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EVALUATING THE EFFICIENCY AND EQUITY OF FEDERAL FISCAL EQUALIZATION

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Evaluating the Efficiency and Equity of Federal Fiscal Equalization
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ABSTRACT

In theory, federal transfers that make household location decisions efficient will offset differences in federal-tax payments and local tax revenues on capital, but not local tax revenues from residents. Transfers that redistribute resources equitably across regions will likely target areas with individuals of low earnings potential or low real incomes. Examining these metrics in practice, federal transfer differences across Canadian provinces are neither efficient nor equitable, but exacerbate pre-existing inefficiencies and underfund minorities. Total locational inefficiencies cost the economy 0.41 percent of income annually and cause Atlantic and Prairie provinces to have populations 31 percent beyond their efficient long-run levels.

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1 Introduction

Federal governments make fiscal equalization payments to local governments with the stated goal of equalizing the fiscal capacity of local governments to provide services. Fiscal equalization programs exist in a number of federations, such as Canada, Australia, Germany and South Africa. Economists have long debated over how fiscal equalization programs may be used to prevent inefficient migration, or target resources more equitably (see Buchanan 1950, 1951, 1952; Scott 1950, 1952; Jenkins 1951; Musgrave 1961; Feldstein 1970; Courchene 1981; Oakland 1994; Usher 2007). Moreover, debates on equalization are closely tied to more general debates on place-based policies (e.g. Gottlieb and Glaeser 2008; Busso et al. 2010) that are of considerable interest in the European Union, the United States, and most other countries.

This research attempts to clarify these debates theoretically under the assumption of long-run mobility, which applies to populations that are mobile over time periods during which federal-transfer payment differences across regions are persistent; such time periods often last generations. The theoretical model used here incorporates heterogeneous populations, inter-regional differences in amenities and productivity (both private and public), land in both residential and tradable sectors, and federal taxes. This makes the model much more applicable to real-world data than existing models, providing the first economic framework for evaluating federal equalization programs that is consistent with observed wage, price, and population differences across areas.

Local fiscal capacities arise from local tax bases, which are divided into two categories. Source, or origin, -based taxes are levied on local factors such as land and capital, which may be owned by non-residents. Residence, or destination, -based taxes are levied on the incomes of local residents, including direct taxes on wages and indirect taxes on property. It is generally accepted that it is efficient and equitable for federal governments to redistribute differences in source-based taxes, unless they are used to provide local services to these local factors (Usher 1977; Boadway and Flatters 1982; Mieszkowski and Toder 1983). For example, there is no compelling economic reason why a migrant should be entitled to revenues from taxes on local oil production, such as the Alaska Permanent Fund, just for moving across a border to an oil-rich region. Instead, this policy

wastes resources by paying people to suffer in the cold.[1]

The literature is less clear over the benefits of equalizing differences in fiscal capacity from residence-based taxes. Tiebout (1956) argues that it is efficient for local residence-based taxes to be linked directly to local expenditures, and thus operate as benefit taxes. The Tiebout equilibrium becomes inefficient if the local tax-benefit link is broken through federal redistribution. Yet, efficiency in the Tiebout equilibrium depends on the assumption that households sort into communities where everyone has the same demand for public goods, which is unlikely to occur within a large jurisdiction, such as a state or province. Without requiring perfect sorting, Buchanan (1950) and, more formally, Boadway and Flatters (1982), argue that it is efficient for the federal government to equalize differences in residence-based tax capacities when tax payments increase with income. Otherwise, households will move inefficiently towards high-income communities, where they receive public services at a low tax price. This argument is now widely accepted in the academic and policy literature on fiscal federalism (see Inman and Rubinfeld 1997; Musgrave 1997; Boadway 2004). Yet, as I show below, it does not provide a rationale for federal transfer differences across regions: the corrective federal transfers needed to eliminate inefficient migration sum up to zero for each region. Instead, eliminating differences in residence-based tax capacities will result in either inefficient migration or public-good provision.

A point often underemphasized, but emphasized here, is that otherwise identical individuals living in separate regions may earn different amounts because of interregional wage differentials. When workers are mobile, wage levels compensate workers for differences in local consumption amenities and costs-of-living, so that workers are no better off in high-wage areas than in low-wage areas. Putting externalities aside, it is not a matter for federal intervention whether a worker in a high-wage area consumes this compensation either in privately-provided or publicly-provided goods, e.g. a nicer car or a nicer roadway. Furthermore, as modeled by Hochman and Pines (1993) and Albouy (2009a), otherwise identical individuals pay more in federal taxes in high-

[1] In certain cases such these tax revenues may be seen as compensation for negative local externalities associated with oil drilling. However, when households are mobile, such compesnation is inefficient since it negates the disincentive for households to avoid polluted areas.

wage areas than in low-wage areas, without receiving greater benefits. Thus, absent other reforms, efficient federal transfers will refund the federal-tax burden inequalities that arise from local-wage differences.[2]

In discussions of horizontal equity and the "equal treatment of equals," Buchanan and others assume that two individuals earning the same nominal incomes in different regions are equals. Yet, if regions offer different wage levels, it is more appropriate to treat two individuals as equals if they were to earn the same income in the same region, i.e., they have the same endowment of labor skills. In addition, cost-of-living differences imply that individuals with the same nominal incomes can have different real incomes, which may arise from differences in consumption amenities. As such, a Hawaiian may have both a lower nominal and real income than a Michigander, but still be better off because of the amenities she enjoys. This underscores the need to disentangle how regional income differences are due to the composition of the labor force or from the region itself.

The theoretical model also provides empirically verifiable conditions that may characterize efficient and equitable federal transfer policy. These conditions are modeled around a measure of per capita *net fiscal benefits*, which adds to federal transfers local source-based revenues and subtracts off federal tax payments, controlling for labor-force composition. In a locationally efficient federation, measurable net fiscal benefits will internalize any net positive externalities, such from paying for non-congestible public goods, that may differ across areas. If no such externalities exist, the net fiscal benefits should be constant across areas, as federal transfer policy rebates differences in federal tax payments and redistributes local source-based revenues.

Many criteria may be chosen to evaluate whether federal transfers are distributed equitably. I focus on two plausible criteria: one based on the average earnings potential; two, on average real incomes. If interregional labor markets are in equilibrium, then fiscal benefits may be targeted towards areas where locals have low earnings potential, controlling for interregional wage differences.[3] It seems more defensible to give to areas where incomes are low because local residents

[2]Poschmann (1998) also considers provincial inequalities in federal taxation, but does not distinguish amounts due to locational wage differences.

[3]This represents a refinement on Buchanan's criteria for equity since it controls for effects of location on income.

lack marketable skills, rather than to areas where incomes are low because the cost-of-living is cheap or the local amenities are desirable. In the case where mobility is hindered, and wages do not compensate for cost-of-living or quality of life differences, then evaluation becomes more difficult, but it may be defensible to target fiscal benefits towards areas where real income levels are low.

These verifiable conditions are examined for Canada, which has a substantial and well-studied system of fiscal equalization that accounts for most federal-transfer differences across provinces. Somewhat surprisingly, there is little evidence of workers sorting across provinces according to their observable or unobservable skills. While the Atlantic and Prairie provinces (excluding Alberta) – those receiving disproportionately more in federal transfers – have a labor force slightly less educated than other provinces, they also contain a smaller proportion of ethnic and immigrant minorities, who generally earn less than similarly-educated white natives. In addition, the wage levels of inter-provincial migrants are very similar to those of non-migrants, largely ruling out sorting on unobservable skills. The lack of sorting suggests that provinces with low wage levels either have low local productivity or high quality-of-life, as modeled fully in Albouy and Leibovici (2009). Ultimately, federal transfers are targeted towards unproductive areas rather than unproductive workers.

In practice, federal transfer policy equalizes residence-based capacities much more than it equalizes source-based capacities and exacerbates federal-tax inequalities, contrary to what efficiency dictates. The net fiscal benefit of living in different provinces varies widely and does not appear to subsidize externalities. Alberta stands out as fiscally advantaged for not sharing its natural resource revenues federally. Meanwhile, on a per-capita basis, Quebec is less fiscally advantaged than all other provinces except for Ontario, contrary to popular grumblings. On average, federal transfers alone negate 43 percent of the income gain from moving to a higher-wage province, while total net fiscal benefits negate 76 percent of this gain, causing labor to be located inefficiently.[4] According to simulated estimates below, the Atlantic and Prairie provinces – where

[4]This effect is explained in a different light by Shaw (1986).

estimated productivity and quality of life are generally low – are over-populated by 31 percent beyond their efficient levels. Rather than reduce the costs of locational inefficiencies from unequal federal taxes and local source-based taxes, federal transfers raise inefficiency costs by 0.15 percent of income, or C$1.6B (billion) per year.

As the potential earnings of residents in transfer-receiving provinces are as high as residents in giving provinces, it is difficult provide an equity justification for fiscal equalization. If equals are defined through their potential income, equals appear to be treated quite unequally according to where they live. In fact, provinces with a greater proportion of linguistic, immigrant, and ethnic minorities are at a fiscal disadvantage. Furthermore, the real incomes of residents in receiving provinces are relatively high, suggesting that the federal government could be transferring funds regressively. If labor markets are in equilibrium, then these higher real income differences compensate for inferior local amenities, and federal payments instead subsidize citizens to live in the least amenable areas. Migration patterns support this conclusion, as people are leaving transfer-receiving provinces to urban provinces where amenities, as well as job opportunities, are more attractive.

Section 2 presents a theoretical model of regions with mobile individuals and local and federal public sectors to determine how federal transfer levels are set efficiently. The measurable net fiscal benefits of residing in each Canadian province are estimated in section 3, which involves determining how much provincial wage differences are due to worker composition differences. Section 4 tests the externality and equity justifications for net fiscal benefit differences across provinces. The long-run effects of fiscal benefit distortions on provincial price levels, wages, employment and national welfare are simulated in section 5. Section 6 concludes and the Appendix contains additional detail on the theory and data used in the main text.

2 Federal Location Model with Transfers

2.1 Model Set-Up

The theoretical model is similar to those in Flatters, Henderson and Mieszkowski, (1974), Stiglitz (1977), Boadway and Flatters (1982), Wildasin (1980, 1986), and Mieszkowski and Zodrow (1989), but allows for regional differences in productivity and quality of life as in Rosen (1979) and Roback (1982). Conditions characterizing efficient levels of federal transfers are presented here without burdening the reader with the details of the full model and various derivations, which are given in Appendix A. In short, there are E types of individuals, $e = 1, ..., E$, which may characterize skills or tastes, and J regions, $j = 1, .., J$, each with a population composition described by the vector $\mathbf{N}^j = (N_1^j, ..., N_E^j)$, using the scalar $N^j = \sum_e N_e^j$ to refer to the total population of region j. The total population of each type in the federation is fixed, and preferences of each type are represented by the utility function $U_e\left(x, y, g^j; Q^j\right)$, which depends on three goods: (i) a tradable private good, x, (ii) a non-tradable (home) private good, y, and (iii) a local publicly-provided good, $g^j = G^j(N^j)^{-\alpha}$, with congestion parameter $\alpha \in [0, 1]$, where $\alpha = 0$ corresponds to the case of a pure public good, and $\alpha = 1$, a publicly-provided private good. All local public-good spillovers occur within province. The local public sector does not provide services to capital or firms. Private consumption bundles in region j may vary by type e, but the publicly-provided good, G^j, is uniformly provided across all types within the population, and each individual contributes equally to congesting it, although tastes for g^j may differ. Each location j is characterized by i) an exogenous quality of life, Q^j, determined by consumption amenities; ii) productivity in the tradable sector, A_X^j; iii) productivity in the non-tradable sector, A_Y^j; iv) productivity in the public sector, A_G^j; and v) the supply of land, L^j. All three goods are produced from land, labor, and mobile capital, K^j, whose total level may be fixed nationally, or determined by an international fixed price. Either the traded good or capital may be modeled in a closed or open-country setting.

Factor markets are perfectly competitive and factors are fully mobile within each region. Thus,

they command the same price within region regardless of sector, including the public sector.[5] Land is immobile across regions and earns a local price r^j. Capital is fully mobile across regions and earns a gross price i^j. Every labor type e is also fully mobile across regions and earns the local wage w_e^j, which will vary to compensate workers for differences in cost-of-living, determined by p^j, quality of life, Q^j, and the local-government good, g^j. Each type also owns a portfolio of capital and land, which earn incomes I_e and R_e that do not depend on where the individual lives. In equilibrium, rents, wages and prices are determined by local attributes: ceteris paribus, areas with better traded-good productivity, A_X, have higher wages and higher prices, while areas with better quality of life, Q, have higher prices but lower wages.[6] As described in Albouy (2009b), the degree to which wages and prices capitalize these attributes depends on the proportion of land and labor devoted to home-good production: the model here applies regardless of these proportions. In contrast, the Boadway and Flatters (1982) model, which has no home-good sector, implies that wages fully capitalize quality-of-life differences, and predicts that larger provinces have lower wages, contrary to empirical evidence.[7]

To pay for the local-government goods, local governments levy taxes, which, without loss of generality, are linear.[8] Source-based taxes on land and capital are levied at rates τ_L^j and τ_K^j. Residence-based taxes on income from wages, rents, and interest are given by τ_w^j, τ_R^j, and τ_I^j. The budget constraint of local governments requires that their expenditures equal their revenues:

$$p_G^j G^j = (\tau_L^j L^j + \tau_K^j K^j) + N^j(\tau_w^j \bar{w}^j + \tau_R^j \bar{R}^j + \tau_I^j \bar{I}^j) \tag{1}$$

[5]Results would not change significantly if another fixed factor used only in the production sector, such as natural resource reserve, is introduced.

[6]If multiple output goods are produced then it seems possible that factor-price equalization will force factor prices to converge across areas. However, productivity differences should still lead to higher wages for workers in more productive areas. With free mobility, cities differing in amenities are likely to specialize in the production of a subset of goods, putting them outside of the cone of diversification in which factor-price equalization holds.

[7]Larger provinces in the Boadway-Flatters model, i.e. those with more land, attract more population, and therefore have greater public-good sharing opportunities, which act as a consumption amenity, lowering wages. The model also predicts that more productive provinces will have larger populations and hence lower wages. Note that the paper does not actually model quality-of-life or productivity differences, but only considers different land endowments.

[8]Progressive tax rates will lead to similar conclusions. To a large extent, whether the tax rates are set endogenously is not important to the locational distortions modeled here. Inefficiencies in local public-sector spending policies or taxes will have an effect on the quality of life or public or private productivity of the community.

where $p_G^j G^j$ are expenditures on the local government good and $\bar{w}^j = (1/N^j)\sum_e N_e^j w_e^j$, $\bar{R}^j = (1/N^j)\sum_e N_e^j R_e$, and $\bar{I}^j = (1/N^j)\sum_e N_e^j I_e$. Local governments pay factors their marginal product and produce and allocate G^j efficiently at the level obeying the generalized Samuelson condition

$$(N^j)^{1-\alpha}\overline{MRS}_{Gx}^j = MRT_{Gx}^j \tag{2}$$

where $\overline{MRS}_{Gx}^j$ and MRT_{Gx}^j are the average marginal rate of substitution and marginal rate of transformation between the local-government good and the private tradable good. This equation applies even with cost differences due to differences in factor prices and public-sector productivity levels, A_G^j. To a large extent, inefficient local tax policies, or even public-sector provision that violates (2), may be seen as lowering productivity or quality of life levels.

The federal government levies taxes τ_w^F, τ_R^F, and τ_I^F to raise revenue. Besides making its own purchases, valued at G^F, the federal government provides transfers to individuals, F_e^j, based upon their type e and region j. By letting F_e^j take negative values, the federal government also has recourse to head taxes. Having transfers target individuals rather than local governments follows the work of Buchanan (1950) and Boadway and Flatters (1982), and allows the federal government to attain "first-best" efficient allocations, although I consider later how results are affected when payments are made to local governments.[9] The federal government obeys the budget constraint:

$$G^F + \sum_j \sum_e N_e^j F_e^j = \sum_j \sum_e N_e^j(\tau_w^F w_e^j + \tau_R^F R_e + \tau_I^F I_e) \tag{3}$$

The average transfer to region j is denoted $\bar{F}^j = (1/N^j)\sum_e N_e^j F_e^j$.

[9]Note that considerations such as the use of matching grants or the "flypaper effect" are ignored in the treatment here, as the subject of this research is not centered on the efficient level of local-government goods, but rather the efficient distribution of the population across regions. In addition, this treatment does not consider how equalization programs affect the incentives of local governments in raising their revenues; see Smart (1998).

2.2 Pareto Efficient Transfers

The set of Pareto efficient transfers is determined under the constraint that each individual type is fully mobile, and hence receives the same utility regardless of their region or residence, although each type may have a different utility level. Full mobility is applicable to a long-run setting, as mobility costs amortized over a long period of time become small. Since all human populations originated from Africa and migrated due to various incentives, mobility is the most natural long-run assumption, and has far more predictive power than the assumption that population is immobile and somehow predetermined. Furthermore, the conclusions here continue to hold even when a large sub-population of each type is immobile, so long as the mobile population is not less than the number of predicted migrants.

Thus, under free mobility, the optimal federal transfer to type e in region j is

$$F_e^{j*} = \tau_w^F(w_e^j - \bar{w}_e^F) + \left(T_e^j - \frac{p_G^j G^j}{N^j}\right) + (1-\alpha)\frac{p_G^j G^j}{N^j} + F_e \tag{4}$$

where $w_e^F = (1/N_e^{TOT})\sum_j N_e^j w_e^j$ is the average wage earned by type e across locations and T_e^j is the sum of residence-based taxes in location j by type e. Each term in the right-hand side of 4 requires explanation:[10]

1. **Federal tax differential**. This term, $\tau_w^F(w_e^j - \bar{w}_e^F)$, gives the excess federal taxes that a worker of type e in region j pays relative to the national average for type e. Assuming federal benefits are uniform across areas for each each type, then federal tax burdens should be uniform as well.

2. **Local taxes in excess of per-capita expenditures**. Substituting in the government budget constraint, this component is given by

$$T_e^j - \frac{p_G^j G^j}{N^j} = \left[\tau_w^j(w_e^j - \bar{w}^j) + \tau_R^j(R_e - \bar{R}^j) + \tau_I^j(I_e - \bar{I}^j)\right] - \frac{\tau_L^j r^j L^j + \tau_K^j i^j K^j}{N^j} \tag{5}$$

[10]This condition characterizes efficiency assuming that there are no other distortions in the economy. Most importantly, capital tax rates τ_K^j must be equal across regions for this equation to hold exactly.

The first term on the right gives the residence-based taxes paid by type e relative to the average local resident: individuals paying more than the average should have excess taxes refunded by the federal government, insuring that local taxes operate as benefit taxes. All income redistribution across types at the local level is undone as it is more efficient to redistribute at the federal level.[11] The second term implies that per-capita revenues from source-based taxes should be fully redistributed across regions.

3. **Public-good externality**, $(1-\alpha)p_G^j G^j/N^j$: when the local-government good is not fully rival, $\alpha < 1$, an individual moving to region j has a beneficial spillover by paying more in local taxes than the amount of the local-government good that they effectively consume. This externality should be internalized using a Pigouvian subsidy, which is proportional to per-capita local public expenditures.[12]

4. **Location-independent transfer**: this is a lump-sum transfer that can be set arbitrarily according to the utility that type e gets in the Pareto optimum, so long as the sum of transfers satisfy the federal budget constraint. Thus, federal grants may be used to perform redistributive or need-based functions and achieve any feasible distribution of utilities.

The total amount that should be transferred to region j per can be determined by averaging F_e^{j*} over types:

$$\bar{F}^{j*} = \tau_w^F(\bar{w}^j - \bar{w}^{j,F}) - \frac{\tau_L^j r^j L^j + \tau_K^j i^j K^j}{N^j} + (1-\alpha)\frac{p_G^j G^j}{N^j} + \bar{F}_e^j \tag{6}$$

where $\bar{w}^{j,F} = (1/N^j)\sum_e N_e^j \bar{w}_e^F$ is the average wage level in region j that would prevail at the national wage level, and $\bar{F}_e^j = (1/N^j)\sum_e N_e^j F_e$. An important result from this aggregation is that all residence-based tax terms sum to zero. The individual federal transfers needed to turn residence-based taxes into pure benefit taxes average out to zero since each depends on the individual tax deviations from the regional average. Thus, the sum of federal transfers to a region needed to

[11] This term corresponds to Buchanan (1949) original concept of the "fiscal residuum."
[12] Buchanan and Goetz (1972)

eliminate this inefficiency is zero.[13]

This second and third terms of (4) are implicit in the equations of Boadway and Flatters (1982), who them to support Buchanan's view that residence-based taxes should be redistributed as (5) is decreasing in the average income level. Both low and high-income types have an incentive to go to areas with a greater proportion of high-income types, where levels of G^j are high. But that does not imply that individuals need to be paid to live in areas with low-income types, but rather that individuals need to pay for their congestion of local government goods. Interregional transfers arise in Buchanan's model out of an implicit rule that the location-independent transfers, F_e, refund exactly the corrective transfers that type e individuals pay or receive on average. Since low-income types pay corrective taxes, while high-income types receive corrective subsidies, areas with more low-income types have a higher $\bar{F}_e^j$. Yet, location-independent transfers can be more or less redistributive than the rule set by Buchanan, and still be efficient.[14]

In a first-best world, the federal government would make transfers F_e^{j*} directly to individuals, who could decide for themselves through the local political progress how to set G^j. But payments made to local governments are necessarily coarser when multiple types live in each region. Ag-

[13]Other results of the aggregation are mostly straightforward. The other important result is that federal grants should refund excess federal taxes paid at the regional level. The location independent transfers aggregate to a regional transfer dependent on the composition of individual in location j, perhaps a function of overall need or redistributive aims.

[14]In Buchanan's (1950) example $j \in \{A, B\}$ and $e \in \{s, u\}$ where s is skilled and u is unskilled, all income is from labor $w_s^A = w_s^B = 10000$, $w_u^A = w_u^B = 1000$ $N_s^A, N_u^A, N_s^B, N_u^B = (2, 1, 1, 2)$, with $\tau_w^A = \tau_w^B = 0.1$. No externalities are considered. This implies efficient transfers are $(F_s^{A*}, F_u^{A*}, F_s^{B*}, F_u^{B*}) = (F_s + 300, F_u - 600, F_s + 600, F_u - 300)$ where F_s and F_u are unspecified, implying aggregate transfers to region A and region B should differ by $F_u - F_s$. In the name of equity, Buchanan imposes the rule that no transfers are made across types, meaning $\sum_j N_e^j F_e^j = 0$, and proposes the solution $(F_s^A, F_u^A, F_s^B, F_u^B) = (-100, -200, 200, 100)$, which is consistent with $(F_s, F_u) = (-400, 400)$. The redistribution from the high wage region to the low-wage regions is not needed for efficiency, i.e. correcting the "fiscal residua" that Buchanan emphasized, but only to satisfy Buchanan's rule.

The supporting statement by Boadway and Flatters (1982, pp. 629-30), translated in the notation here uses the same tax rate for for all income sources, $\tau_I^j = \tau_R^j = \tau_w^j = \tau$, with total personal income termed $PI^j = w^j + I + R$

> Suppose, for instance, that both provinces levied the same personal tax rates ($\tau^1 = \tau^{2'}$). The NFB difference due to residence-based taxes would simply be $\tau(\overline{PI}^1 - \overline{PI}^2)$ and would represent the difference in per capita public sector benefits arising solely from differences in residence-based tax bases. Notice that the NFB difference is identical over all income groups. Therefore the equalization program that is called for on efficiency grounds is one that fully equalizes per capita revenues from both source-based taxes and residence-based taxes.

The problem with this argument is that it does not look at how averaging across residents within a region will eliminate this term.

gregate regional grants of this kind cannot perform the same functions that individually targeted grants can. First, they do not correct for type-specific differences in federal tax burdens if regional wage differentials vary by type. Second, aggregate grants cannot correct for individual-specific differences in residence-based taxes. [15] Third, aggregate grants are coarse instruments for redistributing income. While transferring greater funds to local governments with needier individuals should improve the fiscal situations in those areas, there is no guarantee that local governments will pass those additional funds to achieve an equitable and efficient outcome.

If a government grant to location j is paid to residents in equally-divided lump-sum grants, then the grants do nothing to correct for differences in local residence taxes. According to Bradford and Oates (1971a, 1971b), it is possible that through the political process, grants will cause local governments to lower tax rates, redistributing them according to each type's local tax share. In the extreme, all local goods can be paid for federally, eliminating residence-based taxes altogether. This would eliminate the link between local tastes and local provision, as determined by the Samuelson rule (2), making local provision inefficient, undermining a core benefit of federalism. To the extent that funds are distributed unequally, they provide incentives for individuals to locate in higher-receiving areas, making their locations inefficient.

3 Measuring the Net Fiscal Benefits of Canadian Provinces

Although far from complete, the federal model is realistic enough to incorporate relevant data to shed light on whether an existing federal transfer system is efficient and equitable. The model is applied below to Canada's federation of provinces, for which transfer policies and amenities appear to exhibit a high degree of persistence over time (see below). Canadians exhibit a high degree of mobility (e.g. Bernard et al. 2008). Canada is largely is a country of immigrants: according to the 2001 Census, only 3 percent of the population are aboriginal, while 19 percent are foreign born, and thus are likely to locate in areas with the best economic opportunities (Borjas 2001). Among

[15] This point is point brought up by Musgrave (1961) in a debate with Buchanan.

the native-born, 15 percent live outside their province of birth, and this fraction increases with age. 23 percent of those born in an Atlantic province lived in a non-Atlantic province, while a third of Canadian-born residents in Alberta and British Columbia were born in another province. Meanwhile, only 8 percent of those born in Quebec live in a different province, as Francophones are reluctant to move to Anglophone areas, although how Francophones are treated ends up being fairly unimportant in this application.

Adapting data to the theory is complicated by the fact that not all of the components of (6) are directly measurable: federal transfers, federal tax differentials, and source-based tax revenues can be estimated with considerable accuracy, but public-good externalities and equitable location-independent transfers can only be inferred. Therefore, (6) is rearranged to put all of the observable components on the left-hand side

$$NFB^j = \bar{F}^j - \tau_w^F(\bar{w}^j - \bar{w}^{j,F}) + \frac{\tau_L^j r^j L^j + \tau_K^j i^j K^j}{N^j} = \frac{1}{N^j}\sum_e N_e^j F_e + (1-\alpha)\frac{p_G^j G^j}{N^j} \qquad (7)$$

where NFB^j denotes the *measurable* net fiscal benefits of locating in province j. Efficient and equitable measurable NFB^j should be positively related to inferred estimates of local government expenditures and towards populations that, according to some metric, are most deserving of redistribution. The best year to get data for this application is 2001, since it corresponds to the last Canadian Census with available microdata necessary for a rigorous analysis. A sub-provincial analysis is not attempted since federal transfer data are only available at the provincial level. Using these and other data, I estimate the three components on the left hand-side of (7) at the provincial level, reported in table 1, and compare them to plausible estimates of public-good externalities and measures of fiscal need, reported in table 3. These estimates are presented per capita in 2001 Canadian dollars and presented as deviations from the population-weighted national mean.

3.1 Federal Transfers

Federal transfer differences arise from several sources. The most important are explicit fiscal equalization payments, which are unconditional grants calculated from a Representative Tax System model. This model estimates fiscal capacities from both source and residence bases, roughly using the formula

$$EP^j = \max\left\{0, \sum_k \tau_k \left(\bar{B}_k - B_k^j\right)\right\} \tag{8}$$

where k indicates a tax base, B_k^j is the quantity of the tax base in province j, $\bar{B}_k$ is the population-weighted average of the tax base, and τ_k is a federally chosen representative tax rate. This formula benefits provinces with representative tax bases that are below average, but does not penalize provinces with representative tax bases above average. Equalization payments of this kind in 2001 amounted to C$14.2B (billion).

Explicit equalization payments alone underestimate the amount of federal redistribution. The largest federal transfer, the Canadian Health and Social Transfer, a system of block grants worth C$34.9B, was at that time paid disproportionately to lower income provinces.[16] All other federal transfers combined amount to C$3.5B. The measure of federal transfers used here accounts for all transfers paid to provincial and local governments within provinces, although, as shown in Appendix Table 1, federal transfer differences are still largely driven largely by the equalization program.[17]

Column 1 of table 1 reports the distribution of federal transfers across areas, averaging over 1999 to 2003 to smooth out any temporary variations. Together, residents of Ontario, Alberta, and British Columbia receive $379 less than average, residents of Manitoba and Saskatchewan receive

[16] In 2005, these were separated into the the Canada Health Transfer and the Canada Social Transfer. Since 2007, both programs have been adjusting their formulas to move them closer to an equal per capita basis.

[17] According to the Canadian Constitution

> "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." (Subsection 36(2) of the Constitution Act, 1982)

Because of its asymmetry and omission of cost variables, the formula in (8) does not guarantees this Constitutional goal, which differs significantly from the goal of economic efficiency.

$863 more, residents of the Atlantic provinces, $1511 more, and of the Territories, $15578 more. Although Quebec is technically a net receiver, it receives only $31 per capita more than the typical province.[18]

3.2 Local Wage Levels and Federal-Tax Burdens

Differences in federal tax revenues may be estimated directly from national accounts, however this will not control for differences in labor-force characteristics. Instead, federal tax differences are estimated from inter-provincial wage differences that control for these characteristics, which are then multiplied by the average effective marginal federal tax rate on labor income, $\tau_w = 0.249$.[19]

To calculate wage differences, data on wage earners is taken from the 2.7 percent sample of Canadian Census data from the 2001 Public Use Microdata Files on Individuals. More details are provided in Appendix B. Inter-provincial wage differentials are calculated from the logarithm of hourly wages for full-time workers, ages 25 to 55. The model for wage differences across areas is $\ln w_e^{ij} = X_e\beta + \nu^j + \varepsilon^{ij}$, where ν^j are provincial indicators, X_e, are a set of characteristics with returns β, and an idiosyncratic error term ε^{ij}, with $E(\varepsilon^{ij}|X_e, \nu^j) = 0$.[20] The set of characteristics used is large, fully interacted with gender, and divided into three subsets: i) education (including field of study) and experience, ii) industry and occupation, and iii) immigration, language, and ethnicity. The values of ν^j are estimates of the locational wage effects, interpreted as the causal effect of a worker's location on their wage, while $\bar{X}^j\beta$ are the predicted composition effects, where $\bar{X}^j = (1/N^j)\sum_e N_e^j X_e$. Identifying these differentials requires that workers do not sort across provinces according to unobserved characteristics that affect wages.

[18] After 59 years of being a "have not" province, Ontario received equalization transfers in the 2009-2010 fiscal year, although projected amounts are less than $27 per capita, which, on average, still make it a giving province.

[19] Direct taxes are measured in CANSIM matrix 354-0006 although they exclude the General Sales Tax. Using these data lead to even larger estimates of federal tax differences across provinces that are strongly correlated with the ones here. Given that predicted earnings are fairly similar across provinces it might be appropriate to use these instead if non-labor income is earned evenly across provinces. The measures used here are conservative in comparison. Lastly, given that wage differ across provinces by only a few percentage points, modeling progressive changes in federal tax rates does little to affect the analysis, except to reinforce it slightly.

[20] Note that this model implies that compensating wage differentials across regions are multiplicatively uniform across types. Thus, two individuals who have the same predicted income in one region also have the same predicted income in another.

Table 2 reports the differences in log wages across provinces, decomposing the differences into location and composition effects, with the latter subdivided into the three categories mentioned above. The location effects vary significantly across areas. The Territories offer a 13 percent wage premium above the national average, while Ontario and British Columbia offer a 6 percent premium, and Alberta and Quebec offer wages just below the national average. The remaining six provinces discount wage levels by over 10 percent.

Despite the large set of controls available in the 2001 Census, composition effects are small relative to the location effects, meaning workers are not sorting strongly across provinces according to their overall observable skill levels. Residents of Ontario and British Columbia are better educated, but are also more likely to be immigrants and minorities, and therefore paid less than comparable natives. The opposite situation is true of residents of the Atlantic and Prairie provinces.

Predicted wages in Saskatchewan, Manitoba, and PEI are low mainly because of worker industry and occupation. It is not clear that these variables should be controlled for when estimating locational effects since they are not pre-market characteristics. They should be controlled for if they reflect unobserved skills or compensating wage differentials due to employment, rather than locational, characteristics. They should not be controlled for if they reflect how workers change jobs or industry when they move across provinces.

Interestingly, a regression of composition differences on raw wage differences across provinces yields an insignificant coefficient of 0.01 (s.e.= 0.05), suggesting that wage differences across provinces are driven entirely by location effects rather than composition effects. If industry and occupation are excluded from the composition effects, then the relationship becomes slightly negative with a coefficient of -0.11 (s.e. = 0.03), as workers in lower-paying provinces have higher observed pre-market skills. These relationships are graphed in Figures 1A and 1B, where the location effect of a province is shown by the distance of its marker from the diagonal line.

It is possible that location effects may be driven by worker sorting across provinces according to unobserved skills, despite the lack of strong sorting according to observed skills. To test this possibility, Figure 1C plots the location effects estimated for workers currently in their province

of birth – 68.6 percent of the sample – against location effects estimated for the entire sample. If estimated location effects for the entire sample are driven by selective migration, then the location effects for non-movers should be smaller in size than the full-sample estimates based off of the entire sample. Instead, the effects are virtually identical. Overall, the evidence suggests that the average earnings potentials of workers, due to observed and unobserved skills, are fairly constant across provinces.[21]

Column 2 of table 1 reports the estimated federal tax deficit, i.e. the negative of the federal tax differential, which reports how much less a resident of a province will pay in federal taxes relative to the average Canadian. As shown in table 2A, the relationship with federal transfers is strongly positive and remarkably linear: every extra dollar in federal transfers received is associated with a 47 cent decrease in federal taxes, as federal transfer policy exacerbates federal tax differences.[22]

3.3 Source-Based Tax Revenues

Source-based tax revenues are gleaned from four categories of provincial revenues. First, provincial corporate income taxes, worth $14.3B in 2001, are taken to be taxes on capital. Ontario receives 54 percent of these revenues, but has only 38 percent of the population. Second and third are "mining and logging taxes" and "natural resource taxes and licenses," worth $1.1B together, which are from land-based natural resources. Most of the natural-resource revenues fall under the category of "investment income," worth $28.0B. Alberta receives 44 percent of these revenues, but has only 10 percent of the population.

Differentials averaged over 1999 to 2003 are reported in column 3 of table 1. Alberta offers the most in source-based revenues: $2088 more per head than the national average. Saskatchewan, British Columbia and Manitoba also exceed the average, while all of the other provinces offer less than the average. This is true of Ontario, despite its disproportionate corporate income tax revenues. As seen in Figure 2B, the relationship between federal transfers and source-based rev-

[21] This does not preclude sorting within provinces, such as between or within metropolitan areas, for which there is some evidence (Albouy and Leibovici, 2009).

[22] Given their unusual circumstances, the Territories are excluded from the regression analyses.

enues is only slightly negative and far from offsetting. When federal transfers are compared to source-based revenues and federal-tax deficits together, the relationship again becomes positive, as in Figure 2C, implying that federal transfers typically worsen these other observable location distortions.

4 Explaining Differences in Measurable Net Fiscal Benefits

Differences in measurable net fiscal benefits, reported in table 1, clearly benefit the Atlantic and Prairie provinces and the Territories at the expense of British Columbia, Quebec, and especially Ontario, provinces offering higher wages. The regressions reported in row A of table 4 imply that moving to a province with a wage level one dollar higher is associated with a 43-cent drop in federal transfers and 76-cent drop in net fiscal benefits. Thus, net fiscal benefits severely dull the incentive for labor to move to areas offering a higher return. This apparent inefficiency may be justified if fiscal benefit differences redistribute resources more equitably or correct for externalities.

4.1 Equity

4.1.1 Earnings Potential

It is hard to imagine equity-motivated transfers that would not go disproportionately to provinces with populations of low earnings potential. Columns 4a and 4b of table 3 report two measures of average predicted income, one using all observed characteristics in the wage equation from table 2, and the second excluding industry and occupation.[23] As seen in rows B and C of table 4 there are no significant relationships between the average predicted income of provincial residents and either federal transfers or net fiscal benefits, and when industry and occupation are excluded, the relationships are positive, so that federal transfers seem regressive.[24] Even if the relationships

[23]Sample selection problems are dealt with by using the predicted earnings of the entire population ages 25 to 55, rather than just those in the wage sample.

[24]The differences between these two measures is driven largely by Saskatchewan, which has low paying industries and occupations. Excluding industry and occupation is justified if this lower pay is due to the compensating wage differentials of jobs, i.e. if lower-paying jobs are more pleasant or come with better non-wage benefits. Exclusion is

were opposite in sign, the differences in predicted earnings, which are quite small, cannot justify the much greater differences in net fiscal benefits. The results in row D look at the relationship with predicted income according to language, immigration, and ethnicity, and here the relationship is also positive. This implies that federal transfers and other fiscal benefits are directed towards provinces with more English-speaking native whites, away from provinces with a larger fraction of low-earning minorities.[25]

4.1.2 Wage and Cost-of-Living Differences

In the theoretical model, it is assumed that individuals are perfectly mobile and that inter-regional wage variation provides compensation for cost-of-living or amenities. If labor markets are not fully integrated in this sense, then an area may have low wages because it has an oversupply of labor, unrelieved by emigration because of moving costs or other considerations. In this case, net fiscal benefits may help improve the welfare of residents in low-wage provinces in the short-run, albeit distorting long-run incentives for them to go elsewhere in order to eliminate factor imbalances. It is then useful to measure real incomes, deflated by local cost-of-living, to assess the welfare of local residents.

Measures of local cost-of-living can be derived from a local housing-cost index, derived in Albouy and Leibovici (2009), and reported in column 2 of Table 5. This index may be enriched using data on non-housing prices using the Consumer Price Index from Statcan, although this only has price information on the largest city in each province (plus Ottawa) and may be unrepresentative of the entire province. Real-income differences using two different cost-of-living measures – with and without CPI data – are reported in columns 5a and 5b of table 3. Regressions on these measures, in rows E and F of table 4, reveal that federal transfers or net fiscal benefits are awarded disproportionately to provinces with *higher* real incomes, although the relationship is significant

not justified if industry and occupation variables are due to unmeasured pre-market skills or economic rents that accrue to certain industries or professions.

[25] One caveat to this observation is that transfers are directed disproportionately to provinces with a disproportionate share of aboroginals, but this is a small portion of the population of any province (recall that the Territories are excluded), with Manitoba having the highest portion of 13 percent.

only with the housing-only cost-of-living measure.

Interestingly, real income levels are negatively correlated with provincial growth rates, contradicting the view that migration should equilibrate real-wage differences across areas.[26] This suggests that migration to Ontario and British Columbia is due to individuals pursuing more desirable amenities, possibly climactic or cultural, rather than higher real wages. Yet according to row G, a 1-percent increase in the provincial growth rate is associated with a $70 decrease in federal transfers. This suggests that fiscal incentives inefficiently overpopulate the Atlantic and Prairie provinces, which would otherwise see greater emigration to other provinces.

4.2 Local Public-Good Externalities

The last term in equation (6) represents the externality that an additional migrant to province j has on existing residents through the spillover effects that their additional spending on locally-provided government goods has on others. Efficient federal transfers are supposed to subsidize location in provinces where this externality is strongest. When local-government goods are provided efficiently, this externality is proportional to the local expenditures per capita, and the congestion parameter α. Most empirical estimates of α at the local level are close to one (e.g. Bergstrom and Goodman 1973), implying that locally-provided goods are like private goods. Oates (1988) argues that estimates of α may be systematically biased towards one, and thus spillover effects may exist.

Combined provincial and local expenditures per capita are reported in column 6a in table 3. As reported in row H of table 4, there is no significant positive relationship between this measure and federal transfers or net fiscal benefits, undercutting the explanation that federal transfers help to subsidize public-good sharing. Yet, it is not guaranteed that actual expenditures approximate optimal expenditures. Net fiscal benefits themselves may cause local spending in receiving areas to be too high. This effect is corrected for in the externality measure reported in column 6b of table 3, which estimates the public-good externality by netting out the net fiscal benefit from the

[26]The correlation between the 1991 to 2001 provincial growth rates and the first and second real income measures are -0.81 and -0.31, respectively.

expenditure measure in 6a – using a coefficient of 0.36 to reflect the share of income spent on local and provincial government goods – and multiplying the remainder by 0.25 for the case where $\alpha = 0.75$. The relationship between this measure and net fiscal benefits, shown in row I of table 4, is negative, suggesting that federal fiscal policy may in fact induce individuals to move to areas where their local-public good externality is lower than average, increasing the apparent inefficiency of federal transfer policy.

4.3 Other Efficiency Considerations

Another rationale for federal transfers is that they may help to stabilize local revenue differences over time: local governments provide a form of mutual insurance through these payments, helping to smooth their expenditures, and reducing inefficiencies in consumption and possibly mobility. Yet, as shown in Figure 3, differences in net fiscal benefits are persistent over time, with some provinces consistently receiving higher benefits than others. According to figures in Courchene and Beavis (1973), these differences have largely persisted since at least the 1960s, further justifying the relevance of long-run mobility. In addition, Boadway and Hayashi (2004) find that variation in transfer payments over time appears to have the opposite effect of making provincial revenues less stable over time.

This theoretical analysis in section 2 ignores additional externalities from agglomeration, congestion, and the like, although entering these into the analysis requires quantifying their relative magnitudes across provinces. For example, Toronto could be overcrowded and hence Ontarians are willing to pay others to stay out of their cities.[27] The view that Toronto is overcrowded seems at odds with the results of Albouy and Leibovici (2009) that Toronto offers one of the best qualities-of-life in Canada, with other large cities, Vancouver and Montreal occupying top places. As shown in Albouy and Seegert (2010), while city residents may wish to pay potential migrants to stay out of their city and live in less desirable areas, such a policy may be inefficient federally. Further-

[27] Such an argument might follow the theoretical work of Myers (1990), which argues that, under perfect mobility, some provinces are willing to make optimal transfers, although Myers makes no specific claims about Canada.

more, there are many areas in Ontario that remain largely unoccupied and could absorb additional population. This observation also partly counters arguments, based on conflicting evidence (see Glaeser and Gottlieb, 2008), that agglomeration externalities may be higher in smaller cities, and thus migration to them should be subsidized.

Finally, there is an argument that it somehow desirable to keep remote areas of the country occupied and that this is accomplished through intergovernmental transfers. Yet, it is unclear why market incentives, such as for resource extraction, or targeted purchases by the federal government, such as for defense or road maintenance, need to be supplemented by a general subsidy that goes to any resident, regardless of their business, in order to achieve federal objectives. Policies to achieve population balance are also at odds with policies aimed at preserving wilderness areas and reducing the ecological impact of humans on pristine areas. Ultimately, there is no compelling evidence of externalities from migration strong enough to merit the large fiscal benefit differences seen in Table 1.

5 Simulated Effects of Inefficient Federal Transfers

As differences in measurable net fiscal benefits across provinces are persistent, and do not appear to improve inter-provincial equity or to correct for externalities, it is appropriate to treat them as a locational tax-subsidy system that inefficiently raises the demand to live in fiscally advantaged provinces and lowers the demand to live in fiscally disadvantaged ones. As a result, fiscally advantaged provinces are not only overpopulated relative to efficient levels, but also have inflated land and housing costs, and – assuming regional diminishing marginal products of labor – depressed wage levels.[28] If workers and firms are perfectly mobile, the long-run effects of these fiscal distortions on employment and prices can be estimated in the case where $\alpha = 1$, using the theoretical model with the methods presented in Albouy (2009a).

The effect of fiscal distortions on land rents, wage levels, and housing costs in percentage terms

[28] This requires that agglomeration effects on productivity are fairly weak.

relative to their efficient levels are given by the following approximations:

$$\frac{dr^j}{r^j} = \frac{1}{s_R}\frac{dNFB^j}{\bar{m}} \tag{9a}$$

$$\frac{dw^j}{w^j} = -\frac{1}{s_w}\frac{\lambda_L}{\lambda_N}\frac{dNFB^j}{\bar{m}} \tag{9b}$$

$$\frac{dp^j}{p^j} = \frac{1}{s_y}\frac{\lambda_N - \lambda_L}{\lambda_N}\frac{dNFB^j}{\bar{m}} \tag{9c}$$

where s_R and s_w are average shares of income received from land and labor, s_y is the share of expenditures on housing, λ_N and λ_L are the shares of labor and urban land used to produce tradable private goods, and $dNFB^j/\bar{m}$ is the differential net benefit in province j, divided by average income.[29] Long-run employment effects are estimated with a reduced form elasticity, ε, which gives the percent increase in local employment that arises from a permanent increase in net fiscal benefits equal to one percent of average income, so that by definition

$$\frac{dN^j}{N^j} = \varepsilon\frac{dNFB^j}{\bar{m}}$$

Estimates of this elasticity based on Canadian data are somewhat controversial, although the long-run effects are most plausibly given by Wilson (2003), who extends the short-run estimates of Watson (1986) and Winer and Gauthier (1983). His estimates imply an average elasticity of $\varepsilon = 3.23$.[30]

The deadweight loss from locational inefficiencies created by fiscal imbalances is approximated by the formula

$$DWL = \varepsilon \cdot var\left(\frac{dNFB^j}{m}\right)$$

which is measured as a fraction of total income. In the spirit of Harberger (1964) this formula

[29]The calibrated estimates of these parameters are $s_w = 0.10$, $s_w = 0.70$, $s_y = 0.33$, $\lambda_L = 0.17$, and $\lambda_N = 0.70$.

[30]This is obtained by regressing proportional population flows between provinces, *deltm*, on changes in net fiscal benefits between provinces, *delt77*, normalized as a fraction of income. The estimate of -3.23 using provinces is almost half the size of $\varepsilon = -6$ that Bartik (1991) finds using metropolitan areas. Given that mobility responses across provinces should be smaller than across metropolitan areas, the difference between these estimates seems plausible and mutually consistent.

Note that the symmetric treatment of federal transfers and taxes may not be fully warranted.

captures not only the deadweight loss of individuals locating in the wrong provinces, but also the accompanying distortions in other factor markets, such as mobile capital.

The predicted effects of net fiscal benefits on the long-run prices and employment of Canadian provinces are reported in columns 6 through 9 of Table 5, which ranks provinces according to the net fiscal benefits they offer to residents. Taken together, the Atlantic and Prairie provinces have populations 31 percent, and housing-costs 21 percent, beyond their efficient levels, while their wage levels are slightly depressed. The effects on the Atlantic provinces and Manitoba are due mainly to federal-transfer and tax policy, while the effects in Alberta and Saskatchewan have more to do with uncorrected advantages in source-based revenues. The effects for Quebec and British Columbia are small. This means that average effects would not change considerably if Quebec residents are assumed to be less mobile because they are predominantly French-speaking. Ontario, which pays much more in federal taxes than it receives and is poor in source-based revenues, is the most adversely impacted, with housing-cost and employment levels 10 and 14 percent below their efficient levels.

The average effects of net fiscal benefits on prices, employment, and the deadweight burden are reported in Table 6, which considers effect of each component alone, as well as together. The overall cost of the locational inefficiencies created by differences in net fiscal benefits across provinces is 0.41 percent of income per year. Source-based revenues alone account for a 0.21 percent income loss, and when combined with federal taxes, a 0.26 percent loss. What is most striking is that federal transfers increase the cost of locational inefficiencies by an additional 0.15 percent of income, or 1.6 billion dollars per year, more than 10 percent of the value of the fiscal equalization system.

6 Conclusion

This evaluation should be taken seriously not only by economists and policy makers in Canada, but also in other countries where place-based policies exhibit similar features and are subject to similar

evaluations. At a basic level, this analysis suggests three conclusions about the characteristics of equalization programs that maximize economic efficiency: they (i) distinguish residence-based fiscal capacities from source-based capacities; (ii) separate income differences due to the location of labor from those due to its composition; and (iii) recognize that providing higher grant levels to regions with higher federal-tax burdens may reduce inefficient migration.

The analysis of Canadian federal transfer policies goes against the presumption – seen in Watson (1986) and Wilson (2003), among others – that fiscal equalization helps to mitigate problems of inefficiency and inequity across provinces. Actual federal transfers appear to be efficiency reducing by paying individuals to reside in less productive and less amenable areas – the Atlantic and Prairie provinces – where efficient population levels seem to be much lower than current levels. Nor does federal equalization appear to redistribute resources more equitably, if equity is defined in terms of equalizing differences in labor-market endowments. The bias of federal transfers away from minorities and towards areas with higher real incomes may provoke concern. Since income differences across provinces appear to result largely from productivity and quality-of-life differences, rather than skill differences in the workforce, there is no obvious way to target federal transfers more equitably.

Transfer policy could be more efficient by redistributing source-based revenues more intensely and refunding interregional federal tax differences. Such reform would likely meet considerable political opposition: Evans (2005) finds that per-capita representation in the House of Commons is 50 percent higher for receiving provinces than for giving ones, and finds the relationship between federal transfers and representation exists across time as well as space. Either Canadians have a remarkably high willingness-to-pay individuals to live in certain provinces for reasons outside the scope of this analysis, or perhaps the equalization program may have more of a political basis than an economic one.

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Appendix

A Efficiency

A.1 Set-up

The total population is distributed across the regions according to the constraint $\sum_j \mathbf{N}^j = \mathbf{N}^{TOT}$, where, $\mathbf{N}^{TOT} = (N_1^{TOT}, ..., N_E^{TOT})$. Assume that capital is fixed in the economy at the level K^{TOT}. Consumption bundles within each region are described by the vectors $\mathbf{x}^j = (x_1^j, ..., x_E^j)$, and $\mathbf{y}^j = (y_1^j, ..., y_E^j)$. We use F_X to denote the production function for tradable goods, the quantities K_X^j, L_X^j and $\mathbf{N}_X^j = (N_{1X}^j, ...N_{EX})$ to denote the capital, land, and labor used to produce the traded good, and X^j the amount of the traded good produced in region j. Notation for the non-traded good and government-provided good is similar, leading to the following production constraints for each region j

$$\begin{aligned} F_X(K_X^j, L_X^j, \mathbf{N}_X^j; A_X^j) &\geq X^j \\ F_Y(K_Y^j, L_Y^j, \mathbf{N}_Y^j; A_Y^j) &\geq Y^j \\ F_G(K_G^j, L_G^j, \mathbf{N}_G^j; A_G^j) &\geq G^j \end{aligned}$$

In addition there are J local resource constraints

$$\begin{aligned} K^j &\geq K_X^j + K_Y^j + K_G^j \\ L^j &\geq L_X^j + L_Y^j + L_G^j \\ \mathbf{N}^j &\geq \mathbf{N}_X^j + \mathbf{N}_Y^j + \mathbf{N}_G^j \end{aligned}$$

although federally, capital and land are mobile, so that local resources are simply limited by the two aggregate constraints

$$\begin{aligned} K^{TOT} &\geq \sum_j K^j \\ \mathbf{N}^{TOT} &= \sum_j \mathbf{N}^j \end{aligned}$$

In addition, we may write a plethora of non-negativity constraints, the most interesting ones being

$$K^j \geq 0, \mathbf{N}^j \geq \mathbf{0}$$

for each j. Finally there are two consumption constraints, a global one for the tradable goods, and J local ones for non-tradable goods.

$$\begin{aligned} \sum_j X^j &\geq \mathbf{N}^j \cdot \mathbf{x}^j + x^F \\ Y^j &\geq \mathbf{N}^j \cdot \mathbf{y}^j + y^{jF} \end{aligned}$$

where x_F and y^{jF} are goods appropriated by the federal government.

A.2 Pareto Efficient Allocations under Perfect Mobility

Pareto efficient allocations are solved for using a planner's problem under the constraint of perfect mobility. The perfect mobility case corresponds best with the market economy over the very long run, and avoids problems of redistribution within types across different regions. With multiple types, we maximize the utility of one type in a single region, chosen arbitrarily, guarantee that all others of that type in other regions get the same utility, and that all other types achieve an arbitrary level of utility regardless of where they live. This leads to the program

$$\max U_1\left(x_1^1, y_1^1, \frac{G^1}{(N^1)^\alpha}; Q^1\right)$$

subject to the constraints

$$U_1\left(x_1^j, y_1^j, \frac{G^j}{(N^j)^\alpha}; Q^j\right) \geq U_1\left(x_1^1, y_1^1, \frac{G^1}{(N^1)^\alpha}; Q^1\right)$$

for all j and that

$$U_e\left(x_e^j, y_e^j, \frac{G^j}{(N^j)^\alpha}; Q^j\right) \geq \bar{U}_e$$

for all j and each e.

Combining as many constraints as possible, and leaving out the non-negativity constraints, produces a combined Lagrangian

$$\begin{aligned}\mathcal{L}() = &\sum_j \sum_e \eta_e^j U_e\left(x_e^j, y_e^j, \frac{G^j}{(N^j)^\alpha}; Q^j\right) + \pi_X\left[\sum_j F_X(K_X^j, L_X^j, \mathbf{N}_X^j; A_X^j) - \sum_j \mathbf{N}^j \cdot \mathbf{x}^j - x^F\right] \\ &+ \sum_j \pi_Y^j\left[F_Y(K_Y^j, L_Y^j, \mathbf{N}_Y^j; A_Y^j) - \mathbf{N}^j \cdot \mathbf{y}^j - y^{jF}\right] + \sum_j \pi_G^j\left[F_G(K_G^j, L_G^j, \mathbf{N}_G^j; A_G^j) - G^j\right] \\ &+ \sum_j \pi_K^j\left(K^j - K_X^j - K_Y^j - K_G^j\right) + \kappa\left(K^{TOT} - \sum_j K^j\right) + \sum_j \pi_L^j\left(L^j - L_X^j - L_Y^j - L_G^j\right) \\ &+ \sum_j \boldsymbol{\pi}_N^j \cdot \left(\mathbf{N}^j - \mathbf{N}_X^j - \mathbf{N}_Y^j - \mathbf{N}_G^j\right) + \boldsymbol{\nu} \cdot \left(\mathbf{N}^{TOT} - \sum_j \mathbf{N}^j\right)\end{aligned}$$

where the multipliers follow an obvious notation, with $\boldsymbol{\pi}_N^j = (\pi_{N1}^j, .., \pi_{NE}^j)$, and $\boldsymbol{\nu} = (\nu_1^j, ..., \nu_E^j)$.[31]

There are a large number of first-order Karuch-Kuhn-Tucker conditions, not all of which can

[31] The first term of the Lagrangian comes from defining $\eta_1^1 = 1 - \sum_{j>1} \eta_1^j$.and simplifying

$$U_1\left(x_1^1, y_1^1, \frac{G^1}{(N^1)^\alpha}; Q^1\right) + \sum_{j>1} \eta_1^j\left[U_1\left(x_1^j, y_1^j, \frac{G^j}{(N^j)^\alpha}; Q^j\right) - U_1\left(x_1^1, y_1^1, \frac{G^1}{(N^1)^\alpha}; Q^1\right)\right] + \sum_j \sum_{e>1} \eta_e^j U_e\left(x_e^j, y_e^j, \frac{G^j}{(N^j)^\alpha}; Q^j\right)$$

be explored here. For each of the goods

$$\frac{\partial \mathcal{L}}{\partial x_e^j} = \eta_e^j \frac{\partial U^j}{\partial x} - \pi_X N_e^j \leq 0$$
$$\frac{\partial \mathcal{L}}{\partial y_e^j} = \eta_e^j \frac{\partial U^j}{\partial y} - \pi_Y^j N_e^j \leq 0$$
$$\frac{\partial \mathcal{L}}{\partial G^j} = \sum_e \eta_e^j \frac{\partial U^j}{\partial g} (N^j)^{-\alpha} - \pi_G^j \leq 0$$

which hold with equality when the related quantities are positive. For the the allocation of factors within regions, the conditions have the form

$$\frac{\partial \mathcal{L}}{\partial N_X^j} = \pi_X \frac{\partial F_X^j}{\partial N_{Xe}} - \pi_{Ne}^j \leq 0, \ \frac{\partial \mathcal{L}}{\partial N_Y^j} = \pi_{Ye}^j \frac{\partial F_Y^j}{\partial N_{Ye}} - \pi_{Ne}^j \leq 0$$
$$\frac{\partial \mathcal{L}}{\partial K_Y^j} = \pi_X \frac{\partial F_X^j}{\partial K_X} - \pi_K^j \leq 0, \ \frac{\partial \mathcal{L}}{\partial L_Y^j} = \pi_Y^j \frac{\partial F_Y^j}{\partial N_Y} - \pi_L^j \leq 0$$

Assuming all goods are produced within regions, we get the classical tangency result for private goods and a generalized Samuelson Rule for local-government goods:

$$\frac{N_e^j}{\eta_e^j}\pi_X = \frac{\partial U_e^j}{\partial x}, \frac{N_e^j}{\eta_e^j}\pi_Y^j = \frac{\partial U_e^j}{\partial y} \Rightarrow \frac{\pi_Y^j}{\pi_X} = MRS_{yx}^j = \frac{\partial U_e / \partial y^j}{\partial U_e / \partial x^j} = \frac{\partial F_X^j / \partial N_{Xe}}{\partial F_Y^j / \partial N_{Ye}} = MRT_{yx}^j$$
$$\frac{\pi_G^j}{\pi_X} = \frac{1}{(N^j)^\alpha} \sum_e N_e^j \frac{\partial U^j / \partial g}{\partial U^j / \partial x} \Rightarrow \frac{\pi_G^j}{\pi_X} = (N^j)^{1-\alpha} \overline{MRS}_{Gx}^j = MRT_{Gx}^j$$

The equations imply that within each region, standard allocative, production, and match efficiency conditions should hold.

The most interesting conditions relate to the mobile production factors, particularly labor:

$$\frac{\partial \mathcal{L}}{\partial K^j} = \pi_K^j - \kappa \leq 0$$
$$\frac{\partial \mathcal{L}}{\partial N_e^j} = -\alpha \sum_e \eta_e^j \frac{\partial U^j}{\partial g} \frac{G^j}{(N^j)^\alpha} - \pi_X x_e^j - \pi_Y^j y_e^j + \pi_{Ne}^j - \nu_e \leq 0$$

With sufficient Inada conditions applied to the utility function, all regions will produce home and government goods, with labor in each sector. Some regions may not have production of tradable goods (e.g. resort regions), but this is ignored for now since it adds little to the analysis. Positive agglomeration spillovers may be contained in π_{Ne}^j as there is no assumption of constant returns to scale.

Using the within-region factor equations, the condition for capital reduces to

$$\frac{\partial F_X^j}{\partial K_X} = \frac{\partial F_X^{j'}}{\partial K_X}$$

in any two regions j and j' with capital. Substituting in $\partial\mathcal{L}/\partial G^j = 0$, which assumes that $G^j > 0$ and is set efficiently, the equation for labor, assuming $N_e^j > 0$ becomes

$$\pi_{Ne}^j - \pi_X x_e^j - \pi_Y^j y_e^j - \alpha \pi_G^j \frac{G^j}{N^j} = \nu_e$$

Dividing by π_X and substituting in production conditions, this expression becomes

$$\frac{\partial F_X^j}{\partial N_{Xe}} - x_e^j - MRT_{yx}^j y_e^j - \alpha MRT_{Gx}^j \frac{G^j}{N^j} = \frac{\nu_e}{\pi_X}$$

Since the right-hand side does not depend on j the left-hand side must be equal across all regions with $N_e^j > 0$. The first term accounts for the marginal productivity of labor. The next two terms gives the resource cost of the private consumption (perfectly congestible) that goes to residents of each region. In regions with greater quality of life or uncongested local-government goods, these terms will be smaller, since less consumption is required to compensate residents of type e for living in region j. The term starting with α gives the degree of congestion of the public caused by the new inhabitant: if $\alpha = 0$ this term vanishes.

A.3 Market Equilibrium and Optimal Fiscal Transfers

In the market environment, factors are perfectly mobile across sectors within region, and labor and capital are perfectly mobile across regions. All input and goods markets are perfectly competitive, and the government is efficient and pays factors their marginal product. Take x to be the numeraire good, with a price $p_X = 1$, and let p_Y^j be the market price of home goods. The budget constraint of a worker of type e in region j is given by

$$x_e^j + p^j y_e^j + T_e^j = w_e^j + R_e^j + I_e^j + F_e^j$$

where T_e^j are local taxes to pay for G^j. w_e^j are local wages, R_e^j are incomes from land, I_e^j are incomes from capital, and F_e^j are net fiscal transfers, which can include federal income taxes. All income sources are super-scripted to indicate their possible dependence on location.

With perfectly competitive markets we have that

$$\frac{\partial F_X^j}{\partial N_{Xe}} = p^j \frac{\partial F_Y^j}{\partial N_{Ye}} = w_e^j$$

This can be related to the conditions in the planner's problem through $MRT_{yx}^j = p^j$ and defining $p_G^j \equiv MRT_{Gx}^j$. Putting these into the population condition implies

$$w_e^j - x_e^j - p^j y_e^j - \alpha p_G^j \frac{G^j}{N^j} = \frac{\nu_e}{\pi_X}$$

Substituting in the budget constraint

$$T_e^j - F_e^j = \alpha p_G^j \frac{G^j}{N^j} + R_e^j + I_e^j + \frac{\nu_e}{\pi_X}$$

This condition says that local tax levels, net of fiscal transfers, i.e. total payments to both levels of government, should equilibrate congestion of government-good consumption, and any place-based income differentials from land and capital income. The constant term implies that this can differ across types but not across regions.

Example 1 *Boadway-Flatters (1982) Model*

In this article there is no private home-good sector, and no differences in Q^j, A_X^j, or A_Y^j across locations, only L^j. G^j is produced out of X^j, which can be simulated here by assuming that $p_G^j = 1$. Production exhibits constant returns to scale in all factors, implying falling returns to scale in N and K.

Case 1 *Lump-Sum Taxes and Local Rent Sharing*

In this first case, labor is homogenous and there is no capital. Local government goods are paid with a local uniform head tax, and residents inherit land in the location that they move to, sharing it equally with all other residents (although they don't live on it).

$$T^j = G^j/N^j$$
$$R^j = r^j L^j/N^j$$

where $r^j = \partial F_X^j/\partial L_X = (X^j - N_X^j \partial F_X^j/\partial N_X)/L^j$. Substituting in and rearranging

$$F^j - F^{j'} = (1-\alpha)\left(\frac{G^j}{N^j} - \frac{G^{j'}}{N^{j'}}\right) - \left(R^j - R^{j'}\right)$$

for any two regions j and j'. Federal transfers should subsidize federal externalities, which increase with the level of per-capita government-good provision, and completely tax away differences in locally appropriated land rents.

Case 2 *Source-Based and Residence-Based Taxes*

Labor is still homogenous, but capital is reintroduced, and property is owned uniformly regardless of location. Source-based taxes on capital and land are given by τ_K^j, τ_L^j, and a residence-based tax on labor is τ_N^j. In addition, there is a property-tax rate, τ_P^j on income from land and capital.

$$I^j = \frac{1}{N^{TOT}}\sum_j \left(1-\tau_K^j\right) iK^j = \frac{1}{N^{TOT}} i\left(K^{TOT} - \sum \tau_K^j K^j\right)$$
$$R^j = \frac{1}{N^{TOT}}\sum_j \left(1-\tau_L^j\right) r^j L^j$$
$$T^j = \tau_N^j w^j + \tau_P^j (I^j + R^j)$$
$$G^j = \tau_K^j iK^j + \tau_L^j r^j L^j + \tau_N^j w^j N^j + \tau_P^j (I^j + R^j) N^j$$

where $r^j = \partial F_X^j/\partial L_X = (X^j - K_X^j \partial F_X^j/\partial K_X - N_X^j \partial F_X^j/\partial N_X)/L^j$. Because these taxes are uniform within regions, they do not distort production efficiency within regions. However, they do

distort the allocation of mobile resources across regions. If $\tau_K^j \neq \tau_K^{j'}$ then the allocation of capital will be distorted as

$$i = \frac{\partial F_X^j}{\partial K_X}\left(1-\tau_K^j\right) = \frac{\partial F_X^{j'}}{\partial K_X}\left(1-\tau_K^{j'}\right)$$

The allocation of labor will be distorted unless federal transfers are set so that

$$\begin{aligned} F^j - F^{j'} &= \left(T^j - T^{j'}\right) - \alpha\left(\frac{G^j}{N^j} - \frac{G^{j'}}{N^{j'}}\right) \\ &= (1-\alpha)\left(\frac{G^j}{N^j} - \frac{G^{j'}}{N^{j'}}\right) + \left[T^j - \frac{G^j}{N^j} - \left(T^{j'} - \frac{G^{j'}}{N^{j'}}\right)\right] \end{aligned}$$

Substituting in for T^j and G^j inside the square brackets:

$$F^j - F^{j'} = (1-\alpha)\left[\frac{G^j}{N^j} - \frac{G^{j'}}{N^{j'}}\right] - \left[\frac{\tau_K^j i K^j + \tau_L^j r^j L^j}{N^j} - \frac{\tau_K^{j'} i K^{j'} + \tau_L^{j'} r^{j'} L^{j'}}{N^{j'}}\right]$$

which is the result that fiscal externalities should be subsidized, and that all source-based revenues should be redistributed.

Case 3 *Worker Heterogeneity*

In this case the location condition for workers becomes

$$F_e^j - F_e^{j'} = \left[T_e^j - \frac{G^j}{N^j} - \left(T_e^{j'} - \frac{G^{j'}}{N^{j'}}\right)\right] + (1-\alpha)\left(\frac{G^j}{N^j} - \frac{G^{j'}}{N^{j'}}\right)$$

or just

$$F_e^j = \left(T_e^j - \frac{G^j}{N^j}\right) + (1-\alpha)\left(\frac{G^j}{N^j}\right) + F_e$$

where F_e satisfies the overall federal budget constraint.

With worker heterogeneity, residence-based taxes and total revenues are given by the following formulas

$$\begin{aligned} T_e^j &= \tau_N^j w_e^j + \tau_P^j (I_e^j + R_e^j) \\ G^j &= \tau_K^j i K^j + \tau_L^j r^j L^j + \sum_e \left(\tau_N^j w_e^j N_e^j + \tau_P^j (I^j + R^j) N_e^j\right) \\ &= \tau_K^j i K^j + \tau_L^j r^j L^j + \tau_N^j \bar{w}^j N^j + \tau_P^j (\bar{I}^j + \bar{R}^j) N^j \end{aligned}$$

where $\bar{w}^j = (1/N^j)\sum_j N_e^j w_e^j$. Substituting in we get

$$F_e^j = F_e + (1-\alpha)\frac{G^j}{N^j} - \left\{\frac{\tau_K^j i K^j + \tau_L^j r^j L^j}{N^j} + \tau_N^j\left(\bar{w}^j - w_e^j\right) + \tau_P^j\left[(\bar{I}^j + \bar{R}^j) - (I_e^j + R_e^j)\right]\right\}$$

In addition to subsidizing fiscal externalities and taxing away source-based incomes, residents in areas where their incomes are below average should be given less federal money, and residents in areas where incomes are above average should receive a subsidy.

This implies that the average level of transfers that should be given to region j is given by

$$\bar{F}^j = \frac{1}{N^j}\sum_j N_e^j F_e^j = \frac{1}{N^j}\sum_j N_e^j F_e + (1-\alpha)\frac{G^j}{N^j} - \left\{\frac{\tau_K^j i K^j + \tau_L^j r^j L^j}{N^j}\right\}$$

The terms related to income from labor and property add up to zero when averaged. The transfers have to be targeted directly at the right population or they do not have the corrective effect: effectively taxes on those types who are locating for fiscal reasons are exactly canceled out by subsidies on those with above average incomes. The federal government can give differential grants according to the composition of types across locations, but this is for redistributional purposes, not for efficiency.

The case in the main text is a fairly straightforward expansion of this model, using the assumption that income from capital and land are location independent. In addition, we can redefine federal transfer differences $\tilde{F}_e^j - \tilde{F}_e = (F_e^j + \tau_w^F w_e^j) - \left(F_e + \tau_w^F \bar{w}_e\right)$ to add back in differential federal tax payments, so that they then become pure federal transfers, with federal taxes accounted for separately, and use the previously derived formulas.

B Data and Estimation

We use Canadian Census data from the 2001 Public Use Microdata Files to calculate wage and housing-cost differentials. The wage differentials are calculated for workers ages 25 to 55, who report working at least 30 hours a week, 26 weeks a year. The CMA (Census Metropolitan Area) assigned to a worker is determined by their place of residence, with non-CMA residents pooled by province into a single fictional CMA. The wage differential of an CMA is found by regressing log hourly wages on individual covariates and indicators for a worker's CMA, using the coefficients on these CMA indicators. Province-level wage levels are calculated by averaging CMA-wage effects, weighted by population. Just using province indicators would produce fairly similar results, but would control less for rural-urban disparities.

The covariates are split into three main categories, as mentioned in the text, which can be further sub-categorized.

i.a 9 indicators of educational attainment, and three variables indicating highest grade, years of university, and years of other schooling;

i.b a quartic in potential experience, and potential experience interacted with years of education;

i.c 12 indicators for major field of study;

ii.a 13 indicators of industry (1980 definition);

ii.b 25 indicators of occupation (2001 SOC);

iii.a 4 indicators of marital status (married, divorced, widowed, separated);

iii.b 5 indicators of minority status (Black, Chinese, South Asian, Aboriginal and other);

iii.c Indicators of immigrant status, time since immigration, and citizenship status;

iii.d Indicators of mother tongue (English, French, or other) and indicators for bilingualism interacted with mother tongue, and for other mother tongue interacted with speaking only French and only English;

All covariates are interacted with gender.

TABLE 1: MEASURABLE NET FISCAL BENEFITS OF RESIDING IN CANADIAN PROVINCES, RELATIVE TO THE NATIONAL AVERAGE: 2001

		Measurable Locational Benefits			
Province	Population	Federal Transfer Differential (1)	Federal Tax Deficit due to Wage Level (2)	Source-Based Revenue Differential (3)	Net Fiscal Benefit (1)+(2)+(3)
Newfoundland	522033	2125	606	-487	2243
PEI	136663	1858	808	-637	2029
Nova Scotia	932454	1174	682	-536	1321
New Brunswick	749801	1442	694	-65	2070
Quebec	7396331	31	139	-390	-221
Ontario	11896663	-417	-250	-415	-1082
Manitoba	1151439	1121	459	220	1800
Saskatchewan	1000221	566	581	722	1869
Alberta	3058017	-345	70	2088	1812
BC	4076264	-294	-220	346	-168
Territories	99134	15578	-564	-785	14229

Measured in 2001 Canadian Dollars. Population from CANSIM Table 54-0001. Total federal transfers from CANSIM 384-0011. Federal tax differential based on a marginal tax rate of 24.9 percent and log wage differences from table 2 using an earnings base of $16980. Source-based revenues the sum of corporate income taxes, mining and logging taxes, natural resources taxes and licences, and investment income from CANSIM 385-0002. Federal transfer and source-based revenue differentials averaged over 1998 to 2003. See text for further detail.

TABLE 2: WAGE DIFFERENCES ACROSS PROVINCES: COMPOSITION AND LOCATION EFFECTS, 2001

Province	Total: Location + Composition (1)		Location Effects (2)		Composition (Predicted) Effects (3)		Subcategories of Composition (Predicted) Effects: Education & Experience (4)		Industry & Occupation (5)		Immigration, Language & Ethnicity (6)	
Newfoundland	-0.149	(0.010)	-0.152	(0.010)	0.003	(0.004)	-0.030	(0.003)	-0.009	(0.004)	0.042	(0.003)
PEI	-0.202	(0.016)	-0.209	(0.039)	0.008	(0.003)	-0.017	(0.003)	-0.021	(0.002)	0.045	(0.003)
Nova Scotia	-0.143	(0.007)	-0.173	(0.019)	0.030	(0.003)	-0.002	(0.003)	-0.006	(0.003)	0.038	(0.003)
New Brunswick	-0.163	(0.007)	-0.177	(0.020)	0.013	(0.003)	-0.020	(0.003)	-0.010	(0.003)	0.043	(0.003)
Quebec	-0.028	(0.004)	-0.031	(0.014)	0.003	(0.005)	-0.009	(0.003)	-0.002	(0.003)	0.014	(0.004)
Ontario	0.063	(0.003)	0.060	(0.013)	0.003	(0.003)	0.009	(0.003)	0.009	(0.003)	-0.015	(0.003)
Manitoba	-0.132	(0.006)	-0.112	(0.018)	-0.019	(0.003)	-0.013	(0.003)	-0.015	(0.003)	0.008	(0.003)
Saskatchewan	-0.180	(0.007)	-0.145	(0.021)	-0.035	(0.003)	-0.015	(0.003)	-0.044	(0.003)	0.024	(0.003)
Alberta	-0.005	(0.004)	-0.014	(0.015)	0.009	(0.003)	-0.002	(0.003)	0.003	(0.003)	0.008	(0.003)
BC	0.033	(0.004)	0.053	(0.014)	-0.019	(0.003)	0.008	(0.003)	-0.009	(0.003)	-0.019	(0.003)
Territories	0.141	(0.020)	0.127	(0.042)	0.014	(0.004)	-0.022	(0.003)	0.054	(0.002)	-0.018	(0.005)

Robust standard errors in parentheses. Wage data are taken from the Census 2001 PUMFI. Wage estimates are based on the average logarithm of hourly wages for full-time workers ages 25 to 55. Education: highest grade, years of univeristy, other years, 9 indicators of highest degree, and 12 field of study indicators. Experience: quartic in potential experience and experience interacted with years of schooling. Industry: 13 indicators; occupation: 25 indicators. Immigration, time since immigration, citizenship status, visible minority indicators interacted immigration status, mother tongue interacted with official languages spoken. Composition effects based on all individual ages 25 to 55, regardless of employment. Further detail provided in the Data Appendix.

TABLE 3: RELATIVE NET FISCAL BENEFITS AND POSSIBLE EQUITY AND EFFICIENCY JUSTIFICATIONS: 2001

		Possible Justifications					
		Equity 1: Predicted Income from Composition Effects		Equity 2: Real Income Level Adjusted for Cost of Living		Efficiency: Public-Good Externality: Local & Prov Expenditures	
Province	Measurable Net Fiscal Benefit (1)+(2)+(3)	All Chars. (4a)	Excluding Ind & Occ (4b)	Housing Cost Base (5a)	Incl. Urban CPI (5b)	Raw Expenditures (6a)	Estimated Externality (6b)
Newfoundland	2243	70	265	1344	-386	652	-42
PEI	2029	178	655	-679	-1293	-272	-253
Nova Scotia	1321	705	846	-372	-1318	-1108	-397
New Brunswick	2070	306	530	75	-427	-1119	-469
Quebec	-221	77	114	675	816	748	207
Ontario	-1082	75	-146	-233	-257	-395	0
Manitoba	1800	-440	-111	378	480	221	-109
Saskatchewan	1869	-780	223	428	171	293	-97
Alberta	1812	210	142	30	746	-53	-179
BC	-168	-441	-237	-944	-995	171	58
Territories	14229	325	-903	3550		-3517	-2178

Measured in 2001 Canadian Dollars. Predicted income based off of predicted wages using an income base of $22982. Local and provincial expenditures based off of provincial and local government expenditures in CANSIM 385-0002 and 385-0003 averaging from 1999 to 2003. Estimated externality corrects for net fiscal benefit differences and uses a congestion parameter (alpha) of 0.75. See text for further detail.

TABLE 4: RELATIONSHIP BETWEEN FEDERAL GRANTS AND NET FISCAL BENEFITS WITH POSSIBLE EQUITY AND LOCAL PUBLIC-GOOD EXTERNALITY MEASURES, 2001

(Each entry corresponds to a separte univariate regression)

Specification	Independent Variable	Dependent Variable: Federal Transfer (1)	Dependent Variable: Meas. Net Fiscal Benefit (2)
A.	Local Wage Level (Location Effect Adjusted for Obs. Characteristics)	-0.43 (0.06) Adj. R^2 = 0.79	-0.76 (0.13) Adj. R^2 = 0.61
B.	Predicted Income All Characteristics	0.07 (0.60) Adj. R^2 = -0.12	-0.22 (1.18) Adj. R^2 = -0.12
C.	Predicted Income: Excluding Ind & Occ	1.69 (0.37) Adj. R2= 0.40	3.09 (1.18) Adj. R^2 = 0.33
D.	Predicted Income: Language, Immigration & Ethnicity Only	1.48 (0.29) Adj. R2= 0.61	2.62 (0.80) Adj. R2= 0.46
E.	Real Income Level (Housing Cost Only)	0.45 (0.24) Adj. R^2 = 0.08	0.58 (0.54) Adj. R^2 = -0.04
F.	Real Income Level (Housing + Urban CPI)	-0.01 (0.20) Adj. R^2 = -0.12	0.36 (0.50) Adj. R^2 = -0.07
G.	Percent Provincial Pop. Growth, 1991-2001	-70.25 (20.12) Adj. R^2 = 0.59	-64.61 (54.57) Adj. R^2 = 0.06
H.	Local and Provincial Govt Spending per Capita	0.08 (0.34) Adj. R^2 = -0.12	0.24 (0.74) Adj. R^2 = -0.11
I.	Estimate of Local Public Good Externality	-1.39 (1.09) Adj. R^2 = 0.04	-4.02 (1.69) Adj. R^2 = 0.23

Robust standard errors in parentheses. Regressions using 10 provinces, excluding territories, weighted by population. "Adj. R^2 refers to the adjusted R-squared.

TABLE 5: NET FISCAL BENEFITS ACROSS PROVINCES AND THEIR EFFECTS ON PRICES AND EMPLOYMENT, 2001

Bene-fit Rank	Province	Wage (Location Effect) (1)	Hous. Cost (2)	Inferred Land Rent (3)	Net Fiscal Benefit (4)	Quality of Life (5)	*Predicted Long-Run Effects of Net Fiscal Benefits*			
							Wage (6)	Hous. Cost (7)	Land Rent (8)	Employ-ment (9)
1	Newfoundland	-0.15	-0.68	-2.39	0.10	-0.22	-0.03	0.24	1.01	0.33
2	New Brunswick	-0.18	-0.41	-1.29	0.09	-0.11	-0.03	0.22	0.93	0.30
3	PEI	-0.21	-0.41	-1.13	0.09	-0.08	-0.03	0.21	0.91	0.29
4	Saskatchewan	-0.15	-0.63	-2.06	0.08	-0.19	-0.03	0.19	0.84	0.27
5	Alberta	-0.01	-0.22	-0.72	0.08	-0.14	-0.03	0.19	0.81	0.26
6	Manitoba	-0.11	-0.52	-1.66	0.08	-0.17	-0.03	0.19	0.80	0.26
7	Nova Scotia	-0.17	-0.16	-0.39	0.06	0.01	-0.02	0.14	0.58	0.19
8	BC	0.05	0.36	1.30	-0.01	0.09	0.00	-0.02	-0.09	-0.03
9	Quebec	-0.03	-0.23	-0.80	-0.01	-0.05	0.00	-0.03	-0.11	-0.04
10	Ontario	0.06	0.07	0.15	-0.05	0.03	0.02	-0.11	-0.47	-0.15

All quantities expressed in log terms except for net-fiscal-benefit and quality-of-life, each measured as a fraction of average income. Housing-cost and gross real income measures explained in the Appendix. Quality of life is equal to 0.33 times housing cost minus 0.70 times wages minus net fiscal benefits. Wage, housing-cost, land-rent, and employment effects based off of model in Albouy (2009) using Canadian parameters in Albouy and Leibovici (2009) and using an elasticity of employment with respect to transfers of 3.23 based on Wilson (2003).

TABLE 6: ESTIMATED PRICE, EMPLOYMENT, AND WELFARE EFFECTS OF NET FISCAL BENEFITS, OR ITS COMPONENTS, ACROSS ALL PROVINCES, 2001

	Federal Transfers Only (1)	Federal Taxes Only (2)	Source-Based Taxes Only (3)	Federal Transfers & Fed Taxes (4)	Fed Tran & Source-Based Taxes (5)	Fed Taxes & Source-Based Taxes (6)	Total Net Fiscal Benefit (7)
Average Percent Effects (Mean Absolute Values)							
Net fiscal benefit differential: E|dτ/m|	0.018	0.011	0.027	0.028	0.034	0.030	0.042
Wage effect: E|dw|	0.006	0.003	0.009	0.009	0.011	0.010	0.013
Home-good price effect: E|dp|	0.041	0.025	0.063	0.065	0.079	0.069	0.097
Land rent effect: E|dr|	0.176	0.108	0.270	0.281	0.340	0.295	0.418
Employment effect: E|dN|	0.057	0.035	0.087	0.091	0.110	0.095	0.135
Deadweight Loss from Locational Inefficiency							
As a percent of income, E(DWL/Nm)	0.105%	0.027%	0.212%	0.233%	0.271%	0.257%	0.413%
Total DWL (Billions per year, 2001$)	1.1	0.3	2.2	2.4	2.8	2.7	4.3
Per Capita (per year, 2001$)	36.7	9.5	74.0	81.5	94.7	89.7	144.4

Territories excluded. Net fiscal benefit differential measured as a fraction of average income. Other price changes in terms of log changes. Price effects based on calibrated model similar to Albouy (2009) Employment elasticity with respect to net fiscal benefit based on Wilson (2003). See text for formulas and other details.

TABLE A1: DECOMPOSITION OF FEDERAL TRANSFER DIFFERENCES ACRSOSS CANADIAN PROVINCES: 2001

Province	Federal Transfer Differential (1)+(2)+(3)	Federal Transfer Components: Equalization Payments (1)	Federal Transfer Components: Health and Social Transfer (2)	Federal Transfer Components: Other Federal Transfers (3)
Newfoundland	2125	1678	134	312
PEI	1858	1595	127	135
Nova Scotia	1174	1033	127	14
New Brunswick	1442	1297	127	18
Quebec	31	276	-199	-46
Ontario	-417	-395	25	-46
Manitoba	1121	824	124	174
Saskatchewan	566	-123	120	569
Alberta	-345	-393	-3	50
BC	-294	-361	153	-86
Territories	15578	14560	-16	1034

Measured in 2001 Canadian Dollars. Federal transfer data from CANSIM 384-0011. Federal transfer differentials averaged over 1998 to 2003. See text for further detail.

Figure 1a: Differentials Predicted by Characteristics

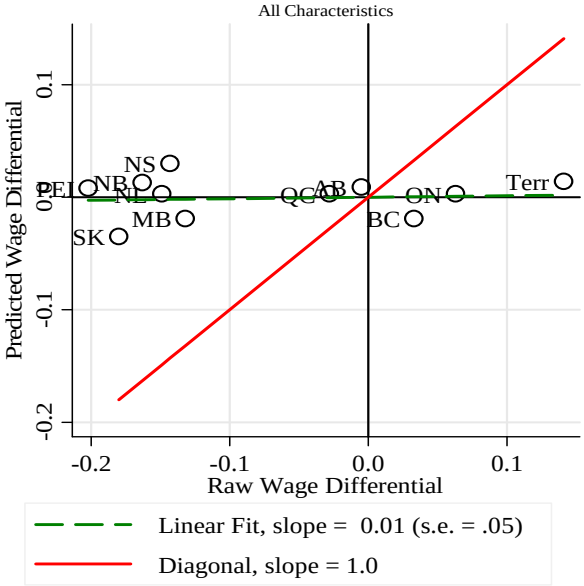


Figure 1b: Differentials Predicted by Characteristics

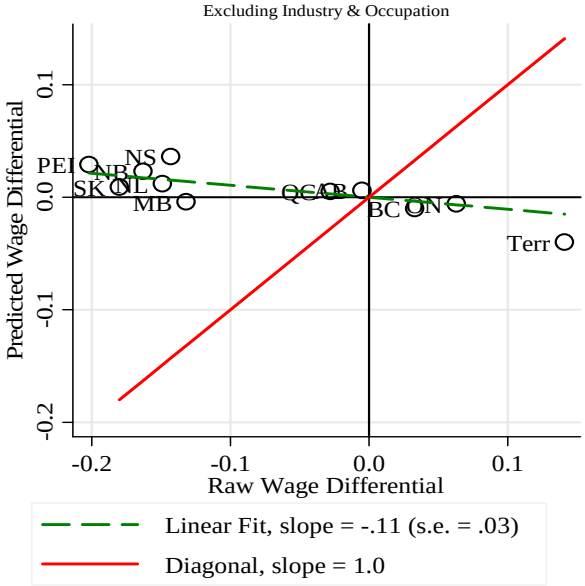


Figure 1c: Location Wage Differentials Adjusting for Mobility

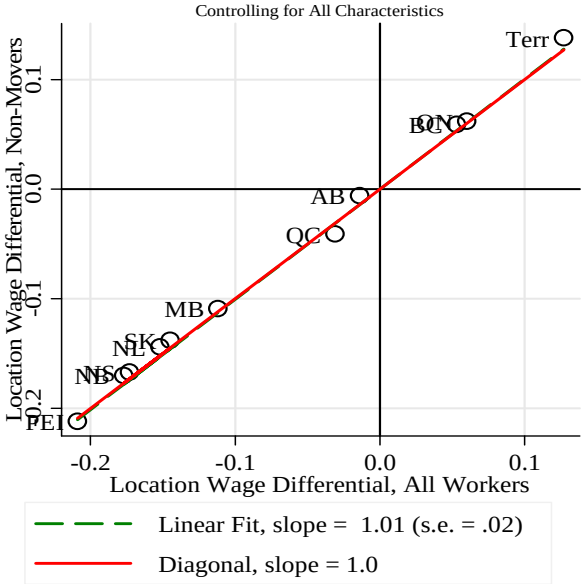


Figure 2: Interaction of Federal Transfers, Federal Taxes, and Source-Based Revenues across Provinces, 2001

Figure 2A: Federal Tax Differential Deficit

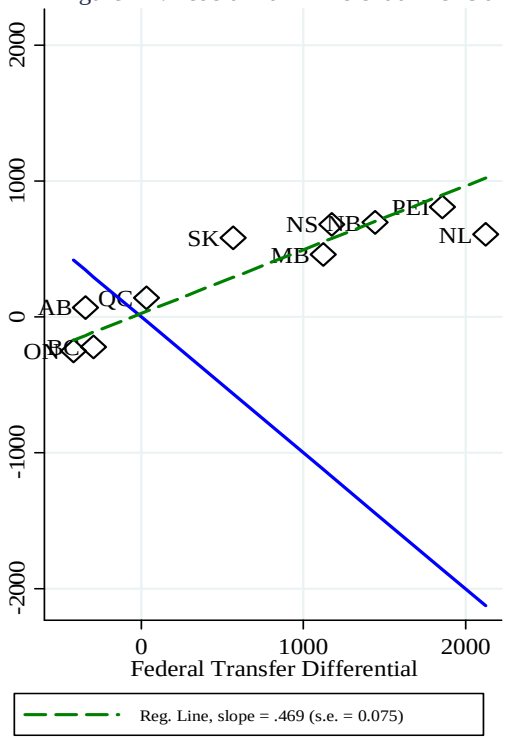


Figure 2B: Source-Based Tax Revenue

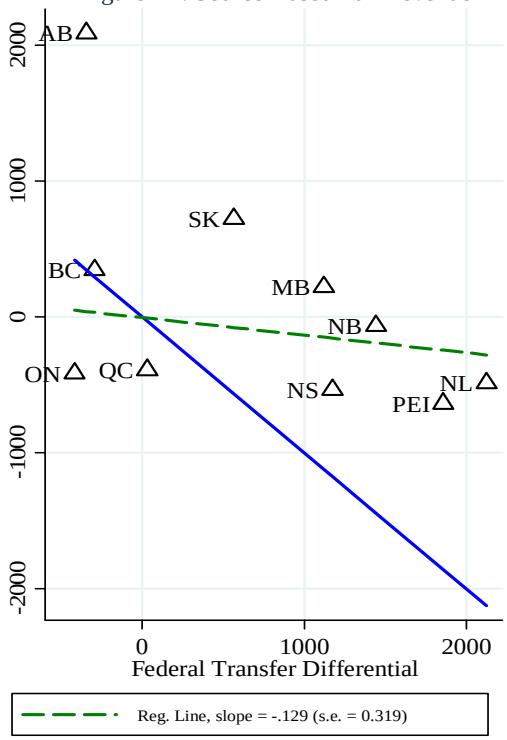
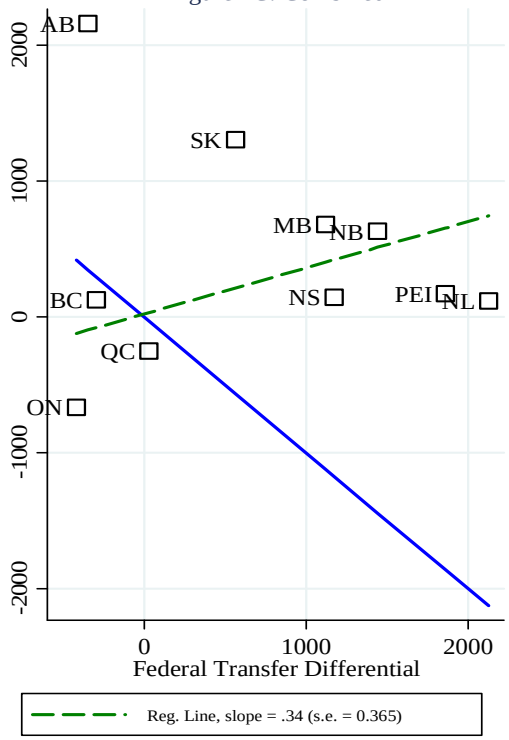


Figure 2C: Combined



Regression lines are population weighted; standard errors are robust. Solid line represents perfect offset.

Figure 3: Net Fiscal Benefits over Time