Université de Montréal

The Determinants of Intergovernmental Transfers in Canada, 1981-2001

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Département des Sciences économiques
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Mémoire présenté à la Faculté des études supérieures
en vue de l'obtention du grade de Maîtrise
en Sciences économiques

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Ce mémoire intitulé :

The Determinants of Intergovernmental Transfers in Canada, 1981-2001

présenté par

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Résumé

Ce mémoire analyse les déterminants des transferts du gouvernement fédéral canadien aux gouvernements provinciaux durant la période 1981-2001. Un estimateur à effets fixes pour chacune des années sous étude a été utilisé pour capter les mouvements dans la contrainte budgétaire fédérale. Les transferts per capita sont une fonction négative linéaire de la capacité fiscale des gouvernements provinciaux, une fonction positive linéaire du taux de chômage provincial, et une fonction négative linéaire du logarithme de la population. Les transferts sont aussi une fonction positive du vote pour le Parti Libéral. Toutefois ces quatre variables indépendantes sont fortement corrélées entre elles. Les données ne supportent pas l'hypothèse, qu'en préparation pour des élections, les parties au pouvoir transfèrent plus d'argent aux régions où la course est serrée. Les données ne supportent pas non plus l'hypothèse que la surreprésentation politique génère plus de transferts, du moins au niveau provincial.

Mots clés : transferts intergouvernementaux; achat de votes; politique Canadienne

Abstract

This thesis examines the determinants of Canadian Federal Government transfers to provincial governments from 1981 until 2001. Year fixed effects were used to capture shifts in the federal government's budget constraint. Per capita transfers are a negative linear function of per capita provincial government tax receipts, a positive linear function of a province's unemployment rate, and a negative linear function of provincial log population. Federal transfers are also a positive function of the Liberal Party vote share. However, all four controls are strongly correlated amongst themselves. There is little evidence that federal transfers are used strategically in the run-up to an election to purchase "swing" provinces. There is also little evidence to support the idea that political per capita over-representation generates higher transfers once the population size is controlled for, at least on the provincial level.

Key words: intergovernmental transfers; intergovernmental grants; vote purchasing; Canadian politics

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I would like to thank Prof. François Vaillancourt for guiding me through this exercise. He clearly places students at the top of his list of priorities, and they certainly benefit from his advice. His comments and attention to detail, even at the penultimate step, have greatly increased the quality of this work. Merci à vous.

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Abstract

This thesis examines the determinants of Canadian Federal Government transfers to provincial governments from 1981 until 2001. Year fixed effects were used to capture shifts in the federal government's budget constraint. Per capita transfers are a negative linear function of per capita provincial government tax receipts, a positive linear function of a province's unemployment rate, and a negative linear function of provincial log population. Politically, regions that support the government in power receive more transfers. These additional transfers are not distributed through the main transfer mechanisms, however. There is little evidence that federal transfers are used strategically in the run-up to an election to purchase "swing" provinces. There is also little evidence to support the idea that political per capita over-representation generates higher transfers once the population size is controlled for, at least on the provincial level.

Key words: intergovernmental transfers; intergovernmental grants; vote purchasing; Canadian politics

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1. INTRODUCTION

This thesis examines the determinants of Canadian federal government cash transfers to provincial governments during the period 1981-2001.

The primary objective is to estimate political influence in the transfer system, controlling for normative considerations and using an estimator that correctly accounts for institutional mechanisms in place. It has been pointed out, by Wallis (1996) for example, that if federal politics drive the allocation of resources the case for the centralization of the fiscal system is weakened.

This thesis also has a comparative objective: it was primarily motivated by a comparative paper written by Boex and Martinez-Vazquez (2004). They present an international comparison of the determinants of intergovernmental grants. Their paper does not include the case of Canada, so this thesis will serve to add to the international comparative literature. This paper will also serve to support the simple empirical model they propose, although some important issues about estimation are brought up.

The choice of the estimation procedure is quite important. It must attempt to capture the institutional mechanisms in place. The transfer system's major components must be estimated without bias, their functional forms correctly expressed. Only this way can political influence be detected.

Using a linear model, real per capita transfers are a negative function of provincial government per capita fiscal capacity, a positive function of the provincial unemployment rate, and a negative function of the log population. This model, has an R-Square of 0.80.

I test four separate political models.

Two of these models are pitted directly against one another in an attempt to describe strategic vote purchasing behaviour. The first is the "swing" model whereby in the run-up to an election the party in power will transfer monies to regions where there are many swing voters. The second model of political behaviour, the "constituent" model, suggests that parties in power will transfer monies to regions that support them.

I also test whether provincial level political over-representation generates more transfers per capita, all else being equal.

Finally, I use party vote shares to see if voting for any one of Canada's major parties generates additional per capita transfers.

The main political result is that the regions that voted for the party in power received extra transfers.

This thesis is divided into three main chapters. Chapter 2 is a literature review. It starts by explaining the pertinence of this exercise. Chapter 3 presents some basics on Canada. I also discuss the transfer system and describe the two main transfers, the Equalization transfer and healthcare transfers. This will lead to the development of an estimation strategy that correctly accounts for the institutions in place. Chapter 4 presents the econometric results.

Chapter 5 concludes.

2. LITERATURE REVIEW

Relevance of the research question

The research topic is relevant considering the importance of federal transfers in the Canadian national fiscal *system*.

First, consider the absolute magnitude of transfers. In 2000, direct (cash) grants from the central government to the provinces were $30 billion[1]. This represents 15% of the federal government's budget. This is a non-negligible fraction of federal public expenditures.

Second, consider the importance of transfers in provincial government budgets. Transfers represent 30% or more of total provincial government revenues for half of the provinces during the period under study, as will be shown in the next chapter.

Third, consider the overall importance of provincial governments in the national provision of public goods and services. Canadian provinces are responsible for delivering key programs, most notably education and healthcare. In fiscal year 2000, the federal government had expenditures of $200 billion. Combined, the ten provinces and three territories spent together $230 billion. Provincial expenditures in healthcare, education, and social security (in order of importance), totaled more than $150 billion. Even taking into consideration local (municipal) government spending, provincial governments account for almost 45% of total public expenditures in Canada.

Finally, another characteristic of the transfer architecture in Canada is that transfers flow from the higher levels of government to the lower levels of government. Here, one simple example will suffice. In 2001, the federal level transferred over $7,300 million to the Ontario provincial government. The Ontario provincial government, for its part, transferred $12,915 million to more local instances of government. Yet the Ontario provincial government transferred only $52 million to the federal government, and local governments transferred a total of $1 million to the government of Ontario.

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[1] Data sources are presented at the beginning of Chapter 3.

Overall, the point is that tax field occupation by certain levels of government and the division of expenditure responsibilities between these same levels of government are jointly determined. Economic efficiency, cost-minimization, administrative feasibility, and appropriate revenue/expenditure matching may push the collection/spending equilibrium in different directions. In the Canadian case, it seems as though the optimal fiscal arrangement is one where more central levels of government occupy and administer the main (lucrative) tax fields only to redistribute, through transfers, a portion of this money to more local instances of government. So the transfer from the federal to the provincial governments is an important part of the overall national fiscal system and certainly an important policy tool.

To conclude the discussion on the relevance of the research topic, I use the words of Wallis (1996) who puts it quite well:

> Intergovernmental grants have become a major part of the fiscal structure. They exist for social and economic reasons that reflect the interests of the electorate, for public finance reasons that reflect the benefits from centralized collection of revenues and decentralized administration of expenditures, as well as political reasons. Grants represent tangible benefits that can be delivered by politicians. For all these reasons grants will continue to be used for a long time, and their determinants will reflect the complex interaction of economic, fiscal, and political forces.

Literature review

The review of the literature is organized as follows. I first present the results from Boex and Martinez-Vazquez (2004), as their paper is the central piece of literature to which this thesis responds. I will then discuss the main normative determinants, some of the principle fiscal and economic determinants, as well as present the relevant political determinants present in the literature. I will finally look at two specific papers that offer alternative procedures in estimating political influence.

Boex and Martinez-Vazquez (2004)

Boex and Martinez-Vazquez (2004) state,

> [...] The general empirical approach followed by the incidence studies in the literature is basically identical. The empirical studies that analyze the distribution of intergovernmental grants across subnational jurisdictions generally consider that the per capita amount of grants received by some local government *i* (PC GRANT) is determined by four factors, including local expenditure needs (NEEDS), some measure of revenue capacity or revenue effort (REVENUE), a variety of political factors (POLITICS), and/or the relative population size of the jurisdiction (POP). This relationship my be represented in linear form as:

$$\text{PC GRANT}_i = \beta_0 + \beta_1 \text{NEEDS}_i + \beta_2 \text{REVENUE}_i + \beta_3 \text{POLITICS}_i + \beta_4 \text{POP}_i + \varepsilon_i$$

They identify 12 papers that analyze intergovernmental grants, or rather they look at 12 different countries. The Boex and Martinez-Vazquez (2004) review shows that the kind of model they examine can generate an adjusted R-Square of 0.9.

Some of the studies use state/province dummies in cross-sectional analysis, so it should not be so surprising that these R-Squares should be so high. The comparative results they present are shown in Table 1 here:

Table 1: Table 1 taken from Boex and Martinez-Vazquez (2004)

	Expenditure needs	Fiscal capacity	Political power	Population size	R^2
Argentina	Pop.density: -	Income: -	Political rep.: + Political support: +	Population: -	0.88
Australia	Exp needs ratios: +	*ns*	Political rep: +	*ns*	0.90
Brazil	*ns*	Income: +	Political rep.: +	*ns*	0.90
Indonesia	Poverty: + Reg. prices: +	GRP: +	*ns*	*ns*	0.23
Israel	Dependent population: +	Local deficit: +	Political support: +	Population: -	0.64
Japan	Urban: *ns*	Income: +	Political rep.: +	*ns*	0.97
Mexico	HDI: +	HDI: +	Political rep.: + Political support: +	*ns*	0.79
Nigeria	Poverty: NS Pop Density: NS School-aged: NS	Fiscal capacity: +	*ns*	Population: -	0.63
Russian Federation	Social service delivery index: +	Profits: -	Spec.Status: + Political support: -	Population: -	0.62
Tanzania	Poverty: + School-aged: +	HH expend: +	Urban: +	Population: -	0.52
Uganda	Pop density: + Poverty: -	Poverty: -	*ns*	Population:-	0.62
United States	Urbanization: -	Income: +	Political support: +	*ns*	0.73

Sources: Argentina (Porto and Sanguinetti 2001); Australia (Worthington and Dollery 1998); Brazil and Mexico (Kraemer 1997); Indonesia (Brodjonegoro and Martinez-Vazquez 2004); Israel (Alperovish 1984); Japan (Meyer and Naka 1999); Nigeria (Alm and Boex 2001); Russian Federation (Treisman 1996); Tanzania (Boex 2003); Uganda (LGFC 2003); and the United States (Wallis 1996)
Source: Boex and Martinez-Vazquez (2004)
Note: *ns*: not significant
Note: HDI: Human Development Index
Note: GRP: Gross Regional Product
Note: HH: median regional household consumption expenditure levels

Normative determinants

Boex and Martinez-Vazquez (2004, 467) state "[…] The empirical literature broadly supports the normative notion that local governments with higher expenditure needs should receive larger transfers…"[2].

What exactly are these normative notions? The most important one is presented here.

Horizontal Equity:

One of the main roles of government is to transfer wealth (or revenue) from the rich to the poor. This can be accomplished through direct transfers to individuals (i.e. welfare, old age pensions, family allowances). Another policy instrument is the transfer from the central level of government to "poor" provincial governments.

The classic reference is Buchanan (1950) who argues for the equalization of fiscal "residua" across provinces for individuals of equal revenue. A fiscal residuum is the difference between what a citizen receives in benefits and what he/she pays in taxes. The residuum is also referred to as the "net fiscal benefit".

What's important is that an individual who earns, say $35,000, receive the same net fiscal benefit (residuum) regardless of the province he lives in. A rich person should not be penalized by lower than average public services because his neighbours are poor. The unemployed should not have the opportunity to 'free ride' by moving to areas of greater prosperity that offer more public services. So transfers from the federal government, by allowing poorer provinces to supply more public goods than they could on their own, may help "equalize" the residua of individuals of equal position (i.e. of the same revenue) in different provinces.

Yet Boex and Martinez-Vazquez (2004, 469) point out: "Perhaps one of the more surprising facts uncovered by the current comparison of international practices is the finding that the impact of local revenue capacity on intergovernmental grants is generally positive. In almost all countries reviewed, wealthier local governments

receive greater intergovernmental transfers while poorer local governments receive smaller transfers". So the coefficient on the REVENUE variable is sometimes positive, although we would expect a negative relationship.

They attribute this counter-intuitive result to this notion of "net fiscal incidence". Imagine that a rich province generates an average of $4 per person in taxes for the central government, while another poorer one generates only $1. Central government revenues are thusly $5. Let's say the central government transfers $3 to the rich province and $2 to the poor province. Redistribution has occurred even though the richer province received more money. Income redistribution cannot be measured by how much more a poor province receives in relation to another in *absolute* terms, but rather it must be measured by how much more it receives *in relation to* how much it contributes to the central treasury. Thus, say Boex and Martinez-Vazquez (2004, 470), "even in countries where we find a positive relationship between subnational revenue capacity and intergovernmental grants, on balance the system of intergovernmental fiscal relations might in fact still be redistributive when considering both the incidence of revenue collections together with the incidence of transfer flows".

It is possible, though, that this problematic result may be due to incorrect econometric specification, which we shall discuss at some length later on. For now it will suffice to say, as Wallis (1996, 19) does, that "The effects of income and urbanization on grants appear to be perverse in a simple pooled-cross sectional regression, but inclusion of fixed effects and accounting for simultaneous grants and local expenditures solves the problem."

Fiscal and economic determinants

It is not quite evident at first to see why a (federal) government should transfer money or tax points to sub-national governments if expenditure obligations and tax revenues are well aligned to begin with. Indeed, if municipalities, provinces, and federal governments tax exactly what they need in order to fulfill their obligations towards their

citizens, one may question the role or necessity of transfers. Unfortunately, this ideal situation is rarely, if ever, achieved – and politics do get in the way.

This section provides both theoretical arguments as to why transfers *should* exist and factual examples of why transfers *do* exist. This section is not a review of the extensive literature on fiscal relations in a federal setting. It is intended to provide the non-specialist with some basic theory and real-world examples. There are many more determinants than are listed here. Those that are highlighted were kept because they are most relevant for the Canadian case and the exercise at hand.

Efficiency:

Economists are often concerned with market efficiency. Traditional market failures such as monopolies or externalities may best be addressed through national legislation. Yet transfers may correct certain other types of market failure, for example failure in the labour market (described further on).

Administrative costs:

In some cases, particularly for small provinces, total administrative costs may be lowered if the federal government collects a province's taxes (sometimes for a fee) and then hands over the money. Such is the arrangement between 9 of Canada's 10 provinces for which the federal government collects personal income tax, and 7 of Canada's 10 provinces for which the federal government collects corporate income tax. One province, Québec, collects its own personal income and business taxes, so that residents and businesses must file two income tax returns. The Canadian federal government also collects provincial sales taxes in three of the four[3] Atlantic provinces, while in Québec the provincial government collects the federal sales tax and surrenders the monies to the central level. In these arrangements administrative duplication is eliminated, reducing the cost of tax collection and increasing absolute yields. Some benefits may also arise from the national harmonization of the tax system.

Such arrangements do not count as transfers here. Rather they are simply administrative agreements.

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[3] Prince Edward Island is the province for which this does not apply.

Merit goods:

A merit good is one that an "outside analyst" views as important but is not considered important by the local population. Vaillancourt (1999) proposes that "a given service may be seen as a merit good by a majority of the national population but not by a majority in each subnational jurisdiction". Either way, sub-national governments will under-provide these public services as compared to the quantity that is considered "optimal" from a national perspective.

Vaillancourt (199) suggests this is behind minority language education in Canada, as financed through the Official Languages Act. This piece of legislation provides funding for French language primary and secondary education in Canada's nine English speaking provinces, and provides funding for English language education in French-speaking Québec. Ontario, for example, has a francophone minority that is 500,000 strong, and New Brunswick has a francophone minority community of almost 250,000 individuals, a full third of its population (Paillé 2000).

Externalities:

Sub-national governments may sometimes engage in activities that generate externalities for the nation or immediate neighbours. Central governments may transfer money to sub-national governments that produce negative externalities in order to get them to stop or reduce these harmful activities. In the case of positive externalities, for example in post-secondary education, transfers would encourage the province to increase the level of beneficial activities.

Labour mobility:

The mobility of labour, particularly that of college graduates, may justify central government intervention in higher education. Indeed, obtaining a college degree greatly increases an individual's mobility, especially in the first few years after graduation (Burbridge and Finnie 2001). This becomes problematic for publicly funded higher education, especially if education is the responsibility of sub-national governments: the human capital financed by the state/province leaves. In this case, it may be appropriate

for the central government to intervene in funding higher education, as the benefits of this higher education spreads around the country - yet are being paid for by local taxpayers. States/provinces that have net migratory outflows[4] will thusly under-provide higher education as compared to what is considered optimal on a national level. Thus transfers from the central to the sub-national government may correct for this problem.

This reasoning leads us to an interesting theory for Québec. If French speakers are less nationally (or internationally) mobile than their English counterparts in the rest of Canada, then the natural consequence is that universities in Québec should receive fewer transfers from the federal government in this domain[5].

Broadway and Flatters (1982) also suggest that "free migration [may] eventually lead to an inefficient allocation of labour over the federation" if there are variations in net fiscal benefits across provinces. In this case equalization can correct this inefficiency (in addition to responding to equity arguments). The fact that migrants respond to net fiscal benefits implies that migrants in this environment do not behave in such a way to equalize the marginal product of labour across the country; they base their mobility on the incorrect signal. The equalization of the marginal product of labour across provinces describes its optimal allocation. It is undesirable that workers migrate in response to differentials in net fiscal benefits, since this movement will reduce the marginal product of labour in zones of immigration and increase it in zone of emigration, taking us away from the optimal allocation (if this optimal allocation were already achieved). Thus Equalization will allow labourers to respond to the correct market signal, namely the marginal product of labour.

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[4] It is not clear how a state/province with net migratory inflows would behave. One could posit that this sub-national government would also underprovide higher education. On the other hand it need not invest in its local population if enough human capital is being "imported".

[5] Bird and Vaillancourt (2004) suggest this idea as it pertains to overall labour mobility. Francophones face greater obstacles when moving, namely they do not speak the local language (English) if they were to migrate outside Québec. Thus there are fewer chances that migratory externalities will arise from this group.

Political determinants

In this section I present the main classes of political determinants. I first start with one counter-example to show how rich the literature is.

Silencing dissenting regions:

Treisman (1996) examines the factors that influence grants and transfers in post-Soviet Russia. Much like this study, he examines social needs, fiscal capacity, and political representation but finds that the most significant determinants are of a political nature. He says: "If a region's leaders declared sovereignty as early as 1990, this seems to have earned it on average about 18,600 roubles[6] per inhabitant in additional transfers and tax breaks in 1992."

He also remarks that if a region voted heavily against Boris Yeltsin in the 1991 election, it received more per capita grants in 1992. Moreover, if a region's workers imposed a costly strike, it also received higher per capita grants. "Together, these results suggest that in the early Post-Soviet period, challenging Moscow – whether by elite declaration, mass action or public voting – paid off far better than complaisance".

Policy coercion:

Policy coercion is most notably achieved in developed countries through the use of conditional or matching grants. Matching grants are widely used in the United States for example, as noted by Wallis (1996).

In a conditional grant, the central government offers a transfer as long as the money is spent on programmes meeting specific criterion (ex. hospital infrastructure development). This is a way for federal governments to achieve ambitious national objectives without having to increase their own payroll significantly and it allows some (optimal) local variation in distribution methods. By accepting this transfer, sub-

[6] In June 1992, the exchange rate was 125 roubles/USD$1. So this amount would have been the equivalent of USD$130, or about CAD$110. Note that immediately after exchange rate liberalization in 1992 Russia experienced massive hyperinflation. Russia also had a currency crisis in 1998.

national governments understand that this money must be earmarked for certain specific expenditures.

Matching grants add a slight nuance: in these grants central governments match provincial expenditures on a dollar-for-dollar basis for certain specific programmes. Total federal outlays usually have a limit for each province. Matching grants thusly provide an incentive for sub-national governments to align their expenditures with the federal government's policy objectives. In Canada, matching grants have been called "shared-cost programmes" (Perry 1997, 173).

An important point to note is that matching grants or shared cost programs generally favour richer provincial or state governments. Indeed, the more a sub-national government spends, the more grants it can receive, and the governments that can afford to spend more are generally richer. In Canada, this has been one of the major criticisms of (the now defunct) shared-cost programmes, since poor provinces "could neither afford to accept nor to reject such grants" (Perry 1997, 204).

Political over-representation:

This is one of the most well-known and well-documented political determinants of intergovernmental transfers. From Table 1 it is clear that this factor is influential in at least 5 countries. Boex and Martinez-Vazquez (2004) say: "In virtually all countries reviewed with district-based political systems, disproportionate political representation (greater representation per capita) consistently results in greater per capita intergovernmental transfers."

Political over-representation occurs in two ways. The first when provinces (or states) of a country each send the same number of representatives to a legislative chamber. This typically occurs in the upper chamber of a bi-cameral legislative system. In the United States, for example, each state sends two Senators to the Senate. This naturally leads to greater per capita political representation for less populous states.

The second way in which political over-representation is induced is when small provinces are allocated a minimum number of representatives. This is the case in Canada with Prince Edward Island, which is guaranteed at least 4 MPs (Evans 2005).

Porto and Sanguinetti (2001) suggest that the first effect is generally stronger than the second. It can be added that the first effect becomes more important as the policy input of the upper chamber increases.

Atlas et al. (1985) documents this effect in the United States.

Porto and Sanguinetti (2001) document this effect in Argentina.

Most recently, Evans (2005) measured this effect for Canada. He does not, however, look at transfers, which is the exercise here. He examines federal expenditures and levels of taxation. There is indeed some variation in average representation per capita across Canadian provinces, but there is an even greater variability in representation per capita *within* each province. He finds a positive effect of over-representation, even controlling for income per capita. He estimates, using provincial-level data (there are three estimations on three different data sets) that one fewer person per electoral riding generates an extra $0.03 per person in spending. At the mean electoral district size this is an increase of $2,880 in total. He also finds that districts with fewer people are taxed less, even controlling for per capita income.

Purchasing "swing" regions in preparation for an election:

This theory was formally developed by Lindbeck and Weibull (1993) and Dixit and Londregan (1996). Henceforth I will refer to this model as the "swing" model. This theory states that in the lead-up to an election the party in power will transfer monies to regions where the race is tight, in other words "swing" regions (or where there are many swing voters). This strategy maximizes the marginal political payoff of transfers. Indeed, it makes no sense to throw money at states/provinces one knows one will lose, but it can certainly help turn the tide if polls show the party in power is only slightly behind.

Dahlberg and Johansson (2002) state that the Lindbeck-Weibull/Dixit-Londregan model "further predicts grants to be targeted at regions with low income, since voters with low income have higher marginal utility of income and thus can be more easily persuaded to vote for a party promising them high transfers than high-income earners".

Rewarding constituents:

This theory was formally developed by Cox and McCubbins (1986). I will refer to it henceforth as the "constituent" model. This model proposes that central governments allocate transfers to regions where they already have high support. Indeed, a risk-averse government will transfer money to its supporters, somewhat less to intermediate regions ("swing" regions), and not at all to regions where there is high opposition.

Boex and Martinez-Vazquez (2004, 470) state: "Furthermore, greater political support in a region of the national government is almost always rewarded by greater grants as well".

Population

Boex and Martinez-Vazquez (2004, 470) state: "A final factor that influenced the allocation of intergovernmental resources with impressive consistency is the size of the subnational jurisdiction's population. In every empirical country study in which population was included as an independent variable, local governments with larger population received significantly fewer per capita grants".

In the case of population density, it is argued that lower population densities increase the per capita cost of delivering public services, such that a geographically uniform distribution of public services requires larger per capita transfers to less populated areas.

Alternative methods of estimation

The Boex and Martinez-Vazquez (2004) paper suggests a linear estimator. This is not the only possible estimation strategy available. This section presents in a little more detail two papers that offer alternative estimation procedures and the rationale behind their estimators.

Wallis (1996):

This paper analyses the allocation of grants in the United States. The main contribution of this paper to the literature is econometric. What's more, this paper uses panel formatted data – many of the papers reviewed by Boex and Martinez-Vazquez (2004) use cross-sectional data only.

It will be useful to paraphrase the paper here:

> One model of the grant process pictures federal government officials structuring grant allocations to maximize the value of those grants to themselves and/or their constituents. Congress decides the formula under which some grants will be allocated and the executive branch has discretionary control in the awarding of other grants. This translates into estimating an equation of the form:
>
> (1) $FG_i = \alpha + \beta E_i + \gamma P_i + \varepsilon$
>
> where FG_i is per capita federal grants to state i, E and P are vectors of economic and political variables; and the error term, ε, is a normal white noise error.
>
> Equation (1) is not, however, an accurate representation of how the grant allocation process actually works. Grants are typically allocated through a series of formulas that include factors like population, income, or highway mileage, as well as measures of state (or local) financial participation. [...] At one extreme, with strict matching, federal grants are simply a linear function of state expenditures. [...] Many grants fall short of strict, open ended matching formulas, but many involve some attempt to reward states that make a larger effort to cooperate with the federal goals by rewarding those states with larger per capita grants.
>
> States also differ in ways not captured by economic or political variables, or captured only imperfectly. These persistent differences between states produce significant differences in state fiscal activity, as well as persistent differences in gains. These "fixed effects" can be controlled for if we have a panel data set that varies over time.
>
> A more appropriate[7] set of estimating equations are:
>
> (2) $FG_{it} = \alpha_g + \beta_1 SX_{it} + \beta_2 E_{it} + \beta_3 P_{it} + \varepsilon_i + \varepsilon_t + \varepsilon$
>
> (3) $SX_{it} = \alpha_s + \lambda_1 FG_{st} + \lambda_2 Z_{it} + + \varepsilon_{si} + \varepsilon_{st} + \varepsilon$

[7] The coefficient notation has been modified from its original format

> where i subscripts refer to states and t refers to time, SX is state expenditures, Z is a vector of variables explaining state expenditures, and ε_g's are the errors for the state expenditure equation.
>
> If equation (1) is estimated when equations (2) and (3) are true then equation (1) estimates will suffer from several defects. One will be omitted variable bias. This may be a problem for all variables, but it turns out to be particularly important for some of the political variables. The political variables tend to be stable over significant periods of time and are correlated with ε_i and ε_t. The coefficients on the political variables, therefore, are sensitive to the specification of the error term.
>
> Second, even if state and local expenditures are included as economic variables in equation (1), the estimates will suffer from simultaneity bias. This turns out to be important for a number of coefficients, the most important being per capita income. [...] If states with higher incomes tend to spend more on social welfare, then estimates of equation (1) will tend to show that states with higher incomes receive higher grants, in direct contradiction to the stated goals."

Thus anytime a fiscal system contains large conditional or matching grants a two-stage least squares estimation (2SLS) approach is warranted. Simultaneity bias is a well-known econometric problem, and the 2SLS estimation procedure is its standard solution.

Islam and Choudhury (1990) test the exogeneity of grants to Ontario municipalities and find that OLS and 2SLS estimates differ significantly, indicating the presence of an endogenous variable (spending). Thusly the issue of simultaneity bias must be taken into account.

Dahlberg and Johansson (2002):

Dahlberg and Johansson (2002) examine the distribution of an ecological sustainable development grant to municipalities in Sweden. I discuss this paper because it pitted political behavioural models against one another.

In this paper the authors look at the distribution of a "specially designed support program intended to support, by means of intergovernmental grants, local investment programs aimed at an ecological sustainable development and to increase municipal employment". Municipalities had to apply to the grant program. Only municipalities

were eligible. Projects had to be submitted with fully detailed proposals, contribute to ecologically sustainable development, and increase employment in the municipality.

This transfer was apt for vote-purchasing analyses for three reasons. First these transfers were allocated a few months before the Swedish elections. Second, there was no explicit formula determining how the grants should be allocated. The government in power decided which of the applying municipalities received a grant and in what amount. Third, it was easier to "disentangle any possible strategic use of grants from the equity and efficiency purposes typically attached to intergovernmental grants". In other words they did not have to control for traditional normative considerations as they focused on a single transfer.

In this paper they tested whether the Lindbeck-Weibull/Dixit-Londregan "swing" model best fitted the central government's behaviour or whether the Cox-McCubbins "constituents" model was more appropriate.

Dahlberg and Johansson (2002) employed a probit estimator as their econometric strategy. They estimated the probability that a municipality received a grant given certain independent variables. They first ran the model with variables that captured the effects of the CM model. They then run the same model, except that political variables were replaced by metrics that captured the LW/DL model.

The data did not support the Cox-McCubbins model: some variables were significant but of incorrect sign. Yet there was evidence to support the Lindbeck-Weibull/Dixit-Londregan model of government behaviour.

Other[8] than the tightness of the race, the authors find that lower unemployment rates, higher environmental ratings, and a larger number of green party voters all increase significantly the probability of receiving a grant. It is interesting then that a

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[8] Dahlberg and Johansson (2002) add several important nuances to the debate taken from the literature, although this discussion is relegated to a footnote. Some papers suggest that the absolute amount of resources transferred is not what matters most to the electorate but rather the number of projects (i.e. the number of different transfers) is what counts. The literature also allows for electorate "awareness" of monies transferred, and the literature suggests a positive relationship between the number of projects and electorate awareness. Thus with "awareness" a role for the media is implicitly allowed.

program designed to create employment and help the environment is exploited by those cities that have no employment problems and are already clean. This may be due to endogenous selection: richer cities have the resources to draft interesting proposals, or cities already deeply concerned with the environment are the most likely to apply for such a "sustainable development" program.

Overall, their approach differs from the one here in its scope. Dahlberg and Johansson (2002) look at vote purchasing behaviour of one particular grant mechanism. They claim their approach is appropriate since the equity or efficiency arguments usually involved are absent. The task of this thesis is to correctly *control* for the usual efficiency/equity mechanisms in political estimates.

3. INSTITUTIONAL MECHANISMS AND MODEL

In this chapter I present some basics on Canada and on its transfer system. Presentation of the main transfers will inform us on how to control for the institutional mechanisms.

I will also discuss the political institutions. This will allow correct modeling of political variables in the Canadian context.

I will then present the four variable linear model. Three variables are fiscal or economic in nature. The fourth is political.

Data sources

The main fiscal and economic data are from Statistics Canada. They are (with the specific series number):

- Federal to provincial government transfers: CANSIM 384-0011
- Provincial government revenues and expenditures: CANSIM 384-0004
- Provincial GDP, nominal prices: CANSIM table 384-0001
- Population: CANSIM 051-0005
- Other provincial data, namely unemployemt: CANSIM 384-0013

In all, there are 210 observations in the data set, each of the ten provinces for 21 years.

Electoral district (riding) level data for every federal election since 1979 were provided by the Library of Parliament.

A note on the sample and period selection

The sample ends in 2001 because at the time of writing this was the most recent available and reliable data. Equalization transfers, for example, are only final at best two years after first disbursement.

The choice of the start date was made considering changes to national accounting practices. The way in which provincial GDP was calculated changed in 1981[9]. It was not thought of as convenient to have to transform or convert older versions of GDP figures into new or vice-versa. So the data was selected to ensure consistency.

The sample also includes only the ten Canadian provinces. Canada also has 3 territories (Yukon, Northwest Territories, Nunavut). Nunavut was born on April 1, 1999, so the territory is new. Tax and transfer arrangements with these territories are different. Indeed, the territories have their own financing deals, which means we would have to properly control for these institutions when examining the political aspects. In terms of per capita transfer payments, these three territories received an average of $17,050 in 2001. This sum of money is substantially greater than the $500-$2,800 figure for the provinces[10]. Yet because of the small population this amounts to less than 4% of total federal transfer monies during our sample period. Moreover, the total population for these three territories is just shy of 100,000 inhabitants[11]. The economic activity there, considering its remoteness, does not significantly add to the dynamics of the Canadian economy (although the discovery and exploitation of diamonds and oil might change this). Yukon is close to Alaska, but Canada's economic activity is mainly channeled through a west-east corridor parallel to the *southern* US border. Lastly, these three territories send only one Member of Parliament each (Evans 2005), so an analysis of strategic political behaviour will be of little value.

Finally, the time period under study is suitable for analysis because it has been a time of relative stability in the transfer system (in terms of per capita amounts). It is quite appropriate here to take one moment's pause to present the historical forces that have brought us to where we are today. The period 1981-2001 does not exist in a vacuum.

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[9] In 2002 Statistics Canada decided to review provincial economic accounts by adopting the chain Fischer formula. These changes were to extend retro-actively to 1981. See Statistics Canada website, "Latest development in the Canadian economic accounts", released November 7, 2002.

[11] Statistics Canada CANSIM table 051-0001

Perry (1997, 99) describes the three broad periods of the postwar ear. Between 1947 and 1957, Ottawa and the provinces entered into "tax rental" agreements, whereby the federal government literally "rented" tax bases for fixed amounts. 1957 saw the start of tax sharing, whereby the federal government and provinces shared personal and corporate income taxes, with provinces being allocated an ever-increasing portion of the pie. In the third and final phase[12], "After the conclusion of the negotiations for the 1977-1982 period, the federal government would no longer offer additional tax room to the provinces. In fact, Ottawa was not in a position to offer the provinces additional resources in any form. The federal government turned instead to fine-tuning the cash transfers to ensure that it was able to meet its minimum objectives in the most economical fashion". This fine-tuning is the state of affairs today.

Some basics on Canada

The following tables presents some basic economic and demographic statistics on Canadian provinces, sorted from Canada's eastern most to western most provinces.

Table 2: Basic statistics on Canadian provinces, 2001, sorted from east to west

	Real* GDP (millions of $CAD)	Population	Real* per capita GDP	Real* per capita provincial government own revenues (excludes transfers)	Real* per capita cash transfers
Newfoundland and Labrador (NL)	12,400	525,380	23,557	3,702	2,809
Prince Edward Island (PE)	3,030	136,393	22,206	3,803	2,813
Nova Scotia (NS)	22,700	933,527	24,347	3,505	2,137
New Brunswick (NB)	18,100	749,715	24,156	4,088	2,323
Québec (QC)**	203,000	7,374,065	27,499	5,130	1,386
Ontario (ON)	395,000	11,800,000	33,537	4,537	582
Manitoba (MB)	30,800	1,148,525	26,792	4,894	1,845
Saskatchewan (SK)	29,300	1,003,688	29,169	4,777	1,437
Alberta (AB)	132,000	3,028,773	43,516	6,513	620
British Colombia (BC)	115,000	4,055,195	28,390	4,952	695
Canada	**961,330**	**30,755,261**	**31,268**	**4,967**	**1006**

Source: Author's calculations from Statistics Canada data. See *Data sources* section for data sources.

* 1992 dollars

** Includes the 13.5% abatement of the basic federal income tax. See *Calculating the value of the Québec abatement* for explanations.

The reader should note several elements from this table. The richest province by far is Alberta, with GDP per head of $43,000. Alberta is fortunate enough to hold vast oil and natural gas reserves (the second largest in the world after Saudi Arabia[13]). It recently managed to pay off all of its provincial debt[14]. Ontario is Canada's second richest province, with GDP per head of $35,000. Ontario, however, is far more populous and thus has total GDP almost four times that of Alberta's. Ontario's economy is twice as large in absolute terms as Canada's second largest province, Québec, and contributes 40% of Canada's total output. Québec, British Colombia, and Saskatchewan follow with GDP per head of around $28,000. Canada's four eastern most provinces are also its poorest. GDP per head in these provinces is in the $23,000 range.

A quick glance at the data indicates that Canada's transfer system is equalizing, i.e. the poorest regions receive the most per capita transfers.

Types of transfers in the Canadian federal arrangement

In Canada, there are two main types of transfers from the federal government to local (provincial/municipal) governments, although other arrangements are possible:

- Cash transfers
- Tax point "transfers"

In the first case, money is simply transferred. Cash transfers may be conditional or unconditional.

In the second case, the central authority leaves a certain "tax space" and permits the sub-national government to fill the void. For example, imagine a province that has a 10% sales tax, half of which is imposed by the province, the other half of which is imposed by the federal government; both levels of government tax the same transaction at 5%. The central government may, instead of transferring cash, reduce its sales tax by, say, 2% so

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[13] *The Economist*. September 10th, 2005. Volume 376, no.8443. Pg.37.
[14] Idem.

that the province can raise its sales tax by 2%. So money no longer changes hands, but the federal government has foregone some revenues to the province's benefit.

The transfer data here are cash transfers only, with the exception of Québec which receives a tax point transfer in lieu of cash (see *Calculating the value of the Québec abatement*).

Composition of transfers

For this study, transfer data was taken from Statistics Canada. These transfers, as defined by Statistics Canada, are:

- Canada Assistance Plan
- Statutory grants
- Taxation agreements (≈Equalization)
- Postsecondary education grants
- Contributions under the Hospital Insurance Act
- Health Resources Fund
- Regional economic expansion payments
- Official languages
- Contributions under the Crop Insurance Act
- Canadian Health and Social Transfer
- Miscellaneous current transfers
- Medicare
- Transfers to provincial universities

Two transfer categories represent 80% of total transfers in Canada at the end of the period of observation. They are Equalization and healthcare transfers (see Table 3).

Table 3: General transfer components in 2001, billions of dollars

Transfer	Amount ($billions)	Share
Equalization	12.2	34%
Healthcare and social[15]	16.7	46%
Other	7.2	20%
TOTAL	**36.1**	**100%**

Source: Author's calculations from Statistics Canada data

[15] $14 billion of which is the CHST.

Thusly particular attention will be paid to the functional form of the Equalization transfer and healthcare transfers.

Transfers to provincial universities, although they are not direct transfers to provincial governments, are included in the analyses. The mobility of highly qualified researchers and the positive externalities they generate for Canada as a whole are sound economic reasons for federal intervention. These monies are in addition to what provinces give Canada's public universities (there are no private universities of significance in Canada). One could suggest that the federal government is intruding on provincial jurisdiction (education). For these reasons this transfer is included in the calculations.

The following table provides summary statistics on transfers from the central level of government to provincial governments. The table is ordered from the eastern-most to the western-most province. The metrics are: per capita transfers, measured in Canadian Dollars[16], and in nominal terms; transfers as a percent of total provincial government revenues including transfers (so that 50% means the provincial government receives as much money from Ottawa as it is able to collect in "own source" taxes on its territory); and transfers as a percent of provincial GDP.

[16] A simple rule of thumb puts $1USD=$1.25CAD.

Table 4: Basic characteristics of federal government transfers, 1981-2001, sorted from east to west.

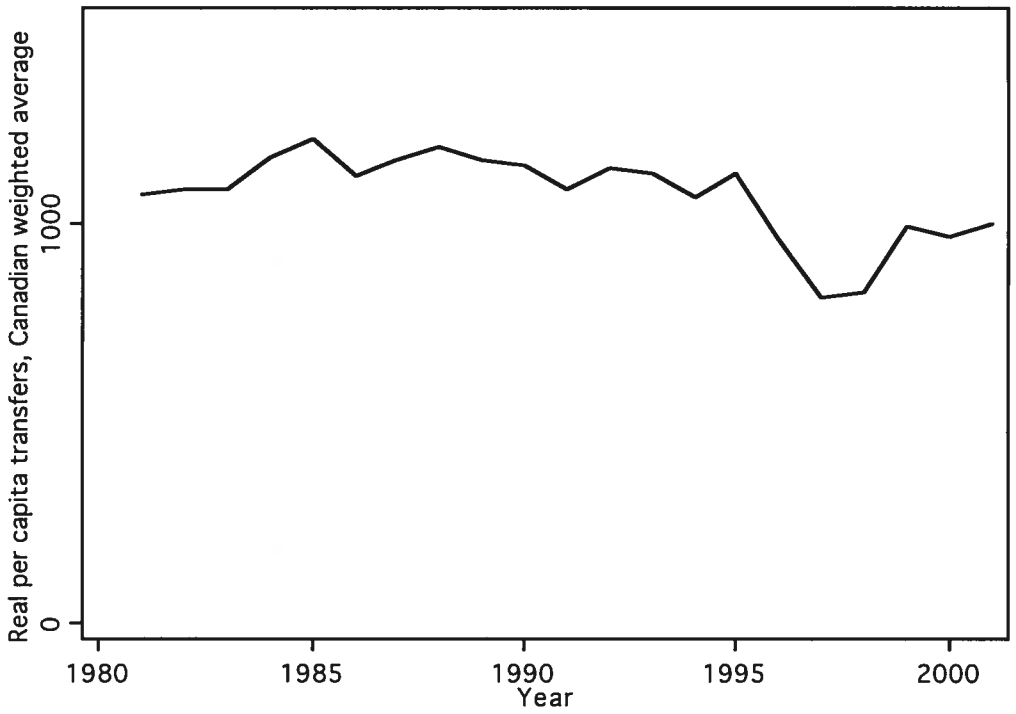
	Per capita transfers (nominal dollars)			Transfers as a percent of total provincial government revenues (including transfers)			Transfers as a percent of provincial GDP		
Province	**Mean (yearly)**	**Min.**	**Max.**	**Mean (yearly)**	**Min.**	**Max.**	**Mean (yearly)**	**Min.**	**Max.**
Newfoundland and Labrador (NL)	2527	1355	3845	46.9%	41.8%	51.4%	15.7%	11.6%	18.3%
Prince Edward Island (PEI)	2274	1484	3226	45.2%	36.9%	55.5%	14.1%	10.3%	18.8%
Nova Scotia (NS)	1779	1121	2451	39.6%	33.6%	47.6%	9.8%	7.9%	12.0%
New Brunswick (NB)	1974	1165	2665	39.1%	32.8%	48.1%	11.1%	8.6%	13.7%
Quebec (QC)**	1292	800	1598	25.8%	20.5%	31.5%	6.1%	4.9%	7.6%
Ontario (ON)	586	363	809	14.4%	8.6%	18.2%	2.2%	1.3%	2.9%
Manitoba (MB)	1520	843	2117	29.6%	23.6%	33.6%	7.0%	5.7%	8.5%
Saskatchewan (SK)	1208	585	1789	22.6%	16.5%	31.4%	5.4%	3.7%	8.4%
Alberta (AB)	702	389	1057	12.5%	7.4%	19.8%	2.3%	1.3%	3.7%
British Colombia (BC)	661	404	833	13.8%	7.7%	19.1%	2.8%	1.6%	3.8%

Source: Author's calculations from Statistics Canada data

** Includes the 13.5% abatement of the basic federal income tax

Stability of per capita grants

Figure I: Real (1992 dollars) federal per capita grants, Canadian weighted average



Source: Author's calculations from Statistics Canada data

One property of the transfer system, as suggested by Perry's (1997) claim that Canada is in a state of "fine tuning", is that the overall level of per capita transfers have been relatively stable over the period under study. It is clear, though, that the years 1997 and 1998 have significantly lower per capita grants. Indeed, the Canadian federal government was attempting to reduce its budget deficit during that time period. The years 1996, 1999, 2000, and 2001 also seem to have a lower level of per capita grants, although the difference is not as marked. Since 2001 there has been an up-tick in federal transfers.

This, however, does not mean that little activity was taking place. Indeed, some transfers were merged with others, whilst large transfers were sometimes split into two. Yet the overall federal commitment was stable over time. Recently, the stability of provincial transfer income has become an explicit policy target for the federal government, particularly with respect to Equalization payments.

Calculating the value of the Québec Abatement

In 1964 the federal government put in place an allowance mechanism for 16 and 17-year-olds that remained in school or were incapacitated (Finances of the Nation, 8:15). Québec already had such a program in place and received, instead of cash payments, a 3% tax point transfer. The federal program eventually came to an end. In order to avoid "the complete revision of the Québec income tax structure" (Finances of the Nation, 8:15), the federal government continued to allow the 3-point abatement under the condition that it recoup the entirety of this abatement.

In 1965 Québec received[17] a tax point transfer of 13.5% of the basic federal personal income tax instead of cash payments for healthcare and social welfare expenditures.

So Québec receives, in total, a 16.5% in tax point transfer that the 9 other provinces do not receive. Of these 16.5% tax points, 3 percentage points are returned to the federal government, so that the total abatement (in real terms) is 13.5% of the basic federal tax. *This tax point transfer is collected by Québec in lieu of cash.*

Note should be taken that this tax transfer was designed to be revenue neutral: Québec receives exactly the same total amount under the abatement than what it would have received had it accepted the cash transfer. Here, political forces (Québec's aspiration towards self-determination and demands for fiscal autonomy) influenced the *type* of transfer, not its absolute amount.

The value of the abatement was calculated using the federal government's personal income tax receipts (CANSIM series v689062: Federal Government: Direct taxes from persons). A simple algebraic manipulation will clarify how the value of the abatement was calculated[18]. Let R represent the value of the basic federal personal income tax base, C the Canadian government's receipts from this base in Québec, and Q the value of the Québec abatement. Then,

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[17] Received or negotiated for.

[18] I would like to thank Li Zhao of Statistics Canada for this information.

$C = 0.835R \Rightarrow R = C/0.835$

$Q = 0.165R \Rightarrow Q = 0.165C/0.835 = 0.1976C$

Thus multiplying the federal government's receipts from the personal income tax base by 0.1976 will give us the value of Québec's *total* abatement, including the 3% it remits to the federal government. Multiplying the federal government's receipts from the personal income tax base by 0.1616 will give us the value of Québec's abatement for healthcare and welfare only.

The real per capita value of the Québec abatement has grown by a yearly average of 2.4%. Please see Appendix 1 that presents the value of this tax point abatement.

Throughout this thesis, the total value (16.5%) of Québec's abatement will be removed from the province's "own source" revenues. Then the 13.5% tax point transfer will be treated as a cash transfer. The 3% tax point transfer for the discontinued Youth Allowance program is removed from Québec's own revenues but not included in cash transfers since the value of this abatement is returned to the federal government in its entirety. This will allow consistent treatment of the data: the 13.5% transfer is revenue neutral and other provinces receive the value of this abatement in cash.

This section on the value of Québec's tax point transfer shows how important it is to correctly "control" for the institutional mechanisms in place.

The Equalization transfer

The Equalization transfer is one of three major transfer programmes in Canada. It accounts for nearly a third of all federal transfers in Canada. Indeed, it is such an important principle in Canadian federalism that it is enshrined in the Constitution Act of

1982. The Equalization transfer thusly deserves some attention, particularly since "[a]ll provinces recognize this program as the cornerstone of Canadian federalism"[19].

In 2004 the Equalization transfer underwent some reforms, with more to come in 2006 as an expert panel is examining the transfer. The discussion that follows pertains to the Equalization program during the 1981-2001 time period only.

The Principle of Equalization

The Constitution Act of 1982 states in section 36(2):

> Parliament and the government of Canada are committed to the principle of making equalization payments to ensure that provincial governments have sufficient revenues to provide reasonably comparable levels of public services at reasonably comparable levels of taxation.

It has been noted that although the principle of Equalization is constitutionally protected, the program in its current form is not. The Parliament could achieve the objective described above with another policy instrument, or it could use another formula.

Equalization ensures that poor provinces will not have to resort to extraordinarily high levels of taxation in order to provide public services comparable to that of other richer Canadian provinces. What underlies the above statement is the idea that the *level* of public services should be somewhat uniform or comparable within a federation. Buchanan (1950, 589) states: "An individual should have the assurance that wherever he should desire to reside in the nation, the over-all fiscal treatment which he receives will be approximately the same." The Equalization transfer is clearly based on normative factors (as has been discussed above).

An important feature of Equalization is that it is unconditional: provinces may use this transfer to finance whichever expenditures they so choose.

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[19] British Columbia, Ministry of Finance, "Statement by the Honourable Merv Leitch, Provincial Treasurer of Alberta, on Behalf of All Provincial Ministers of Finance and Provincial Treasurers, at the Meeting of Ministers of Finance and Provincial Treasurers, Ottawa, December 6 and 7, 1976", in *British Columbia Budget*, January 24, 1977, at 36.

The mechanics of Equalization

Simply and generally put, the Equalization formula, until the reforms of 2004, brings provinces up to the "national fiscal capacity average". The Equalization payment compensates for, on a dollar-for-dollar basis, the difference between a standard measure of per capita fiscal capacity and a province's actual per capita fiscal capacity. So, for example, if provincial governments are able to collect an average of $6,000 per person through taxes but one particular province is only able to collect $5,000 per person (using average tax rates), then the federal government will fill in the void by providing an equalization transfer of $1,000.

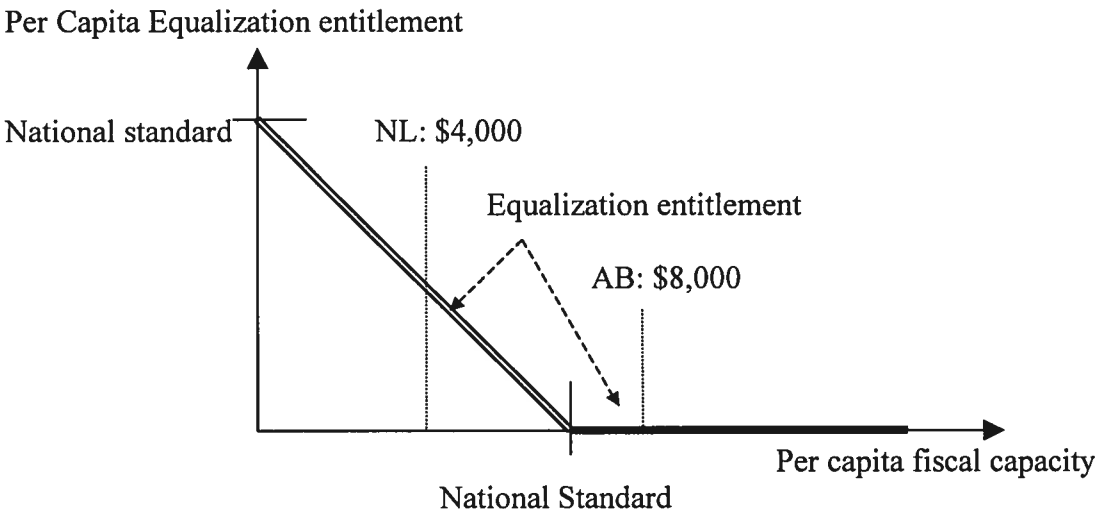
The following equation, in which $equalization\_percapita_{i,t}$ is a province's per capita equalization entitlement in year t, describes the transfer:

$$equalization\_percapita_{i,t} = \begin{cases} \text{per capita standard fiscal capacity - per capita provincial own revenues, if standard}_t > \text{actual}_{i,t} \\ 0, \text{ otherwise} \end{cases}$$

The total transfer is the per capita entitlement multiplied by the province's population.

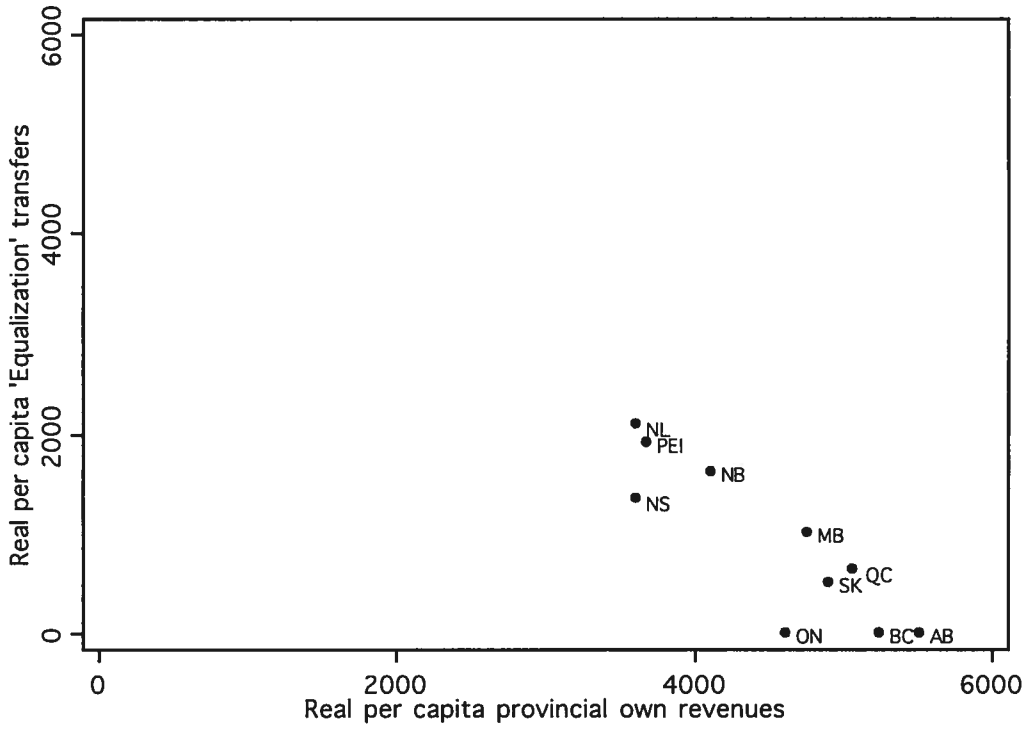
Graphically, per capita equalization payments can be conceptualized like so:

Figure II: Graphical representation of per capita equalization payments



The following graph shows how close to reality this graphical representation really is. The national standard (as computed by this author from macroeconomic data) in the year shown is $5350.

Figure III: Equalization payments and fiscal capacity, 1999



The scatter points do no exactly fall on the theoretical line because provinces deviate from the "national average" rate of taxation. Provinces are free to set rates as they wish. So for example we can see that Ontario has a lower per capita fiscal yield than the other large provinces. This is because despite a larger base Ontario imposes lower rates of taxation. Any province that sets taxes above the average rate will lie to the right (or above) the theoretical line prescribed above; any province that sets taxes below the average rate will lie to the left (or below) the theoretical line.

I shall now explain in more detail the computation of Equalization payments[20]. For the purposes of this exposition, the subscript i represents a province, and the subscript j represents a tax base. Tax rates in province i on good j are denoted by τ_{ij}.

[20] I would like to thank Sean Keenan, of Finance Canada, for his helpful comments and corrections.

The tax base[21] for τ_{ij} is denoted by b_{ij}, so that total revenues accruing from this tax, also called the *yield*, is the product of τ_{ij} and b_{ij}.

For each tax, the total yield over all 10 provinces is computed. The total base is also computed over the 10 provinces. The division of the total national yield by the total national base gives the average tax rate, ar_j, for each tax category:

$$\forall j: \quad ar_j = \frac{\sum_i \tau_{ij} \cdot b_{ij}}{\sum_i b_{ij}}$$

Note that the above formula produces a *base-weighted* average.

Here, an important interpretation of the equalization formula is worth taking a moment for. Once the mechanism is understood, it becomes clear that *the equalization transfer is not revenue equalizing, but base equalizing*. It compensates provinces for tax bases they have only limited access to (for example corporate income). Moreover, compensation is determined on the basis of how, *on average*, Canadian provinces exploit this base.

Now, a per capita standard measure of each tax base is created. This standard measure, sm_j, is a simple average of the per capita tax bases for the five "middle income provinces": Québec, Ontario, Manitoba, Saskatchewan, and British Columbia.

$$\forall j: \quad sm_j = \frac{1}{5} \cdot \sum_{i=ON,QC,SK,MB,BC} \frac{b_{ij}}{pop_i}$$

For each province, the difference between this standard per capita measure and its own per capita fiscal capacity is calculated. Note that what is used to calculate fiscal capacity is not a province's actual rate of taxation but the weighted average tax rate

[21] The base of a tax is what the tax rate is applied to. Taxable income (with some adjustments) is the base for income tax, for example. Other bases include the sales of goods and services, or the value of residential and commercial property.

computed above. We will call this the per capita fiscal capacity differential, denoted d_{ij}, and it is allowed to take a negative value:

$$\forall i,j: \quad d_{ij} = sm_j \cdot ar_j - \frac{ar_j \cdot b_{ij}}{pop_i}$$

Equalization entitlements are the sum of all these "fiscal capacity differentials" - positives and negatives canceling each other out - multiplied by the province's total population. If the entitlement is negative, you receive no equalization payment.

$$\forall i: \quad equal_i = \begin{cases} pop_i \cdot \sum_j d_{ij} \text{ if } \sum_j d_{ij} > 0 \\ 0, \text{ otherwise} \end{cases}$$

Provincial governments have access to a whole array of taxes, from traditional taxes on personal and corporate income, to excise taxes on alcohol, tobacco, and gasoline. Perry (1997) shows more explicitly the array of taxes used in the computation of equalization entitlements and an example of the computation in a matrix format. It is presented in Appendix 2. The interested reader can look at the table to see the wide variety and alternative definitions of tax bases to which provinces have access.

In sum then, per capita equalization payments are equal to the difference between what a province *could* collect at the 10-province weighted average tax rate on the 5 province per capita standard measure of the tax base and what a province *could* collect if it applied the 10-province weighted average tax rate to the per capita tax base it actually has access to.

Size and importance of Equalization transfers

In the Statistics Canada data source, Equalization transfers are included in the general category of "Taxation agreements". This category includes a share of utilities taxes, federal estate taxes, and so-called reciprocal taxation agreements. The amount of these

transfers is at least one order of magnitude smaller than Equalization transfers. So Equalization payments have a slight measurement error. For Alberta, which has never received Equalization payments, the figures below have an average imprecision of $63 in 1992 dollars. This represents 1% of own revenues, while Equalization solely is 0%. This is the worst case. For Ontario, the average per capita transfer is $8. It should also be $0. Finally, British Columbia received no Equalization transfers in the period under study, and the average amount of other transfers included in the data series is $3.

The following table shows the *cumulative* importance of Equalization payments over the 1981-2001 period. Per capita sample statistics are in real dollars. We see from this table that Equalization payments are very important for the provincial governments of Newfoundland & Labrador, Nova Scotia, Prince Edward Island, and New Brunswick: for these provinces Equalization represents a fifth to a quarter of total provincial resources including other federal transfers. They are also important for Québec, as Equalization payments represent 10% of the total provincial government budget for this province.

The columns in Table 5 showing "equalization" as a percent of provincial government revenues have been modified to reflect the fact that British Columbia, Ontario, and Alberta did not receive Equalization payments in the period under study (the figures have been set to 0% for these three provinces). However the per capita absolute amounts are still reported; these have not been set to zero.

Note that negative equalization is due to the fact that during years in between censuses the formula uses population estimates. When more certain population estimates are produced, it is sometimes the case that the federal government has overpaid (i.e. population estimates turned out to be too high). Provinces must reimburse this difference.

Table 5: "Equalization" payments, 1981-2001

	"Equalization" payments as a percent of provincial own revenues, cumulative average	"Equalization" as a percent of total provincial revenues, including other federal transfers and equalization, cumulative average	Per capita "equalization" transfers, real 1992 dollars			Per capita "Equalization" payments, 2001 (nominal dollars)
			Average	Min.	Max.	
Newfoundland and Labrador (NL)	53.6%	28.7%	1,697.73	1,335.66	2,114.13	2,424.91
Prince Edward Island (PE)	49.9%	27.9%	1,591.72	1,217.13	1,987.95	2,280.18
Nova Scotia (NS)	37.0%	22.6%	1,130.15	864.66	1,463.45	1,678.58
New Brunswick (NB)	36.3%	22.6%	1,280.14	1,074.00	1,625.73	1,864.71
Québec (QC)**	14.1%	10.4%	604.16	490.99	758.15	758.06
Ontario (ON)	0.0%	0.0%	8.35	-2.15	42.47	0.00
Manitoba (MB)	20.8%	14.8%	836.06	546.57	1,099.93	1,261.62
Saskatchewan (SK)	7.2%	5.6%	309.62	-65.60	736.89	431.41
Alberta (AB)	0.0%	0.0%	63.38	-3.47	145.26	0.00
British Columbia (BC)	0.0%	0.0%	3.35	-1.50	36.98	42.41

Source: Authors's calculations

** Own revenues do not include the 16.5% abatement of the basic federal income tax

Equalization thusly represents at least 22% of total provincial government revenues for Canada's four poorest provinces.

Healthcare funding, social funding, and the CHST

Overall healthcare transfers were computed as being the sum of the cash components of the following transfers:

- Canada Assistance Plan (CAP)
- Postsecondary education grants
- Hospital Insurance Act
- Health Resources Fund
- Canadian Health and Social Transfer
- Medicare
- Québec abatement (13.5%) as calculated above

I describe briefly the historical factors that have influenced healthcare funding and social welfare funding in the period under study. Whereas Equalization was relatively stable, programmes for healthcare and social welfare went through substantial reforms. At the end of the period under study the main healthcare transfer was the Canadian Health and Social Transfer (CHST), which was in fact two transfer programs combined into one. Today the CHST has been split into two parts, the CHT and the CST. Let me present the historical evolution of the main healthcare transfers for the period under study and the basic mechanics.

In the 1970's provincial governments were asking for increased autonomy in healthcare and education. They received it. In 1977 Established Programs Financing (EPF) replaced a system of matching grants (see Laurent and Vaillancourt 2004 for a succinct historical timeline). It replaced, for example, the Medicare programme whose costs were shared 50/50 with the federal government. There were three transfers under EPF: two for health services and one for post-secondary education.

The nomenclature "Established Programs Financing" can be explained by the fact that by that point in time expenditures in healthcare and education had become "well established"; both levels of government and the electorate knew full well these

programs were central to the government's mission (Perry 1997, 243). The need for these programmes, as well as their importance, left no doubt.

Unlike its predecessors though, EPF was not a matching grant system, but a loose conditional grant system targeted towards *broad* expenditure areas. The upside then was that under EPF there were no real specifics other than general (national) guidelines. An example of a conditional grant *before* EPF: the Health Resources Fund created in 1965 was specifically targeted "to help the provinces meet the capital costs of planning, acquiring, constructing, renovating, and equipping health training and research facilities" (Perry 1997, 188). No such hard constraints existed under EPF.

The EPF transfer was composed of two parts. The first was an income tax point transfer (13.5% of the basic federal income tax).

The second part was a trident of cash transfers. "The basic cash contribution consisted of 50 percent of the federal national per capita contributions for the three established programs in 1975-76 plus $7.63, multiplied by provincial population and adjusted by an escalator that represented the average increase in gross national product per capita over the previous three years" (Perry 1997, 250). Because the tax point transfer had a different value for different provinces (with tax points being worth more in richer provinces), the federal government provided "equalization" payments to ensure that per capita payments were the same across all provinces. The third and final cash component was a $20 per capita transfer for "extended health care service" programmes, to be escalated with GNP (Perry 1997, 253).

The Canada Assistance Plan (CAP) replaced in 1965 a whole myriad of social transfers. CAP was the last large shared cost program in Canada. The costs of social assistance and welfare programmes supported by CAP were split 50/50 between the federal and provincial governments. In other words the federal government matched provincial expenditures on a dollar-for-dollar basis. "What distinguished CAP from earlier federal programs was the open-ended nature of the federal assistance it provided and the freedom it gave provinces to set benefits and rates of assistance" (Perry 1997, 197).

Thus during the period under study the presence of a system of conditional grants is noted. In fact, CAP transfers were only about half as large as EPF transfers.

For example for the fiscal year 1986-1987 Ontario received more than $3 billion in EPF transfers and over $1.1 billion in CAP transfers. Perry (1997) presents appendices that detail transfer payments.

Established Program Financing and CAP were merged in 1996 into the Canada Health and Social Transfer (CHST).

The CHST, like the EPF, is a mix of tax point and cash transfers. The tax points consist of 14.9% (31.4% in the case of Québec due to opting-out agreed to in 1966) of the basic federal personal income tax and 1.0% of taxable corporate income (Vaillancourt and Laurent 2004, 7). A tax point transfer allows greater provincial autonomy. But tax points are not the entirety of the transfer. The federal government calculates the per capita CHST transfer. The difference between this amount and the value of the tax transfer is made up in cash. The cash portion of the transfer is thusly equalizing.

It is worthwhile to highlight again the design of the CHST. *The CHST is a flat per capita transfer allocated to all provinces.* The federal government determines the per capita amount of this transfer. Each province first receives 13.5% of the basic federal personal income tax under this transfer. The federal government calculates the value of this tax point transfer. The difference between the per capita CHST amount and the value of the tax point transfer is then paid in cash. According to certain estimates (Vaillancourt 2002) Newfoundland receives 55% of its CHST transfer in cash while Ontario receives 45% of this transfer in cash.

Political modeling

Political factors can be introduced into transfers in two ways. The first way is in mechanism design, where one subnational jurisdiction or population sub-group is favoured systematically; preferential treatment may become institutionally or constitutionally engrained. The second way in which politicians may interfere is through discretionary funds. In this case the executive branch or cabinet sets up a temporary transfer program.

Political gains may be realized in two ways. The first is vote purchasing. Transfer programmes are aimed at particular groups of individuals in return for votes. Second, voters may reward a government that sets up an appropriate transfer program (the electorate generally supports a government if it is doing a "good job" at resolving economic or social problems; voters who do not directly benefit from a transfer may still support it if the transfer makes economic sense or if the transfer responds to an individual's own social welfare function). The difference between the two then is short-term electoral gain versus long-term sound economic policy making that can be politically rewarding.

Political institutional framework

A succinct explanation of the Canadian political system is warranted here in order to help understand the political (voting) measures. Canada's central government closely resembles the British Parliamentary system. Members of the House of Commons (Members of Parliament or MPs), are elected in a plurality vote in a single round election and on a territorial basis (Vaillancourt and Bird 2002). In 2005 there are 308 seats in the House of Commons, each representing one riding[22]. A candidate is elected to the House of Commons if he wins the plurality[23] of votes in his riding. The party that has the most seats in the House of Commons forms the government.

Provincial governments are similarly set-up.

Canada also has a Senate, although it is highly ineffectual and quite vestigial. Its members are appointed by the Prime Minister and serve until they reach the tender age of 75. Not once since 1939 has the Senate vetoed a bill that has been passed in the Commons (Vaillancourt and Bird 2002).

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[22] A riding is simply an electoral district. In sparsely populated provinces, a riding can cover vast expanses of land. In dense urban areas, simply a neighbourhood or a suburb.

[23] Plurality differs from majority in that plurality does not imply more than 50% of votes. In a strict majority election, for example, a person cannot be elected unless they have received 50% of the vote.

Modeling must take into account the national political structure, not only federal parliamentary workings. Dahlberg and Johansson (2002) use one political variable that may be appropriate in Sweden but is not appropriate in the Canadian situation. They estimate the effect of municipal political alignment with the central government on the probability of receiving a grant, in two ways. During their period of observation socialists formed the central government in Sweden. The first political alignment measure they use a binary variable equal to 1 if the municipal council contains a socialist majority. The second measure is the share of voters in that municipality that voted for the socialists in the previous election. Both of these measures assume that the same parties (same organizations) appear at both the central and municipal level, and so some interaction between the two levels of government occurs. The United States are a clear example of partisan alignment between the state/local and federal level. The Republican Party and the Democratic Party are truly *national* parties that field candidates at all levels of government, from the President, to state legislatures, to governors. In Canada, there is very little alignment between provincial parties and federal parties that bear the same name. This does not mean that Canadian parties that bear the same name do not share the same broad ideological agenda. However, policy platforms are different from one province to the next. And political parties from one province to the next are distinct legal entities with their own organizations. There is very little crossover between provinces, and only a little crossover between the federal and provincial political parties.

Recent History

The four main parties on the national scene are the Liberal Party, the New Democratic Party (NDP), the Progressive Conservatives, and the Bloc Québécois.

During the period of study, only two parties have been elected to the government: the Liberals and the Conservatives. The Liberals held power for 12 years, and the Conservatives 9. Federal elections were held in 1980, 1984, 1988, 1993, 1997, and 2000. The Liberal Party was in power at the start and at the end of our period of

study, while the Conservative Party was in power during the middle. Indeed, the Liberals won the 1980, 1993, 1997, and 2000 elections, whilst the Conservatives were elected in 1984 and 1988.

It is noteworthy that minority governments are not observed during this period. Some have argued that provinces are able to extract greater transfer payments (or better agreements) when the party in power is in a minority.

Several political trends are worthy of attention, particularly in light of this study. The first is the volatility of voting patterns in Québec. During the early Liberal reign, Québec sent 74 Liberals to the House of Commons out of a total possible 75, and only 1 Conservative. During the Conservative majority of 1984-1988 and 1988-1993, the province elected 58 and 63 Conservative party candidates. Then followed the rise of the Bloc Québécois. In 1993, the voters of Québec elected Bloc Québécois candidates in 54 ridings. During the 4 subsequent years, the Bloc Québécois formed the official opposition in the House of Commons, a role that is now filled by the Conservative Party.

The second trend worthy of attention is the rise, fall, and rebirth of the Conservative Party of Canada. This paragraph could also be interpreted as a recent history of the conservative movement in Canada. The timeline presented here is by no means exact to the day, but the basic story is nonetheless accurate[24]. In 1993, and after being in power for nine years, only two Progressive Conservative (PC) candidates were elected to the House of Commons. Indeed, there was a huge backlash against the PC party, the reasons for which are beyond the scope of this text. Suffice it to say that the sentiment against the PC party was strong enough that another conservative alternative, the Reform Party of Canada, hitherto *sans* MP, won 52 seats in that same election. In the 1997 election, the Reform party, with its main stronghold in Alberta and British Colombia, won 60 seats. The Progressive Conservative (PC) party won 20. Thus, the total for the conservative movement in that election was 80. In 2000, the Reform Party transformed itself into the Alliance Party in an attempt to unite the Canadian right. In that election the Alliance Party won 66 seats and became the official opposition in the

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[24] www.answers.com; articles on Canadian Alliance, Progressive Conservative Party, Conservative Party of Canada

House of Commons. In the 2003 election, the Alliance Party merged with the battered Progressive Conservative party to form the Conservative Party of Canada. This move was necessary to effectively combat Liberal dominance; the conservative movement needed to consolidate its base. Indeed, the PC party was truly a national party (when it was in power it held 58 and then 63 of Quebec's 75 seats, for example, and the majority of seats for all four Atlantic provinces in the 1984 election), but the Alliance (=Reform) party was highly regionalized. This consolidation strategy may have paid off. The Liberal party was forced into a minority position with 135 seats while the Conservative Party tallied 99 seats in the 2004 election. In the January 2006 elections, two weeks before final submission of this thesis, the Conservative party won the plurality of seats in the House of Commons. However, they did not win enough seats to become a majority government.

As such, considering the recent consolidation of the Canadian conservative movement and the fact that the Reform and Alliance parties are the same parties except under different names, votes and seats for the Alliance, Reform, Progressive Conservative, and Conservative party have been aggregated into one.

The following table shows voting patterns, in terms of both the number of MPs and the total national voting percentages:

Table 6: Number of seats* and percentage popular votes for each of the major parties in Canada, 1981-2001

Year	Bloc Québécois		NDP		Liberal Party		conservative (Alliance + Reform + PC + C)		Other		Total*
	Seats	% Votes	Seats	% Votes	Seats	% Votes	Seats	% Votes	Seats	% Votes	
1981	0	0%	31	19.7%	**147**	**44.4%**	101	32.5%	0	3.4%	279
1982	0	0%	31	19.7%	**147**	**44.4%**	101	32.5%	0	3.4%	279
1983	0	0%	31	19.7%	**147**	**44.4%**	101	32.5%	0	3.4%	279
1984	0	0%	30	18.8%	40	28.0%	**208**	**50.0%**	1	3.1%	279
1985	0	0%	30	18.8%	40	28.0%	**208**	**50.0%**	1	3.1%	279
1986	0	0%	30	18.8%	40	28.0%	**208**	**50.0%**	1	3.1%	279
1987	0	0%	30	18.8%	40	28.0%	**208**	**50.0%**	1	3.1%	279
1988	0	0%	42	20.3%	81	31.9%	**169**	**45.1%**	1	2.6%	292
1989	0	0%	42	20.3%	81	31.9%	**169**	**45.1%**	1	2.6%	292
1990	0	0%	42	20.3%	81	31.9%	**169**	**45.1%**	1	2.6%	292
1991	0	0%	42	20.3%	81	31.9%	**169**	**45.1%**	1	2.6%	292
1992	0	0%	42	20.3%	81	31.9%	**169**	**45.1%**	1	2.6%	292
1993	54	13.6%	8	6.8%	**175**	**41.2%**	54	34.7%	1	3.6%	292
1994	54	13.6%	8	6.8%	**175**	**41.2%**	54	34.7%	1	3.6%	292
1995	54	13.6%	8	6.8%	**175**	**41.2%**	54	34.7%	1	3.6%	292
1996	54	13.6%	8	6.8%	**175**	**41.2%**	54	34.7%	1	3.6%	292
1997	44	10.7%	20	11.0%	**153**	**38.5%**	80	38.2%	1	1.6%	298
1998	44	10.7%	20	11.0%	**153**	**38.5%**	80	38.2%	1	1.6%	298
1999	44	10.7%	20	11.0%	**153**	**38.5%**	80	38.2%	1	1.6%	298
2000	38	10.7%	13	8.5%	**169**	**40.8%**	78	37.7%	0	2.3%	298
2001	38	10.7%	13	8.5%	**169**	**40.8%**	78	37.7%	0	2.3%	298

* Please note that for each year there were 3 more seats in the legislature than the total presented here. The three territories each send one Member of Parliament to the House of Commons. See Evans (2005) for the number of electoral districts per province in each federal election since Confederation.

One can also see from the table above that having a geographically narrow base may be politically rewarding in the context of Canadian federalism. Compare the number of seats won and vote percentages between the Bloc Québécois and the NDP. The BQ has its base in Québec only, while the NDP is a truly national party, with MPs being elected in British Colombia, Manitoba, Saskatchewan, Ontario, and some eastern provinces. The BQ is able to generate twice as many seats as the NDP with the same number of votes.

The table below displays *cumulative* political variables over the 1981-2001 period. It is intended to show that for certain provinces political analysis is tantamount to imposing joint significance tests on provincial dummies (for example for the conservative vote for the Western-most provinces).

Table 7: "Cumulative" number of seats and "cumulative" vote shares per provinces for all elections held 1981-2001

	Liberal		conservative (PC + C + Reform + Alliance)		NDP		BQ		Other		TOTAL SEATS
	Seats	Vote share	Seats	Vote share	Seats	Vote share	Seats	Vote share	Seats	Vote share	
Alberta (AB)	8	19.7%	137	68.2%	1	9.5%	0	0.0%	0	2.6%	146
British Colombia (BC)	19	24.0%	123	47.7%	46	24.8%	0	0.0%	0	3.5%	188
Manitoba (MB)	31	33.1%	31	40.4%	22	23.5%	0	0.0%	0	3.0%	84
New Brunswick (NB)	31	42.9%	26	42.5%	3	12.8%	0	0.0%	0	1.8%	60
Newfoundland and Labrador (NL)	29	45.8%	13	40.1%	0	13.0%	0	0.0%	0	1.1%	42
Nova Scotia (NS)	28	38.9%	29	41.6%	9	18.1%	0	0.0%	0	1.4%	66
Ontario (ON)	408	44.1%	155	39.0%	29	14.6%	0	0.0%	2	2.2%	594
Prince Edward Island(PE)	19	48.3%	5	42.8%	0	8.1%	0	0.0%	0	0.7%	24
Québec (QC)	184	40.7%	128	27.1%	1	6.1%	135	22.2%	2	4.0%	450
Saskatchewan (SK)	8	22.8%	42	41.7%	34	34.2%	0	0.0%	0	1.3%	84
TOTAL SEATS		765		689		145		135		4	1738

Source: Author's calculations

The most important of these "political fixed effects" is the case of the two westernmost provinces, British Columbia and Alberta. Indeed, one can easily argue that the conservative vote *is* a provincial fixed effect for these two westernmost provinces.

Imagine analyzing transfers through political dummies, for example a dummy equal to one if the province sent more conservative representatives to the House of Commons than any other party. Then for these two provinces the dummy would be equal to one, which is the same as imposing a joint significance restriction on the provincial dummies.

A variant of this theme is the Bloc Québécois. Since no other province has elected or voted for BQ candidates, any analysis using either the number of seats or the vote share will measure Québec fixed effects after 1993. So instead of measuring the joint significance of several provincial dummies, any analysis using the Bloc Québécois will in fact be equivalent to a Québec provincial dummy for the latter half of the period under study; the Bloc Québécois vote captures a *part* of the Québec provincial fixed effect.

Definition of political variables

Variables were computed using riding level (electoral district) political data on every federal election in Canada since 1979. These data were provided by the Library of Parliament. From this micro or riding-level I computed variables that capture the two political behavioural models. I was also able to compute party vote shares and a variable capturing representation per capita.

The variables constructed here use *actual* election data. In other words the tightness of a given race can only be measured *ex post*. This may be problematic if, for example, in the run-up to an election transfer programmes designed to purchase votes were successful enough to make the riding an easy win. One would thusly prefer riding-level opinion polls, but these are unavailable.

Although the original "swing" and "constituent" models are more formally developed in the original papers than it is here, it is worthwhile to discuss some empirical modeling issues that arise when dealing with Canada.

The distribution of preferences becomes slightly more problematic in plurality legislative elections than it is in the case of the United States. The United States use the Electoral College system, where the totality of a state's Electoral College votes goes to the winner of the state (except for the state of Colorado). In this case the per capita strategy is simple since per capita Electoral College votes are approximately equal across states: per capita grants should decrease as the difference between Republican and Democratic votes increases.

In the Canadian case it is not so clear how transfers to a provincial government affect heterogeneous electoral district level preference distributions. Québec sent 75 representatives to the 300-odd House of Commons throughout the period under study. What if during an election only 5 ridings are tight? The effect of a transfer to the provincial government is thusly dissipated, as opposed to a direct transfer to individuals in this riding. What's more, the transfer policy must be designed to target these swing voters (for example if "undecideds" are of a particular ethnic or linguistic background, or if they are concerned about one particular policy issue).

First, in order to test the "swing" model, several measures of tightness of race were constructed. There were two broad sets of measures, one using overall votes in the province, and the other using the proportion of tight races.

Variables *swing2* and *swing5* are dummy variables equal to one if difference between the winner of the *overall* popular vote and the second place party was 2% and 5%, respectively, in the previous election. 17 or 8.1% of our observations were swing provinces at 2%, and 55 or 26.2% of the observations were swing provinces at 5%.

The argument for a variable defined this way is of the type "a rising tide lifts all boats". There is in fact a statistically significant empirical correlation (at the 1% level) between the tightness of the overall race and the tightness of individual ridings. Although this measurement may have some weaknesses because percentages of votes do not translate directly into seats, it is nonetheless a good starting point.

The problem with this measure is that a province can remain a swing province three years after an election because of the panel-formatted data set. These two variables were thusly shifted two years into the past[25] and are called *fswing2* and *fswing5* (*f* for before and after). These variables were also restricted in another way: they were reset in the third year after an election[26]. Shifting into the past makes sense: politicians would have access to pre-election survey data (opinion polls) and would thusly increase transfers to swing provinces. It is not unreasonable to see this behaviour after an election either. If the newly elected government narrowly won or lost certain provinces, it might immediately change the transfer to give more money to these provinces in preparation for the *next* election. If a government is to systematically favour one group over an other, it should probably start doing so as soon as possible to ensure an easier race the next time around.

The variables *bswing2* and *bswing5* are also dummy variables, except these are equal to 1 in the electoral year and two years preceding the election if the province was an overall swing at 2% or 5% (*b* for before). This variable is meant to capture behaviour related to the electoral cycle.

We also used the *percentage* of ridings that were tight races. This is important for the distributional reasons discussed above. These variables are called *riding_swing2*, *riding_swing5*, *friding_swing2*, *friding_swing5*, *briding_swing2*, and *briding_swing5* following the logic described above. The availability of riding-level data thus makes such distributional nuance possible.

This last set of variables, even if they are distributionally more correct, are a little problematic because they are not continuous and nicely normally distributed around a mean. *Riding_swing2*, for example, is equal to zero for 78 observations (or 37% of the total number of observations), even though it is not discrete.

Second, in order to test the "constituents" model, two dummy variables were constructed. The first is called *voted_winner*, and it is equal to 1 if the winner of the

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[25] Let's say two elections took place, one in 2000 and the other in 2005, and that the province is a 5% swing province in 2000. The swing5=1 for 2000-2004, while fswing5=1998-2002.

[26] So if Manitoba was a swing at 5% in 1988 – which it was – fswing5=1 for 1987, 1988, 1989, and 1990.

overall plurality of votes in a province was also the winner of the national general election. The second is called *seated_winner*, and it is equal to 1 if the winner of the plurality of seats in a province was also the winner of the national election.

Measures of support for the party in power were allowed to be continuous, not just discrete. The variable *winner_votes_prop* is the total vote share percentage for the winner in each of the provinces. The variable *winner_seats_prop* is the percentage of seats allocated to the winner in that province. This second variable in some sense measures a province's lobbying power within the governing party.

Third, partisan variables were measured in two ways. The first measure is simply each party's vote share (*lib*, *cons*, *bq*, *ndp*, *other*). The second set uses the proportion of a province's seats going to each party (*lib_seats*, *cons_seats*, *bq_seats*, *ndp_seats*, *other_seats*).

For regression analysis only variables for the Liberal Party and the NDP are included. Including all four major parties would introduce multicollinearity. The Bloc Québécois vote is eliminated because it captures half of a provincial dummy.

Fourth, and finally, political over-representation was tested. The variable called *seats_pop* is the number of seats per 100,000 inhabitants for the province.

It would be interesting to test the "dissident" effect, as noted by Treisman (1996), in the Canadian context. It has been suggested that the transfer system was designed to keep Québec in the federation[27]. Yet because this would involve including an "undesirable" provincial dummy, this exercise is not conducted here.

Before moving on it will be useful to present the summary statistics of the political variables:

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[27] I would like to thank André Noël who pointed this out.

Table 8: Summary statistics of political measures

	Variable	Mean	Std. Dev.	Min	Max	Obs
"Swing" model	swing2	0.081	0.27	0.0	1.0	210
	swing5	0.26	0.44	0.0	1.0	210
	fswing2	0.066	0.25	0.0	1.0	210
	fswing5	0.21	0.41	0.0	1.0	210
	bswing2	0.043	0.20	0.0	1.0	210
	bswing5	0.17	0.38	0.0	1.0	210
	riding_swing_2	7.35	8.96	0.0	28.6	210
	riding_swing_5	18.8	16.4	0.0	75.0	210
	friding_swing_2	7.40	9.01	0.0	28.6	210
	friding_swing_5	18.6	16.6	0.0	75.0	210
	briding_swing_2	5.50	8.62	0.0	28.6	210
	briding_swing_5	12.8	16.0	0.0	75.0	210
"Constituents" model	voted_winner	0.552	0.498	0.0	1.0	210
	seated_winner	0.552	0.498	0.0	1.0	210
	winner_votes_prop	54.2	32.4	0.0	100	210
	winner_seats_prop	42.8	12.1	20.7	68.8	210
Partisan analysis	prov_lib	36.1	13.1	12.7	68.2	210
	prov_ndp	16.6	10.8	1.50	44.2	210
	prov_lib_seats_prop	40.4	34.8	0.0	100	210
	prov_ndp_seats_prop	11.8	18.8	0.0	71.4	210
Over-representation	seats_pop	1.34	0.60	0.84	3.24	210

Note that even though the *seated_winner* and the *voted_winner* variables have identical sample statistics they are not necessarily equal for each observation.

Estimator

Recall that Boex and Martinez-Vazquez (2004) suggest the following generic linear estimation equation:

$$\text{PC GRANT}_i = \beta_0 + \beta_1 \text{NEEDS}_i + \beta_2 \text{REVENUE}_i + \beta_3 \text{POLITICS}_i + \beta_4 \text{POP}_i + \varepsilon_i$$

Which variables should be used for each of the categories? How many variables are necessary for each of the categories? These choices are non-trivial. If the objective is to estimate political influence in the transfer mechanism, then we must first develop an unbiased estimator of the normative portions of the transfer system.

If we cannot estimate functional forms of individual components of the transfer system without bias, then attempting to estimate political influence in the entire system is a flawed exercise to begin with.

The following basic model will be estimated using both the Ordinary Least Squares (OLS) procedure and a panel Generalized Least Squares (GLS) estimator correcting for serial correlation and heteroscedasticity:

$$real\ GRANTS\ pc_{i,t} = \beta_0 + \beta_1 real\ revenues\ pc_{i,t} + \beta_2 unemployment_{i,t} + \beta_3 \ln(pop_{i,t}) + \beta_4 POLITICS_{i,t} + Z_t \mathbf{year} + u_{i,t}$$

Real variables all use 1992 as the base year. *real GRANTS* $pc_{i,t}$ are real per capita transfers to province *i* in year *t*. *Real revenues pc* are real provincial government own revenues per capita (what a provincial government can collect from its own sales taxes, income taxes, excise taxes, etc.). These revenues exclude transfers. *Unemployment* is the unemployment rate and is defined as a percent ($0<x<100$). ln(*pop*) is the natural logarithm of provincial population. Finally **year** is a vector of year dummies, which is why it is in bold script.

The *POLITICS* variable will be iteratively substituted in order to test competing models of political behaviour (i.e. swing vs. constituent), and also to test partisan rewards and the effect of over-representation. In other words the above model is run once for each of the political variables; only one political variable is included in a regression.

What's more, when estimating political influence, the dependent variable will be specified in two different ways: total transfers and "other" transfers.

When examining Equalization transfers and the entire transfer system, Alberta will be removed from econometric estimations.

Before presenting the results, I will discuss the reasons why this estimation procedure was chosen and why the empirical model is defined as it is. The OLS procedure was chosen not only because it is a well-known, easily interpretable model, but also because the underlying assumptions upon which this estimator is based were generally verified. The variables used for the empirical analysis were also carefully selected.

Correcting for serial correlation and heteroscedasticity

STATA provides a panel estimator that corrects for serial correlation. Considering the time-series nature of the data, correcting for AR(1) type serial correlation is appropriate. It is well known that macroeconomic variables contain such autocorrelation. Indeed, the estimated factor of serial correlation for the transfer system as a whole is least 0.8.

This estimator applies a constant correction factor across all panels and all years. Although this is a strong restriction, it is not too worrisome as we are dealing with provinces of the same country.

Correcting for serial correlation is important. Positive serial correlation biases coefficient standard errors *downward*, leading us to believe certain coefficients are significant when they are not. We would not want this to occur when examining political variables.

Choice of variables

The discussion on Equalization shows that horizontal equity is a factor that needs to be controlled for. The policy variable that best captures the institutional mechanism is the fiscal capacity differential. Yet because of the formula's functional form the fiscal capacity differential is not a good variable in econometric estimation: it is censored. A province that has above average fiscal capacity has a differential of zero, not a positive differential. 88 observations are censored this way.

Real per capita provincial government own revenues will be used as a measure of fiscal capacity. This variable is chosen over per capita GDP as the measure of *REVENUES*. These two variables are highly collinear: the simple regression of one on the other produces a slope of 0.15 with a standard error of 0.006. The regression R-square is 0.75. So including both of these measures would be a mistake, as this would introduce multicollinearity in the system. Only one measure of income is needed.

This may explain the comment made by Wallis (1996): "Major results are reversed when more appropriate specifications are used". He complains at length about sign reversal. Indeed, results do flip-flop if too many variables are included.

The unemployment variable was chosen over other measures of *NEEDS*, for example the proportion of the young and the elderly in the population. The federal government is responsible for Employment Insurance, and programs financed through Human Resources and Skills Development Canada may reduce these liabilities. In other words the federal government has a mandate when it comes to employment, so the unemployment rate is an appropriate

Results are robust whether we use unemployment or the proportion of the elderly in the population. The proportion of youngsters in a province did not present itself to be significant (which may in itself suggest political behaviour: youngsters can't vote).

Justifying the linearity assumptions

Scatter plots are shown to prove that relationships are linear and that imposing the linearity assumptions is appropriate. Imposing a linear functional form when the true relationship is not linear produces a biased estimator.

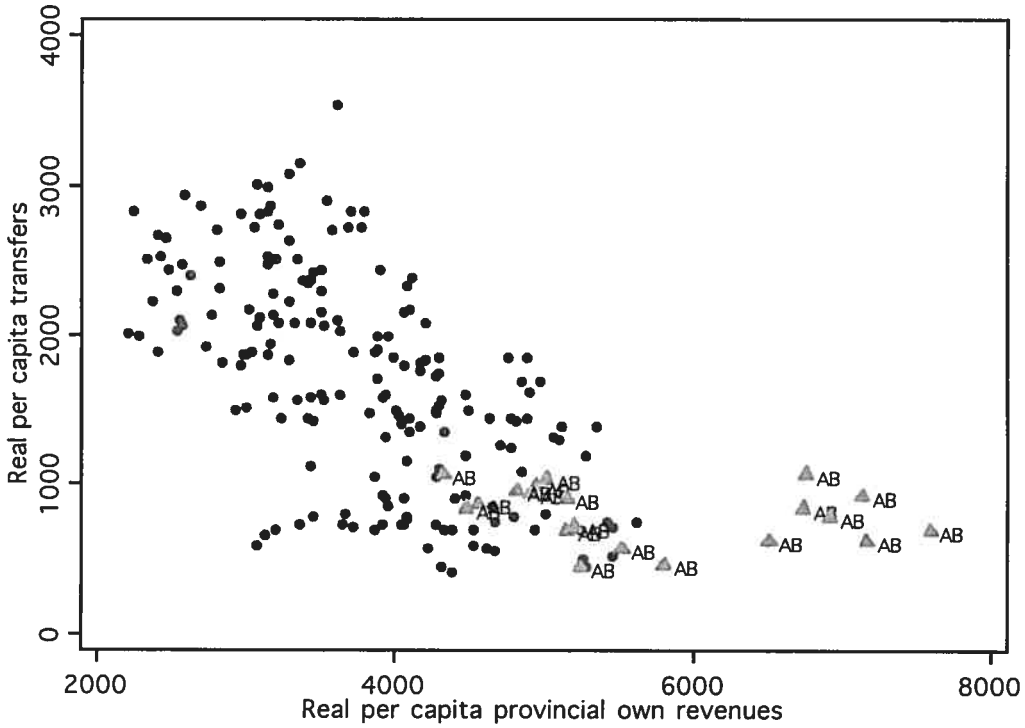
In fact, the linearity assumption was not well justified with regards to the population variable. Taking the natural logarithm, a standard practice when using such variables, did produce the desired linear functional form.

The first figure plots real per capita transfers against the measure of fiscal capacity. The outliers to the right are Alberta.

The second shows that transfers are a negative function of the log population size.

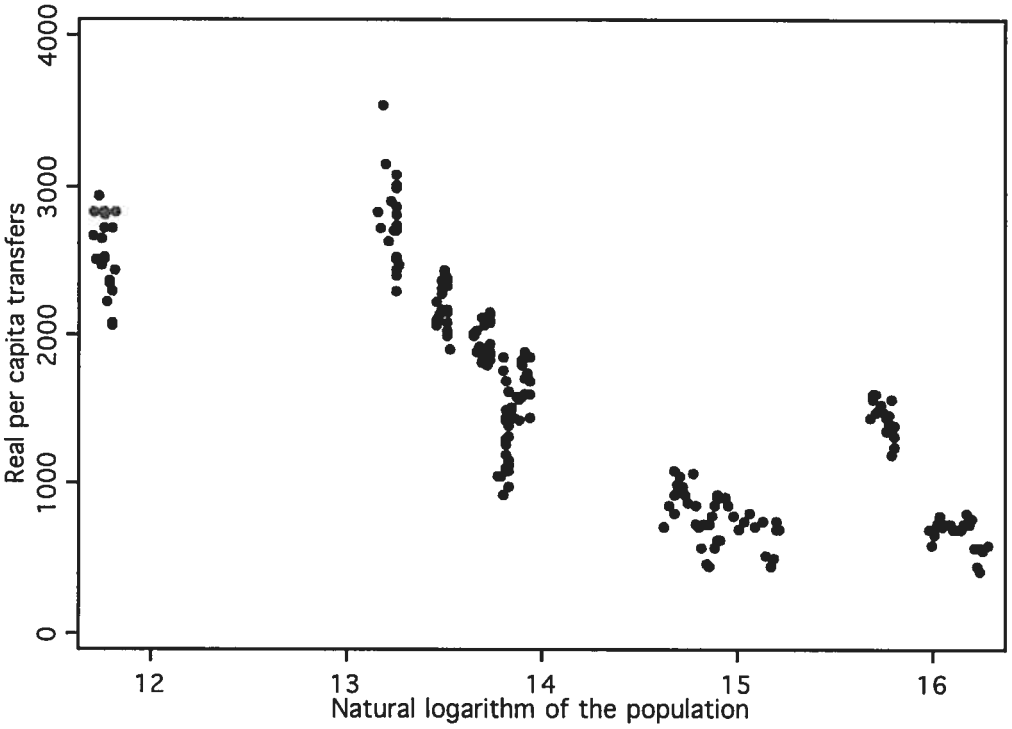
The third shows that transfers are a positive function of the unemployment rate.

Figure IV: Real per capita transfers plotted against real per capita provincial own revenues



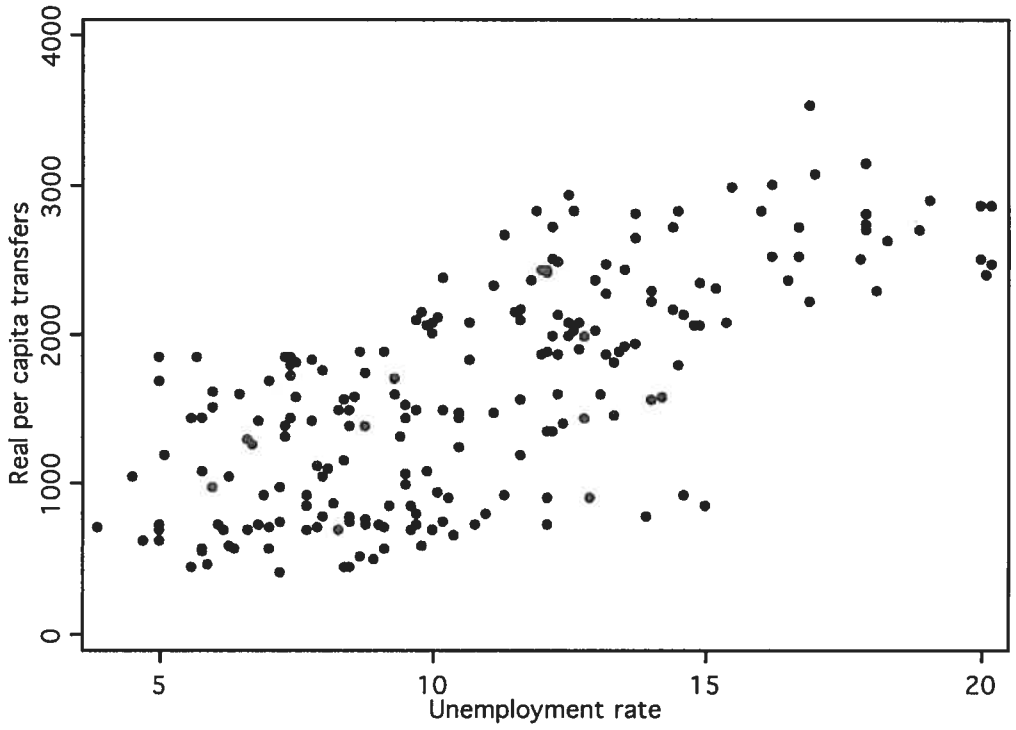
Source: Author's calculations from Statistics Canada data

Figure V: Real per capita transfers plotted against ln(population)



Source: Author's calculations from Statistics Canada data

Figure VI: Real per capita transfers plotted against the unemployment rate



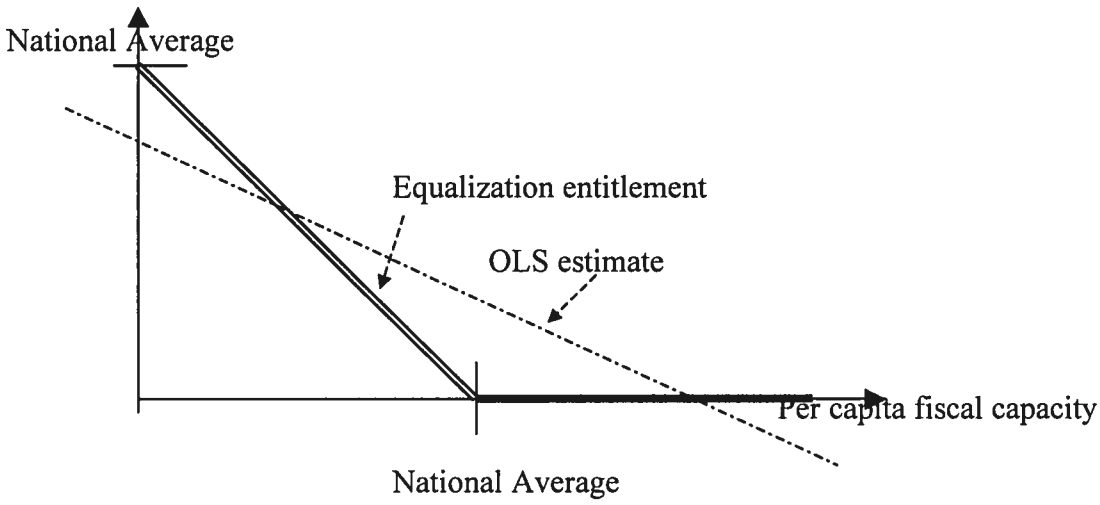
Source: Author's calculations

Alberta: one possible source of bias

There exists one possible source of bias in our OLS estimates, particularly in regards to the fiscal capacity measure. It arises from the fact that the Equalization transfer is a piece-wise linear function. Indeed, any province that exceeds the national standard of fiscal capacity receives no money from the Equalization mechanism.

From the following graph, one can see how Ordinary Least Squares incorrectly estimates a piece-wise linear function:

Figure VII: OLS bias of a piece-wise linear function



Ordinary least squares analysis will thusly underestimate the magnitude of the slope in this case. The piece-wise line presented above actually closely resembles the scatter plot of overall transfers per capita (Figure IV). Eliminating Alberta will remove the horizontal arm of this piece-wise function and allow an unbiased estimation of the equalizing factor applied to other provinces.

One can argue that removing Alberta is appropriate, for two more reasons besides bias in estimation. First, Albertan voters will not respond (at the margin) to monies sent by the Liberal government: they are steadfastly conservative in the period under study. Second, their marginal utility of money (or public services) is low, since they already have so much of it (in fact is has been suggested that at this point the Alberta government is running out of ideas of what to do with its money[28]).

We can empirically measure the effect of removing Alberta from the sample. When per capita transfers are regressed only on fiscal capacity and year dummies, the slope is almost -0.6. Removing Alberta increases the absolute magnitude of the coefficient to -0.9. When we regress on the full set of controls and correct for serial correlation and heteroscedasticity, the system goes from an equalizing factor of -0.10 to

[28] The Economist. September 10th, 2005. Volume 376. No.8443. page 37.

an equalizing factor of -0.15 once Alberta is removed. *The presence of Alberta causes the equalization factor to be underestimated by 50%.*

Discarding the provincial fixed effects estimator

It was argued that the stability of the overall system was a desirable property as the determinants were probably also stable. Stability of the system implies that it is easier to control for the institutions in place. The stability - or persistence - of the system is the exact reason why provincial fixed effects estimators are inappropriate.

The graphs on the next page show the persistent nature of the policy outcome. The first graph shows the evolution of per capita transfers over time for each of the ten provinces. The subsequent graph shows the evolution of per capita GDP. For presentation purposes the average annual 1% increase in real provincial GDP has been removed (it was considered a common time trend).

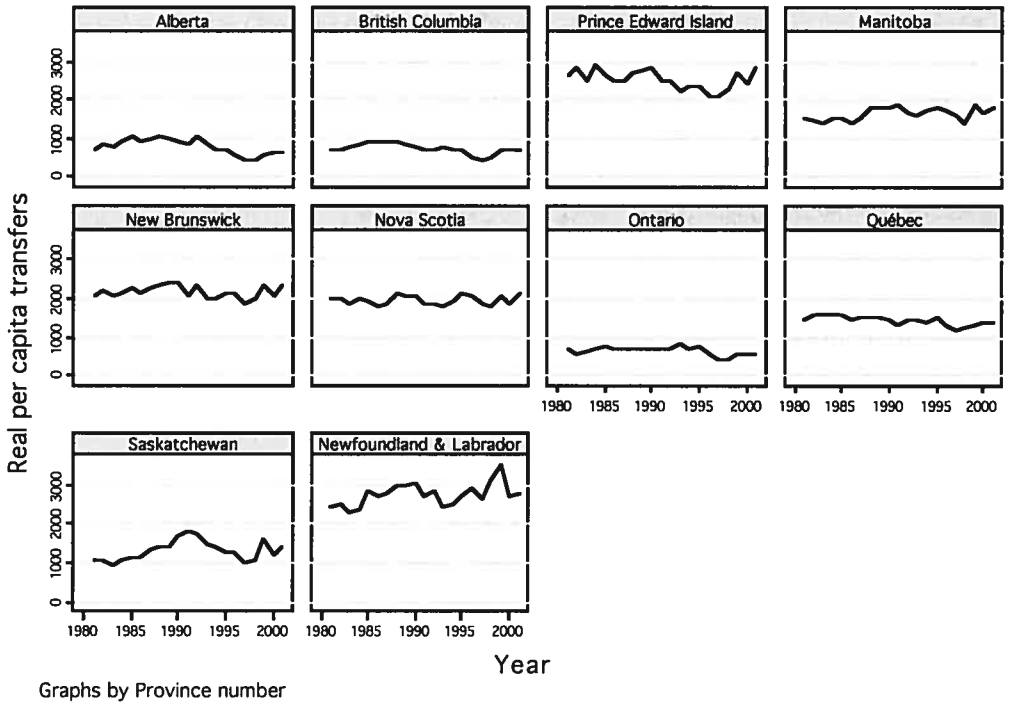
If per capita transfers are stable throughout the time period, it is because income and real economic differences have also been stable. Remember that high per capita income produces low per capita transfers.

Regressing per capita transfers *only* on 9 dummies (the base group is Alberta) produces an R-Square of 0.94. The coefficients on the dummies (not shown), but they are all significant at the 1% level with the exception of British Columbia. When we add provincial fixed effects to the economic model, the coefficients on the measure of fiscal capacity and the unemployment rate drop to almost zero and are statistically insignificant.

Introducing provincial fixed effects sucks out the cross-sectional variation in the data (it actually sucks out 94% of the variation in per capita transfers across Canada). Provincial fixed effects will capture any policy based on "persistent" macroeconomic measures, such as per capita income, better than the income variable itself. One will be mistakenly led to believe that policy outcomes are persistent, while in reality the policies are based on macroeconomic variables that only happen to be persistent.

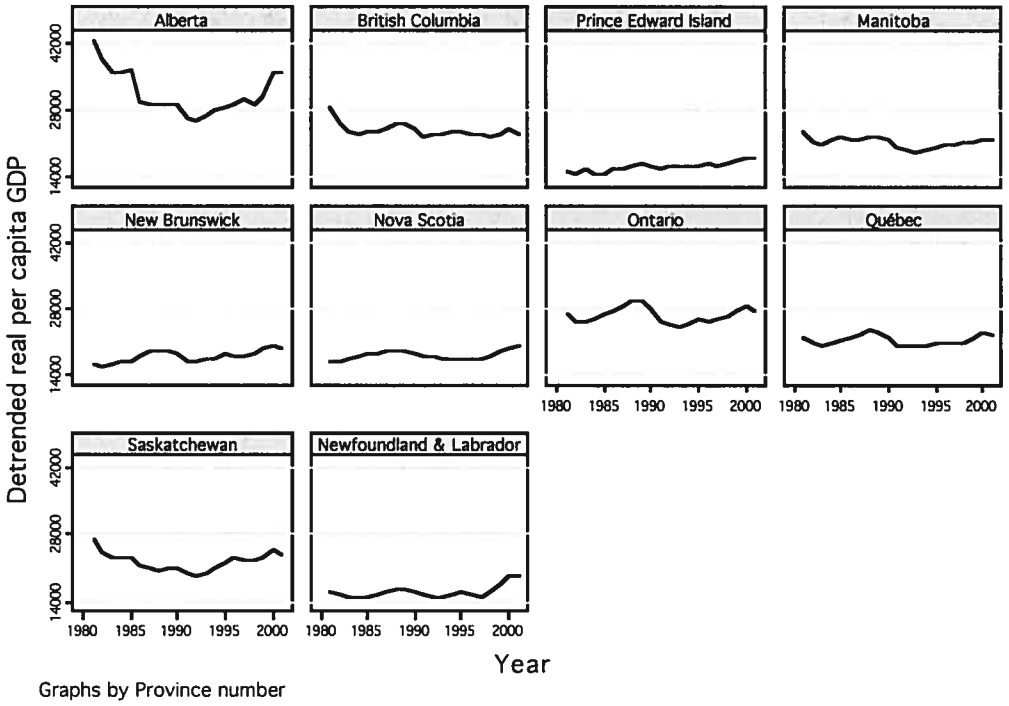
Some economists, notably Wallis (1996), argue for provincial fixed effects. This may be a reasonable approach given the data *he* had. Observations were taken every ten years in his study. Yet these are unnecessary and undesirable in the case of a yearly panel such as this one.

Figure VIII: Per capita transfers over time to each of the ten provinces



Source: Author's calculations from Statistics Canada data

Figure IX: Real per capita de-trended GDP over time for each of the ten provinces



Source: Author's calculations from Statistics Canada data

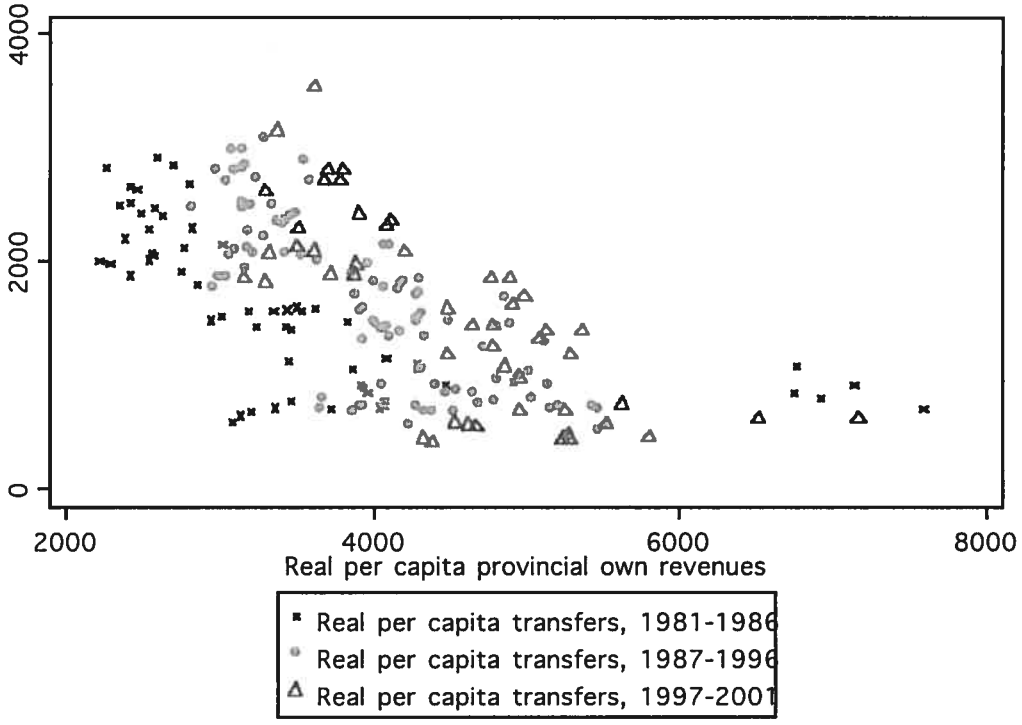
Justifying the year fixed effects estimator

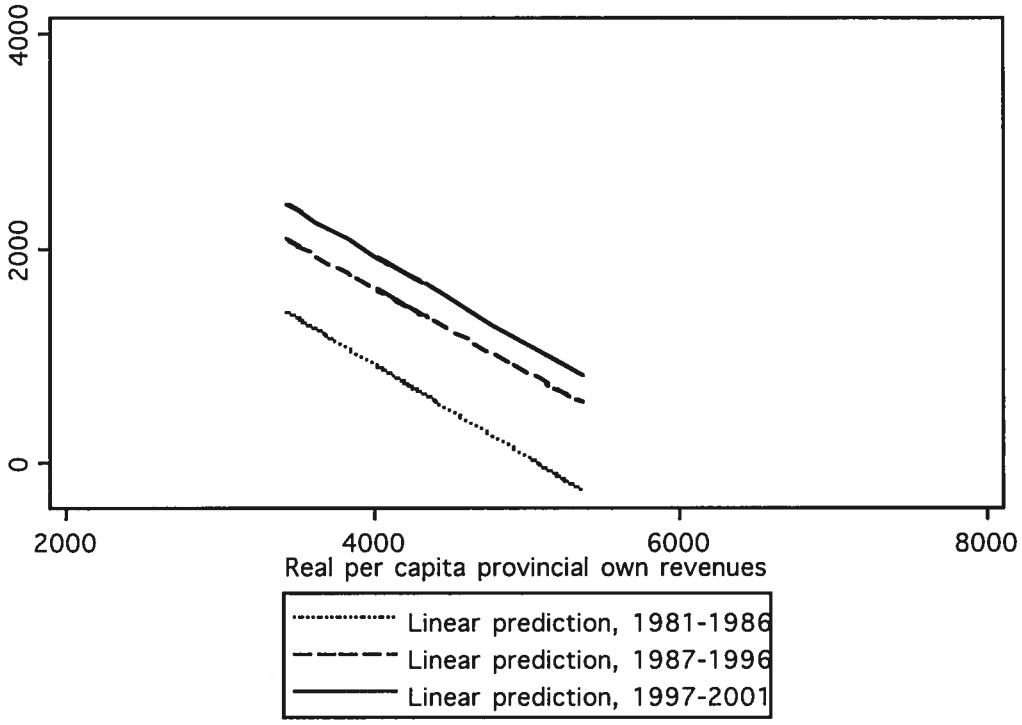
The year fixed effects estimator, year dummies are simply added to the linear regression, is quite appropriate. The year fixed effects estimator permits the intercept of the linear model to vary by year. This will capture overall shifts in the federal government's (per capita) budget constraint.

Year fixed effects will also capture the per capita healthcare transfer that applies to all Canadians for each of the years under study.

The following graph will prove this point.

Figure X: Real per capita transfers and fitted values plotted against real per capita provincial own revenues





Source: Author's calculations from Statistics Canada data

The x's represent transfers in the earliest years, the triangles represent transfers in the middle years of the period under study, and the hollow circles the final years. There are also three fitted regression lines: one for each of the three sub-periods.

From the graph above it is clear that total per capita transfers have increased with time: the linear curve has *shifted* outwards. The year fixed effects estimator captures the overall increase in the federal government's per capita budget (the budget constraint moves outward), and permits the intercept of the linear function to change every year.

The graph above suggests that the slope has remained the same but that the intercept has shifted. Such fine-tuning of the model will produce more efficient estimators.

Endogeneity of per capita income and per capita tax revenues; 2SLS

The Canadian transfer system did present a matching grant mechanism in the period under study. The robustness of the results was verified using the 2SLS procedure suggested by Wallis (1996), as well as a pair of alternate specifications. The 2SLS results did not greatly differ than those of the simple linear model, suggesting that such a procedure was not necessary.

Appendix 3 is provided to this effect.

4. RESULTS

I will first present the results of the core model during which I decompose per capita transfers into four parts: all transfers, Equalization, healthcare transfers, and "other" transfers. I will use each of these transfer categories as a dependent variable in the three variable model. Standard errors are presented in parentheses under each coefficient.

Then, I will show a summary of the iterative procedure results. Full results are presented in Appendix 4

Results of the core model

Overall, empirical functional forms closely match expectations.

Total transfers

Table 9 below shows estimation results of the core model for total transfers. Each regression successively imposes another estimation assumption.

Table 9: Results of the "core" model estimation, total transfers

	Real per capita transfers					
	(T1)	**(T2)**	**(T3)**	**(T4)**	**(T5)**	**(T6)**
Real per capita provincial own revenues	-0.48 (0.039)***	-0.89 (0.054)***	-0.57 (0.041)***	-0.58 (0.065)***	-0.30 (0.050)***	-0.15 (0.053)***
Unemployment				80.8 (11.7)***	68.1 (8.24)***	34.9 (12.2)***
ln(Population)					-275 (20.8)***	-385 (42.3)***
Constant (1981)	3506 (161)***	4364 (22)***	3548 (225)***	2706 (313)***	5800 (320)***	7201 (616)***
Restriction	Alberta removed	Alberta removed	None	Alberta removed	Alberta removed	Alberta removed
R-squared	0.37	0.62	0.51	0.71	0.86	
Log-likelihood						-1172.86
No. obs.	189	189	210	189	189	189
Method	OLS	Year FE	Year FE	Year FE	YEAR FE	GLS, Year FE, AR(0.85), heteroscedastic panels

*: significant at the 10% level; **: significant at the 5% level; ***: significant at the 10% level
Note: Year fixed effect coefficients not shown

Column **(T1)** provides the simplest specification, where per capita transfers are a function of per capita provincial government own revenues (income). The slope is -0.48 and is precisely estimated with a standard error smaller than 10% of the coefficient's magnitude. The regression R-Square is 0.37.

Adding a full set of year dummies in Column **(T2)** almost doubles the factor of equalization to -0.89. Again it is precisely estimated. The R-Square jumps to 0.62. So "controlling" for healthcare transfer mechanism by adding year dummies highlights the redistributive nature of the transfer system.

Column **(T3)** was provided as proof of coefficient under-estimation in the presence of Alberta. Here the equalizing factor is -0.57 when Alberta is included in the sample, substantially less than -0.89 in **(T2)**, especially considering the small coefficient standard errors. Notice that the intercept is also lower than the intercept in **(T2)**, which is predicted by Figure VII above.

Columns **(T4)** and **(T5)** add unemployment and the natural logarithm of the population, respectively, as controls. As expected, the coefficient on unemployment is positive, and that on population is negative.

When the unemployment variable is introduced the magnitude of the fiscal capacity coefficient is diminished. When the population variable is introduced the magnitudes of both the fiscal capacity and the unemployment coefficients are reduced. This is a direct result of the correlation between these variables: they capture the same effect. The estimates remain precisely estimated, however.

Column **(T6)** is the Generalized Least Squares estimation that allows for a common factor of serial correlation in each of the panels. There is indeed a high level of serial correlation in the data (it is 0.85). Correcting for positive autocorrelation increases the coefficient standard errors as predicted by econometric theory. Nonetheless all coefficients remain significant that the 1% level.

The point estimate of the unemployment coefficient in **(T6)** is 34.9, which suggests that on average a one percentage point increase in the provincial unemployment rate increases per capita transfers by about $35.

As for the population variable, it needs to be interpreted carefully[29]. A one percent increase in the population will decrease per capita transfers by $3.85 in **(T6)**.

The coefficients are slightly different between **(T5)** and **(T6)**, but they are of the same order of magnitude. A smaller unemployment coefficient is compensated for by a more important population effect.

Overall, the system is equalizing, with the degree of equalization diminishing as other controls are added. The linear model with year fixed effects and three independent variables, column **(T5)**, generates an R-Square of 0.86, which is quite strong.

[29] When the independent variable is expressed in log form the partial derivative is expressed as: $\Delta y = \beta_3 \%\Delta x/100$

Equalization

Table 10: Results of the "core" model estimation, "Equalization" transfers

	Per capita "Equalization" transfers			
	(E1)	**(E2)**	**(E3)**	**(E4)**
Real per capita provincial own revenues	-0.82 (0.042)***	-0.36 (0.041)***	-0.10 (0.047)**	-0.12 (0.046)***
Unemployment		55.0 (6.77)***	37.1 (9.27)***	49.2 (8.15)***
ln(Population)		-208 (17.1)***	-318 (32.2)***	-198 (28)***
Constant (1981)	3245 (180)***	4254 (263)***	5224 (466)***	3610 (377)***
Restriction	Alberta removed	Alberta removed	Alberta removed	AB, ON, BC removed
R-square	0.69	0.88		
Log-likelihood			-1125	-860.77
No. obs.	189	189	189	147
Method	Year FE	Year FE	GLS, Year FE, AR(0.86), heteroscedastic panels	GLS, Year FE, AR(0.77), heteroscedastic panels

*: significant at the 10% level; **: significant at the 5% level; ***: significant at the 10% level
Note: Year fixed effect coefficients not shown

The R-Square of regression **(E1)** is 0.69. The coefficient on the fiscal capacity measure is -0.82, which is close, but not close enough, to -1.0, the functional form suggested by mechanism design; the 95% confidence interval of the coefficient is [-0.90, -0.74]. The only disadvantage of small standard errors is that in this case the 95% confidence interval does not include the null hypothesis of β_1=-1. In fact, the variable used here *is not* the variable used in the actual mechanism. The equalization transfer

uses a fiscal capacity *differential*. This explains the fact that the estimated slope is not -1. A variable measuring the fiscal capacity differential was created and used in a simple linear regression. the estimated slope was indeed -1. This variable is censored so the results are not presented here.

The R-Square in **(E1)** is 0.69 and it is higher than the R-Square of the same regression model applied to the entire transfer system (0.62 in **(T2)**).

Adding the control variables reduces the coefficient magnitude of the fiscal capacity variable. The results are as expected and are highly significant.

The regression in **(E2)** has an R-Square of 0.88, higher than when the entire system is considered with the same controls.

Finally, regression **(E4)** removes Alberta (AB), British Columbia (BC), and Ontario (ON) from the sample. Over the period under study none of these provinces have received equalization payments. Results are not that different, and an increased (more positive) point estimate on the population variable compensates for a smaller constant term.

Overall, a simple one variable linear regression produces an R-Square of almost 0.70 for Equalization. Examination of the regression R-Square is appropriate: it is important to be able to explain individual components of the transfer system better than the entire transfer system itself.

Healthcare and social welfare transfers

The following table presents regression results for healthcare, social, and postsecondary transfers. Postsecondary transfers are included here because they were part of the Established Programs Financing set of transfers. They are now included in the CHST. For simplicity I will refer henceforth to the combination of these three transfers categories as healthcare and social transfers; the reader should keep in mind that postsecondary grants are included.

In order to present the year dummies, coefficient standard errors are presented next to the coefficient, as opposed to directly under them as previously. This method of presentation is used only here.

Table 11: Results of the "core" model estimation, healthcare and social transfers

	Real per capita healthcare and social transfers					
	(H1)		(H2)		(H3)	
	Coefficient	(Std.Error)	Coefficient	(Std.Error)	Coefficient	(Std.Error)
Real per capita provincial government own revenues	-0.032	(0.0093)***			0.0033	(0.0068)
Unemployment	7.97	(2.48)***			6.08	(1.72)***
ln(Population)	11.5	(6.78)*			-3.4	(6.76)
1982			-72.9	(26.5)***	-98.6	(7.36)***
1983			-21.4	(26.5)	-53.8	(10.1)***
1984			48.51	(26.5)*	15.0	(11.4)
1985			111.9	(26.5)***	77.0	(12.6)***
1986			48.3	(26.5)*	15.2	(12.8)
1987			31.9	(26.5)	2.26	(13.2)
1988			39.2	(26.5)	12.6	(13.6)
1989			-9.00	(26.5)	-37.8	(14.2)***
1990			-40.5	(26.5)	-69.6	(14.9)***
1991			-72.4	(26.5)***	-107.8	(15.3)***
1992			-1.44	(26.5)	-32.4	(16.1)**
1993			59.1	(26.5)**	27.5	(16.6)*
1994			-13.7	(26.5)	-43.2	(17.1)**
1995			-15.1	(26.5)	-38.4	(16.6)**
1996			-137.5	(26.5)***	-156.0	(17.0)***
1997			-239.7	(26.5)***	-260.6	(16.8)***
1998			-257.7	(26.5)***	-273.3	(16.6)***
1999			-133.3	(26.5)***	-144.4	(17.0)***
2000			-147.0	(26.5)***	-166.1	(17.6)***
2001			-172.5	(26.5)***	-189.7	(17.0)***
Constant (1981)	492.3	(108.9)***	662.8	(18.8)***	660.7	(96.7)***
Log-likelihood					-930	
R-Square	0.19		0.75			
No. obs.	210		210		210	
Method	**OLS**		**OLS**		**GLS, AR(0.84), heteroscedastic panels**	

*: significant at the 10% level; **: significant at the 5% level; ***: significant at the 10% level

First, notice the low R-Square for regression **(H1)**: it is 0.19. The three control variables on their own generate an R-Square of 0.79 when the dependent variable is the entire transfer system. Even though the coefficients are significant, all their values are a

full order of magnitude smaller than those produced in regression **(T5)**. What's more, the coefficient of the population variable is positive, which is unexpected.

Regressing healthcare and social transfers on only year dummies in **(H2)** *produces many significant coefficients and a regression R-Square of 0.75.* Truly the correct way to model the healthcare and social transfers is through a vector of year dummies. The importance of the regression R-Square in this case cannot be understated. At 0.75 with only year dummies, we can be fairly certain that our model is good.

The dummies for the last 5 years are significant and negative. I have already mentioned (see *Stability of per capita transfers*) the fact that 1996 through 2001 had lower per capita transfers. This supports the claim made by Vaillancourt and Laurent (2004, 8) that "The introduction of the CHST was not the product of a new vision of federalism but simply a result of the federal government's need to reduce its deficit".

Overall, the healthcare and social transfer system is only slightly equalizing. The coefficient on fiscal capacity is economically small at -0.03 in **(H1)** and statistically insignificant in regression **(H3)**. The coefficients for the unemployment rate and the natural logarithm of the population are also economically small.

The constant term in **(H3)** is easy to interpret. $660.70 represents the per capita health and social transfer in 1981, measured in real 1992 dollars.

"Other" transfers and comparison

The following table presents the core model when the dependent variable is composed of "other transfers", the difference between total transfers and the two transfer mechanisms described above. Previous regression results are shown again to highlight the differences in the results.

Table 12: Results of the "core" model estimation, "Other" transfers and comparative analysis

	Total transfers (T6)	Equalization (E3)	Healthcare and social (H3)	"Other" (O1)
Real provincial own revenues	-0.15 (0.053)***	-0.10 (0.047)**	0.0033 (0.0068)	-0.0069 (0.0075)
unemployment	34.9 (12.2)***	37.1 (9.27)***	6.08 (1.72)**	-0.49 (3.30)
ln(pop)	-385 (42.3)***	-318 (32.15)***	-3.4 (6.76)	-48.6 (7.41)***
Constant	7201 (616)***	5224 (466.331)***	660.7 (96.7)***	885.9 (121.6)***
Restrictions	Alberta removed	Alberta removed	none	none
Log-likelihood	-1172	-1125	-930	-1162
No. obs.	189	189	210	210
Method	GLS, Year FE, AR(0.85), heteroscedastic panels	GLS, Year FE, AR(0.85), heteroscedastic panels	GLS, Year FE, AR(0.84), heteroscedastic panels	GLS, Year FE, AR(0.49), heteroscedastic panels

***: Significant at the 1% level
**: Significant at the 5% level
*: Significant at the 10% level
Note: year fixed effects not shown

For "other" transfers in column **(O1)**, fiscal capacity and unemployment matter not. The sizes of these coefficients are well, well below those for the entire transfer system, and they are not significant. Population size is significant, but the magnitude of the point estimate is much smaller than when we consider the entire transfer system in **(T6)**.

What's more, just over half of the year dummies (not shown) are insignificant. This suggests that "other" transfers are not distributed evenly on a per capita basis.

Since normative factors do not affect the level of "other" transfers, the removal of Alberta no longer seems justified. The claim that the presence of Alberta biases downward the coefficient on fiscal capacity is moot if this coefficient is zero, with or without Alberta. So when looking at strategic vote purchasing through "other" transfers Alberta will be included in the analysis.

The degree of persistence of other transfers is smaller than when the entire transfer mechanism is considered. The common autoregressive factor for "other" transfers is only 0.49 whereas it is above 0.80 when the dependent is the entire transfer system.

Overall, "other" transfers are less persistent, not driven by normative factors, somewhat sensitive to the absence of economies of scale (population), and not distributed evenly on a per capita basis. These transfers are ripe for political analyses.

Results of the iterative procedure: political variables

I will use total transfers and "other" transfers as alternative definitions of the dependent variable throughout this section.

The process used here is simple. The above three variable model was appended with a measure capturing a particular political hypothesis. The model was estimated and the results noted. The political metric was removed and replaced by the next. The model was estimated again, the results noted, etc. Only one political variable is estimated at a time.

The model was estimated using a panel generalized least squares (GLS) procedure. It allows for a common factor of autocorrelation across panels and corrects for heteroscedastic standard errors. Year dummies were also included.

Alberta is always removed when all transfers are considered. It is included when "other" transfers are used as the dependent. For each table I discuss whether results are sensitive to the inclusion or exclusion of Alberta.

I present the results to the regressions in the order I presented the variables in Chapter 3. Only significant political variables are presented. Insignificant variables are marked *ns* (not significant).

The results for each of the different models are briefly discussed before a more comprehensive discussion is left to the next section.

Table 13: Results of the iterative substitution of political variables, "swing" model:

		"Swing" model	
		All transfers	**"Other" transfers**
Dummies	***swing2***	-84.2*	*ns*
	swing5	*ns*	*ns*
	fswing2	*ns*	*ns*
	fswing5	*ns*	*ns*
	bwsing2	*ns*	*ns*
	bswing5	*ns*	*ns*
Percentages	***riding_swing2***	*ns*	*ns*
	riding_swing5	*ns*	*ns*
	friding_swing2	*ns*	1.59*
	friding_swing5	*ns*	1.10**
	briding_swing2	*ns*	*ns*
	briding_swing5	*ns*	*ns*

***: significant at the 1% level; **: significant at the 5% level; *: significant at the 10% level; *ns*: not significant
Note: GLS estimator used, correcting for AR(1) type serial correlation and for heteroscedastic panels. Controls include real per capita provincial own source revenues, the unemployment rate, the natural logarithm of the population, and a full set of year dummies.
Note: Alberta always removed when all transfers are considered

Only two variables had the correct sign and were statistically significant, and they were related. These two variables were the percentage of tight ridings before *and* after the race, at 2% or 5% (*friding_swing2* and *friding_swing5*).

When the dependent is the entire transfer system, no political variable is significant in the presence of Alberta.

The result on *friding_swing5* when the dependent is "other" transfers is robust to removing or adding Alberta. The result on *friding_swing2* is not.

The fact that the political variable of significance is the tightness of race before *and* after an election needs to be explained. This may be because transfers set up in the run-up to an election have implementation lag time or have a certain amount of inertia, or both, such that the full effect of a new transfer program is felt after the election. It is also possible that an electoral promise of more transfers can only be fulfilled once the new cabinet is created.

When looking at the entire transfers system, many of the political coefficients were negative, which goes against expectations. However most political coefficients were positive when "other" transfers were looked at. If any vote purchasing is going on, it is not through the main transfers, but rather through "other" transfers. This not preclude vote purchasing through expenditure or taxation policies, however, as noted by Evans (2005).

Overall, it may be that the 2% "tightness" of race measure was *too* tight. I had the advantage of riding-level data collected *ex post* by Elections Canada. It is hard to believe politicians could respond to a fine-tuned measure they did not have access to.

On the other hand, they do have access to polling data. And we would certainly expect seasoned politicians to come to understand the non-linearities of the votes to seats function. So the non-significance of the various variables indicating tightness of race is evidence that there is little vote purchasing going on.

If there were a "swing" effect we would have expected more variables to be significant – or at least of the correct sign - especially since metrics were altered in many ways.

Table 14: Results of the iterative substitution of political variables, "constituents" model:

		"Constituents" model	
		All transfers	"Other" transfers
Dummies	**voted_winner**	*ns*	*ns*
	seated_winner	*ns*	27.2**
Percentages	**winner_votes_prop**	*ns*	1.21**
	winner_seats_prop	*ns*	0.39*

***: significant at the 1% level; **: significant at the 5% level; *: significant at the 10% level; *ns*: not significant
Note: GLS estimator used, correcting for AR(1) type serial correlation and for heteroscedastic panels. Controls include real per capita provincial own source revenues, the unemployment rate, the natural logarithm of the population, and a full set of year dummies.
Note: Alberta always removed when all transfers are considered

The coefficient on *seated_winner* is $27. $27 is an economically significant amount. For example for Québec this translates into $162 million in additional transfers.

The results for the metrics measured in percentages are not economically unimportant, either. For Québec, for example, one more MP for the party in power (a 1.3% increase) generates an extra $0.51 in per capita transfers, or a total of around $3million. Remember that Québec has 75 ridings, and at the Bloc Québécois holds around 50 of these.

No political variable capturing the "constituent" effect is significant when the dependent is the entire transfer system. This is true whether or not Alberta is included.

Some sensitivity analysis was performed for "other" transfers within the "constituents" framework. *When "other" transfers are the dependent and Alberta is excluded, all political variables are insignificant.* This weakens the evidence for the "constituents" model. The Alberta exclusion restriction is the only one that makes all the political variables insignificant. In other words if I exclude any province other than Alberta the political variables capturing the "constituents" effect still remain at least somewhat significant (by somewhat I mean that at least one of the three initially significant variables remains significant). Clearly the results hinge on the Alberta exclusion restriction.

Overall, results here suggest that parties in power do transfer monies to constituents, although the sensitivity of the results to the exclusion of Alberta does mitigate support for this model. If the reader supports the hypothesis that Alberta is the area of Canada where transfers offer the lowest marginal political payoff, then its exclusion from the analyses should unveil the federal government's relationship with the other, more persuadable, provinces. In other words the electoral incentives should become clearer. On the other hand, one could argue this result highlights the long-term cost of Alberta's support for any party *that is not* the Liberal party; opposing the party that has dominated Canadian federal politics for 75 years is certainly not a moneymaking strategy.

As with "swing" transfers, constituency driven transfers are from the "other" category, not from the two main transfer categories.

Table 15: Results of the iterative substitution of political variables, partisan analysis

		Partisan analysis	
		All transfers	**"Other" transfers**
Vote shares	***Lib***	*ns*	*ns*
	NDP	*ns*	*ns*
Percentage of seats	***Lib_seats***	*ns*	*ns*
	NDP_seats	*ns*	*ns*

***: significant at the 1% level; **: significant at the 5% level; *: significant at the 10% level; *ns*: not significant
Note: GLS estimator used, correcting for AR(1) type serial correlation and for heteroscedastic panels. Controls include real per capita provincial own source revenues, the unemployment rate, the natural logarithm of the population, and a full set of year dummies.
Note: Alberta always removed when all transfers are considered

Here, the evidence of partisan rewards is extremely limited.

However, when the dependent is all transfers and Alberta is included, the coefficient on the Liberal vote share becomes significant at the 5% level and is $5.50. This implies that every percentage increase of the popular vote accorded to the Liberal party is rewarded by an increase of $5.50 in per capita transfers. The reader should

consider this result carefully, as the Liberal vote is highly negatively correlated with the measure of fiscal capacity. It was shown that the estimated slope for the fiscal capacity function is biased upwards in the presence of Alberta. The Liberal vote share variable as an independent may compensate for this bias, since this measure is strongly negatively correlated with the fiscal capacity variable that is underestimated. The fact that the Liberal vote share is significant and *positive* supports this interpretation.

Table 16: Results of the iterative substitution of political variables, over-representation:

	Over-representation	
	All transfers	**"Other" transfers**
Seats per capita	*ns*	*ns*

***: significant at the 1% level; **: significant at the 5% level; *: significant at the 10% level; *ns*: not significant
Note: GLS estimator used, correcting for AR(1) type serial correlation and for heteroscedastic panels. Controls include real per capita provincial own source revenues, the unemployment rate, the natural logarithm of the population, and a full set of year dummies.
Note: Alberta always removed when all transfers are considered

I find no support for the idea that provinces with higher per capita representation receive more transfers controlling for the log population, at least on the macroscopic level.

Discussion of results

The evidence that transfers are used to purchase votes strategically in "swing" regions is not convincing. Variables capturing this model were modified in many ways, to capture the electoral cycle for example, but only two related metrics turned out to be significant and of the expected sign, and many coefficients were negative (see Appendix 4). If anything, the benefits of being a "swing region" are felt after the conclusion of the election, not before.

Second, there is some mixed evidence that supports the "constituents" model, although results are extremely sensitive to excluding Alberta. Because excluding

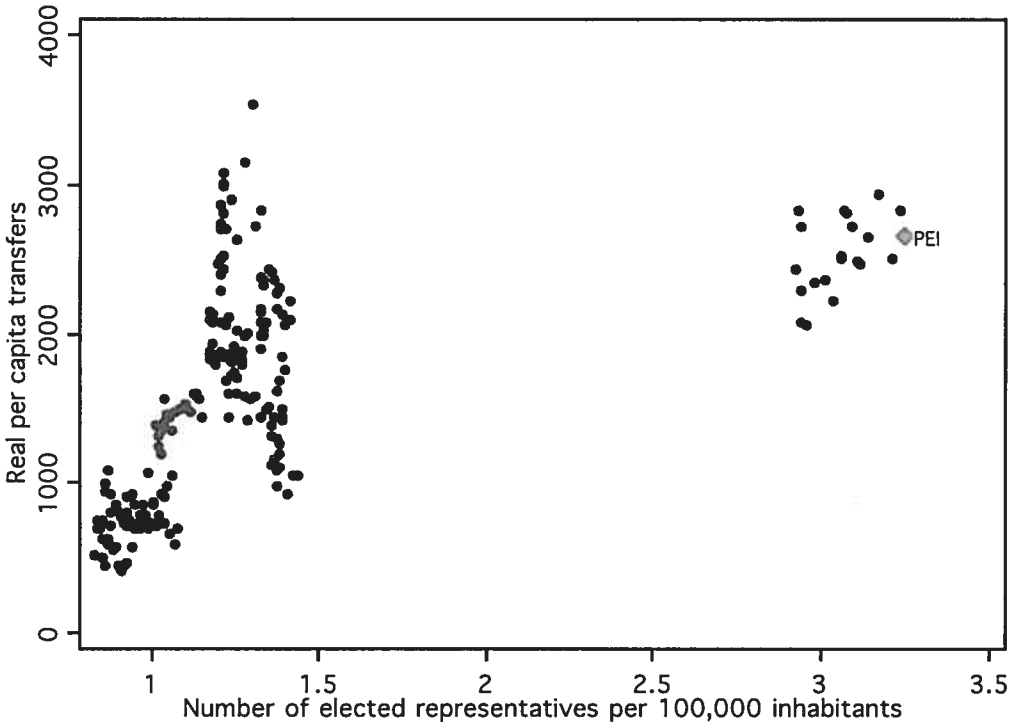
Alberta renders all political variables insignificant, we cannot say the results support strongly the "constituents" model. That being said, it is the most significant result found here.

Third, it does not appear that voting for the Liberal party generates higher transfers (or that voting Conservative lowers them). Close examination of results in Appendix 4 reveal that although the NDP coefficients are statistically insignificant they are all negative. This lends support to the results of the "constituents" model as the NDP never formed the government in the period under study.

Fourth, and finally, I find little evidence that over-representation significantly contributes to increasing transfers, all else being equal. This contradicts Evans (2005), although this thesis differs from his paper in two respects. He looks at spending and taxation, not transfers. His level of observation is the electoral district, not the province.

In Canada only Prince Edward Island (PEI) exhibits political over-representation on a provincial level. The following scatter-plot shows transfers per capita transfers as a function of the number of elected MPs per 100,000 inhabitants. The outliers at the top right are Prince Edward Island.

Figure XI: Real per capita transfers plotted against the number of MPs per 100,000 inhabitants



Although there seems to be a positive relationship, we saw above that controlling for population and other normative factors makes over-representation insignificant.

Overall, the transfers that were most sensitive to political influence were "other transfers". The main transfers are set by formulas and are hard to openly manipulate.

5. CONCLUSION

I presented several competing models of political behaviour and went on at some length about correctly modeling national fiscal and political institutions. I hope to have demonstrated that simply applying the Boex and Martinez-Vazquez (2004) approach to the entire transfer system without showing deference to actual mechanisms may not be the best approach. Their model's simple functional form is an excellent starting point, though.

Econometric estimation supported the expected functional forms for the two main transfer categories. Equalization transfers regressed on fiscal capacity and year dummies generated an R-Square of 0.70 and a slope of -0.80. Healthcare and social transfers regressed on the three normative controls produces a much smaller R-Square of 0.17. On the other hand, when regressing healthcare and social transfers on only year dummies, the R-Square jumps to 0.75. We can be fairly satisfied that the main components of the transfer system were controlled for. Careful analysis also permitted me to remove Equalization and healthcare transfers from potential political influence, allowing me to take a closer look at "other" transfers.

Great care was taken when constructing the econometric model. Including too many macroeconomic variables as controls introduced multicollinearity. I presented scatter-plots justifying the linearity assumptions, something empirical papers should do more when relying upon linear estimators. Paying great attention to this type of specification mistake should take precedence over the modeling of standard errors.

I also came out against the use of the provincial/state fixed effects when using a yearly panel. Provincial fixed effects removed any cross-sectional variation in the data.

On the other hand, I suggested that using year fixed effects made good sense. The year fixed effects can capture shifts in the federal government's per capita budget constraint, as well as capturing the flat per capita healthcare transfer.

The fact the transfers in Canada can be modeled with a single equation, as opposed to a system of two equations, is not a trivial result either. In fact, testing the

endogeneity of grants should be the first step when modeling a country's transfer mechanisms.

It is possible to generate R-Square of 0.80 with only three variables and without year or province dummies. This is quite good and supports the Boex and Martinex-Vazquez (2004) linear model. Although models derived from theory or first principles may be more desirable to some, the robustness of their empirical model leaves no doubt. I hope the reader is convinced of the empirical value of their model.

Overall, the transfer system is equalizing: the coefficient for fiscal capacity is -0.15 (standard error = 0.05). A one percentage point increase in the unemployment rate increases per capita transfers by $35 (standard error = 12). A one percent increase in population decreases per capita transfers by $3.85 (standard error = 0.4).

The main political result concerns the "constituents" effect. Three of the four metrics capturing the "constituents" effect were positive, and statistically and economically significant when the dependent was "other" transfers.

The following can be used to complete the comparative analysis of the Boex and Martinez-Vazquez (2004) paper.

Table 17: Comparative results for Canada

	Expenditure needs	**Fiscal capacity**	**Political power**	**Population size**	**R^2**
Canada	Unemployment: +	Revenue: - GDP: -	Political support: +	Population: -	0.86

Future research should further breakdown the transfer system. Healthcare and social transfers should be separated. In doing this the health and the social parts of the Canadian Health and Social Transfer need to be distinguished. Future research also needs to take a closer look at not only "other" transfers as defined here, but the category "Miscellaneous current transfers". In 2001, these totaled more than $4 billion, a substantial absolute amount. What lurks in here may the most susceptible to political manipulation, since the government has chosen to aggregate transfers into this category as opposed to reporting its components as line items.

More specifically, future research should apply the core model to the following:

Social transfers:	- Canadian Health and Social Transfer, *social portion* - Canada Assistance Plan - Postsecondary education grants
Health transfers:	- Canadian Health and Social Transfer, *health portion* - Health Resources Fund - Medicare - Contributions under the Hospital Insurance Act
Equalization:	- Taxation agreements (≈Equalization)

Each of the following taken separately:

- Miscellaneous current transfers
- Regional economic expansion payments
- Official languages
- Contributions under the Crop Insurance Act
- Transfers to provincial universities
- Statutory grants

More rigorous treatment of some of Canada's smaller transfers can be afforded in this way. Take the case of the Official Languages Act that finances minority language education. I suggested that minority language education was a merit good. Given this, one can append the three variable model described above with a variable that measures the percentage of the provincial population that was in a minority language position. The expected sign of this variable's coefficient is positive.

The fact that real per capita transfers are a piece-wise linear function, with Alberta occupying the horizontal arm, should at the very least provoke some normative

discussions. Alberta on its own basically messes up the nice linear equalizing aspect of the transfer system by a factor of about 50%. Transfers to Alberta were on average $800 per person during the period, while for the rest of Canada (excluding Alberta) the unweighted average was $1700. In other words, one could say that in order to maintain the current linear equalization aspect of the transfer system, Alberta should receive significantly fewer transfers than it does now.

The outlying Alberta observations, however, were from the start and the end of the period of observation. During these years the price of oil was relatively high. Modeling Alberta's fiscal capacity and attempting to net out the effect of oil prices could improve the national model.

There may also be efficiency gains to be had by modeling the clustered nature of the population variable.

Yet I controlled for over 80% of the transfer system.

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APPENDIX 1: ESTIMATED VALUE OF THE QUÉBEC ABATEMENT

The following table shows the estimated per capita value in both nominal and real terms of the 13.5% healthcare tax point transfer of the basic federal personal income.

Table A 1: Value of the 13.5% Québec personal income tax abatement for healthcare on a per capita basis, 1981-2001

Year	Value of abatement, per capita, nominal dollars	Value of abatement, per capita, 1992 real dollars
1981	109	196
1982	117	189
1983	122	181
1984	130	183
1985	146	199
1986	175	228
1987	192	241
1988	204	245
1989	219	253
1990	255	279
1991	258	264
1992	261	263
1993	248	245
1994	249	243
1995	267	259
1996	280	267
1997	296	276
1998	318	294
1999	320	294
2000	360	323
2001	370	322

Source: Author's calculations from Statistics Canada data.

APPENDIX 2: MATRIX FORM OF EQUALIZATION PAYMENTS

Table A 2: Calculation of Equalization for 1982-1983, taken from Perry (1997):

Table 11.2 Calculation of Equalization for 1982-83: Average Per Capita Yield for the Representative Average Standard and Per Capita Deficiency or Excess by Province[a]

Revenue source[b]	Average per capita yield, representative average standard	Average per capita yield, deficiency (+) or excess (–)									
		Nfld.	PEI	NS	NB	Que.	Ont.	Man.	Sask.	Alta.	BC
		dollars									
Personal income taxes	703.09	330.83	358.84	236.54	284.48	88.51	–56.27	154.90	112.49	–149.04	–126.61
Business income revenues	116.60	59.97	66.38	43.75	30.88	19.33	–10.87	24.18	2.96	–131.52	–20.95
General sales taxes	352.75	104.47	140.56	69.55	71.88	58.61	–13.04	59.68	–22.19	–244.41	–109.37
Tobacco taxes	46.57	12.85	3.41	–1.26	1.17	–6.18	2.40	3.97	7.12	–11.20	2.90
Gasoline taxes	105.63	27.52	4.72	4.62	–10.00	10.91	–5.13	7.79	–8.18	–39.52	–9.36
Diesel fuel taxes	26.84	7.81	17.23	7.02	–9.57	4.80	–1.71	–0.26	–8.04	–16.23	–2.90
Non-commercial vehicle licences	34.59	13.18	2.37	–1.24	4.40	1.51	–0.84	–2.42	1.22	–6.56	–0.45
Commercial vehicle licences	19.40	1.01	3.86	2.46	–2.28	5.07	1.56	–8.17	–15.67	–31.18	–8.10
Revenues from the sale of spirits	49.73	6.12	–10.58	–4.09	8.74	16.01	–4.33	–12.45	–4.01	–15.99	–17.65
Revenues from the sale of wine	13.42	9.40	7.27	5.55	7.42	–0.52	0.92	3.78	6.56	0.68	–5.34
Revenues from the sale of beer	21.09	–1.56	2.87	2.73	2.10	–1.35	0.01	2.05	3.96	3.28	0.95
Hospital and medical insurance premiums	76.79	7.60	4.30	–1.28	1.70	4.80	–4.85	4.83	8.76	3.67	–0.92
Succession duties and gift taxes	1.90	1.33	1.17	0.85	1.13	0.43	–0.34	0.66	0.25	–0.87	–0.27
Race track taxes	5.80	5.60	1.76	3.95	4.39	1.52	–1.77	1.35	4.40	–1.85	–0.06
Forestry revenues	12.20	2.44	12.20	11.11	–1.24	6.73	7.66	10.01	9.55	10.03	–46.31
Crown oil revenues	18.87	18.87	18.87	18.87	18.85	18.87	18.87	13.60	–262.01	–1,255.77	–15.68
Freehold oil revenues	1.96	1.96	1.96	1.96	1.96	1.96	1.78	–5.20	–26.59	–83.22	1.16
Crown gas revenues	15.66	15.66	15.66	15.66	15.54	15.66	15.66	15.66	–25.31	–912.04	–81.66
Freehold gas revenues	0.21	0.21	0.21	0.21	0.21	0.21	–0.12	0.21	–0.60	–31.97	0.03
Sales of Crown leases	5.28	5.28	5.28	5.28	5.28	5.28	5.23	5.28	–45.87	–228.58	–14.35
Other oil and gas revenues	1.02	1.02	1.02	1.02	1.02	1.02	1.02	0.90	–7.68	–58.86	–3.19
Mineral revenues	10.05	–27.35	10.05	4.56	–1.39	3.97	–0.31	–4.09	–0.27	6.17	–6.62
Water power rentals	9.07	–57.48	9.07	7.89	4.37	–4.51	5.29	–5.83	6.35	8.32	–6.04
Insurance premium taxes	13.64	6.90	4.91	3.93	2.65	–0.47	–0.33	2.51	1.77	–1.54	0.58
Payroll taxes	61.55	25.94	26.49	14.49	19.39	6.26	–5.95	7.08	14.56	–1.15	–3.71

(Table 11.2 is concluded on the next page.)

Table 11.2 Concluded

Revenue source[b]	Average per capita yield, representative average standard	Average per capita yield, deficiency (+) or excess (–)									
		Nfld.	PEI	NS	NB	Que.	Ont.	Man.	Sask.	Alta.	BC
		dollars									
Property school taxes	201.99	66.86	62.65	52.21	53.14	23.89	–12.39	2.21	–7.00	–56.27	–15.25
Lottery Revenues	16.00	6.26	4.51	3.04	4.35	1.66	–1.11	0.81	0.70	0.20	–0.93
Miscellaneous provincial taxes	89.34	35.94	35.07	27.63	26.90	11.09	–5.35	8.21	–10.20	–47.21	–8.55
Shared tax on undistributed income	0.07	0.06	0.07	0.07	0.07	0.03	–0.06	0.05	0.07	0.05	0.06
Shared oil export charge	8.26	8.26	8.26	8.26	8.26	8.26	8.26	7.56	–159.79	–37.12	8.26
Municipal tax revenues	342.49	113.38	106.22	88.53	90.11	40.50	–21.01	3.75	–11.87	–95.42	–25.86
Potash revenues	9.35	9.35	9.35	9.35	9.35	9.35	9.35	9.35	–181.64	9.35	9.35
Capital tax	32.76	13.58	20.19	13.27	11.65	7.79	–3.31	2.52	0.11	–42.46	–8.73
Local government sales of goods and services	120.04	48.30	47.13	37.12	36.15	14.90	–7.18	11.03	–13.71	–63.43	–11.48
Total	2,544.03	881.60	1,003.35	693.63	703.06	375.91	–78.24	325.50	–629.80	–3,521.67	–527.05

[a] The calculations were performed to five decimal places; for the sake of simplicity, they have been rounded here to two. [b] The classification of revenue sources in this table does not agree in all particulars with table 11.1. This is so because not all revenue sources and bases had been redefined in the regulations when the calculations were made. Until this was done, the calculations had to conform to existing regulations, even though changes had been made internally. Later calculations reflect the revised classification shown in table 11.1.

Source: Canada, Department of Finance, Second Estimate of Equalization Payments for 1982-83, July 5, 1982.

Source: Perry (1997)

APPENDIX 3: TWO-STAGE LEAST SQUARES ESTIMATION

Endogeneity of per capita income and per capita tax revenues (fiscal capacity) was detected using a (linear) simplification of the Hausman specification test[30]. Suppose the following regression model, where we suspect y_2 of being an endogenous regressor:

$$y_1 = \beta_0 + \beta_1 y_2 + \beta_2 x_1 + \beta_3 x_2 + u$$

Regress the suspect variable on all other exogenous variables (and any other instruments you may have if performing an IV estimation):

$$y_2 = \pi_0 + \pi_1 x_1 + \pi_2 x_2 + e$$

We can obtain the fitted values of e, ê, and put them back into the original equation model, such that,

$$y_1 = \beta_0 + \beta_1 y_2 + \beta_2 x_1 + \beta_3 x_2 + \alpha_0 \hat{e} + u$$

This procedure basically splits the error term in two parts: one is correlated with the independent variable, and the other is uncorrelated with the independent variable. Sometimes it is said that this procedure "purges" the (true) error term (u) of its correlation with the independent variable.

Under the null hypothesis of this test – that the error term is uncorrelated with the independent variable or that OLS is unbiased - the coefficient on the fitted residual, α_0, should be zero. ê is the part of the error term that is correlated with y_2. One can use OLS (with robust standard errors) to obtain a t-statistic on α_0 to test the null.

Using this method, both per capita income and per capita tax revenues were found to be endogenous. These two measures are linearly related and can be viewed as proxies for one another, so it is not surprising that the endogeneity of one implies the endogeneity of the other.

So, the use of a 2SLS estimation method is well motivated, since it is a known fact that correlation between an explanatory variable and the error term causes bias in OLS estimates.

What's more, this model was run with real per capita provincial government spending, and this variable was not found to be endogenous.

Wallis (1996) posits that bias occurs because per capita spending and per capita grants are simultaneous determined. It was empirically verified that per capita fiscal capacity measures and per capita income are correlated with the error term, which is what he predicts. Thus proposing a second stage where real own revenues per capita are endogenously determined makes sense, since this is the variable that is correlated with the error term. Thus two alternative estimation models are proposed. All fiscal variables are in real and per capita terms.

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[30] See Wooldridge (2002)

Wallis's original, where $SPEND_{i,t}$ provincial government spending (with own revenues also explaining expenditures in the second stage):

(A3-1) $FG_{i,t} = \beta_0 + \beta_1 SPEND_{i,t} + \beta_2 own\ revenues_{i,t} + \beta_3 unemployment_{i,t} + \beta_4 \ln(population_{i,t}) + \mathbf{Z} year_t + \varepsilon_{i,t}$

(A3-1') $SPEND_{i,t} = \alpha_0 + \alpha_1 FG_{i,t} + \alpha_2 own\ revenues_{i,t} + \alpha_3 unemployment_{i,t} + \alpha_4 old_{i,t} + \alpha_5 young_{i,t} + \upsilon_{i,t}$

Two alternative specifications of a second model will also be estimated:

(A3-2) $FG_{i,t} = \beta_0 + \beta_1 own\ revenues_{i,t} + \beta_2 unemployment_{i,t} + \beta_3 \ln(population_{i,t}) + \mathbf{Z} year_t + \varepsilon_{i,t}$

(A3-2') $own\ revenues_{i,,t} = \alpha_0 + \alpha_1 unemployment_{i,t} + \alpha_2 old_{i,t} + \alpha_3 young_{i,t} + \upsilon_{i,t}$

(A3-3) $FG_{i,t} = \beta_0 + \beta_1 own\ revenues_{i,t} + \beta_2 unemployment_{i,t} + \beta_3 \ln(population_{i,t}) + \mathbf{Z} year_t + \varepsilon_{i,t}$

(A3-3') $own\ revenues_{i,,t} = \alpha_0 + \mathbf{P} province_i + \alpha_1 unemployment_{i,t} + \alpha_2 old_{i,t} + \alpha_3 young_{i,t} + \upsilon_{i,t}$

In these models *FG* are real per capita federal grants; *SPEND* is real per capita provincial government spending; *own revenues* are real per capita provincial own revenues; unemployment is the unemployment rate ($0<x<100$); and ln(*population*) is the natural logarithm of the population. **Z** is a vector of coefficients applied to the set of year dummies, *year*. *Old* and *young* are the proportion of the elderly and the young in the population. Finally **P** is a vector of coefficients applied to the set of provincial dummies, *province*.

The first set of equations is proposed by Wallis (1996) to correct for simultaneity bias induced by a matching grant system.

The two subsequent 2SLS models I propose (A3-2; A3-3) are actually instrumental variable regressions. Since per capita own revenues were found to be endogenous, it is only natural to want to instrument *this* variable. I suggested, to add, in the section above that provincial government spending per capita was not found to be endogenous.

In (A3-2), real per capita provincial own revenues are a linear function of demographic factors. I do not include real per capita GDP because[31] this is highly collinear with the demographic variables, and a reversal of results occurs. Regardless, I have already estimated that real per capita own revenues are a positive linear function of per capita GDP and that the slope is around 0.15, which is what you would see if this specification were presented here.

In (A3-3), real per capita own revenues are simply a function of a set of provincial dummies. This is meant to capture the fact that differences in provincial

[31] The results presents in columns (14) and (15) are robust to alternative specifications as long as all demographic variables and per capita GDP are not included in the same regression (as was discussed before).

revenues are persistent and may be due to local (invariant) fixed effects, such as natural endowments or proximity to export markets.

A common error in constructing simultaneous equation models is that the two equations represent the behaviour of the same agent, "so neither equation can stand on its own" (Wooldridge 2003, page 529). It is important to describe the behaviour of the federal government in the fist equation and the "behaviour" of provincial governments in the second.

One would like to include another fiscal variable in the system's first equation that describes the federal government's willingness to distribute grants, for example budget surpluses. This would involve more data than is necessary, since we will eventually discard the 2SLS estimator. For the purposes of this study we will restrict ourselves to using year dummies which should capture any shift in the government's (per capita) budget constraint.

It is also important to identify the first equation with an exogenous variable that is included in the second equation but not in the first. These variables will be the proportion of young and the elderly in the population. Although some could argue that this is an important variable in federal behaviour, one could argue that it is more important for local governments, since they provide for education and healthcare. Empirically one can find a negative linear relation between federal grants and the proportion of youngsters, but this relationship is due to the fact the per capita income and the proportion of youngsters is also strongly linear and negative. Furthermore, the federal government intervenes only at the post-secondary level and health-care grants are approximately distributed on a flat per capita basis. This suggests the actual proportion of old people in any given province is of no concern to the federal government.

We will find that the 2SLS estimates from the systems above are the sensibly the same as those in the OLS estimates.

My OLS model does not suffer from simultaneity bias – as suggested by the fact that 2SLS and OLS estimates are sensibly the same[32]. I can proceed with confidence with the OLS estimations.

Table A3 below presents the results.

[32] Wooldridge (2003) and Islam and Choudhury (1990) both suggest this approach to verifying *ex post* whether a 2SLS was necessary.

Table A 3: 2SLS regression results of the "core" economic model

		Real per capita transfers		
		(A3-1)	(A3-2)	(A3-3)
FIRST STAGE	Real per capita spending	0.13 (0.27)		
	Real per capita own revenues	-0.24 (0.11)**	-0.052 (0.052)***	-0.27 (0.034)***
	Unemployment	72.15 (18.6)***	96.5 (9.12)***	70.47 (7.63)***
	ln(population)	-284.28 (32.7)***	-327.7 (20.4)***	-281.7 (19.2)***
	Constant	5118.13 (1251.97)***	5451.155 (315.30)***	5907.07 (305.7)***
	Pseudo R-squared	0.89	0.84	0.85
	Note	Year FE	Year FE	Year FE
		Real per capita provincial gov. spending	Real per capita own revenues	
SECOND STAGE	Real per capita transfers	0.46 (0.083)***		
	Real per capita own revenues	0.56 (0.042)***		
	Unemployment	39.7 (15.29)***	-176.29 (13.6)***	-189.42 (11.5)***
	Old prop.	37.9 (24.0)	-205.9 (32.5)***	-128.55 (27.2)**
	Young prop	-12.3 (14.4)	-126.1 (20.8)***	-191.7 (27.2)***
	Constant	2179.52 (708.3)***	11581.4 (814.6)***	13356.1 (1213.4)***
	Pseudo R-squared	0.55	0.50	0.78
	No. obs.	210	210	210
	Note			Province FE

Note: First stage always includes year dummies, coefficients not shown.
***: significant at the 1% level
**: significant at the 5% level
*: significant at the 10% level

The Wallis (1996) specification is not applicable to the Canadian case. Yet any researcher examining a system where matching grants are widely used should take care to verify robustness of results.

APPENDIX 4: COMPLETE RESULTS OF THE ITERATIVE PROCEDURE

The following are the results of the iterative procedure. The total number of tables for each of the models is presented at the end of each table's title, in parantheses (#/#).

Table A4- 1: Results of political estimation, "swing" model, 1/4

	Real per capita transfers Dummy variables					
	swing2	**swing5**	**fswing2**	**fswing5**	**bswing2**	**bswing5**
Real per capita provincial own revenues	-0.16 (0.053)***	-0.16 (0.053)***	-0.16 (0.053)***	-0.16 (0.053)***	-0.16 (0.053)***	-0.16 (0.054)***
Unemployment	36.0 (12.0)***	37.4 (12.2)***	37.9 (11.9)***	39.1 (12.0)***	36.3 (12.1)***	35.4 (12.1)***
ln(Population)	-383 (39.7)***	-382 (40.6)***	-384 (39.0)***	-379 (38.5)***	-383 (40.7)***	-384 (41.2)***
Political variable	**swing2**	**swing5**	**fswing2**	**fswing5**	**bswing2**	**bswing5**
	-84.2 (46.2)*	-27.7 (33.4)	21.8 (43.8)	-5.53 (29.6)	-17.1 (60.8)	-11.1 (34.7)
Constant (1981)	7202 (610)***	7160 (617)***	7172 (620)***	7084 (589)***	7161 (606)**	7185 (617)***
Restriction	Alberta removed	Alberta removed	Alberta removed	Alberta removed	Alberta removed	Alberta removed
Log-likelihood	-1172	-1173	-1175	-1175	-1173	-1173
No. obs.	189	189	189	189	189	189
Method	GLS, Year FE, AR(0.84), heteroscedastic panels	GLS, Year FE, AR(0.84), heteroscedastic panels	GLS, Year FE, AR(0.83), heteroscedastic panels	GLS, Year FE, AR(0.82), heteroscedastic panels	GLS, Year FE, AR(0.84), heteroscedastic panels	GLS, Year FE, AR(0.84), heteroscedastic panels

*: significant at the 10% level; **: significant at the 5% level; ***: significant at the 10% level

Table A4- 2: Results of political estimation, "swing" model, 2/4

	Real per capita transfers Percentage of ridings					
	riding_swing2	**riding_swing5**	**riding_fswing2**	**riding_fswing5**	**riding_bswing2**	**riding_bswing5**
Real per capita provincial own revenues	-0.15 (0.053)***	-0.15 (0.053)***	-0.15 (0.053)***	-0.15 (0.053)***	-0.17 (0.053)***	-0.15 (0.054)***
Unemployment	36.2 (12.2)***	35.0 (12.2)***	34.3 (12.2)***	38.2 (12.1)***	32.7 (12.2)***	34.7 (12,3)***
ln(Population)	-385 (41.9)***	-386 (42.1)***	-391 (42.3)***	-380 (40.0)***	-382 (41,5)***	-386 (42.3)***
Political variable	**riding_swing2**	**riding_swing5**	**riding_fswing2**	**riding_Fswing5**	**riding_bswing2**	**riding_bswing5**
	-199 (181)	-12.9 (79.5)	-233 (167)	57.4 (79.0)	-233 (171)	5.65 (90.6)
Constant (1981)	7205 (610)***	7212 (617)***	7312 (620)***	7076 (589)***	7221 (606)**	7205 (617)***
Restriction	Alberta removed	Alberta removed	Alberta removed	Alberta removed	Alberta removed	Alberta removed
Log-likelihood	-1172	-1172	-1172	-1173	-1172	-1173
No. obs.	189	189	189	189	189	189
Method	GLS, Year FE, AR(0.84), heteroscedastic panels	GLS, Year FE, AR(0.85), heteroscedastic panels	GLS, Year FE, AR(0.85), heteroscedastic panels	GLS, Year FE, AR(0.83), heteroscedastic panels	GLS, Year FE, AR(0.84), heteroscedastic panels	GLS, Year FE, AR(0.85), heteroscedastic panels

*: significant at the 10% level; **: significant at the 5% level; ***: significant at the 10% level

Table A4- 3: Results of political estimation, "swing" model, 3/4

	Real per capita "other" transfers Dummy variables					
	swing2	**swing5**	**fswing2**	**fswing5**	**bswing2**	**bswing5**
Real per capita provincial own revenues	-0.0069 (0.0074)	-0.0078 (0.0076)	-0.0063 (0.0072)	-0.0074 (0.0078)	-0.0065 (0.0073)	-0.0069 (0.0076)
Unemployment	-0.186 (7.39)	-0.330 (3.33)	-0.037 (3.30)	-0.62 (3.52)	-0.30 (3.20)	-0.51 (3.34)
ln(Population)	-48.1 (7.38)***	-48.9 (7.5)***	-50.1 (7.68)***	-49.8 (7.88)***	-49.2 (7.23)***	-48.6 (7.46)***
Political variable	**swing2** -11.7 (21.6)	**Swing5** -13.4 (15.8)	**fswing2** 14.2 (23.5)	**fswing5** 7.77 (16.3)	**fswing2** 16.6 (25.9)	**bswing5** 4.04 (17.9)
Constant (1981)	878 (119)***	898 (128)***	900 (125)***	907 (132)***	891 (119)***	887.8 (122)***
Restriction	None	None	None	None	None	None
Log-likelihood	-1163	-1162	-1164	-1165	-1162	-1162
No. obs.	210	210	210	210	210	210
Method	GLS, Year FE, AR(0.47), heteroscedastic panels	GLS, Year FE, AR(0.49), heteroscedastic panels	GLS, Year FE, AR(0.48), heteroscedastic panels	GLS, Year FE, AR(0.50), heteroscedastic panels	GLS, Year FE, AR(0.47), heteroscedastic panels	GLS, Year FE, AR(0.49), heteroscedastic panels

*: significant at the 10% level; **: significant at the 5% level; ***: significant at the 10% level

Table A4- 4: Results of political estimation, "swing" model, 4/4

	Real per capita "other" transfers Percentage of ridings					
	riding_swing2	**riding_swing5**	**riding_fswing2**	**riding_fswing5**	**riding_bswing2**	**riding_bswing5**
Real per capita provincial own revenues	-0.0067 (0.0079)	-0.0068 (0.0074)	-0.0033 (0.0071)	-0.0010 (0.0072)	-0.0061 (0.0074)	-0.0057 (0.0074)
Unemployment	-0.10 (3.22)	-0.066 (3.11)	0.99 (3.17)	0.98 (3.12)	-0.029 (3.26)	-0.13 (3.23)
ln(Population)	-48.9 (7.19)***	-48.5 (6.89)***	-48.1 (7.26)***	-45.9 (7.05)***	-48.1 (7.23)***	-47.7 (7.25)***
Political variable	**riding_swing2**	**riding_swing5**	**riding_fswing2**	**riding_fswing5**	**riding_bswing2**	**riding_bswing5**
	-0.18 (0.917)	-0.14 (0.456)	1.59 (0.87)*	1.10 (0.45)**	0.55 (1.02)	0.45 (0.51)
Constant (1981)	890 (118)***	883 (116)***	838 (120)***	793 (119)***	873 (120)***	866 (120)***
Restriction	None	None	None	None	None	None
Log-likelihood	-1164	-1162	-1161	-1158	-162	-1161
No. obs.	210	210	210	210	210	210
Method	GLS, Year FE, AR(0.46), heteroscedastic panels	GLS, Year FE, AR(0.44), heteroscedastic panels	GLS, Year FE, AR(0.47), heteroscedastic panels	GLS, Year FE, AR(0.47), heteroscedastic panels	GLS, Year FE, AR(0.47), heteroscedastic panels	GLS, Year FE, AR(0.47), heteroscedastic panels

*: significant at the 10% level; **: significant at the 5% level; ***: significant at the 10% level