Riding the Orange Wave:
A statistical and geospatial analysis of NDP support in Canada's 2011 federal election

by

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF MAPS

LIST OF TABLES

ABSTRACT

The surprising outcome of Canada's 2011 federal election illustrated regional cleavages in Canada's electorate as Quebec's representation shifted from primarily Bloc Québécois to the New Democratic Party. Research has determined theoretical socioeconomic and demographic determinants of NDP support across Canada, but not within Quebec itself. This thesis aims to locate areas of NDP support in Quebec and the rest of Canada (ROC), and determine the different socioeconomic and demographic characteristics of NDP supporters in these areas using a statistical and spatially analytical methodology. OLS regression models determine variation in NDP support for both Quebec and ROC, and the predictor variables are different from those in previous literature—indicating the 2011 election was particularly unusual. Areas in Quebec where the models do not accurately predict NDP support indicate that not only is there regional variation between Quebec and ROC, but there is regional variation within Quebec itself.

CHAPTER 1: Introduction

The results of the 2011 Canadian federal election represented a potential realignment of Canada's political structure. For the first time in Canada's political history the New Democratic Party (NDP) was elected to the Official Opposition in Parliament; an unexpected result considering the party's previous electoral trajectories. While NDP is supported across the country, overwhelming NDP support stemmed from Quebec: 79% of federal electoral districts (FEDs) turned orange—up from 1% in the 2008 federal election (Elections Canada, 2011; LeDuc, 2012). The Bloc Québécois' (the Bloc's) stronghold on Quebec's electorate has been lifted. Within the field of electoral geography, this thesis analyses the compositional and contextual differences that influence determinants of NDP vote share in Quebec versus the rest of Canada (ROC) in an attempt to demystify the unexpected voting behaviour in the 2011 election.

I seek to explain how political support is anchored in particular places and contexts through a statistical and spatially analytical methodology. I aim to locate areas of NDP support in Quebec and ROC, and indicate the socioeconomic and demographic compositions that describe the variation in NDP support across these areas to finally describe how these determinants of voting behaviour differ between Quebec and ROC. I test theories of voting cleavages across Canada and apply this cleavage theory to the electorate within Quebec. I review trends in electoral geography which analyse spatial variation in voting behaviour, and determine which trend NDP vote share from the 2011 election satisfies.

I have two research questions:

1. After the 2011 election, what are the typical characteristics of districts with high levels of NDP support in Quebec, and how do these compositionally differ from areas in the rest of Canada (ROC)? How do support areas in Quebec and ROC differ pertaining to the socioeconomic and demographic determinants of NDP support?
2. Where in Quebec are there significant clusters of unexpected levels of NDP support, and what local-contextual factors can explain this?

This study concludes that districts in Quebec and ROC with high levels of NDP support are largely compositionally similar—demographics are evenly distributed across the study areas. However, the significant socioeconomic and demographic determinants of NDP support are different among Quebec and ROC ridings. The similar populations in both Quebec and ROC

districts support political parties in different ways—this indicates the presence of a regional cleavage in Canada's voting patterns and points to how local geography is important when studying electoral behaviour. Certain areas in Quebec have clusters of unexpected levels of NDP support, where support is either higher or lower than expected. These areas are examples of where political party legacies are rooted in territory, and where previous political party support can spread to adjacent ridings over several elections. These findings indicate that not only is there regional variation between Quebec and ROC, but there is regional variation within Quebec itself.

Chapter Two provides an overview of the academic context and Canada's electoral system. I outline the structure of Canadian parliament, the Canadian electoral model, and the typical dynamics between political parties. I discuss the three prominent issues that structure voting behavior in Canada (valence issues, party leader images, and partisan attachments), and the typical cleavages in Canada's electorate. The chapter details current theories in electoral geography and methods for analyzing spatial variation in voting behaviour as discussed in recent scholarship.

Chapter Three provides electoral context and a data description for the analysis. I present and discuss the results of the 2011 election and its peculiarities, and provide detail about why this election is particularly important. I describe the sources, format, and means of selection of both electoral and census data used in this analysis.

Chapter Four concerns my first research question. I compare and contrast partial correlation coefficients between select census variables and NDP vote share for both ROC and Quebec to illustrate regional cleavages in voting behaviour and verify that Canada's electorate cannot be analysed homogeneously. I then construct multivariate OLS regression models to explain variation in NDP vote share for both ROC and Quebec. I compare and contrast these two models to explain socioeconomic and demographic cleavages in voting behaviour, identify the different socioeconomic and demographic determinants of NDP support in each region, and calculate to what extent variation in each region's vote share can be explained.

Chapter Five concerns my second research question. I test Quebec's OLS regression model for spatial autocorrelation by conducting spatial analytic techniques on the model's residuals. After initial residual mapping I perform a global Moran's I followed by a local Moran's I (a LISA indicator) to detect areas where the model significantly under- or over-

predicts NDP support levels in comparison to those areas' observed values. I infer reasoning for this spatial variation through literature and regional context, and point to future research for further explanation.

CHAPTER 2: Academic context

This chapter provides a contextual overview of the academic scholarship on electoral geography and Canadian voting patterns. First, I will give a basic description of the electoral system in Canada, outlining the composition of the Canadian parliament and make-up of the electoral model. Second, I give a background of party dynamics and party support in Canada; overviewing the different political parties, Quebec's distinctiveness, and prominent factors influencing voting behaviour (valence issues, party leader image, and partisanship attachments). Third, I outline critical points of current knowledge on electoral geography and voting patterns; noting the importance of combining broad theory and methodology with a local dimension. Last, I note common theory and methodology used in electoral geography case studies by Clem and Craumer (2005) and Shin and Agnew (2011), notable in their relevance due to similar statistical and geospatial analyses of voting behaviour patterns.

2.1 The electoral system in Canada

2.1.1. Canadian parliament

The parliament of Canada consists of two houses: an appointed upper house (the Senate), and an elected lower house (the House of Commons). This study focuses on the election of the lower house; comprised of 308 members elected from single member districts. Districts may have any number of candidates running within them, and political parties may only endorse one candidate per riding. The elected individual gets a seat in the House of Commons, and the political party that holds the most seats in the House wins the election— in Canada's first-past-the-post electoral model an absolute majority is not required. A winning party that does not have an absolute majority forms a minority government, whereas a winning party that has an absolute majority forms a majority government (Dyck, 2008).

2.1.2 Canadian electoral model

The first-past-the-post electoral model can produce distortions of party support during translation of vote shares to seats. Large parties with a slightly higher percentage of the vote share can take a much higher share of seats. This model tends to disadvantage smaller parties that do not have particular concentrations of votes (Forest, 2009; Linzer, 2012).

2.2 Party dynamics and party support in Canada

2.2.1 Canadian federal political parties

Canada's federal political environment comprises several political parties forming a multi-party system. As of 2011, there are five political parties represented in the House of Commons: Conservative Party of Canada, Liberal Party of Canada, the NDP, the Bloc, and Green Party of Canada. Historically, the dominant parties are the Conservatives and the Liberals, though the NDP has risen to prominence in the 2011 federal election (see Chapter 3). Prior to the 2011 election, Canada had three consecutive elections producing minority governments (Liberals in 2004, Conservatives in 2006 and 2008), and each election witnessed a change in the Liberal Party leader. The instable federal political environment makes electoral outcomes and political party futures difficult to predict (LeDuc, 2007). Party support is uneven across Canada; major cities (Toronto, Montreal, Vancouver) are predominantly Liberal, and Quebec has a different electorate altogether (Dyck, 2008).

2.2.2 Distinctiveness of Quebec

Quebec's electorate is distinct from ROC (Johnston, 1992). The presence of the Bloc complicates cross-Canada comparisons, so most Canadian political studies focus on either Quebec or ROC (Roy, 2009). Up until the 2006 federal election, it was generally presupposed that the Conservatives and NDP had little credibility within the province (LeDuc, 2007). The support for the Bloc has declined since the 2004 federal election, but the party still held a strong presence in the 2008 election. The Bloc's large losses in 2011 (declining to 4 seats) surprised most observers (LeDuc, 2009).

2.2.3 Prominent issues affecting voter behaviour in Canada

In the Canadian federal political environment, valence issues (issues in which most voters share the same opinion, for example, a healthy economy or accessible health care), party leader images, and—to a lesser extent—partisan attachments influence the vote shares of federal parties as determined by studies analysing pre- and post-election surveys (Clarke, Kornberg, Scotto, & Twyman, 2006; Clarke, Kornberg, & Scotto, 2009; Clarke, Scotto, & Kornberg, 2011; Cutler, 2002). Canadian voters focus on large problems—valence issues shift attention away from smaller-scale political programs, and opinions on these issues have strong explanatory power on voting outcomes. Valence issues can be complex, and higher complexity indicates a greater

likelihood in voters assessing the management ability of party leaders when deciding their vote (Gidengil, Blais, Nadeau, & Nevitte, 1999). A key event in Canadian federal elections are the party leader debates (Blais, Gidengil, Nadeau, & Nevitte, 2003), from which many voters solidify their perceptions of the leaders and their respective parties. Valence issues and party leader images are inconsistent across elections and result in weak and flexible partisanship (Clarke et al., 2006) which is augmented by institutional arrangements (Gidengil, 1992). Further, parties claim to discourage partisanship among the electorate (Johnston, 1992). Historically, Canadian partisanship follows an issue-based model (Johnston, 1992) and is therefore incredibly volatile, pointing towards the unpredictability of elections (LeDuc, 2007). Valence issues, party leader images, and flexible partisanship are particularly important to note because of their role in the 2011 election. The admiration of NDP leader Jack Layton and the party's increasing popularity in the polls post-debate (LeDuc, 2012) confirm the significant role that these factors play in explaining voter behaviour.

2.2.4 Cleavages in Canada's electorate

Canada's electorate experiences general cleavages in voting behaviour along social (class, religion, gender) and geographic lines (Lipset & Rokkan, 1967). Identity and social group membership create a lens which shapes political perceptions and affects voting behaviour (Bittner, 2007). Scholarship suggests that voters' preferred party has little to do with particular group interest, but more rooted in social group identification and subsequent inheritance of community values (Mendelsohn & Nadeau, 1997). Gidengil, Blais, Nadeau, and Nevitte (1999) note cleavages in political culture among regionalist economic and social terms, which are an effect of party political legacies rooted in territory. This claim of cleavages due to political legacy goes against other scholars' claims of weak partisan ties. Gidengil et al. (1999) claims Canada's partisan climate is rooted in regionalism and implies that individuals' behaviour is place-specific. Thus, voting behaviour cannot be explained in terms of differences in social composition, and the electorate cannot be analysed as one national group in electoral research (Vilalta y Perdomo, 2004). Regional differences creating cleavages in party support may cause a differential impact of various explanatory factors in voting behaviour, where strength of correlations between party support and socioeconomic and demographic variables can vary (a weak form of support cleavages), the variables themselves can differ (a moderate form of support cleavages), or the same variable can have opposite effects on party support in different

regions (a strong form of support cleavages) (Gidengil et al., 1999). Where regions have similar social compositions yet differing party support, the resultant cleavages can be explained through differences in the political agenda from one region of the country to another (Henderson, 2004; Simeon & Elkins, 1974).

2.3 Current knowledge on electoral geography and voting patterns

2.3.1 Electoral geography: a primer

Electoral geography analyses spatial patterns of voting to understand electoral patterns and behaviors (Agnew, 1996; Warf & Leib, 2011). Electoral geography tests electoral outcomes quantitatively, developing and improving theoretic conceptions of geography (Flint, 2000). Agnew (1987, 1996) argues that geography is a fundamental component of political behaviour—politics and places are related social processes and have a mutual recursive relationship. In addition, electoral geography informs political theory through empirical observation and social theory (Flint, 2000).

2.3.2 Analysing spatial variation in voting behaviour

Traditional electoral geography uses election results to investigate the spatiality and causality of voting behavior (Forest, 2010). Quantitative methodologies are used to analyse political patterns at a large scale. Two explanatory trends for analysing these patterns are prevalent in the literature: the *components effect* theory (commonly compositional effects) and the *local-contextual effects* theory (Vilalta y Perdomo, 2004), outlined below. Further, the spread of political party support may be explained by the *contagious diffusion* theory (Lutz, 1990).

Components effect

Scholars supporting the components-effect theory of spatial variation in voting behaviour propose that variation is "caused by the aggregate effect of socioeconomic characteristics that happen to covary with location" (Vilalta y Perdomo, 2004, p. 404), where this covariance is indicative of a functional—as opposed to territorial—division (McAllister & Studlar, 1992). This explanation implies that people from similar social backgrounds will vote similarly, regardless of their location (McAllister, 1987). Consequently, areas with similar social compositions should expect similar electoral results, and a country's electorate can be analysed as one national group whose behaviour is independent of place (Stokes, 1967). Clem and Craumer (2005) determined underlying demographic and socio-economic correlates of the vote through components-effect

analysis, and produced results which match relationships gathered from individual-level survey analyses.

Local-contextual effects

Conversely, other scholars suggest that spatial variation in voting is independent from regions' compositional characteristics (Agnew, 1987; Burbank, 1995; Vilalta y Perdomo, 2004), and local social, economic, and political conditions and issues influence voters' interests in specific places that may differ from national trends (Agnew, 1996). Burbank (1995) outlines how voters are informed by their local social environment to make political decisions. This explanatory trend implies that a nation's electorate should not be studied as a homogeneous group as demographic and socio-economic vote correlates intersect in diverse ways across different locales (West, 2005), and local context social phenomena impact voters' decisions (Cox, 1987).

Contagious diffusion

Previous scholarship finds political support to diffuse through space, where support is dependent on districts' physical proximity to other support districts (Lutz, 1990). The notion of spatial diffusion and greater connection between objects in close proximity is intrinsic in geography studies (see Tobler, 1970). Contagious diffusion typically causes higher levels of support to appear near previously established party support (Vilalta y Perdomo, 2004), confirming theories where geographies and local factors matter in electoral studies.

Emerging trends in electoral geography

The resurgence of electoral geography in the past two decades sees a shift away from modernist and structuralist approaches towards post-structuralism and social theoretical perspectives (Warf & Leib, 2011). Incorporation of place-based social theory in electoral geography is important in determining voter behaviour, augmenting analyses of national socio-demographic categories as a source of causality (Agnew, 1996). Studies are exploring the concept of place within electoral geography, solidifying the connection between the political and the socio-structural geographical setting of a space. Agnew (1996) argues that there is more to context and place than conventional understandings allow, and multiple techniques must be used to evaluate the role of place in political behaviour—human agency and the social-geographical setting must be emphasised. Political information is funnelled in a local arena, and local places must be regarded as settings for electoral geography studies. Traditional quantitative electoral

geography must engage with theories of the social construction of space in order to further the constructivist conceptions of political and spatial dynamics.

2.4 Common theory and methods from similar case studies

Following these trends, common methodology in electoral geography includes quantitative analyses at different scales. Non-spatial and spatial statistics are typically used to determine broad trends in voting behaviour, and studies are augmented with the incorporation of place-based social theory (Johnston et al., 2001).

Quantitative methodology helps determine how geographical biases of spatial autocorrelation and spatial heterogeneity are implicated in models of voter behaviour. Shin and Agnew (2011) perform multiple spatial statistical methods with GIS and statistical software—an initial geographically-weighted regression (GWR) on geo-referenced electoral and census data is augmented by a Moran's I test to determine statistically significant clustering of political party support. This thesis follows a similar methodology of a global statistical test to identify broad trends in voting behaviour, then using a local spatial statistic to identify clustering of outliers—indicating that there is another factor contributing to a particular area's voting behaviour.

Clem and Craumer's (2005) work aims to determine underlying demographic and socio-economic correlates of the vote from one election to the next. Using bivariate and multivariate regression models, they determine the most significant factors explaining voting differences using census data. This is similar to this thesis which uses census data in the initial analysis. To add theoretical discussion to quantitative studies, other academics have turned to different kinds of surveys—such as the British Household Panel Survey (Johnston et al., 2001), and the Canadian Electoral Study (Bittner, 2007; Blais & Bodet, 2006; Gidengil et al., 1999; Johnston, Matthews, & Bittner, 2007). These surveys offer more insight to voters' motivations and are useful in accounting for inexplicable variations in voting. This thesis points to research which would follow these analyses using surveys in a secondary analysis on unexpected clusters of NDP support.

CHAPTER 3: Electoral context and data description

This chapter outlines the importance of the 2011 federal election in the Canadian federal political environment. Results of the election are detailed and then explained. This chapter gives an overview and description of the data used for the analysis.

3.1 The 2011 Canadian federal election

3.1.1 Results of the election

After three consecutive elections forming minority governments in Canada (2004, 2006, 2008), the 2011 election of a majority Conservative government brought an end to eight years of instability in the political environment (LeDuc, 2012). In addition, the outcome of the election reshaped the Canadian political map and altered the composition of the political stage. The Conservatives hold a majority government with 166 of the 308 seats in the House of Commons (Table 3.1). The NDP holds the position of the Official Opposition in Parliament for the first time in Canadian electoral history with 103 seats. The historically dominant Liberals were reduced to 34 seats while the Bloc suffered a catastrophic reduction to four seats in the House. The Green Party won a seat for the first time in Canadian electoral history.

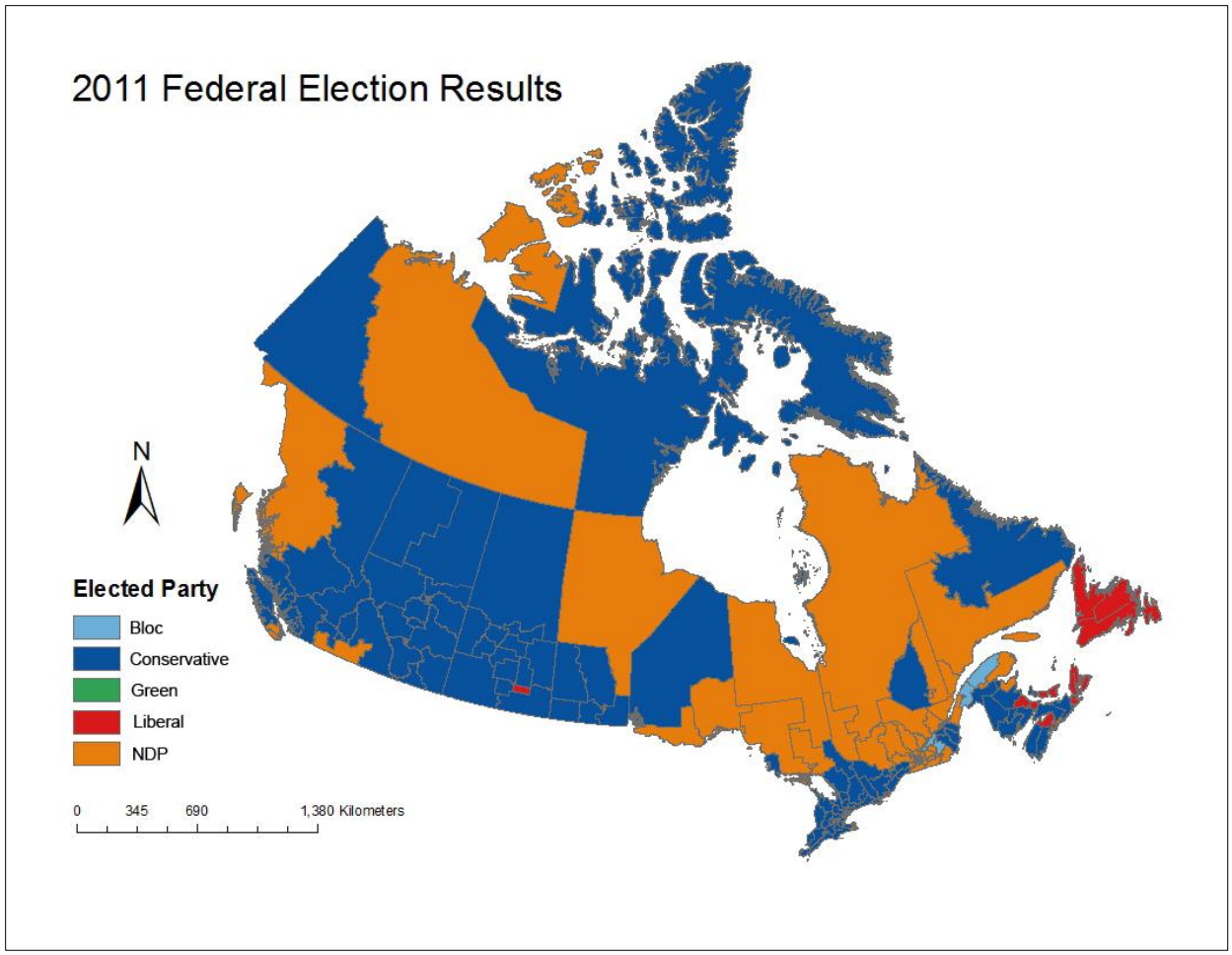
Table 3.1: 2011 federal election results

Party	**Seats**	**Votes**	**Percentage of vote (%)**	**Percentage of seats (%)**
Conservative	166	5 832 401	39.62	53.90
NDP	103	4 508 474	30.63	33.44
Liberal	34	2 783 175	18.91	11.04
Bloc	4	889 788	6.04	1.30
Green	1	576 221	3.91	0.32
Total	308	14 590 059	100	100

Source: (Elections Canada, 2011)

The 2011 election revealed important regional cleavages in party support (Map 3.1). The Conservative Party's support is concentrated in the Prairie Provinces, Yukon, Nunavut, and regions in British Columbia, Ontario, and the Maritime provinces. Southern Ontario voted Conservative except for ridings in the downtown core of Toronto and surrounding GTA, which remained Liberal and NDP. This relatively left-wing support is typical in the urban centres of

Canadian geography (Walks, 2004). Quebec is overwhelmingly represented by the NDP, save four Bloc seats and a Conservative region in the Capitale-Nationale and Chaudière-Appalaches regions. The Montreal area is primarily NDP with some Liberal representation, and only one Bloc riding. The Green Party's sole seat is on Vancouver Island.



Map 3.1: 2011 federal election results by FED

3.1.2 Significance of election

The massive increase in NDP representation in the 2011 election was a surprise that is best illustrated through the results of the previous federal elections (Table 3.2). Support for political parties was relatively stable in the 2004, 2006, and 2008 elections, although Liberal and Bloc support decreased while Conservative and NDP increased. The 2011 election saw a stark decrease in both Liberal and Bloc representation, the latter of which were decimated by the surge in NDP support.

Table 3.2: Federal elections results 2004-2011for all of Canada

		% of votes (number of seats)					
Election year	**Turnout (%)**	**Liberal**	**Conservative**	**NDP**	**Bloc**	**Green**	**Others**
2004	60.9	43.8 (135)	32.1 (99)	6.2 (19)	17.5 (54)	n/a	0.3 (1)
2006	64.7	30 (103)	36 (124)	18 (29)	11 (51)	4 (0)	1 (1)
2008	58.8	26 (77)	37 (143)	18 (37)	10(49)	7 (0)	2 (2)
2011	61.1	19 (34)	40 (166)	31 (103)	6 (4)	4 (1)	1 (0)

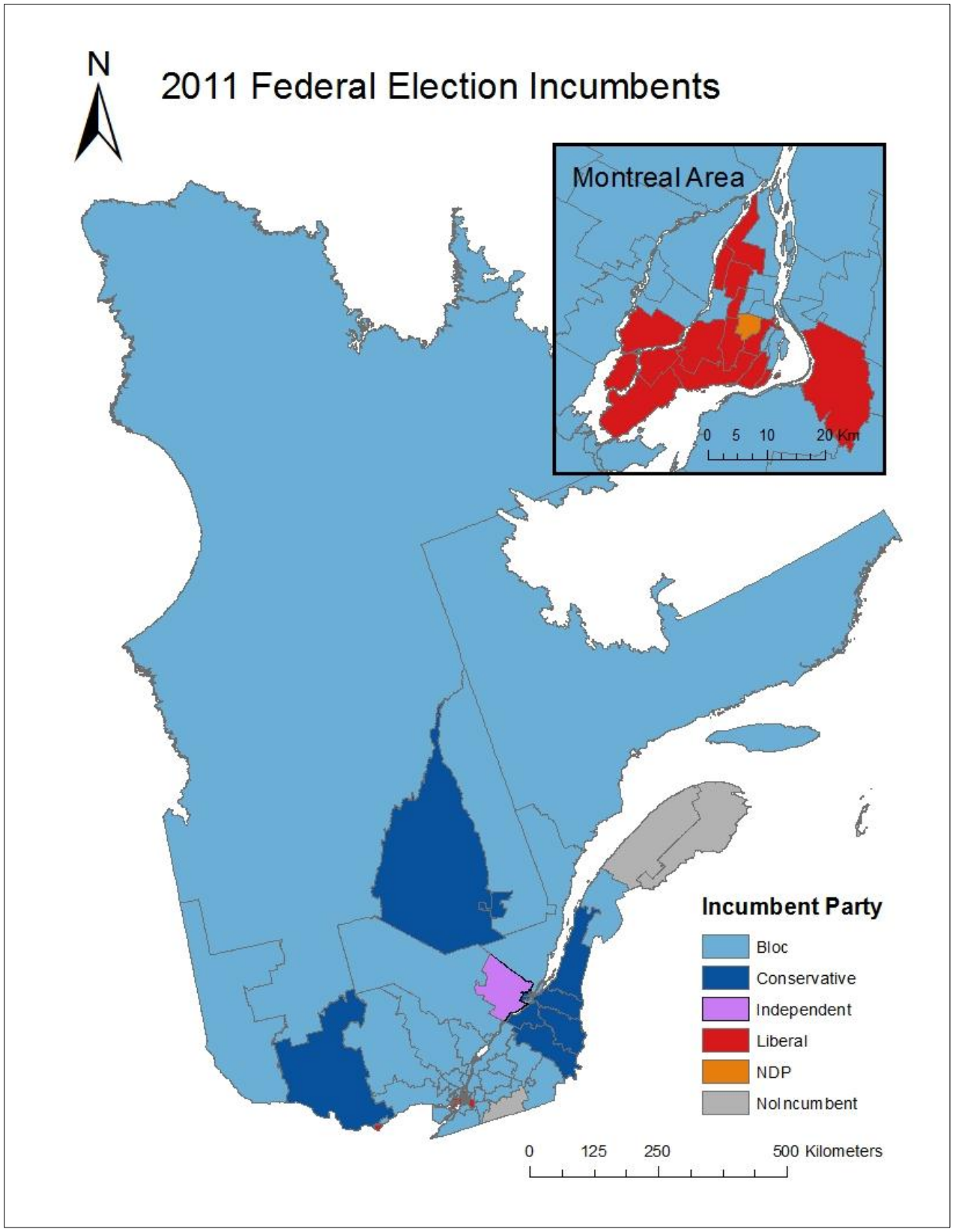
Source: (Elections Canada, 2011)

Large shifts in representation are even more noticeable within Quebec (Table 3.3), where the NDP went from holding one seat in 2008 to holding 59 (nearly 80% of the province's share) in 2011. As shown in Map 3.2 (2011 election incumbents) and Map 3.3 (districts with 2011 representative change) the NDP's gains came primarily at the expense of the Bloc.

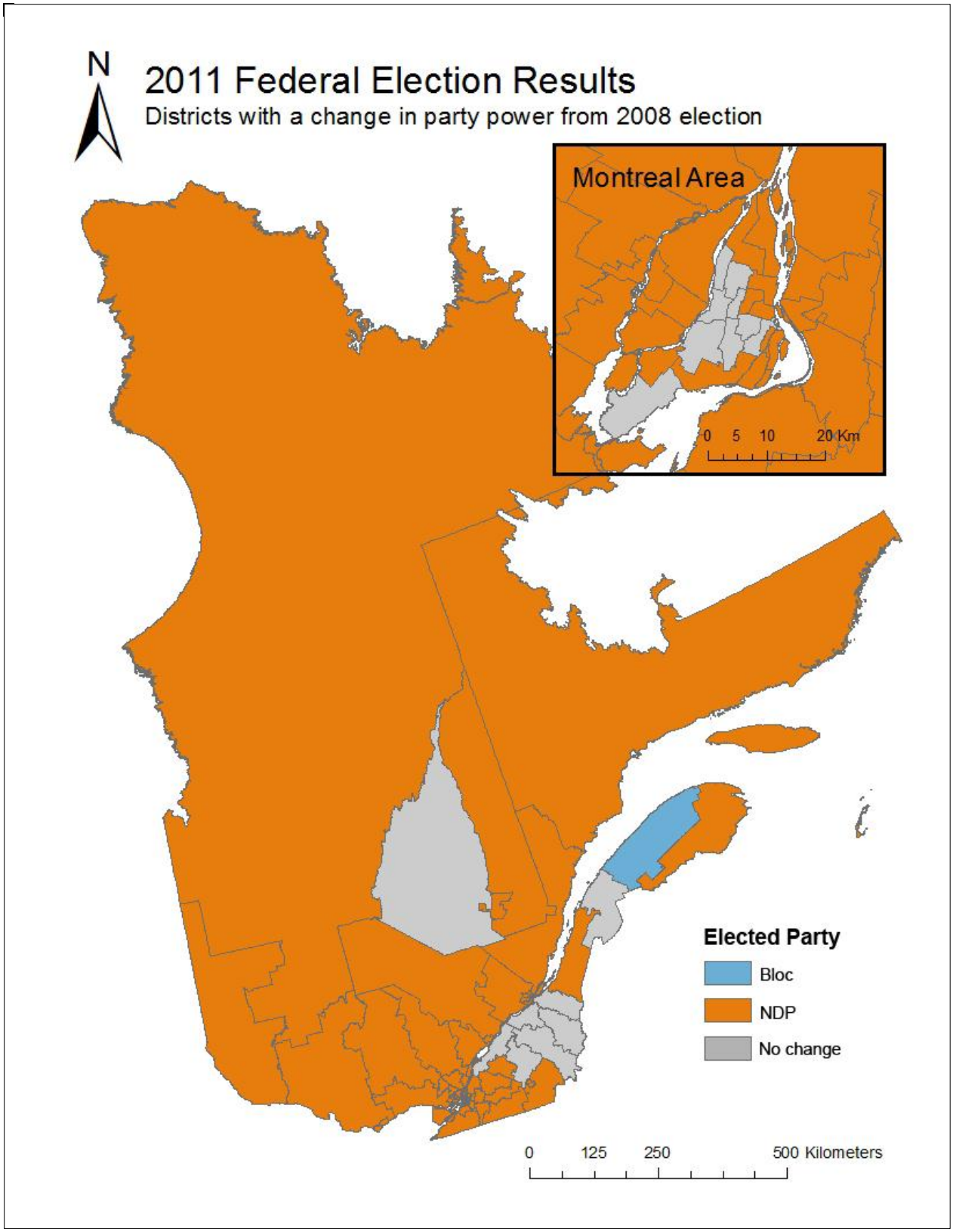
Table 3.3: Federal elections results 2004-2011 for Quebec only

		% of votes (number of seat					
Election year	**Turnout (%)**	**Liberal**	**Conservative**	**NDP**	**Bloc**	**Green**	**Others**
2004	60.5	34 (21)	9 (0)	4 (0)	49 (54)	3 (0)	1 (0)
2006	63.9	21 (13)	25 (10)	8 (0)	42 (51)	4 (0)	1 (1)
2008	61.1	24 (14)	22 (10)	12 (1)	38 (49)	4 (0)	1 (1)
2011	62.2	14 (7)	17 (5)	43 (59)	23 (4)	2 (0)	1 (0)

Source: (Elections Canada, 2011)



Map 3.2: 2011 federal election district party incumbents



Map 3.3: Districts with 2011 representation that differs from incumbent

Almost all of Quebec has turned orange in Map 3.3, indicating the 59 of 75 districts that now have NDP representation.

3.2 Data description

This analysis uses electoral data and census data. This section reviews each in turn.

3.2.1 Electoral data

This analysis is led by the results of the 2011 election by FED provided by Elections Canada (Elections Canada, 2011). The districts used are those from the 2003 Representation Order (used for the 2011 election), and each has a unique identifier (number and name). This analysis uses the vote share percentage for the NDP, incumbent party, and elected party data. Summary statistics for national NDP vote share are located in Appendix A. Other data collected from Elections Canada include results from the 2004, 2006, and 2008 elections (both vote share and seats held) for all of Canada and for Quebec (seen above in Tables 3.2 and 3.3, respectively).

The electoral data are joined with a shapefile of federal electoral districts, available for download from GeoGratis of National Resources Canada (Statistics Statistics Canada, 2012). All maps in this analysis use the North American 1983 datum and Lambert Conformal Conic projection system.

3.2.2 Census data

This analysis uses demographic and socio-economic data from the 2006 Canadian Census aggregated by FED, obtained from the CHASS Canadian Census Analyser of the University of Toronto (CHASS, 2011). Previous scholarship on theoretical determinants of NDP support and Canadian voting patterns is used to guide the selection of socio-demographic and economic variables (see section 4.1 "Theoretical determinants of NDP support areas"). The investigated variables are immigrant populations, young adult populations (pooled data of populations aged 18 to 35), middle class populations (pooled data of households with income between $40,000 and $70,000), allophone populations, married populations, populations where high school is the highest level of education achieved, population density (calculated as district population divided by district area), and incumbency. Incumbency is a dummy variable indicating whether a district had an incumbent representing the NDP (value = 1), or an incumbent representing another party (value = 0). Each of these variables (excluding incumbency) has a percent value, individually calculated by the raw census values for each district divided by the district's total population. For

reference, the variable names used in this analysis, their explanations, and their summary statistics are located in Appendix B.

CHAPTER 4: Regional support for the NDP

This chapter analyses the characteristics of districts that strongly supported the NDP in the unusual 2011 federal election, and examines the differences between Quebec and ROC in NDP vote share determinants.

I first discuss the spatial distribution of NDP vote share in Quebec and outline theoretical determinants of NDP support. I then detail my methodology for this chapter's analysis. I summarise relevant socio-economic and demographic characteristics of FEDs for both Quebec and ROC to show any compositional differences in the spatial pattern. I then analyse the amount of variation in NDP vote share in ROC that is explained by these characteristics using ordinary least squares (OLS) regression complete with post-estimation diagnostics. I run this OLS model on NDP vote share in Quebec to determine goodness of fit, and thus highlight the distinction between determinants for variation in NDP vote share in ROC and Quebec. Using the same methodology, I analyse the determinants of variation in NDP vote share in ROC. The ROC model is run on NDP vote share for Quebec for further comparison. Finally, the differences in NDP support for Quebec and ROC is discussed.

High school educated populations, young adult populations, and NDP incumbent districts are significant predictors for NDP vote share in both Quebec and ROC districts. Quebec is most influenced by high school educated populations, whereas ROC is most influenced by married populations. Quebec has a much greater range in variables' influence on NDP vote share than ROC. NDP vote share determinants are more predictable in ROC than in Quebec, indicated by the amount of variance in the vote share that is captured by the models.

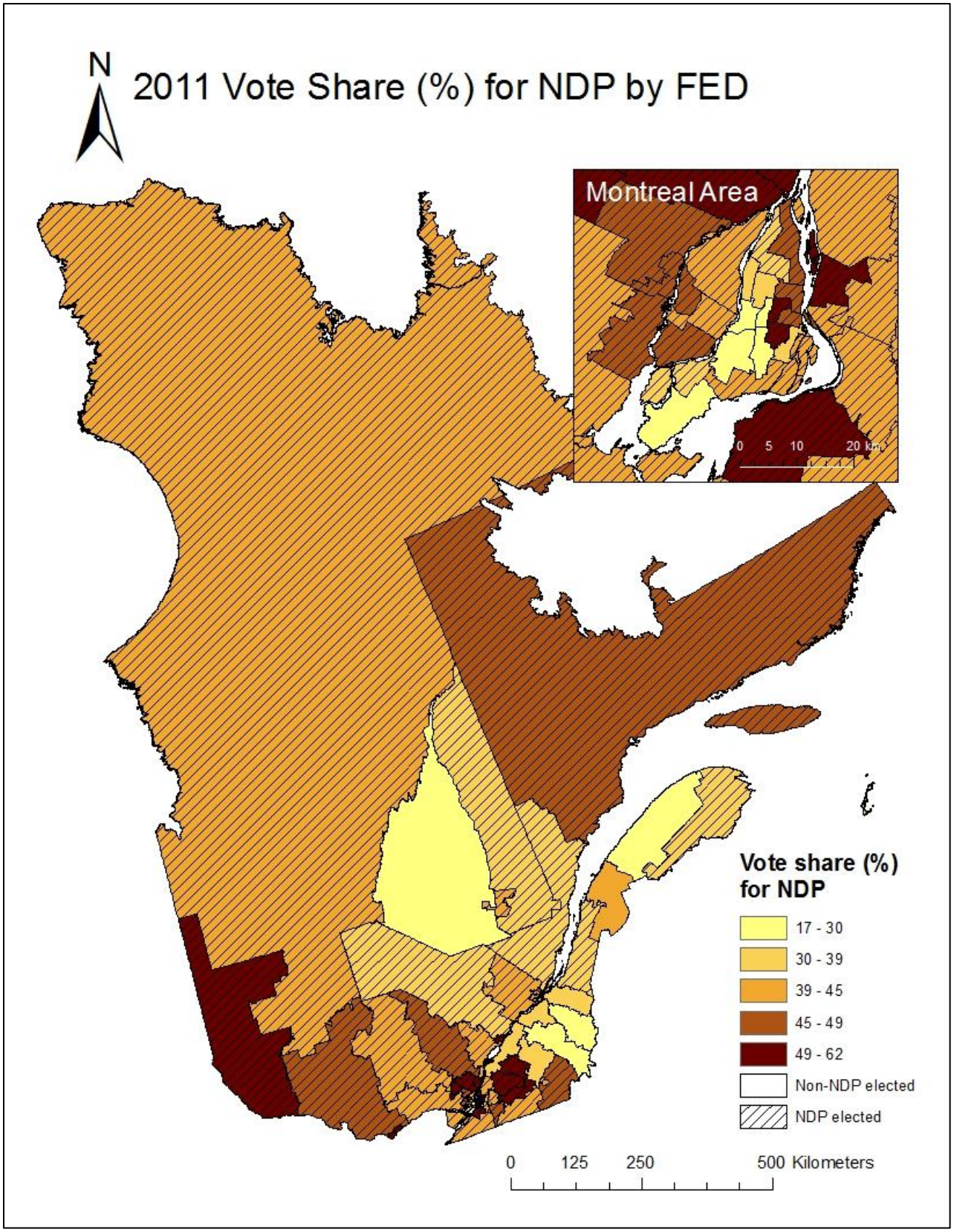
This section yields some unexpected results: immigrant, married, and middle class populations theoretically support the NDP, yet the models depict these variables to have a negative influence on NDP vote share in Quebec and ROC. Voting behaviour is less predictable in Quebec than ROC, where the models account for 46 and 67 percent of variation in NDP support, respectively.

4.1 Theoretical determinants of NDP support areas

For the purposes of this study NDP support is defined by the percentage of NDP vote share in a particular FED. The terms "NDP support" and "vote share" are used interchangeably. In Quebec, the vote share ranges from 17 to 62 percent. The majority of high-support FEDs is in

Greater Montreal, the Eastern Townships, and the Ottawa area (Map 4.1). In Greater Montreal there is high NDP support in the suburbs. The Island of Montreal has two ridings with high vote shares. The NDP competed with the Liberal party on the island; consequentially, low vote share FEDs on the island have Liberal representation and are clustered. Elsewhere, the NDP competed with the Bloc; a cluster of Bloc ridings are found in the Chaudière-Appalaches region.

Previous scholarship analysing NDP support has either analysed all of Canada or Canada save Quebec, but not Quebec alone. Given the low NDP presence in Quebec prior to the 2011 election, this is not surprising. Generally, urban areas with higher population densities have higher levels of NDP support (Gerber, 1986). NDP support also comes from first generation immigrants and visible minorities (Gidengil, Blais, Everitt, Fournier, & Nevitte, 2006; Taylor, 2012), young people (Gidengil, Everitt, Blais, Fournier, & Nevitte., 2006), unionized labour workers (Bowler & Lanoue, 1992), high voter turnout (Martinez & Gill, 2006), married couples (Gidengil, Blais, et al., 2006), and middle class voters (Gerber, 1986). This literature guides the variable selection for this analysis.



Map 4.1: NDP vote share for Quebec FEDs

Canadian elections see some fluidity among voting determinants from one election to the next (LeDuc, 2007). Theoretical characteristics for NDP support may not hold true for the 2011 election in either Quebec or ROC, considering the election's peculiarity. Further, Canada has low partisanship levels and voting decisions are made primarily on sentiment surrounding valence issues and party leader attachment (Clarke et al., 2009)—thus, the socio-economic and demographic characteristics which depict voting behaviour may change, and vary across the country. This chapter finds some theoretical predictors significant and finds others insignificant. Significant determinants differ for Quebec and ROC. The following sections analyse which characteristics best explain variation in NDP support in Quebec and ROC and how they differ from one another.

4.2 Methods

I first calculate partial correlation coefficients between select census variables (as per the literature) and NDP vote share by FED for both Quebec and ROC. This initial calculation is indicative of differences in voting determinants for both regions, as suggested by differences in the direction and magnitude of the coefficients. I then detail descriptive statistics for FEDs in the fifth quintile of NDP vote share (equating to the 15 ridings with the highest levels of NDP vote share) and in the fifth quintile of ROC vote share (47 ridings), and compare these with the descriptive statistics of all districts in Quebec and ROC.

Using a manual backward elimination method, I construct an OLS multivariate regression model to specify and test the relationship between the socio-economic and demographic census variables and NDP vote share in FEDs. I begin with a model fit for ROC and run post-estimation diagnostics to verify the model's credibility (see below). I then run it on the Quebec FEDs to explore the differences between voting determinants in the two regions. I expect that the ROC model will not fit the Quebec observations, indicating that NDP vote share in Quebec is determined by different parameters. I then construct a model for Quebec to further explore these differences (and run post-estimation diagnostic). I run the Quebec model on ROC to assess its fit, with the expectation that it will not be significant. These two different models show distinct differences between the two regions and their voting determinants.

Assumptions of an OLS regression are: (1) the model is linear in parameters, (2) independent values are fixed in repeated sampling, (3) the error term has a mean of zero and is uncorrelated with the independent variable, (4) residuals have constant variance, (5) there is no

autocorrelation between the error terms, and (6) there is no perfect multicollinearity (independent variables are not perfectly correlated with one another).

Model parameters are linear with the exception of incumbency, a dummy variable (assumption 1). All independent variables have one value for each FED and all variables cover the same FEDs (assumption 2). Preceding regression analysis, correlations and scatterplots were calculated to test linearity between the independent and dependent variables. Correlations were calculated between independent variables to account for multicollinearity (assumption 6). Population density is collinear with immigrants and young populations, resulting in the exclusion of population density the final models. Allophone and immigrant populations are collinear, causing only one or the other to be included in each model. Quebec's model sees autocorrelation in the error term, which biases the results of the model by affecting assumptions of independence (this is explored in Chapter 5).

To satisfy assumptions 3, 4, and 5 and ensure the models' credibility, I run several post-estimation diagnostics on the models. Variance inflation factors (VIF) provide an index measuring how much of a regression coefficient is increased because of collinearity between variables. An index greater than five is indicative of high multicollinearity (Burt & Barber, 1996). I plot the models' residuals to check for heteroscedasticity and constant variance, indicating that the error term has a mean of zero. A leverage test determines the presence of data points which have excessive influence on the regression line. Unlike VIF calculations, a leverage test does not have a generally accepted cut off value—it varies depending on the number of parameters (census variables) and observations (districts) in the model calculated by the following equation (Burt & Barber, 1996):

$$leverage\ threshold\ value\ = \frac{3p}{n} \quad \text{where } p \equiv \text{parameters;}$$
$$n \equiv \text{observations}$$

The model is re-run excluding the leverage observations to assess their influence on the model (Burt & Barber, 1996).

4.3 Results

4.3.1 Initial statistics for Quebec and ROC

Table 4.1 shows partial correlation coefficients between select census variables and NDP vote share by FED. These correlations show some unexpected patterns. The calculated positive correlation for high school education, allophone, and incumbency is expected. Literature dictates that first generation immigrants and visible minorities are likely to vote NDP (Taylor, 2012), however, the correlation between immigrants and NDP vote share is negative. This indicates that 2011 was an unusual election. Unexpected results are seen for young adult and allophone voters in ROC, and middle class and married voters in Quebec. Population density is negative in ROC, running contrary to previous research.

Table 4.1: Partial correlations between NDP vote share and census variables by FED

Variable	**Correlation Coefficient**	
	Quebec	**ROC**
Immigrant	-0.375	-0.008
High school education	0.357	0.159*
Young adults (18-35)	0.075*	-0.096
Middle class	-0.287*	0.175*
Allophone	0.175*	-0.377*
Married	-0.089*	0.150*
Population density	0.142	-0.002*
NDP incumbent	0.399*	0.736

*significant at the 95% confidence level

Difference in strength, magnitude, and significance of variables' correlations between Quebec and ROC is an initial indicator that determinants of NDP support areas in Quebec are different than ROC. Middle class, young adult, allophone, and married voters have correlations of opposite directions in each region, illustrating a clear difference in what determines NDP vote share for Quebec and ROC. In Quebec, immigrants hold a moderate association with NDP support, but see little correlation with ROC at all. High school education is a significant correlation in ROC, but the correlation is much stronger in Quebec. Population density is only significant in ROC, yet the low coefficient indicates minimal correlation. Incumbency is

significant in Quebec but much stronger in ROC, attributable to the higher amount of ridings with NDP incumbents in ROC.

Table 4.2 details descriptive statistics for FEDs in the fifth quintile of NDP vote share for Quebec and ROC, as well as statistics for all FEDs in Quebec and ROC. Compared with all of Quebec, districts in the fifth quintile have above-average populations of both young adults and people holding a high school diploma as highest education attained. They have below-average immigrant and allophone populations, and the middle class populations are about the same. There is only one Quebec riding with an NDP incumbent, and it is in the fifth quintile.

Compared to all of the ROC, Quebec NDP-support areas have above-average middle class and allophone populations, and below-average immigrant and high school diploma populations. The young adult populations are about the same. Quebec's riding with NDP incumbents are below the ROC average.

The biggest differences between NDP support areas in Quebec and the ROC are the immigrant and allophone populations—Quebec has fewer immigrants and more allophones on average. Otherwise, populations in Quebec and the ROC are fairly similar, but vote differently.

Table 4.2: District average values for census variables

	Variable average (average percentage of total district population)						
	Immigrant	**High school education**	**Young adult**	**Middle class**	**Allophone**	**Married**	**Incumbency**
Quebec fifth quintile	8,391 (8.20)	19,021 (18.35)	23,006 (22.24)	11,778 (11.36)	603 (5.98)	30,366 (29.28)	0.07 (6.67)
All of Quebec	11,353 (10.99)	18,366 (18.21)	21,513 (21.34)	11,398 (11.36)	938 (9.26)	31,491 (31.26)	0.01 (1.13)
ROC fifth quintile	23,552 (21.62)	20,904 (20.99)	23,062 (23.36)	9,664 (9.82)	2,752 (2.49)	37,321 (37.68)	0.70 (70.2)
All of ROC	22,898 (19.92)	22,212 (21.33)	22,789 (21.89)	10,064 (9.91)	1,930 (1.69)	43,384 (41.75)	0.15 (14.6)

4.3.2 OLS multivariate regression model for ROC

Table 4.3 shows the results of the OLS regression model for ROC. Stemming from previous research discussed in Section 4.1, I chose five variables that best fit the model at the 95% significance level using a manual backward elimination method to create the following equation:

$$NDP\ vote\ share = 56.73 - 0.94married + 0.83high\ school + 0.75allophone + 25.77incumbent + e$$

Table 4.3: ROC OLS regression model results

Variable	**Coefficient**	**Std. Error**	**t-statistic**	**p-value**
Married	-0.94	0.15	-6.40	0.000
High school education	0.83	0.22	3.77	0.000
Allophone	0.75	0.24	3.12	0.002
Young adult	-0.60	0.19	-3.08	0.002
NDP incumbent	25.77	1.57	16.44	0.000
Constant	56.73	9.93	5.71	0.000
$R^2 = 0.67$	Total SS = 42298.91	F(4, 228) = 90.16	Prob > F = 0.000	

The entire model explains 67% of the variation in NDP vote share across ROC's FEDs, and is significant at the 95% confidence level. All things constant, married populations and young adult populations have a negative influence on vote share, whereas high school educated and allophone populations have positive influences on NDP vote share. In ROC, married and young adult populations do not support the NDP, whereas high school educated and allophone populations do support the NDP. NDP incumbency, a dummy variable, has an extremely strong positive influence on NDP vote share—if a district has an NDP incumbent, vote share is expected to increase by almost 26% (holding all else constant).

Post-estimation diagnostics

The model has a mean VIF of 1.54 (Table 4.4), indicating that the variances of the estimated coefficients are not greatly affected by multicollinearity, and the model holds OLS assumptions. Following the equation to determine leverage threshold values, this model's leverage values should be below 0.08 (calculations in Appendix C). There are eight observations

with a leverage value greater than 0.08. I re-ran the model without them, excluding any undue influence on the regression line (results in Appendix D). The model remains significant with an R-squared value of 0.65. Differences from the mode's previous run include the magnitude of high school education, young adult, and allophone populations. However, these differences in magnitude are slight and the variables' direction of influence remains unchanged, indicating that leverage observations do not make a difference in terms of the general conclusions to be drawn from this analysis.

Table 4.4: ROC OLS regression model VIF

Variable	**VIF**
Married	2.07
High school education	1.09
Allophone	1.27
Young adult	2.14
NDP Incumbent	1.14
Mean VIF	1.54

Figure 4.1 plots the residuals for heteroscedasticity. With the exception of a few notable outliers above 20, the majority of residuals are within an even range across all fitted values of NDP vote share, indicating a constant variability. The calculated mean of the error term is <0.001. Residual stratification is due to incumbency—all orange residuals represent NDP-incumbent FEDs, whereas all blue residuals represent non-NDP-incumbent FEDs.

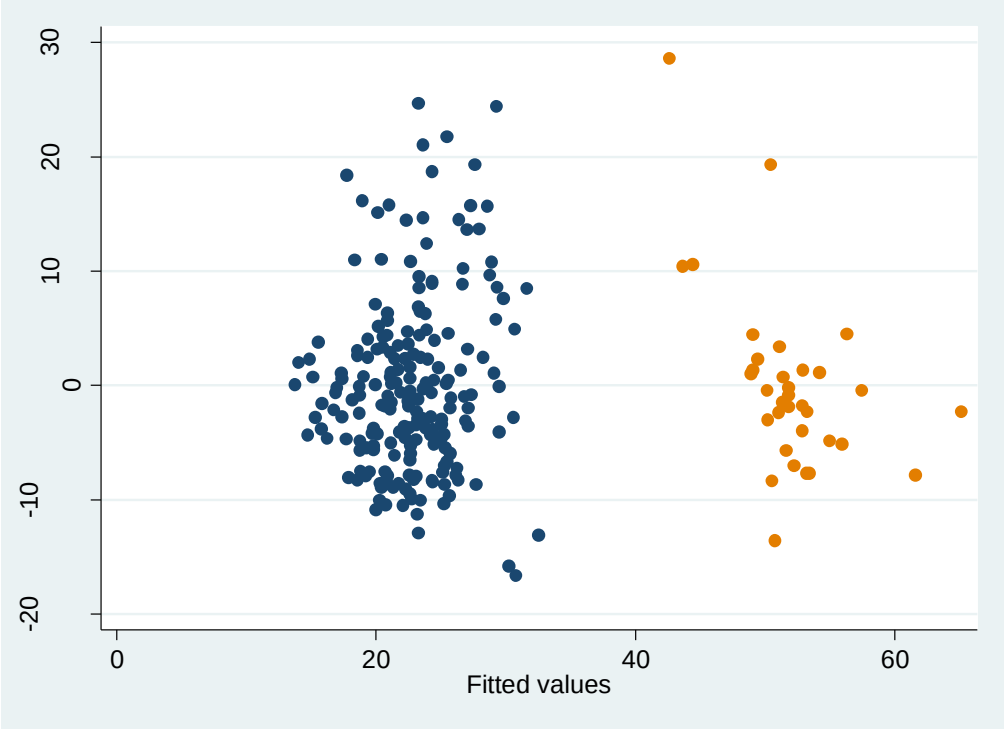


Figure 4.1: ROC model residuals plotted against predicted values of NDP vote share

Testing ROC model on Quebec

The ROC model is run on Quebec's FEDs for comparison of fit (Table 4.5). This application signifies whether or not variables determining variation in NDP support for ROC similarly determine variation in NDP support for Quebec.

Table 4.5: ROC model run on Quebec districts

Variable	**Coefficient**	**Std. Error**	**t-statistic**	**p-value**
Married	-0.88	0.25	-3.56	0.001
High school education	1.82	0.56	3.26	0.002
Allophone	-1.24	0.76	-1.64	0.106
Young adult	-0.01	0.35	-0.02	0.988
NDP incumbent	24.38	7.70	3.17	0.002
Constant	37.59	18.03	2.08	0.041
$R^2 = 0.39$	Total SS = 5517.97	F(5, 69) = 8.97	Prob > F = 0.000	

The ROC model fits Quebec's electorate relatively well overall, but is not the best-fit model to determine variation in Quebec's NDP support. While the overall model is significant,

allophone and young adult variables are not. All variables' magnitude have changed and allophone's direction of influence has changed, indicating cleavages between Quebec and ROC (Gidengil, 1992). Using the ROC model on Quebec's electorate highlights that while the model can significantly predict variation in NDP support overall, the coefficients are likely not appropriate for explaining variation in Quebec's NDP support. It indicates the same combination of parameters that account for variation in NDP support in ROC do not account for variation in NDP support in Quebec, and post-estimation diagnostics are not performed for this reason.

All variables have a low p-value except for the young adult variable. The model is re-run without this variable (results in Appendix D), and is significant with an R^2 of 0.39. Thus, this slightly modified model accounts for 39% of the variation in NDP vote share in Quebec, indicating that Quebec's NDP vote share is harder to determine by a regression model—the vote share is less predictable. Determinants of Quebec's vote share are explored further in the following section.

4.3.4 OLS multivariate regression model for Quebec

Table 4.6 shows the results of the OLS regression model. The model uses three variables from the ROC model and an additional two derived from literature that best fit the model at the 95% significance level to create the following equation:

$$NDP\ vote\ share = 3.75 - 0.53immigrant + 2.66highschool$$
$$+0.85youngadult - 1.97middleclass + 24.89incumbent + e$$

Table 4.6: Quebec OLS regression model results

Variable	**Coefficient**	**Std. Error**	**t-statistic**	**p-value**
Immigrant	-0.53	0.09	-5.98	0.000
High school education	2.66	0.55	4.85	0.000
Young adult	0.85	0.28	3.01	0.004
Middle class	-1.97	0.78	-2.52	0.014
NDP Incumbent	24.89	7.28	3.42	0.001
Constant	3.75	15.91	0.24	0.814
$R^2 = 0.46$	Total SS = 5517.97	F(5, 69) = 11.55	Prob > F = 0.00	

The entire model explains 46% of the variation in NDP vote share across Quebec's FEDs, and is significant at the 95% confidence level. All things constant, high school educated and young adult populations have positive influences on vote share. Immigrant and middle class populations have negative influences on vote share. In Quebec, high school educated and young adult populations support the NDP, whereas immigrant and middle class populations do not support the NDP. Similar to the ROC model, NDP incumbent ridings have a very strong influence on variation in NDP support, where support is expected to increase 25% for incumbent ridings (holding all else constant).

Post-estimation diagnostics

Table 4.7 shows a mean VIF calculation of 2.06, indicating that the variances of the estimated coefficients are not greatly affected by collinearity, and the model holds OLS assumptions.

Table 4.7: Quebec OLS regression model VIF

Variable	**VIF**
Immigrant	2.25
High school	1.41
Young adult	2.04
Middle class	3.16
NDP Incumbent	1.20
Mean VIF	2.01

For this model, leverage values should be below 0.24 (calculation in Appendix F). A leverage test produces two observations with values greater than 0.24 – the sole district with an NDP incumbent and the district with the highest population of young adults. To assess these two districts' influence on the entire model, they are excluded and the model is re-run (results in Appendix G). The model remains significant with an R^2 of 0.43. All variable coefficients remain unchanged, indicating that leverage observations do not make a difference in terms of the general conclusions to be drawn from this analysis, similar to the ROC model.

Plotting the model's residuals in Figure 4.2 shows that the majority of residuals are within an even range across all fitted values of NDP vote share, and indicates constant

variability. The calculated mean of the error term is <0.001. These residuals are mapped in Chapter 5.

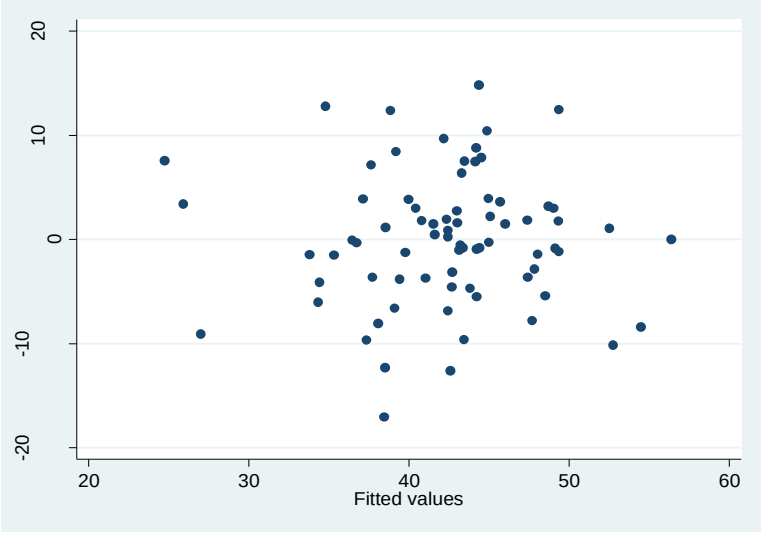


Figure 4.2: Quebec model residuals plotted against predicted values of share NDP vote

Testing Quebec model on ROC

The Quebec model is run on ROC for a comparison of fit (Table 4.8). Again, this application signifies whether or not variables determining variation in NDP support for Quebec similarly determine variation in NDP support for ROC.

Table 4.8: Quebec model run on ROC districts

Variable	**Coefficient**	**Std. Error**	**t-statistic**	**p-value**
Immigrant	0.03	0.04	0.86	0.388
High school education	0.27	0.26	1.03	0.302
Young adult	0.54	0.18	3.03	0.003
Middle class	1.29	0.45	2.84	0.005
NDP Incumbent	28.26	1.60	17.82	0.000
Constant	-8.19	7.86	-1.04	0.298
$R^2 = 0.61$	Total SS = 42298.91	F(5, 227) = 72.38	Prob > F = 0.000	

Similar to the cross-analysis of the ROC model, the Quebec model fits the ROC's electorate relatively well overall. However, it is clear that it does not fit as well as the calculated ROC model in Section 4.3.2, as the R^2 value is lower and some variables are not significant predictors of variation in NDP support. Further, the middle class and immigrant coefficients have

changed directions. This difference and the insignificance of particular parameters reiterate that other variables determine NDP vote share for ROC. Post-estimation diagnostics are not performed on this model for this reason.

4.4 Discussion

Determinants for NDP support differ for Quebec and ROC FEDs, as evidenced in the models. There are differences in magnitude and direction of partial correlation coefficients as well as one notable difference in the demographic composition of the regions' respective districts. There are also differences in the models' variables and in each model's goodness of fit.

4.4.1 Regional cleavages and different support determinants

The differences in determinants for NDP support for ROC and Quebec is initially clear from preliminary partial correlation calculations. The only parameter with a similar coefficient across both regions is incumbency. The varying degrees of association indicate that the same groups in each geographic region support the NDP to different degrees. Following Gidengil et al.'s (1999) description of cleavages in party support, immigrant populations and populations that hold a high school diploma as their highest attained education level demonstrate weak forms of support cleavages between Quebec and ROC, as their partial correlation coefficients vary in strength. Population density and young adult, middle class, allophone, and married populations demonstrate strong forms of support cleavages between Quebec and ROC, as their coefficients go in opposite directions.

With the exception of immigrant and allophone populations, districts in Quebec and ROC have similar social compositions—indicated by the variables' consistent proportions across these regions. Following the components effect of electoral behaviour, these regions with similar compositions should expect similar electoral results (McAllister, 1987; McAllister & Studlar, 1992). However, the electoral patterns do not satisfy this theory. Evidently, the 2011 election sees regional cleavages, and Quebec and ROC are experiencing local-contextual effects.

The regression model results expand on this regional cleavage. Again following Gidengil (1999), the high school education variable experiences a weak cleavage between Quebec and ROC. Married and middle class populations experience a moderate cleavage in NDP support between Quebec and ROC, as these variables differ between the two models—married populations do not account for variation in NDP support in Quebec, and middle class populations

do not account for the variation in ROC. Finally, Canada's young adult populations experience a strong cleavage in NDP support as this variable is expected to increase NDP support in Quebec and decrease support in ROC. These resulting cleavages within regions whose compositions are fairly consistent point to future research for explanation through dissecting local-contextual factors of each region, and verify that Canada's electorate cannot be analysed homogeneously.

4.4.2 Unexpected results

Some of the variable coefficients in the two regression models follow previous scholarship, while others do not. For ROC, allophone is used as a proxy for immigrants and visible minorities (ROC allophone and immigrant populations have a correlation coefficient of 0.82), and its positive coefficient follows the pattern of these populations typically voting NDP. However, immigrant populations have a negative effect on NDP vote share in Quebec. Literature states a positive relationship between married couples and middle class populations and NDP support (Gerber, 1986; Gidengil, Blais, et al., 2006), but the ROC model illustrates a negative correlation. Scholarship also determines urbanised areas to have a positive influence on vote share (Gerber, 1986), but population density, a proxy measure for urbanisation, was insignificant in the models due to its confounding nature with immigration populations (a correlation of 0.70 and 0.75 for Quebec and ROC, respectively). These unexpected results indicate that something unusual occurred in the 2011 election.

The regression models show that people were voting in unexpected ways in both Quebec and ROC. The difference in the goodness of fit of the models illustrates that voting behaviour is easier to model for ROC than for Quebec; the models account for 67 and 46 percent of the variation in NDP vote share, respectively. Voting behaviour in Quebec is less predictable—more factors need to be considered than those captured by census variables. The Quebec regression model does not fit the variation in Quebec FEDs evenly—some districts' NDP vote share is significantly over-predicted, and others are significantly under-predicted. These clusters of unexpected and unexplained NDP support are examined in Chapter 5.

CHAPTER 5: Areas of unexpected NDP support in Quebec

This chapter will identify and investigate areas of unexpected NDP support in Quebec. These are areas where the variation in NDP support is not explained by the Quebec regression model from Chapter 4; areas where a district's predicted level of NDP vote share is significantly higher or lower than its observed level. I perform global and local spatial analyses to determine these areas and to test for their significance.

The presence of spatial autocorrelation in a dataset signifies the relationship between a particular variable and its observation in nearby spatial units (Getis, 2010). In this case, this variable is the calculated residuals from Quebec's OLS regression model. Spatial autocorrelation amongst model residuals is indicative of model misspecification. This chapter will determine areas in Quebec where NDP support is not adequately explained by the model—that is, areas where the model under- or over-predicts the observed NDP vote share in the district. This analysis points to the need for further research on what is responsible for any spatial autocorrelation that may exist in the dataset.

5.1 Methods

I begin this analysis by calculating the residuals of the Quebec regression model in Section 4.3.4. A residual is the difference between the observed value and the predicted value derived from the model (Burt & Barber, 1996). In a dataset without spatial variation (determined at the regional scale) and spatial autocorrelation (at the local scale), residuals are expected to have a random distribution. A dataset with spatial variation or autocorrelation will lead to correlations in residuals – positive values will occur together, and negative values will occur together (Shin & Agnew, 2011). Negative residuals indicate that the model is over-predicting, whereas positive residuals indicate that the model is under-predicting. A residual of zero indicates that the model fits the observation perfectly.

First, I map the residuals using the GeoDa software package. This is done using a box map (displaying residuals by quartiles where outliers are shown in the map). I then perform a univariate Moran's I to test for global spatial variation, which provides a single summary value of spatial pattern for the region as a whole. This test uses a queen's contiguity spatial weights matrix (contiguity is defined by districts' common boundaries and vertices) to summarize the linkages between each district. The Moran's I value ranges from -1 indicating perfect dispersion

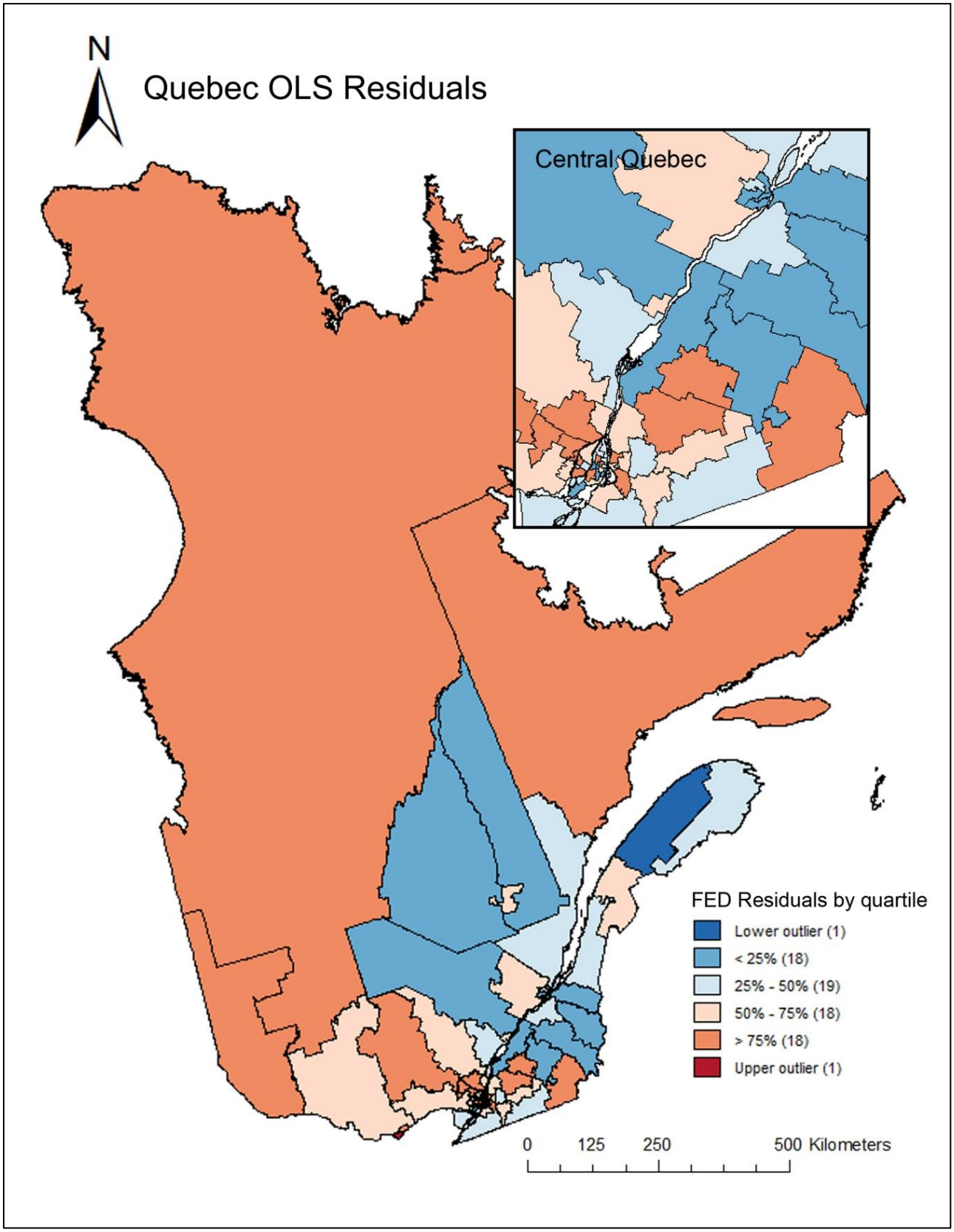
to 1 indicating perfect correlation, with 0 indicating perfect randomness (Burt & Barber, 1996). These values are randomized at 999 permutations to calculate z-scores for significance testing, where values smaller than -1.96 or greater than 1.96 indicate significant spatial autocorrelation at the 95% confidence level.

After, I perform a Local Indicators of Spatial Association (LISA) statistic to test for local spatial autocorrelation. A LISA statistic indicates the extent of significant spatial clustering of similar values around an observation. It provides a statistic for the similarity of each district in relation to its neighbours, ultimately revealing any presence of local clustering (Anselin, 1995). I run a univariate local Moran's I test on the mapped residuals to produce a cluster map and a significance map. Clusters illustrate regions where the model is significantly under- or over-predicting the district's level of NDP Support, and indicates hotspots of positive spatial autocorrelation (districts with high values surrounded by districts with similarly high values, or districts with low values surrounded by districts with similarly low values), or spatial outliers (districts surrounded by districts with dissimilar values) (Shin & Agnew, 2011).

5.2 Results

5.2.1 Mapping model residuals

Map 5.1 illustrates the distribution of the residuals from Quebec's OLS regression model. Residuals are evenly distributed across the quartiles, with one district as a lower outlier and one district as an upper outlier. It is clear, however, that the residuals do not have even spatial distribution. Areas where the model under- or over-predicts districts' NDP support seem to be concentrated in particular areas across the province. Districts in the lower quartiles (where the model over-predicts support, or where observed NDP support is lower than expected) are primarily found in the Capitale-Nationale and Chaudière-Appalaches region, and districts in the upper quartiles (where the model under-predicts support, or where observed NDP support is higher than expected) are primarily found north of the Island of Montreal in the Lanaudière and Laurentides regions, as well as in the Abitibi-Témiscamingue and Côte-Nord regions. The Island of Montreal itself sees a mix of residuals in different quartiles. The upper outlier is located in the Outaouais region, and the lower outlier is located in the Bas-Saint-Laurent region. The extent to which these observed spatial patterns are significantly regionalized is explored in the following analyses.



Map 5.1: Quebec model residuals by quartile with outliers

5.2.2 Global Moran's I

The mapped residuals has a statistically significant Moran's I value of 0.274 at 999 permutations (p = 0.001). This translates to a z-score of 3.56. The Moran's I scatterplot in Figure 5.1 visually depicts the types of spatial association the residuals are experiencing.

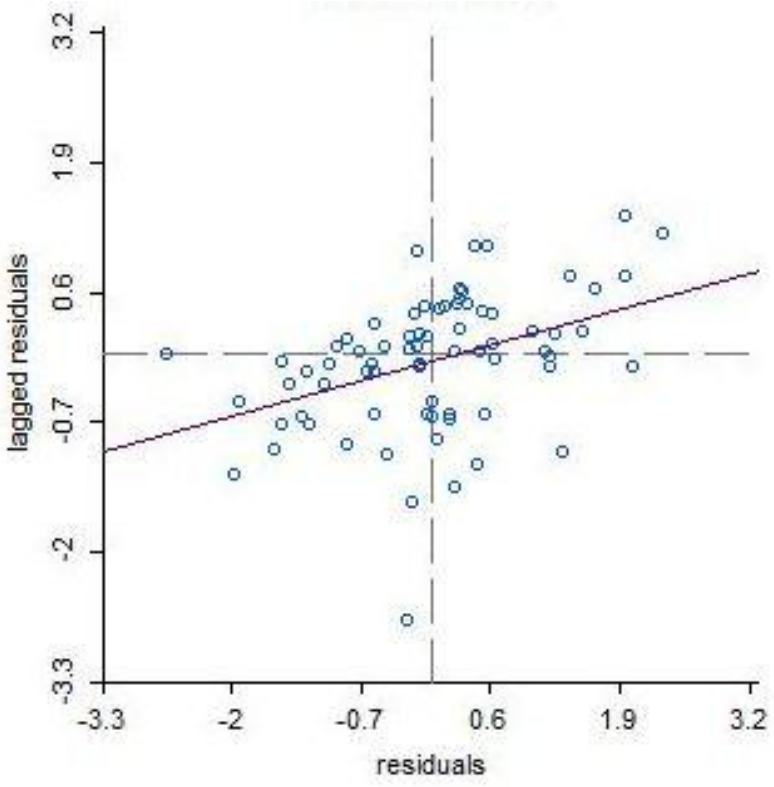


Figure 5.1: Global Moran's I scatterplot

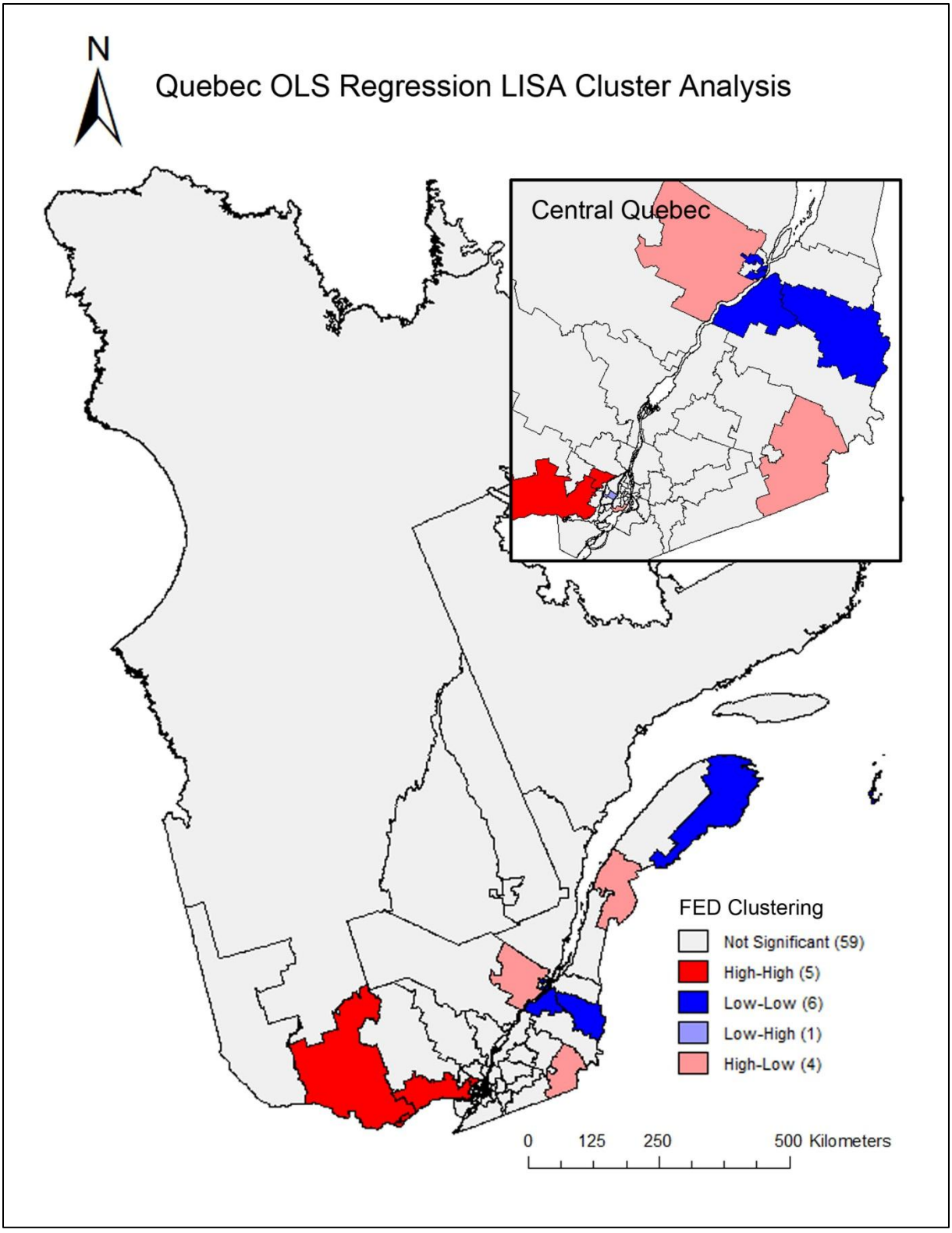
Points in the upper right quadrant depict districts with high residual values surrounded by districts with similarly high values, and points in the lower left quadrant depict districts with low residual values surrounded by districts with similarly low values. Points in the upper left and lower right quadrants depict districts that are surrounded by districts with dissimilar residual values. The Moran's I value takes the slope of the line.

These results indicate that there is slight significant spatial variation amongst all residuals from the model depicting NDP vote share in Quebec. I explore which individual districts experience significant clustering in the next section.

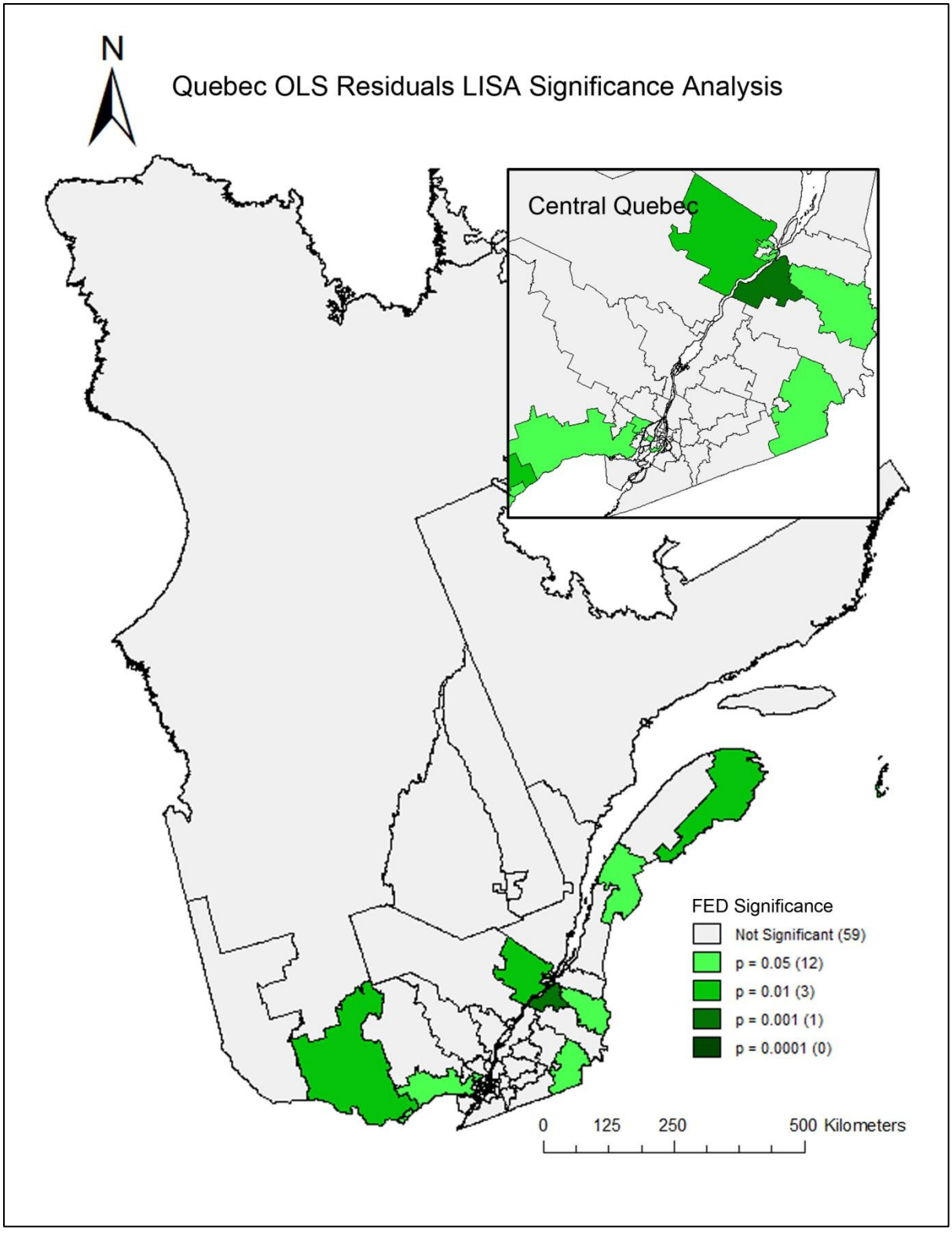
5.2.3 LISA – Local Moran's I

I perform a local Moran's I on the residuals to identify significant clusters of positive spatial autocorrelation or spatial outliers. Map 5.2 shows these clustered districts. Notably, there is spatial autocorrelation indicated by the clustering of low-low districts (districts with low residual values surrounded by other districts with low residual values) in the Capitale-Nationale and Chaudière-Appalaches regions, and the clustering of high-high districts in the Outaouais and lower Laurentides region.

Map 5.3 shows Quebec districts with significant local Moran's I values. The clustered districts in Map 5.2 are all significant at the 95% confidence level. These significant districts help produce the global result seen in the previous section.



Map 5.2: Hotspot map showing residuals' Local Moran's I score



Map 5.4: Significant local Moran's I districts

5.3 Discussion

The results clearly show slight significant spatial autocorrelation among the residuals, indicating that Quebec's OLS regression model is mis-specified. The model does not accurately account for variation in NDP vote share consistently across the province, indicating that not only is there regional variation between Quebec and ROC, but there is regional variation within Quebec itself.

Visually, residuals mapped in Map 5.1 appear to be clustered in particular regions. However, the local Moran's I significance test (Map 5.3) illustrates that many of the "low" and "high" apparent clusters are not significant. It is the significantly clustered districts that warrant further investigation. The clusters where model significantly under- or over-predicts can be compared with the levels of NDP vote share mapped in Map 4.1. The "low" cluster in the Capitale-Nationale and Chaudière-Appalaches regions comprises districts that have low levels of NDP vote share. These districts do not have NDP representation from the 2011 election (Map 3.3), and are mostly represented by the Conservative Party (Map 3.1). These districts had Conservative incumbents (Map 3.2). The "high" cluster in the Outaouais and lower Laurentides regions comprises districts that have high levels of NDP vote share, and do have NDP representation. These districts had Bloc, Conservative, and Liberal incumbents in the 2011 election.

These results signify that spatial autocorrelation is embedded within a variable – presumably NDP vote share itself. The misspecification of the model proves how voting behavior is spatially clustered and varies over places, due to the different local economic and political conditions that vary over Quebec and their influence on voters' decisions (Cox, 1987). A significant non-random voting pattern determines that local contextual effects are a determining factor in the Quebec electorate voting behaviour, and there is variation which cannot be captured with aggregate socioeconomic and demographic characteristics of a district. Further, the results suggest that, in some areas, districts' support (or lack of) for the NDP is affected by geographical proximity of one district to another or political legacy. The previously mentioned "low" cluster may have lower observed levels of NDP support because of the Conservative political legacy in the area. The "high" cluster may have higher observed levels of NDP support because of contagious diffusion stemming from the Hull-Aylmer riding in the Outaouais region,

which had the fourth-highest level of NDP vote share in the 2008 election (Elections Canada, 2011).

This finding locates the hotspots and outliers which can direct future research to further exploration and explanation. The spatial analytic techniques presented complement and extend research on Quebec's changing political landscape, and can be used to inform strategies for election surveys and interviews.

CHAPTER 6: Conclusion

Through analyzing the outcome of the 2011 federal election, this thesis identifies determinants of NDP support and notes their variance between Quebec and the rest of Canada. It indicates anchors of NDP support within a cleavage theory framework (Gidengil et al., 1999) and tests different theories of spatial variation in voting behaviour. After calculating general models for variation in NDP support in Quebec and ROC, it proposes directions for future research to further analyse vote share determinants in areas that do not fit the prescribed models.

Canada experiences a regional cleavage in voting patterns, most notably between Quebec and the rest of Canada. Cleavages in voting patterns are also seen in socioeconomic and demographic variables—districts in Quebec and ROC have similar compositions, but produce different electoral results. The two models include a different combination of socioeconomic and demographic characteristics to explain variation in NDP support, indicating strong cleavages in the two regions' electorates. Further, variables that are included in both ROC and Quebec models yield different directions of influence on variation in NDP support. Voting behaviour is easier to determine in ROC than in Quebec, as indicated by the regression models' goodness of fit. ROC's model accounts for 67 percent of variation in NDP support, whereas Quebec's model accounts for 46 percent of variation in NDP support. Quebec's electorate is more unpredictable, and more factors than the selected census variables intersect to determine political party support.

Some socioeconomic and demographic determinants of 2011 NDP support contradict previous scholarship, thereby reiterating that this election was peculiar and surprising. Quebec's regression model produced significant slight spatial autocorrelation amongst the residuals, indicating areas of party support that are significantly under- or over-predicted by the model. This presence of spatial autocorrelation biases the results of the OLS model by affecting assumptions of independence and residual autocorrelation in the error term. Support in areas which experience this autocorrelation may be caused by political legacy from an opposing party or contagious diffusion of NDP support stemming from districts with prior high support. Future research can delve further into the local-contextual factors which impact political party support in these areas. These results illustrate significant intra-Quebec variation, demonstrating how regional cleavages exist within Quebec in addition to across the country and concluding that provincial electorates cannot be analysed homogeneously. Local-contextual effects need to be analysed in electoral geography studies as party support can be rooted in territory.

This analysis is limited by the scope of the data. While studies solely using census data can determine broad trends in voting behaviour, many possible determinants of party support are left unacknowledged. The tripartite explanation of issues affecting voter behaviour in Canada (Section 2.2.3)—valence issues, party leader images, and partisanship—details how Canadian voting behaviour cannot be determined solely through socioeconomic and demographic characteristics. Incorporating pre- and post-election surveys from the Canadian Electoral Study would increase the sophistication of and add another dimension to this study. Finally, following trends of political legacy and contagious diffusion, the addition of districts' NDP vote share from the 2008 election may account for variation in 2011 levels that is not captured in the current models.

This thesis complements current scholarship on electoral cleavages and voting determinants in Canada. The conclusions founded on this study's empirical analysis add to theoretical knowledge of inter- and intra-provincial electoral cleavages, particularly within Quebec. It contributes to the limited literature on Quebec's NDP support, highlights particular areas of interest, and underlines the unusual political divide between Quebec and the rest of Canada in the 2011 federal election.

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APPENDIX A: Summary statistics for national NDP vote share (%)

Variable	Observations	Mean	Std. Dev.	Minimum	Maximum
NDP vote share (%)	308	30.8	14.1	9.1	71.2

APPENDIX B: Select 2006 census variables and summary statistics

Variables used with variable name and explanation

Variable	Explanation
Immigrant	% of immigrant populations in a district
High school education	% of populations who hold a high school diploma as their highest education achieved in a district
Young adults	% of populations aged 18-35 in a district
Middle class	% of pooled households with income between $40,000 - $70,000 in a district
Allophone	% of allophone populations (mother tongue neither French nor English) in a district
Married	% of married populations in a district
Population density	A district's total population divided by a district's area
NDP incumbent	Dummy variable, 1 = incumbent with NDP representation, 0 = incumbent with other party representation

Summary statistics for above variables by federal electoral district for all of Canada

Variable	Observations	Mean (%)	Std. Dev. (%)	Minimum (%)	Maximum (%)
Immigrant	308	17.74	16.46	0.53	67.53
High school education	308	20.57	2.66	7.12	25.57
Young adults	308	21.76	3.89	15.17	39.76
Middle class	308	10.30	1.88	5.72	14.08
Allophone	308	1.51	2.25	0	12.33
Married	308	39.20	6.72	13.49	51.26
Population density	308	1,344	2,083	0	11247
NDP incumbent	308	34 districts with NDP incumbents 274 districts with other party incumbents			

APPENDIX C: ROC OLS regression model's leverage threshold value calculation

$$leverage\ threshold\ value\ = \frac{3p}{n} \quad \text{where } p \equiv \text{parameters;}$$

$$n \equiv \text{observations}$$

$$= \frac{3(6)}{233}$$

$$= 0.077$$

$$rounded\ to\ 0.08$$

APPENDIX D: ROC OLS regression model without leverage observations (output)

Variable	Coefficient	Std. Error	t-statistic	p-value
Married	-0.99	0.16	-6.00	0.000
High school education	0.76	0.25	3.05	0.003
Allophone	1.04	0.29	3.64	0.000
Young adult	-0.69	0.22	-3.19	0.002
NDP incumbent	25.88	1.65	15.72	0.000
Constant	61.94	12.10	5.12	0.000
$R^2 = 0.65$	Total SS = 38658.89	F(5, 219) = 81.02	Prob > F = 0.000	

APPENDIX E: ROC regression model run on Quebec without young adult variable (output)

Variable	Coefficient	Std. Error	t-statistic	p-value
Married	-0.87	0.18	-4.98	0.000
High school education	1.82	0.54	3.38	0.001
Allophone	-1.25	0.63	-1.99	0.050
NDP incumbent	24.35	7.48	3.26	0.002
Constant	37.36	10.18	3.67	0.000
$R^2 = 0.39$	Total SS = 5517.97	F(4, 70) = 11.38		Prob > F = 0.000

APPENDIX F: Quebec OLS regression model's leverage threshold value calculation

$$leverage\ threshold\ value\ = \frac{3p}{n} \quad \text{where } p \equiv \text{parameters;}$$

$$n \equiv \text{observations}$$

$$= \frac{3(6)}{75}$$

$$= 0.24$$

APPENDIX G: Quebec OLS regression model without leverage observations (output)

Variable	Coefficient	Std. Error	t-statistic	p-value
Immigrant	-0.53	0.09	-5.98	0.000
High school education	2.66	0.55	4.85	0.000
Young adult	0.85	0.28	3.01	0.004
Middle class	-1.97	0.78	-2.52	0.014
NDP Incumbent	*omitted*			
Constant	3.75	17.01	0.24	0.814
$R^2 = 0.43$	Total SS = 5318.68	F(4, 69) = 13.03		Prob > F = 0.00