typically measured by a 'small' winning vote margin. However, the voters' willingness to change their vote is a critical component of a better, volatility-adjusted, measure of winning margins. We study empirically how the use of volatility-adjusted instead of simple margins alters the outcome of an RDD analysis of incumbency for Canadian federal elections. Unobserved heterogeneity in the selection of constituencies used in such an analysis arises when the electoral readiness of a political organization - a potentially important determinant of its candidate's success - is not considered. We investigate empirically how allowance for the quality of the organizations contesting an election affects the outcome of an RDD study of incumbency over the history of federal elections. We find that adjusting for volatility alters conclusions about the exact magnitude of the incumbency effect, while taking organizational quality into account eliminates the incumbency effect entirely in the Canadian case.

3.1 Introduction

The Regression discontinuity design (RDD) is an effective method to mimic a randomized control trial (RCT) at the cutoff by assuming that observations close to a discontinuity are essentially randomized into treatments and controls. As with any experiments, issues with randomness and unobserved heterogeneity arise with this design. However, these issues are often more significant because the sampling method is not in the hand of the researchers. Furthermore, the RDD also allows the study of different entities, such as political organizations. These have not yet been scrutinized to the extent of RCT subjects, which is of concern with regard to potential unobserved heterogeneity of treatment. This paper explores these fundamental issues in the context of the estimation of the incumbency effect.

In recent years, the RDD has been widely utilized to estimate the incumbency effect by using the vote margin to determine narrow winners or incumbents as if they were randomly selected subjects from a pool of candidates (e.g. Lee (2008), Kendall and Rekkas (2012), Ariga et al. (2016)). The vote margin is also recognized as a basic measure of current electoral competitiveness. However, Przeworski and Sprague (1971) highlighted that the expectation of winning the election is mainly driven by two components: the distance to win the election, and how candidates can expect to close that distance. While the first component is usually represented by the vote margin, the second component depends upon the volatility or how individuals are willing to change their voting allegiance.[1] In the context of the RDD, the volatility paired with the vote margin can also provide some information about the level of sorting, which has been debated in recent years.

This paper adds to the current understandings of the RDD in the electoral context by discussing volatility, which is of importance when determining if close elections are also competitive. While the vote margin is a simple measure to compute and is often used by researchers as the sole measure of competitiveness (e.g. Daniel and Lott, 1997; Masket and Lewis, 2007; Singh, Lago and Blais, 2011), electoral volatility has long been acknowledged as a crucial aspect of any electoral system and particularly as an indicator of the level of political competitiveness (e.g. Przeworski and Sprague, 1971; Budge, 1982; Taagepera and Grofman, 2003; Baldini and Pappalardo, 2009; Powell and Tucker, 2014; Ferris, Winer and Grofman, 2016). Indeed, when volatility is low, close vote margins might be very secure for incumbents and thus not very competitive. At the same time, when volatility is high, wide margins might be very insecure and thus very competitive.

Figure 3.1 presents the after-war party incumbency effect in Canada using non-parametric kernel regression when restricting on a minimum level of volatility.[2] We see that as the minimum volatility increases in a constituency election and thus the level of competitiveness increases for a given vote margin, the incumbency effect for the resulting sample of con-

[1] To alleviate confusion, the vote margin or the margin of victory, refers to the margin that defines the assignment to the treatment in the RDD. This margin also refers to the lagged vote margin when discussing competitiveness measures as this is an ex ante measure of competitiveness. For example, the vote margin at election t defines the assignment to the treatment for an outcome at election t+1. Therefore, the vote margin at t could also be defined as the lagged vote margin for election t+1.

[2] Within the existing literature, a common representation of volatility is the sum of vote shares difference between the two most recent elections over each parties.

stituencies decreases and eventually becomes insignificant.[3] This provides further rationale for the study of the volatility in the incumbency effect. However, if the vote margin is not an appropriate measuring tool of randomness, restricting the set of elections in relation to the minimum volatility level should not yield more accurate results. We therefore discuss an alternate measure of competitiveness that embodies both concepts of electoral competitiveness: the volatility adjusted margin. When comparing the vote margin to the volatility adjusted margin, we find that the set of competitive elections differs by as much as 25% to 30% when ranking elections according to both measures. Also, elections deemed competitive by both measures are ordered differently regarding their relative level of competitiveness and the relative distance between elections is also different which can impact on the RDD estimates using a local polynomial regression.

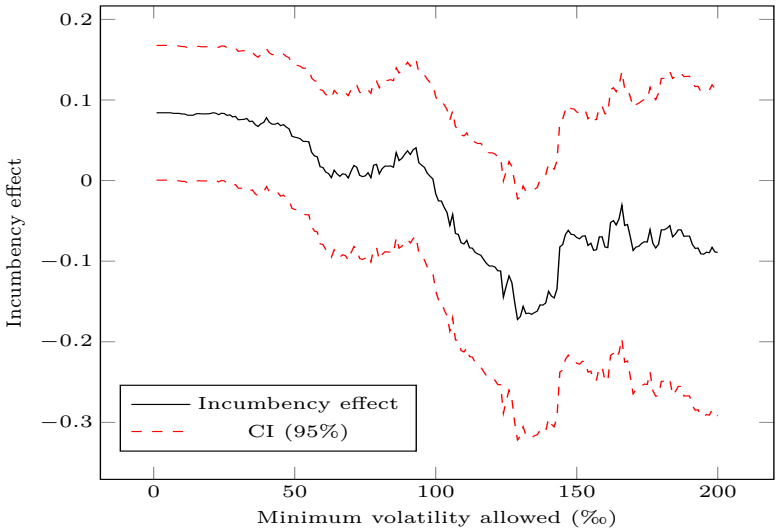


Figure 3.1: Canadian liberal incumbency effect after 1950, restricting election on the minimum volatility

This paper also discusses how the problem of unobserved heterogeneity may present challenges in a RDD. It is acknowledged that the estimate of the RDD treatment effect cannot be generalized to observations outside the discontinuity. However, this does not assume that the treatment effect is homogenous around the discontinuity. Furthermore, in a RDD, heterogeneity may be difficult to identify because often the number of observations is limited. As seen in chapter 2, even when some heterogeneity is observed, it remains difficult to divide the observations into subsamples.

In the context of electoral spending at t+1, the vote margin at t proves to be a more suitable measure of current electoral spending than the vote margin at t+1. Figure 3.2 shows candidates spendings in recent Canadian federal elections.[4] We see that in some

[3]The incumbency effect was computed by incrementing the minimum volatility by 0.5% beginning at 0. The first point of Figure 3.1 is therefore the RDD estimate of the incumbency effect without any restriction on volatility. Each estimation has its own data-driven bandwidth because every sample depends upon the minimum level of volatility. We obtain similar results with fixed bandwidth of 5% or 10%.

[4]We used federal election 39th to 41st federal elections to avoid redistricting issues.

close elections, challengers expenses were very low. We call these elections 'unexpected close elections'.[5]

These different patterns in spending could relate to different incumbency effects, as low spending generally indicates low grassroots quality. We find that the incumbency effect disappears when restricting these elections using the vote margin. This issue relates to a longstanding debate within the RCT literature, explained in Stokes (2014) as the search for interactions.

This paper is structured as follows. Section 2 presents a literature review. Section 3 compares the vote margin to the volatility adjusted margin. Section 4 discusses the unobserved heterogeneity that steams from electoral readiness and section 5 concludes.

3.2 Literature review

The study of incumbency advantage became a topic of discussion in the 1960s, a time during which it became apparent that incumbents were overwhelmingly winning elections. Erikson (1971) is the first to clearly frame the problem of reverse causality that biases the estimation of the incumbency effect: the best candidate should become the incumbent and eventually win successive elections. To estimate the effect, he uses the difference between new incumbents in their first and second elections. Following Erikson (1971), many studies offered other strategies to estimate the incumbency effect (e.g. Garand and Gross, 1984; Gelman and King, 1990; Cox and Katz, 1996). However, Lee (2008) is the first to propose potentially more robust estimates of the effect using the RDD. His study renewed interest in the estimation of the incumbency effect.

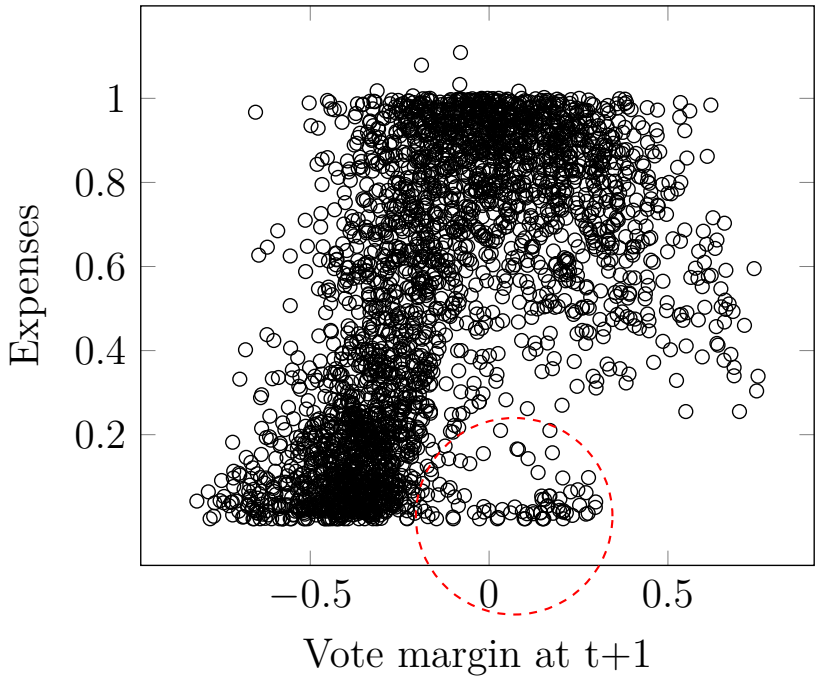
Historically, the literature on incumbency has referred to the candidate incumbency effect as discussed by Erikson and Titiunik (2015). However, most RDD studies estimate the party incumbency effect, which can be defined as the impact of winning on future election for the overall local party organization. In a system where the influence of local candidates is not overly significant, it can somehow prove misleading to solely consider candidates and not the overall local organizations.[6]

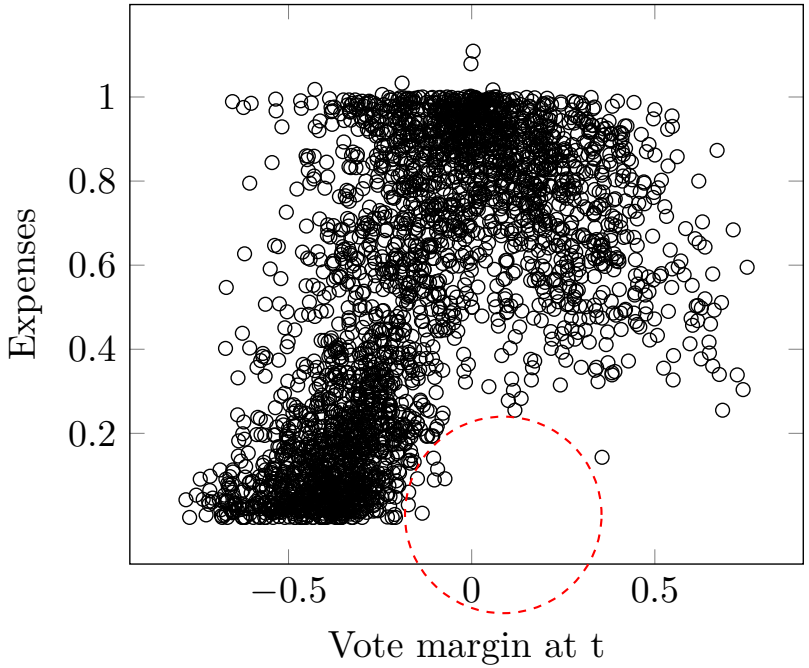
The use of the RDD in the electoral context poses challenges. Several studies addressed the problem of observations sorting around the discontinuity. Indeed, the design would be invalidated if candidates could accurately determine or manipulate the number of votes. Caughey and Sekhon (2011) found that in the U.S. house, incumbents disproportionally win close elections and that close winners and close losers covariates differ significantly. However, after studying more than 40,000 close elections in different countries, Eggers et al. (2015) found no particular sorting around the discontinuity. Also, according to de La Cuesta and Imai (2016), the local randomization assumption is not required when the continuity assumption holds: the winners and the losers may differ systematically around the cutoff as long as only the treatment status changes at the discontinuity.

[5] Unexpected from the point of view that one challenger was much more competitive than expected.

[6] Erikson and Titiunik (2015) and Kendall and Rekkas (2012) discussed the identification of the candidate incumbency effect in relation to the assumption that there is no strategic retirements.

Figure 3.2:
Share of spendings in the spending limit at the constituency level for the 39th, 40th and 41st federal elections in Canada for the 5 major parties (spending is at t+1)





The definition of a party from which an incumbent candidate is selected is an issue commonly raised within the RDD. In the context of a majoritarian Westminster system, in which party affiliation dominates voter selection at the constituency level, the exact definition of a 'party' becomes an important consideration. Indeed, the number of observations that will be used in the RDD and thus the estimate will often depend upon such definition. Furthermore, when parties rise and fall, information is lost because the lagged margin cannot be linked to current electoral results. However, when parties split or merge, the local organization and often the candidate will remain the same in the new parties. This embodies the concept of continuation under another name discussed by Powell and Tucker (2014). The exact definition of what can be considered a 'party' is therefore an important empirical consideration that can potentially shape the estimates. We choose to discuss the incumbency effect for the Liberal Party of Canada over the after-war period, since the party remained stable during that time which limits the assumptions we have to make.

Pederson (1979) discussed that splits, merger and new parties can generate challenges when computing volatility. More specifically, they might considerably increase the volatility measurement, which does not necessarily represent the actual volatility level.[7] Redistricting is also problematic for both the estimation of the vote margin and the volatility, as new district boundaries can prevent the use of previous elections. To compute volatility, we use the concept of superconstituencies (areas not subjected to redistricting) that include many constituencies (See Ferris, Winer and Grofman (2016)). This allows us to compute the volatility over regions during any election year regardless of redistricting.

3.3 Dealing with the definition & measurement of competitiveness

Alternative measures of competitiveness have been studied by scholars. Competitive races may not be explained solely by the electoral results since the current vote share is a realization of an expectation. The vote margin is used in the RDD to determine the effect of incumbency on future electoral outcomes. At the same time, this margin can be referred to the lagged vote margin with regard to future outcomes, which is a commonly-used measure of expected competitiveness. Altogether, this means that the RDD should estimate the incumbency effect in competitive races, allowing that the vote margin is a good measure of competitiveness. To follow the usual RDD convention we refer to the vote margin with regard to future outcome.

3.3.1 Vote margin

The vote margin is the distance to win or to lose the election. At the constituency level we define it as:

[7] For example, the Conservative Party of Canada succeeded to the Canadian Alliance that succeeded to the Reform Party of Canada. In Calgary Southeast, the same candidate ran for the Reform Party of Canada in 1997, the Canadian Alliance in 2000 and the Conservative Party of Canada in 2004. In each election, he won by more than 30% of the vote. Following the volatility measure presented in section 3.3.2, the succession of new parties would have created a great volatility, but electoral results appear to tell a different story.

$$M_{t,p,c} = v_{t,p,c} - v_{t,o,c} \quad [3.1]$$

where $M_{t,p,c}$ is the vote margin for the party p in the constituency c where time t represents the time of the election. $v_{t,p,c}$ is the vote share for the party and $v_{t,o,c}$ is the highest other vote share in the constituency.[8] In the RDD, the vote margin at t is the running variable because assignment to winning the previous election and becoming the incumbent is discontinuous at 0.

3.3.2 Volatility

The volatility is a measure that represents the uncertainty of the votes and thus how easily one challenger can expect to bridge the gap. Taagepera and Grofman (2003) provide a good review of the different volatility measurements. We focus on the primary volatility measure discussed by Przeworski and Sprague (1971) and Pedersen (1983):

$$V_{t,c} = \sum_{p=1}^{n} |v_{t,p,c} - v_{t-1,p,c}| \quad [3.2]$$

where $V_{t,c}$ denotes the volatility, v is the share of vote, p is the party and n is the number of parties in the constituency. This measure of volatility represents the vote fluctuation between the two most recent elections. When a large volatility is anticipated, parties can expect a contested race and thus an increase in competitiveness. This measure of volatility depends on parties and has the disadvantage of being too sensitive to party splits and mergers.[9]

Another challenge faced by researchers when estimating the volatility is the redistribution of electoral boundaries. Indeed the share of vote must be comparable between elections. Redistribution leads to a reduction in the number of elections where the volatility adjusted margin can be computed. In Canada, we use the concept of superconstituencies to define geographical areas that include several boundaries.[10] Within these, we compute the volatility. While the volatility within a constituency will not be the same, it allows some kind of spill-over effect for volatility between constituencies.

The limitations in precisely determining the level of volatility will be taken into account when presenting our methodological strategies.

[8] The vote margin or margin of victory is sometimes used as the absolute value of $M_{t,p,c}$. In this case, the distance to lose and the distance to win are treated as similar.

[9] For example, if a given party A becomes party B in the following election, that B receives the same vote share as A in the previous election and that we did not account for the change, then the impact on volatility in the district would be $v_{t-1,A,c} + v_{t,B,c} = 2v_{t-1,A,c} = 2v_{t,B,c}$. However, if both parties are treated as the same, the impact would be zero. Recognizing that the maximum volatility is 200% this increase could be problematic when a main party split or merge. Nevertheless, splits and mergers should increase the volatility since they are likely not perfect. Therefore, matching every parties that merge and split to reduce volatility is certainly inaccurate.

[10] The problem of computing volatility in superconstituencies only occurs in a few cases where new regions appear for the first time. These few cases did not happen in the post-war period.

3.3.3 Volatility adjusted vote margin

The volatility adjusted margin is computed using the vote margin and the volatility:

$$VAM_{t,p,c} = \frac{M_{t,p,c}}{\frac{1}{2}V_{t,c}} \quad [3.3]$$

This measure of competitiveness has the advantage of including both the remaining distance and how easy it would be to bridge the distance. Indeed, a small margin with a low volatility might not be very competitive while a large margin with high volatility might be very competitive. Note that total volatility is divided by two, as half of the vote margin is the minimum increase in vote share that a challenger required to defeat the incumbent.

3.4 Canadian elections data

To empirically compute and compare the competitiveness measures and the incumbency effect, we used Winer (2019) *Data Set on Federal Elections, With Superconstituencies, Canada 1867 - 2015, Elections 1 - 42*. This dataset provides voting information for each constituency election since the first Canadian election following data from Election Canada and the *List of ridings represented in the House of Commons from 1867 to today* available on the Library of Parliament website. A replication of Kendall and Rekkas (2012) incumbency effect for the Liberal Party of Canada in the post-1950 period is available in the appendix.[11]

The post-1950 or post-war period is used since the parties, and particularly the liberals, remained fixed during that time.[12] This allows more consistency when computing both the lag vote margin and the volatility as less choices have to be made with regards to party split and mergers.

3.4.1 Summary statistics

Table 3.1 provides summary statistics for constituencies in the Canadian federal election during the post-1950 period. The main statistics come from districts with a liberal candidates at t and t+1.[13] During this period, a general election occurred in 5,977 districts and in 5,210 of these elections a liberal vote margin could also be computed in the previous election. This number decreases to 4,583 when looking at elections where a liberal vote margin could also be computed at t-1. The sample used also excluded acclamations, elections with two seats and elections that had no volatility adjusted margins for any of these reasons.[14] Acclamations

[11] The appendix also discusses how the dataset deals with redistricting in comparison to Kendall and Rekkas (2012).

[12] The results of the 1943 and 1949 elections are used to compute the volatility and the lag vote margin of the 1953 election.

[13] The names of the constituencies were used to establish if the constituency existed in the previous election. As explained in the Kendall and Rekkas (2012) replication appendix, we also follow the information available on the Library of Parliament website to track constituencies that stayed the same but changed name.

[14] In five cases, superconstituencies were also newly defined (i.e. Northwest Territories). Constituencies within these superconstituencies would therefore lack volatility for the first two elections.

and elections with two available seats in the same constituency, remained a rare occurence in the post-1950 period. Acclamation and two seats lead to a reduction of the sample by 15.

As shown in Table 3.1, our sample consists of 42.8% of constituencies where a liberal candidate won at t.[15] The election at t+1 was won by 41.9% of the liberal candidates, however liberals incumbent won 75.4% of the races. This leads to the usual observation that incumbents disproportionally win elections.

The number of ballots provides an idea of the size of local elections. In terms of electors, rural constituencies are usually smaller than urban constituencies. The lowest number of ballots was 4,300, reached in the constituency of Îles-de-la-madeleine during the 1953 election. The largest number of ballots was 148,608, reached in the constituency of York-Scarborough during the 1965 election. The difference between the number of electors in constituencies has been decreasing as seen in the 2011 elections number. Rejected ballots are usually less than 5% share of all ballots. The highest share of rejected ballots was 13.5% in 1972 in the constituency of Nickel Belt. As expected, we found no discontinuity in the number of rejected ballots at the vote margin cutoff. This indicates that liberal incumbents were unable to manipulate the number of rejected ballots to gain an unfair advantage.

The average number of candidates was 4.8 and at most, 13 candidates participated in a local election. In most elections, two or three candidates receive a number of votes that can be considered as competitive. Therefore, there would also be an average of two or three fringe candidates by local elections.

Table 3.1 also provides summary statistics for the competitiveness measures. The liberal vote margin average is close to zero. It can be expected, as liberals won about 42% of the elections. The volatility minimum is very low, indicating that in some super constituencies the vote share of the parties remained almost the same between elections. However, when the conservative party splits we see peaks in volatility. As discussed previously, the volatility adjusted margin can be greater than 1 in absolute value and is not bound like the vote margin.

To compare some of the key variables within the same election, Table 3.1 presents statistics for the 2011 election. The 2011 election is the newest election unaffected by redistricting. Therefore, the number of seats coincides with the number of constituencies where liberals have a lagged vote margin. In average, the number of electors represents 76.7% of the population and casted ballots represent 61.1% of the number of electors. There were 308 constituencies within 80 superconstituencies and in average the number of constituencies within a superconstituencies is 3.85 with a maximum of 9 constituencies. Some superconstituencies consist of only a unique constituencies. These superconstituencies usually represent large territories that have a low population such as the North Western Territories, Nunavut or Yukon.

[15] We did not modify the incumbency because of by-elections as two-third of the about 200 by-elections end-up with the incumbent party winning. Also, votes during by elections do not necessarily reflect the general election results as the turnout is generally low.

Table 3.1: Summary statistics for Canadian federal elections in the post-1950 period

VARIABLES	Mean	Standard deviation	Minimum	Maximum
Constituencies with a liberal candidate at t and t+1				
Liberal victory at t	0.428	(0.496)	0	1
Liberal victory at t+1	0.419	(0.493)	0	1
Liberal incumbent victory at t+1	0.754	(0.431)	0	1
Number of ballots	38,623	(14,536)	4,300	148,608
Number of rejected ballots	408	(505)	23	4,853
Number of candidates	4.802	(1.663)	2	13
Liberal vote margin at t	-0.035	(0.274)	-0.780	0.860
Volatility at t	0.297	(0.237)	0.013	1.419
Liberal volatility adjusted vote margin at t	-0.448	(3.857)	-52.998	42.245
Statistics for the 2011 election				
Population	102,639	(21,855)	26,364	170,422
Number of electors	78,758	(17,555)	17,349	153,972
Number of ballots	48,128	(11,687)	7,931	90,890
Number of rejected ballots	323	(244)	52	1,193
Number of seats	308			
Number of superconstituencies	80			
Number of seats by superconstituencies	3.85	(2.38)	1	9
Number of constituencies in the post-1950 period				
In a general election	5,977			
With a liberal vote margin at t and t+1	5,210			
With a liberal vote margin at t-1, t and t+1	4,583			
With two seats	12			
With an acclamation	3			

Notes: The quantities in brackets are standard deviations.

3.4.2 Comparison between competitiveness measures

To compare the vote margin and the volatility adjusted margin, we rank each election for both competitiveness measures and examine if elections are considered competitive in both cases. For instance, there were 352 elections where the Liberal margin was less than 1%. Of the 352 most competitive elections using the volatility adjusted margin, 250 had also a margin lower than 1%. Table 3.2 shows these results for bandwidth of 1%, 5%, 10% around the vote margin. In the bottom half of Table 3.2, close elections are defined following the Przeworski and Sprague (1971) measure where an election is defined as competitive when the vote margin is less than half of the volatility in the election. Alternatively, we show results when further restricting to 50% and 25% of this measure. Determining close election using the volatility adjusted measure allows a much higher number of competitive elections.

In each presented case, 25% to 30% of elections are not considered competitive by both standards. This percentage gradually decreases as the number of elections increases. This is to be expected, since when all elections are considered competitive, the set of competitive elections would be the same independently of the measure.

Another important measure is the ranking and the relative difference between the competitiveness measurements. This is because the RDD often includes polynomial terms to differently weight observations moving away from the discontinuity, and also this will shape the data-driven bandwidth. Table 3.2 shows Kendall and Spearman rank correlation coefficients for observations that are considered competitive by both measures. Kendall rank correlation provides an idea of the proportion of concordant and discordant pairs, while Spearman rank correlation emphasizes the deviation between both groups. The rank correlations are high but imperfect, which implies that the ranking is not exactly similar for both measures, while the ranking deviation is low. This has to be expected since the vote margin is a main component of the adjusted vote margin.

While the value of both measures is not directly comparable, some general comparisons are interesting. For example, Figure 3.3 shows the probability that a Liberal incumbent loses. This probability varies more for the volatility adjusted margin, but is also higher for values very close to 0. Figure 3.4 presents the distribution of competitiveness measures by constituencies across all Canadian elections. The distribution is decreasing faster for the volatility adjusted margin, but there is a high distribution for values greater than 8 (the last line). This is due to the fact that the volatility adjusted margin has no upper bound. To conclude these comparisons, Figure 3.5 and 3.6 are heat maps of Canadian federal elections, where each rectangle is the distribution of local elections with a competitiveness measure within both bounds during the election. When looking at the vote margin, the distribution of close elections was high during the early elections, but has consistently decreased since then. We see a similar pattern but less pronounced for the volatility adjusted margin. Both results indicate a decrease in electoral competitiveness.

Table 3.2: Comparison between the vote margin (VM) and the volatility adjusted margin (VAM)

Liberals VM around 0			
	$< 1\%$ VM	$< 5\%$ VM	$<10\%$ VM
Number of observations	167	828	1,594
Competitive for both criteria	124	598	1,196
	74.3%	72.2%	75.0%
Kendall rank correlation	.72	.76	.75
Spearman rank correlation	.90	.92	.92
Liberals VAM around 0			
	abs(VAM) < 1	abs(VAM)< 0.5	abs(VAM)<0.25
Number of observations	581	1,142	2,029
Competitive for both criteria	419	846	1,551
	72.1%	74.1%	76.4%
Kendall rank correlation	.75	.75	.75
Spearman rank correlation	.92	.92	.92

3.4.3 Incumbency effect results

We now compare the RDD estimates of the incumbency effect using the simple vote margin and the volatility adjusted margin. We use the regression discontinuity methodology defined in 2.2.1.1 is used. The regression discontinuity is estimated by local linear regression and we use a data-driven bandwidth estimated from the minimization of the asymptotic approximation of the mean square error. To estimate the local polynomial regression and the data-driven bandwidth, we follow Calonico, Cattaneo and Titiunik's (2014b) methodology and its implementation through Calonico, Cattaneo and Titiunik (2014a), who also estimate robust confidence intervals because data-driven bandwidths are too large.

3.4.3.1 Results

Table 3.3 presents the RDD estimates of the incumbency effect using the vote margin and the volatility adjusted margin. In both cases, we use a data-driven bandwidth. To reduce concern about splits and mergers, Table 3.3 also shows estimates when restricting observations to elections and lagged elections where the main parties were stable.[16] The results are positive

[16]We exclude the 35th, 37th, 38th elections as we saw important splits and mergers for the main parties. Following the 34th election, the Reform Party of Canada and the Bloc Québecois were created. Following the 36th election, the Reform Party of Canada was succeeded by the Canadian Alliance. Finally, in the 37th election, the Reform Party of Canada and the Progressive Conservative Party of Canada merged into the Conservative Party of Canada.

Figure 3.3: Probability of losing for the Liberal party incumbent depending on the measure of competitiveness after 1945

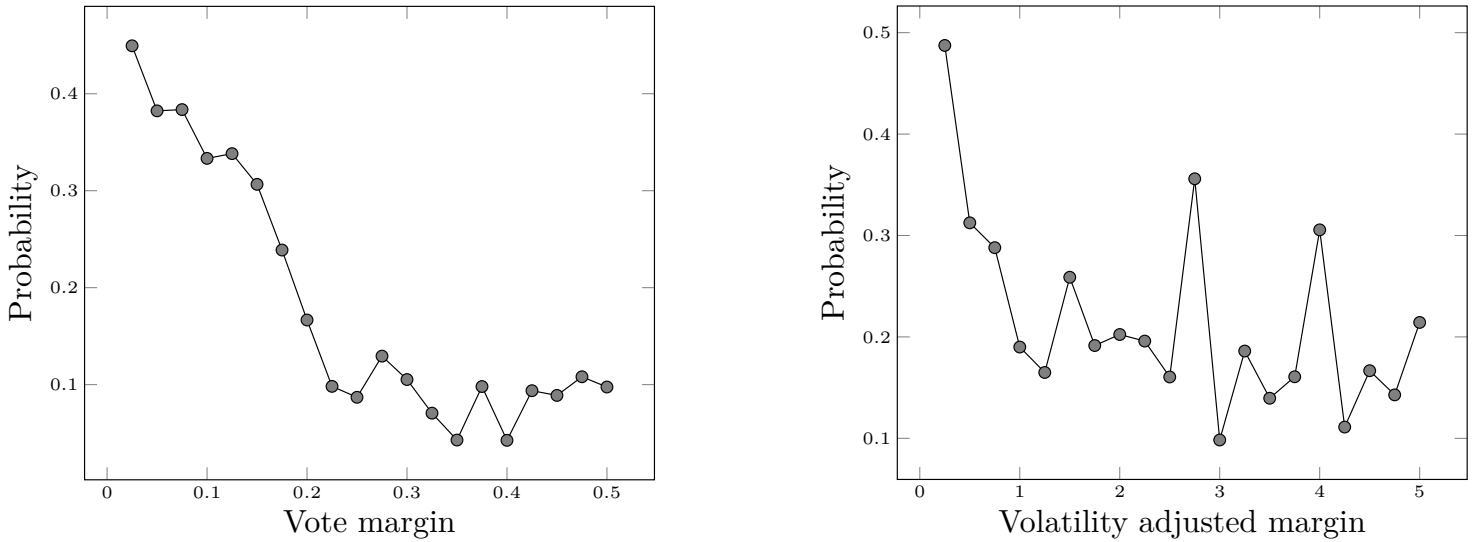


Figure 3.4: Distribution of competitiveness measures by constituencies across Canadian elections

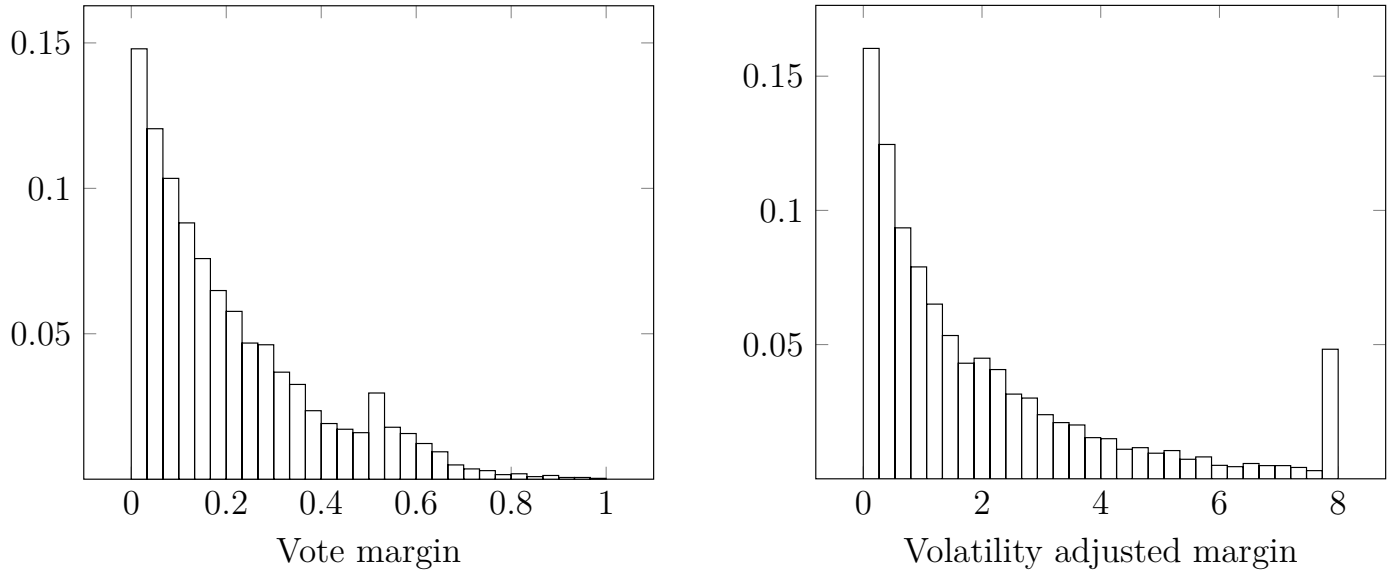


Figure 3.5: Heat map of the proportion of constituency elections by vote margin for each Canadian elections (2nd to 42nd)

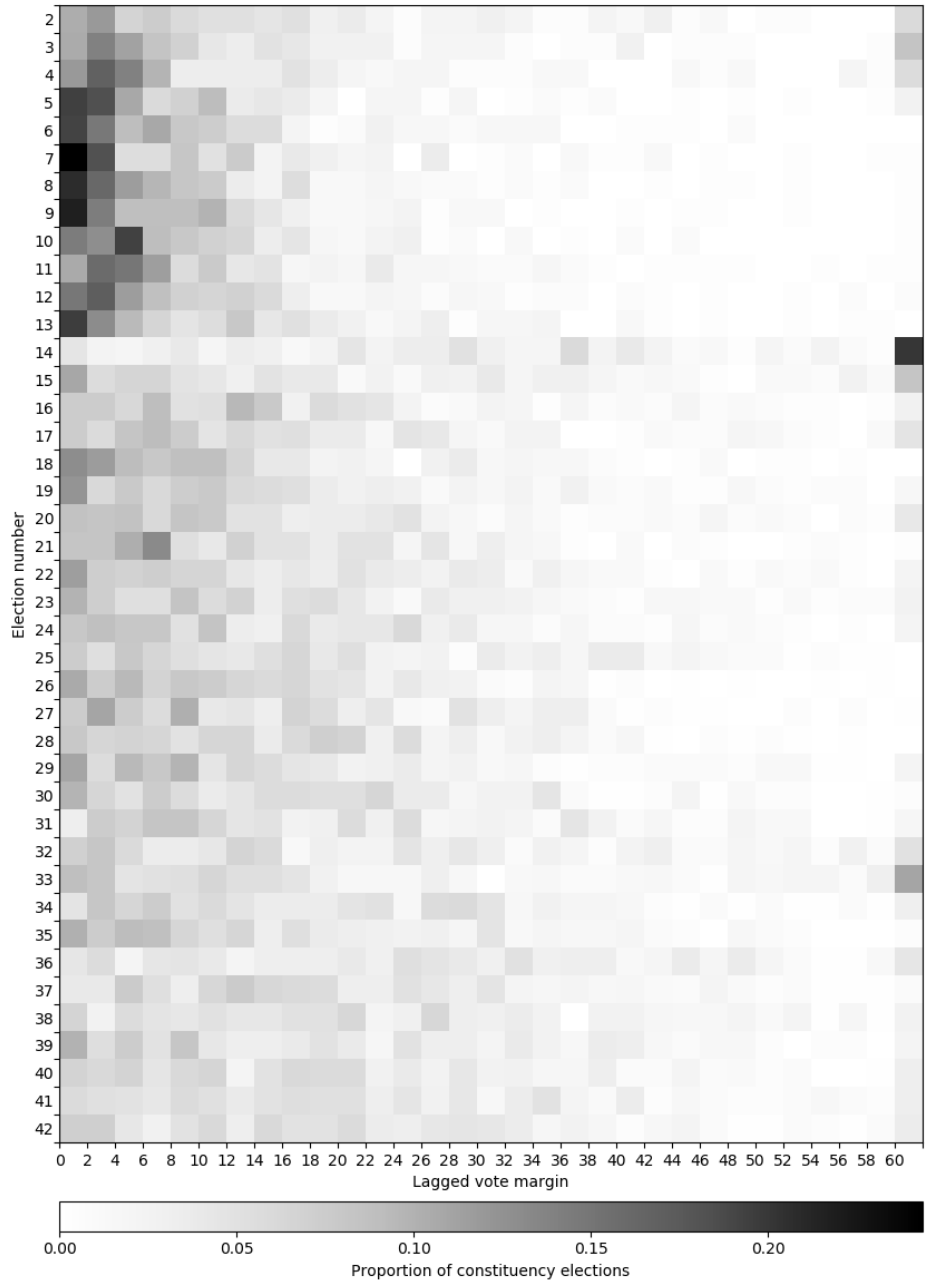


Figure 3.6: Heat map of the proportion of constituency elections by volatility adjusted margin for each Canadian elections (3rd to 42nd)

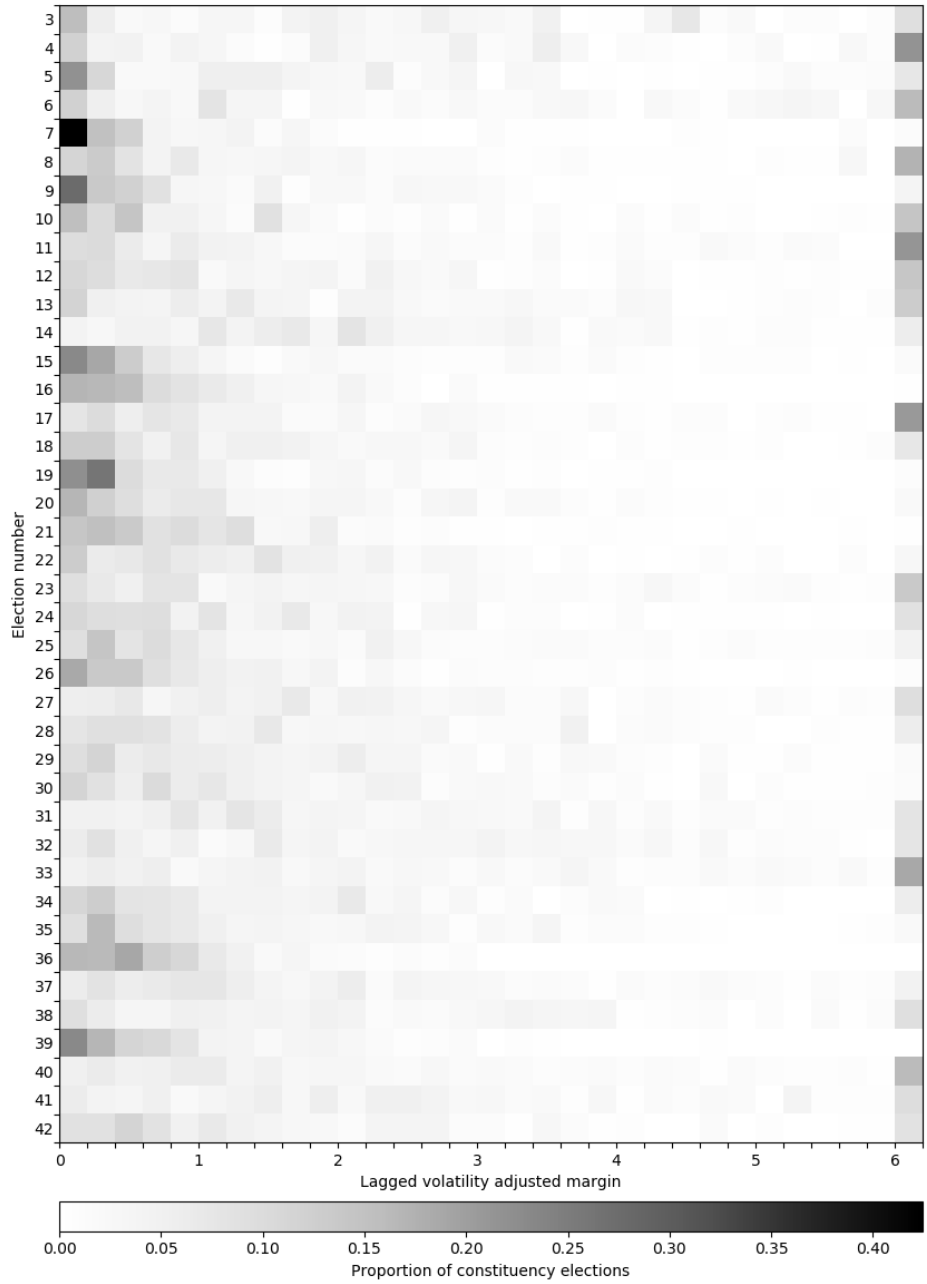


Table 3.3: RDD estimates of the incumbency effect by competitiveness measure for the Liberal Party of Canada after 1950

	Vote margin		Volatility adjusted margin	
	Overall	Restricted[1]	Overall	Restricted[1]
Incumbency effect	.1106**	.0969	.1636***	.1716***
	(.0416)	(.0469)	(.0396)	(.0425)
Bandwidth	.17	.16	1.368	1.439
Number of observations	5,214	4,433	5,214	4,433
Number of observations used	2,381	1,951	2,393	2,131

Standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.

[1] Exclude elections 35th, 37th, 38th.

and significant in most cases. In both estimations, the adjusted vote margin incumbency effect is higher and more significant. We also find that excluding elections with splits and mergers has little effect on the estimates using the volatility adjusted margin.

While the simple vote margin ignores volatility, the volatility adjusted margin may put too much emphasis on volatility. We therefore estimate the incumbency effect using only observations that are competitive for both measures. As in section 3.4.2, we rank each election for both competitiveness measures and examine if elections are in the set of competitive elections depending on commonly used bandwidths. Table 3.4 and Table 3.5 shows the estimates of the incumbency effect when determining competitive elections respectively using the vote margin and the volatility adjusted margin. In fact, only the number of observations are different from Table 3.4 to Table 3.5. In both tables, the results are always positive but insignificant. These results may relate to the idea that for high competitiveness, the incumbency effect becomes insignificant. However, we find no strong evidence of a difference between using the simple vote margin or the volatility adjusted margin.

Table 3.4: RDD estimates of the incumbency effect when elections are competitive using both measures of competitiveness for the Liberal Party of Canada after 1950

	Vote margin		Volatility adjusted margin	
Bandwidth	abs(VM)<5%	abs(VM)<10%	abs(VM)<5%	abs(VM)<10%
Incumbency effect	.1574*	.1000*	.1073	.1421*
	(.0810)	(.0569)	(.0726)	(.0512)
Number of observations	563	1,119	563	1,119

Standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1.

Table 3.5: RDD estimates of the incumbency effect when elections are competitive using both measures of competitiveness for the Liberal Party of Canada after 1950

	Vote margin		Volatility adjusted margin	
Bandwidth	abs(VAM)< 0.5	abs(VAM)<1	abs(VAM)< 0.5	abs(VAM)<1
Incumbency effect	.0692	.0769	.1377	.1515*
	(.0626)	(.0467)	(.0609)	(.0437)
Number of observations	809	1,442	809	1,442

Standard deviation in brackets. *** p<0.01, ** p<0.05, * p<0.1.

3.5 Dealing with unobserved heterogeneity

The incumbency effect could depend on the quality of the local organization. Low quality organizations that unexpectedly win races might receive higher benefit from incumbency since marginal value of improvement to the organization is likely high.[17] At present, there is a lack of data on covariates such as estimated spending over an extended period of time. However, the lagged vote margin has traditionally been used as a competitiveness measure and according to Jacobson (1978) and McAdams and Johannes (1987), it is a good indicator of candidate's quality. Therefore, to investigate only incumbents in expected close races, we restrict the elections to be competitive at $t-1$.

Figure 3.7 presents the liberal incumbency effect on the probability of winning at $t+1$ for different restrictions on electoral results at $t-1$. In the first plot we see the usual incumbency effect without any restrictions. When we restrict elections at $t-1$ to have a close margin of 5% and 10%, the incumbency effect is not apparent. However, these restrictions impact upon the number of elections. Without restrictions we had 5,226 elections. However, when restricting on $t-2$ elections with less than 10% vote margin, we have 1,381 observations, and for 5% vote margin we have 711 observations.[18] These plots seem to indicate that districts with a history of competitiveness have no incumbency effect.

In Table 3.6 we show estimates of the incumbency effect restricting on election at $t-1$. As in the plots, when restricting on districts that were historically competitive, we find insignificant incumbency effect for both measures. This provides further evidence that increased competitiveness may impact negatively on the incumbency effect.

[17] We could also make the assumption that they receive a lower benefit because they are unable to use incumbency efficiently.

[18] The decrease is also due to redistricting since three consecutive elections in the same district are needed.

Table 3.6: RDD estimates of the incumbency when restricting on elections at t-1 effect for the Liberal Party of Canada after 1950

	Vote margin at t-1		Volatility adjusted margin at t-1	
	abs(VM)<5%	abs(VM)<10%	abs(VAM)<.5	abs(VAM)<.25
Incumbency effect	.0980	.0884	.1316	.1017
	(.0944)	(.0674)	(.0778)	(.0694)
Bandwidth	.167	.173	1.592	1.298
Number of observations	711	1381	1020	1805
Number of observations used	477	933	673	918

Standard deviation in brackets. *** p<0.01, ** p<0.05, * p<0.1.

[1] Exclude elections 35th, 37th, 38th.

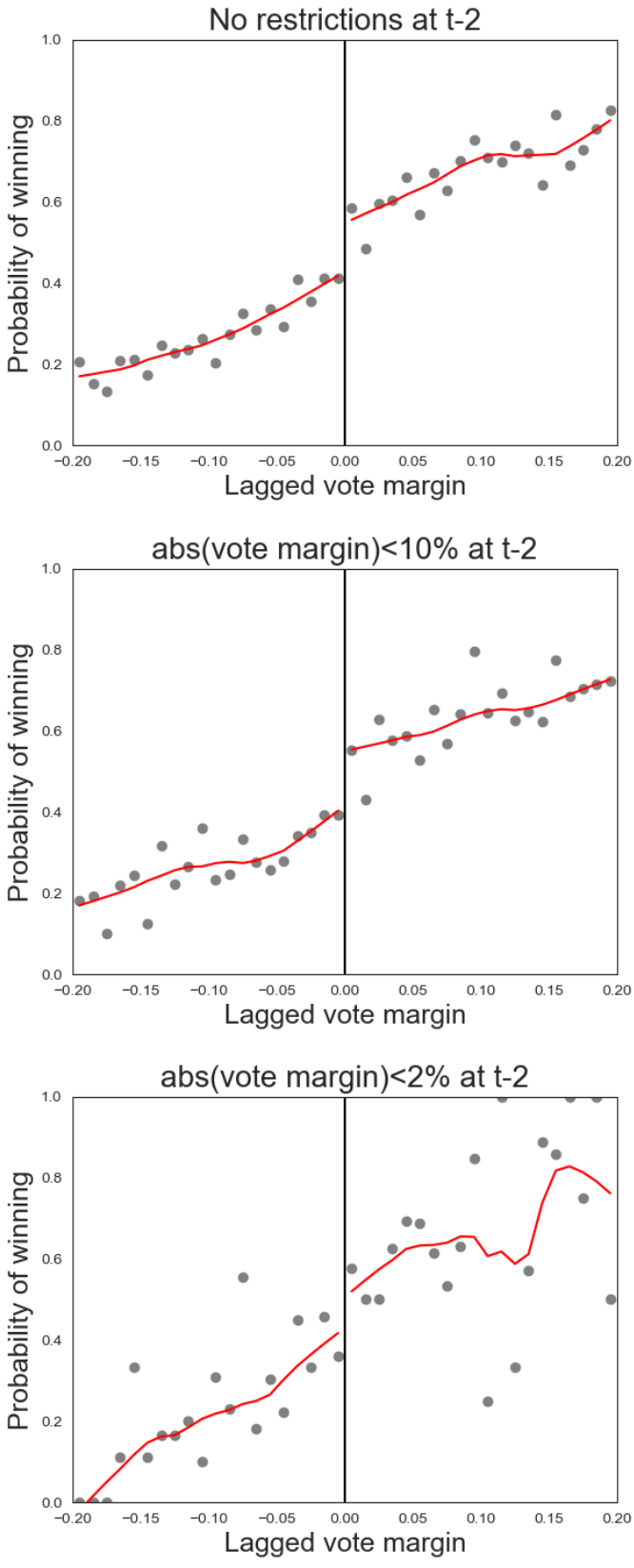
Overall, expected competitiveness impacts grassroots organizations' readiness. It also attracts qualified candidates to run and increases fundraising. Therefore, an already-competitive local organization is not expected to gain from incumbency. In this perspective, unexpected wins can be considered as victories by organizations that are not well-implemented locally. These organizations will usually have less volunteers, and low funding. The party candidates in these districts are likely inexperienced at running a campaign and have usually low public recognition. In these cases, the incumbency effect could be important because it might help the grassroots organization to grow. However, observing unexpected elections might prove complex because a low ex ante measure of competitiveness does not necessarily indicate that the election was unexpected.

3.6 Conclusion

In this paper we discussed two fundamental methodological considerations of the RDD in the context of the incumbency effect: random assignment and the presence of unobserved heterogeneity. We compared the volatility adjusted margin to the simple vote margin. Our findings indicate that although using different measures leads to different sets of competitive elections and different ordering between elections, the incumbency effect is not significantly different when using both measures.

We also demonstrated that unobserved heterogeneity in the level of electoral competitiveness may be an important factor in determining the incumbency effect. More specifically, we found that for high volatility and for history of competitiveness at $t-1$, the incumbency effect is insignificant. Expected competitiveness could predict challenger readiness and the long-term quality of the local organization, which could explain why we do not find incumbency effect in this case. It is also possible that we have failed to identify the exact reason for the unobserved heterogeneity, as all the estimates remained positive even though they became insignificant.

Figure 3.7: Comparison between incumbency effect for liberals



Our main concern with the RDD comes with its comparison with the RCT. Aside from the theoretical similarity between both techniques, their pre-estimation phases remain completely different. The RCT has been used for over 100 years for the same type of subjects. Moreso, researchers have been trained to carefully select their samples to focus on specific populations. This partly resulted in a pre-existing search for interactions which currently has no direct counterpart in the RDD context. Sampling is also a very important tool to decrease estimates variance. The RDD allows researchers to study new types of subjects that have not yet been scrutinised to the extent of the RCT subjects. Therefore, in many applications, the RDD may provide an alternative source of evidence, rather than replacing observational studies.

3.7 References

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3.8 Kendall and Rekkas (2012) replication appendix

This section provides a replication of Kendall and Rekkas (2012) incumbency effect on the probability of winning for liberal incumbents in the post-1950 period until the 2008 election. Kendall and Rekkas (2012) main empirical specification is

$$W_{it} = \alpha + \beta D_{i,t-1} + \gamma MV_{i,t-1} + \delta D_{i,t-1} MV_{i,t-1} + \epsilon_{it}$$

where W is a binary variable that is 1 if the liberal candidate in district i during election t won the election. D is a binary variable that is 1 if the district was won by a liberal candidate during the previous election. MV is the margin of victory and ϵ is the stochastic error term. The term β is the estimate of the liberal incumbency effect. Time and province fixed effects are also included in the estimation. The standard errors are determined by clustering on ridings. Additional nuisance parameters in the margin of victory and the corresponding interaction terms are also added in the cubic and the quartic specification. Kendall and Rekkas (2012) used different lengths of fixed bandwidth, namely +-10% and +-15% for the linear regression and +-70% in the cubic and quartic case.

Differences between Kendall and Rekkas (2012) findings and our dataset remain. Our dataset used the *List of ridings represented in the House of Commons from 1867 to today* to determine the constituency names. Kendall and Rekkas (2012) highlighted that redistricting is an issue. At times, a constituency boundaries will change but its name won't necessarily vary. At other times, the constituency's name is modified but not the boundaries. To address these problems, we follow the strategy of matching district with the same names or with a district which has a riding history stating that the name has changed. This is of importance, as a name can be modified outside of the redistricting period thus without a change in boundaries. For example, St. John's East became St. John's North in 2004 and shifted back to St. John's East in 2006. Since it is specified in the *List of ridings represented in the House of Commons from 1867 to today*, that the district changed its name, we used St. John's East in each of the three periods. In this case, the number of observations with a lag vote margin would increase by two (2004 and 2006). We also made sure that in between redistricting, all constituencies have a match.

Accentuation and wording were also problematic. For example, *Quebec East* changed to *Québec Est* in 1967 and *Québec East* in 1997. Again, the *List of ridings represented in the House of Commons from 1867 to today* says that the electoral district's English name changed each time. In this case the number of observations with a lag margin would increase by four.

As we implemented about 200 modifications for the post-1950, it is difficult to point out the exact difference between our dataset and the one of Kendall and Rekkas (2012). However, this results in an overall increase in observations by 5% to 10%.

Another difference is that we did not use the by-election results to compute the vote margin and we kept the previous election results for the lagged vote margin. There was about 200 by-elections during the period. It can be argued that this does not represent the incumbency at the time of the election. However, in two thirds of the cases the incumbent party won the by-election. We also considered that during by-elections the vote shares are much more volatile, since the turnout is generally low.

Table 3.7 shows the replication of Kendall and Rekkas (2012) using our dataset for the same period and when adding both the 2011 and the 2015 elections. The point estimates that we obtained are less than half of a standard error away from Kendall and Rekkas estimates. The significance level is also similar, but it increases slightly for the quartic regression. We can see that the number of elections is higher no matter the bandwidth. This number reaches almost 300 when looking at the +-70% bandwidth. However, the results stay consistent in each case. This is demonstrated when adding the 2011 and 2015 elections since it does not significantly affect the results.

Table 3.7 also shows the results using a nonparametric local linear regression with a triangular kernel and a data-driven bandwidth. The significance level is given by the robust confidence interval proposed by Calonico, Cattaneo and Titiunik (2014b). In this case, the estimates of the incumbency effect are close but slightly higher. The data-driven bandwidth is +-17% which is close to the +-15% bandwidth but much lower than the +-70% bandwidth. Controlling for volatility inside the parametric regression leads to higher and significant estimates in each cases.

Table 3.7: Kendall and Rekkas (2012) replication of the incumbency effect for liberals post-1950 (Table 1, p. 1574)

	y=probability of winning the election				
	Kendall and Rekkas	Replication			
	Post-1950	Same period, post-1950	Including 2011 and 2015	Volatility adjusted margin	Controlling for volatility
Linear (+/- 15%)	0.1080***	0.0940***	0.0911***		0.1517***
	(0.0371)	(0.0359)	(0.0335)		(0.0579)
Linear (+/- 10%)	0.0697	0.0537	0.0528		0.1737***
	(0.0443)	(0.0441)	(0.0409)		(0.0667)
Cubic (+/- 70%)	0.0868**	0.0849**	0.0773**		0.1604***
	(0.0384)	(0.0329)	(0.0309)		(0.0536)
Quartic (+/- 70%)	0.0862*	0.1000**	0.1049***		0.2023***
	(0.0456)	(0.0405)	(0.0381)		(0.0661)
Data-driven bandwidth		0.1205**	0.1106**	0.1714***	0.1636***
		(0.0431)	(0.0416)	(0.0415)	(0.0396)
N (linear +/- 15%)	1,886	1,985	2,126		1,985
N (linear +/- 10%)	1,337	1,407	1,509		1,407
N (cubic & quartic +/- 70%)	4,406	4,701	5,190		4,701
N (Data-driven bandwidth)		2,259	2,381	2,176	

Notes: As in Kendal and Rekkas, clustered standard errors are in parentheses; clustering is by riding. Time and province fixed effects are included.
The reported results are restricted to margins of victory except for the local polynomial regression that used a data-driven bandwidth. Also, the significance level for the data-driven bandwidth is from the robust confidence interval of Calonico, Cattaneo and Titiunik (2014).*** p<0.01; ** p<0.05; * p<0.1.