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**Working Paper**

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Queen's Economics Department Working Paper, No. 1287

**Provided in Cooperation with:**

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*Suggested Citation:* Albouy, David; Leibovici, Fernando; Warman, Casey (2012) : Quality of life, firm productivity, and the value of amenities across Canadian cities, Queen's Economics Department Working Paper, No. 1287, Queen's University, Department of Economics, Kingston (Ontario)

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# Quality of Life, Firm Productivity, and the Value of Amenities across Canadian Cities

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1-2012

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August 29, 2011

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## **Abstract**

This paper presents the first hedonic general-equilibrium estimates of quality-of-life and firm productivity differences across Canadian cities, using data on local wages and housing costs. These estimates account for the unobservability of land rents and geographic differences in federal and provincial tax burdens. Quality-of-life estimates are generally higher in Canada's larger cities: Victoria, Vancouver are the nicest overall, particularly for Anglophones, while Montreal and Ottawa are the nicest for Francophones. These estimates are positively correlated with estimates in the popular literature and may be explained by differences in climate. Toronto is Canada's most productive city; Vancouver, the overall most valued city.

Keywords: Quality of life, firm productivity, cost-of-living, firm productivity, compensating wage differentials.

JEL Numbers: H24, H5, H77, J61, R1

# 1 Introduction

While capital and labor are largely mobile within the borders of Canada, wage and cost-of-living levels vary significantly across Canadian cities and provinces. Coulombe and Lee (1995) and Coulombe (2000) find that although income and price levels have converged significantly since 1960, this convergence has largely stopped since the 1980s, despite equalization policies of the federal government. The most natural explanation for these persistent differences in wages and cost levels is that there are persistent differences in local advantages to households and firms, broadly termed as "amenities," that prevent prices from converging. To clarify terminology, consumption amenities, which benefit households, determine an area's overall quality of life (QOL), while production amenities, which benefit firms, determine an area's overall productivity. The primary goal of this paper is to identify the overall differences in these advantages across Canadian cities.

Some places in Canada undeniably have advantages over others. Most Canadians live south, close to the United States border, where the climate is warmer and trading costs are lower than further north. Canadians are acutely aware of regional disparities in natural resource wealth, from oil in Alberta, forest in British Columbia, to depleted fish stocks in the Atlantic provinces. Much of the population is concentrated in a handful of large cities, which benefit from sizable agglomeration economies and vast cultural opportunities, but also suffer disproportionately from urban disamenities such as crime, pollution, and congestion. Strong local and provincial governments, as well as differential treatment of regions by the federal government, also lead to geographic differences in public services and taxation

Although some places appear more advantaged than others, much of the population and firms are still located in less advantaged areas. Although heterogeneity in household tastes and production technologies may partly explain this, the importance of heterogeneity should not be overstated: most individuals prefer temperatures above -40 and most firms benefit from low transportation costs. Furthermore, many Canadians are quite mobile over their lifetime (e.g. Bernard et al. 2008) and have only limited local attachments. In this setting, households and firms in areas with less advantageous amenities should be largely compensated by more advantageous local prices. Specifically, households in areas with lower QOL are compensated through higher real incomes, either through higher nominal wages or lower cost-of-living. Firms in less productive areas are compensated through lower costs, either in labor or non-labor inputs. This is the essence of

the methodology of Rosen (1979) and Roback (1982), which has been used extensively by researchers to measure QOL and productivity differences in the United States (e.g. Blomquist et al. 1988, Beeson and Eberts 1989; Gyourko and Tracy 1991; Gabriel and Rosenthal 2004; Shapiro 2006; Chen and Rosenthal 2008). Surprisingly, this popular methodology has never been applied to Canadian data.

Several issues arise when applying the Rosen-Roback framework to Canada. First, while most areas of Canada are mainly English-speaking, certain areas, especially in Quebec, are predominantly French-speaking, while other areas, such as Ottawa and New Brunswick, are largely bilingual. Different language groups naturally have preferences for different areas, as most would likely prefer to live where their mother tongue is predominant. Roback (1988) and Beeson (1991) provide a model to estimate QOL advantages for different groups, defined by education; this paper applies this methodology to a more obvious setting where groups are defined by mother tongue. The theoretical Section 2 presents this theory, and extends it to estimate productivity differences across groups.

Second, federal and provincial governments play a large role in taxing income and redistributing it with intergovernmental transfers. The role of federal and provincial taxes on residents is dealt with in the model using adjustments in Albouy (2008a; 2009). It is less clear how the model should be amended to accommodate intergovernmental transfers and fiscal advantages due to disparities in natural resource wealth, documented in Albouy (2010). And thus we exclude these from the main analysis, and consider them only in alternative results at the end.

Third, unionization rates in Canada are still relatively high but vary across regions, meaning that some areas may have high real wage levels not because of low amenities, but because of a strong union presence. The correction for unionization differences is explained in Section 3, which discusses the estimation wage and housing-cost differences used to infer QOL and productivity differences, as well as how the model is calibrated to the Canadian economy.

According to our estimates in Section 4, the city with the greatest QOL in Canada is Victoria, followed by Vancouver, Kelowna, Toronto, and Calgary. The specific ranking for Anglophones is roughly the same, while among Francophones the ranking is led by Montreal and Ottawa-Hull. Among Allophones (those whose mother tongue is neither English nor French), Vancouver exhibits the highest QOL, followed by Toronto and Montreal. These estimates are positively correlated with popular rankings and are largely explained by climate and access to cultural opportunities.

To our knowledge, this is also the first paper to provide local productivity estimates for Canadian cities

based on wage and housing data, despite the large number of estimates for the United States. These estimates are based on weighted factor costs, reflecting the average marginal productivity of different factors, or alternatively, providing the average firm willingness-to-pay to produce in each city. The most productive city in Canada is estimated to be Toronto, followed by nearby Oshawa, and then Calgary, Vancouver, and Ottawa-Hull. In a few cities, we attempt to estimate the relative productivity of labor by mother tongue. This productivity depends ultimately on the unknown elasticity of substitution between labor with different language skills: a lower value of this elasticity implies that relative quantities of labor employed provide information on productivity levels in addition to relative wage levels. The results suggest that Francophones are relatively more productive than Anglophones in Montreal and Ottawa-Hull. We add together the aggregate value of urban amenities to households and firms, i.e. quality of life and productivity, to create a measure of the total value of Canadian cities. According to this metric, the most valuable city in Canada is Vancouver, followed by Victoria, Toronto and Calgary. It should be noted that these rankings would change if interprovincial fiscal advantages were efficiently "equalized," as proposed in Albouy (2010): in this case, cities in the Atlantic and Prairie provinces fall in value, while those in Ontario rise.

While QOL is a subject that greatly interests policy makers as well as the general population, published indicators of QOL for Canadian cities have broadly consisted of weighted sums of arbitrarily chosen amenities, where the weights are determined in an ad-hoc fashion. Examples of such indices are found in *Cities Ranked & Rated*, *Places Rated Almanac*, and *Mercer's Quality-of-Living Reports*. These shed light into what cities people appreciate the most only to the extent that the ad-hoc weighting schemes used in their calculations actually reflect peoples' values. On the other hand, the willingness-to-pay methodology implemented here does not depend on the set of amenities chosen or which ad-hoc weighting scheme is used to aggregate their values, but instead makes use of data on local wages and housing rents to identify the aggregate value of the different amenities. We show in Section 5, while our estimates are generally in line with the popular rankings, they put more weight on measured indices of climate and culture than the popular rankings do. Finally, in Section 6 we consider how our estimates would be influenced by including intergovernmental transfers or alternative price data from the CPI or using housing-cost data from rental units alone.

To our knowledge, the only attempt to measure QOL across Canadian cities in an economic hedonic framework, distantly related to the one here, is Giannias (1998), who does so for 13 cities using 1981 data. This work measures QOL according to how housing costs covary with six amenity measures, controlling

for three housing characteristics, and assuming that incomes do not depend on where households locate. Furthermore, the model depends on a highly parametric model with strict normality assumptions and a linear housing price equation, which departs from more established log-linear specifications. The model applied here instead endogenizes wage differences, controls for many worker and housing characteristics, is independent of any set of chosen amenities, and is illustrated clearly through graphs mapping the relationship of wage and housing-cost differences to QOL and productivity differences. Furthermore, our analysis covers all 33 currently defined Census Metropolitan Areas (CMAs), which refer to loosely as "cities," as well as the non-metropolitan areas of Canada, organized by province or territory.

## 2 Theoretical Model of Spatial Equilibrium

Quality-of-life and productivity differences across cities are measured from wage and housing-cost differences across cities using the theoretical framework of Albouy (2008a, 2009). This framework builds upon that of Rosen (1979) and Roback (1982), but also accounts for non-labor income, housing production, cost-of-living differences from non-housing sources, and inequalities in both federal and provincial taxation. Furthermore, to allow for differences across language groups, we account for multiple household types, but in a richer setting than Roback (1988) and Beeson (1991).

### 2.1 Setup

The national economy is closed and contains many cities, indexed by  $j$ , which trade with each other and share several populations of mobile households, indexed by  $g \in \{1, \dots, G\}$ . The population in city  $j$  is denoted as the vector  $\mathbf{N}^j = (N_1^j, \dots, N_G^j)$ . Each household consumes a numeraire traded good,  $x$ , and a group-specific non-traded "home" good,  $y_g$ , with local price,  $p_g^j$ , which varies by city and type. In the empirical implementation of the model, the local price of home goods for type  $g$  is equated with the local cost of housing paid by that type.<sup>1</sup>

Firms produce traded and home goods out of land, capital, and labor. Within a city, factors are mobile and receive the same payment in any sector. Land,  $L$ , is fixed in supply in each city at  $L^j$ , and is paid a city-specific price  $r^j$ . Capital,  $K$ , is fully mobile across cities, and is paid the price  $\bar{r}$  everywhere: this price may be set either nationally or internationally, although for simplicity net foreign asset holdings are

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<sup>1</sup>Non-housing goods are considered to be a composite commodity of traded goods and non-housing home goods.



set to zero. Households of each type  $g$ ,  $N_g$ , are fully mobile within the country, have identical tastes and endowments, and each supplies a single unit of labor. Because households care about local prices and QOL, wages, denoted by the vector  $\mathbf{w}^j = (w_g^j, \dots, w_G^j)$ , may vary across cities. The total number of worker-households is fixed at  $\mathbf{N}^{TOT} = (N_1^{TOT}, \dots, N_G^{TOT})$ , so  $\sum_j \mathbf{N}^j = \mathbf{N}^{TOT}$ . Households of each type own identical diversified portfolios of land and capital, which pay an income  $R_g$  from land and  $I_g$  from capital. Gross income,  $m_g^j \equiv R_g + I_g + w_g^j$ , varies across cities only as wages vary. Out of this income households pay a federal income tax of  $\tau(m_g)$ , which is redistributed in lump-sum transfers,  $T^j$ , which may vary by city. For expositional ease, provincial taxes are discussed in the Appendix.

Cities differ in two types of attributes: quality of life, which raises household utility and is given by the vector  $\mathbf{Q}^j = (Q_1^j, \dots, Q_G^j)$ , and productivity in the traded-good sector, which varies by factor and is given by the vector  $\mathbf{A}^j = (A_1^j, \dots, A_G^j, A_L^j, A_K^j)$ . These attributes, in turn, depend on a vector of amenities,  $\mathbf{Z}^j = (Z_1^j, \dots, Z_k^j)$ , natural or artificial, according to some unknown functions  $\mathbf{Q}^j = \tilde{\mathbf{Q}}(\mathbf{Z}^j)$  and  $\mathbf{A}^j = \tilde{\mathbf{A}}(\mathbf{Z}^j)$ . For a consumption amenity, e.g. safety or clement weather,  $\partial \tilde{Q}_g / \partial Z_k > 0$ ; for a production amenity, e.g. navigable water or agglomeration economies,  $\partial \tilde{A}_g / \partial Z_k > 0$ . It is possible that a single amenity affects both productivity and QOL.<sup>2</sup>

Household preferences are modeled by a utility function  $U_g(x, y_g; Q_g)$ , that is quasi-concave over  $x$  and  $y_g$ , and increasing in  $Q_g$ . The expenditure function for a worker of type  $g$  in city  $j$  is  $e_g(p_g^j, u_g; Q_g^j) \equiv \min_{x,y} \{x + p_g^j y : U_g(x, y; Q_g^j) \geq u_g\}$ .  $Q_g$  is normalized so that  $e_g(p_g^j, \bar{u}_g; Q_g^j) = e_g(p_g^j, \bar{u}_g) / Q_g^j$ , where  $e_g(p_g^j, \bar{u}_g) \equiv e_g(p_g^j, \bar{u}_g; 1)$ , meaning that one-percent increase in  $Q_g$  is equivalent to a one-percent increase in disposable income. Since households are fully mobile, their utility must be the same across all the cities that they inhabit. Thus, the after-tax income households earn in each city should equal the expenditure needed to obtain the common level of utility,  $\bar{u}_g$ , given local prices and QOL.<sup>3</sup>

$$e_g(p_g^j, \bar{u}_g; Q_g^j) = m_g^j - \tau(m_g^j) + T^j \quad (1)$$

for all types  $g$  and cities  $j$  where  $N_g^j > 0$ .

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<sup>2</sup>It is worth noting that amenities may be endogenous to quantities in the model, and that this poses different problems when measuring values by using comparative statics. For example, an increase in population,  $N^j$ , may lead to greater pollution, lowering  $Q^j$ . If a city were to receive a theme-park, improving  $Q$ , this would raise  $N$ , raising pollution, and indirectly decreasing  $Q$ . The value of the theme-park could be measured empirically by controlling for pollution, although the value when accounting for pollution externalities should not control for pollution. Both direct and indirect effects of amenities have to be taken into account when using comparative statics to determine the causal effect of an amenity on the attributes and prices in a city.

<sup>3</sup>The mobility condition need not apply to all households, but only a sufficiently large subset of mobile marginal households.

All input and goods markets are perfectly competitive, and firms produce under constant returns to scale. Let the vector  $\mathbf{A}_N^j = (A_1^j, \dots, A_G^j)$  denote labor productivity, the vector  $\mathbf{N}_X^j = (N_{1X}^j, \dots, N_{GX}^j)$  denote labor used to produce the traded good, and  $\mathbf{N}_{Yg}^j = (N_{Yg1}^j, \dots, N_{YgG}^j)$  denote the labor used to produce each home good  $g$ , with  $\mathbf{N}_Y^j = \sum_g \mathbf{N}_{Yg}^j$ ; similar notation is used for land and capital, with  $L_Y^j = \sum_g L_{Yg}^j$ , etc. Then the production functions of representative traded-good and home-good firms are  $X^j = F_X^j(\mathbf{A}_N^j \cdot \mathbf{N}_X^j, A_L^j L_X^j, A_K^j K_X^j)$  and  $Y_g^j = F_{Yg}^j(\mathbf{N}_{Yg}^j, L_{Yg}^j, K_{Yg}^j)$ , for all  $g$ , where  $F_X$  and  $F_{Yg}$  are concave and exhibit constant returns to scale. All factors are fully employed:  $\mathbf{N}_X^j + \mathbf{N}_Y^j = \mathbf{N}^j$ ,  $L_X^j + L_Y^j = L^j$  and  $K_X^j + K_Y^j = K^j$ . Unit cost in the traded-good sector is  $c_X(\mathbf{w}^j, r^j, \bar{v}; A^j) \equiv \min_{\mathbf{N}, L, K} \{ \mathbf{w}^j \cdot \mathbf{N} + r^j L + \bar{v} K : F_X^j(\mathbf{A}_N^j \cdot \mathbf{N}_X^j, A_L^j L_X^j, A_K^j K_X^j) = 1 \}$ . A symmetric definition holds for the unit costs in the home-good sectors,  $c_{Yg}$ , except that the productivity is 1 for all  $g$  and  $j$ . As markets are competitive, firms make zero profits in equilibrium, so that

$$c_X(\mathbf{w}^j, r^j, \bar{v}; A^j) = 1 \quad (2)$$

in all cities  $j$  and

$$c_{Yg}(\mathbf{w}^j, r^j, \bar{v}) = p_g^j \quad (3)$$

for all types  $g$  and cities  $j$  where  $N_g^j > 0$ .

Let variables with superscripts  $j$  refer to city-specific values, and variables without superscripts refer to national averages. The share of all income that goes to households of type  $g$  is denoted  $\mu_g \equiv N_g^{TOT} m_g / (\sum_g N_{g'}^{TOT} m_{g'})$ , with  $\boldsymbol{\mu} = (\mu_1, \dots, \mu_G)$ . For households, denote the average share of gross expenditures spent on traded goods and home goods as  $s_{xg} \equiv x_g / m_g$  and  $s_{yg} \equiv p_g y_g / m_g$ ; denote the shares of income received from labor, land, and capital income as  $s_{wg} \equiv w_g / m_g$ ,  $s_{Rg} \equiv R_g / m_g$ , and  $s_{Ig} \equiv I_g / m_g$ . Each share may be put into a vector of the form  $\mathbf{s}_x = (s_{x1}, \dots, s_{xG})$ . Using averages, it is possible to write the aggregate expenditure shares,  $s_y = \boldsymbol{\mu} \cdot \mathbf{s}_y$ , and income shares  $s_w = \boldsymbol{\mu} \cdot \mathbf{s}_w$ , and so on. For firms producing traded goods, denote the cost shares of labor, land, and capital as  $\theta_{Ng} \equiv w_g N_{Xg} / X$ ,  $\theta_L \equiv r L_X / X$ , and  $\theta_K \equiv \bar{v} K_X / X$ , with  $\boldsymbol{\theta}_N = (\theta_{N1}, \dots, \theta_{NG})$ , and the overall labor-cost share  $\theta_N = \sum_g \theta_{Ng}$ . Denote similarly-defined cost shares in the home-good sector  $\phi_{gN}$ ,  $\phi_{gL}$ , and  $\phi_{gK}$ , with the cost-share of home-good  $g$  from labor type  $g'$  given by  $\phi_{gNg'}$ , so that  $\phi_{gN} = (\phi_{gN1}, \dots, \phi_{gNG})$ .

## 2.2 Measuring Quality of Life and Productivity

We begin this section by considering the case of where there is only one type of household precluding the need to use subscripts,  $g$ . It continues with an explanation of multiple types, and shows under what assumptions certain results may be aggregated to produce results similar to the single-type case.

### 2.2.1 Single Household Type

To analyze the effect of city attributes on prices we log-linearize the equilibrium conditions (1), (2), and (3) around the national average. Thus, for any variable  $z$ ,  $\hat{z}^j = \ln z^j - \ln \bar{z} \cong (z^j - \bar{z}) / \bar{z}$ , approximates the percent difference in city  $j$  of  $z$  relative to the geometric average  $\bar{z}$ , which is the value for a nationally representative city. Log-linearized versions of (1), (2), and (3) describe how prices co-vary with city attributes.

$$\hat{Q}^j = s_y \hat{p}^j - s_w(1 - \tau') \hat{w}^j - dT^j/m \quad (4a)$$

$$\hat{A}^j = \theta_N \hat{w}^j + \theta_L \hat{r}^j \quad (4b)$$

$$\hat{p}^j = \phi_N \hat{w}^j + \phi_L \hat{r}^j \quad (4c)$$

These equations are first-order approximations around a nationally-representative city and so the share values are national averages. Equation (4a) measures the QOL differential,  $\hat{Q}^j$ , from how high the cost-of-living,  $s_y \hat{p}^j$ , is relative to after-tax nominal income,  $s_w(1 - \tau') \hat{w}^j$ , and differential transfers expressed as a fraction of income,  $dT^j/m$ . Thus  $\hat{Q}^j$  expresses the fraction of income households are willing to pay – or if negative, to accept – to live in city  $j$  relative to a city with an average QOL. Equation (4b) measures the productivity differential,  $\hat{A}^j$ , from how high the labor costs,  $\theta_N \hat{w}^j$ , and land costs,  $\theta_L \hat{r}^j$ , are in traded-good production. It measures the percent cost-savings that firms experience from locating in city  $j$  relative to the national average. Equation (4c), constrains the home-good price differential,  $\hat{p}^j$ , to equal the labor-cost differential,  $\phi_N \hat{w}^j$ , plus the land-cost differential,  $\phi_L \hat{r}^j$ .

In practice, wage and home-good price differentials are observable and so QOL differentials are measurable directly from (4a). Land-rents are generally unobserved, making it difficult to measure productivity directly from (4b). However, by assuming that home-good productivity is the same across cities, it is possible

to infer both land-rent and productivity differentials using only data on home-good costs and wages

$$\hat{r}^j = \frac{1}{\phi_L} (\hat{p}^j - \phi_N \hat{w}^j) \quad (5)$$

$$\hat{A}^j = \frac{\theta_L}{\phi_L} \hat{p}^j + \left( \theta_N - \phi_N \frac{\theta_L}{\phi_L} \right) \hat{w}^j \quad (6)$$

The total value of amenity-differences for city  $j$  is equal to the QOL differential plus the productivity differential times its share of expenditure

$$\begin{aligned} \hat{\Omega}^j &= \hat{Q}^j + s_x \hat{A}^j \\ &= \frac{s_R}{\phi_L} \hat{p}^j + \left( \tau' s_w - \frac{s_R \phi_N}{\phi_L} \right) \hat{w}^j - \frac{dT^j}{m} \end{aligned} \quad (7)$$

The second equality, expressed in terms of observables variables, results from substituting in (4a) and (4b). Collecting terms and using (5), and simplifying, we obtain that the total amenity differential, which expresses the social value of land, is equal to the differential value of private land rents, measured as a percent of income, plus the fiscal externalities in terms of additional federal taxes paid net of federal transfers received.

$$\hat{\Omega}^j = s_R \hat{r}^j + \tau' s_w \hat{w}^j - dT^j/m \quad (8)$$

### 2.2.2 Multiple Household Types and Aggregation

With multiple types, the log-linearized version of the mobility condition (1) is

$$\hat{Q}_g^j = s_{yg} \hat{p}_g^j - s_{wg} (1 - \tau'_g) \hat{w}_g^j - dT^j/m_g \quad (9)$$

for each group  $g$ . Note that this requires each group's price and wage differentials,  $\hat{p}_g^j$  and  $\hat{w}_g^j$ , but also each group's specific marginal tax rate,  $\tau'_g$ , expenditure share  $s_{yg}$  and income share  $s_{wg}$ . It is possible to define an aggregate quality-of-life index  $\hat{Q}^j \equiv \mu \cdot \hat{\mathbf{Q}}^j$  that is consistent with equation (4a) if we define the aggregate home-good price differential as  $\hat{p}^j \equiv (1/s_y) \sum_g \mu_g s_{yg} \hat{p}_g^j$ , the aggregate wage as differential as  $\hat{w}^j \equiv (1/s_w) \sum_g \mu_g s_{wg} \hat{w}_g^j$ , and assume that all groups face the same marginal tax rate  $\tau'$ .

The log-linearized zero-profit condition for tradable-good firms is

$$\hat{A}^j = \theta_N \cdot \hat{\mathbf{w}}^j + \theta_L \hat{r}^j$$

where  $\hat{A}^j \equiv \theta_N \cdot \hat{\mathbf{A}}_N^j + \theta_L \hat{A}_L^j + \theta_K \hat{A}_K^j$ . This estimate of productivity replaces the labor-cost measure with  $\theta_N \cdot \hat{\mathbf{w}}^j$ . Now, if for all  $g$ , group  $g$ 's fraction of total labor costs are proportional to  $g$ 's share of total labor income, i.e.

$$\frac{\theta_{Ng}}{\theta_N} = \mu_g \frac{s_{wg}}{s_w} \quad \text{for all } g \quad (10)$$

then  $\theta_N \cdot \hat{\mathbf{w}}^j = \theta_N \hat{w}^j$  and (4b) applies as before in describing overall productivity. The log-linearized zero-profit conditions for the home-good firms take the form

$$\hat{p}_g^j = \phi_{gN} \cdot \hat{\mathbf{w}}^j + \phi_{gL} \hat{r}^j$$

This equation constrains the price differential  $\hat{p}^j$  to equal the labor-cost differential,  $\phi_{gN} \cdot \hat{\mathbf{w}}^j$ , plus the land-cost differential,  $\phi_{gL} \hat{r}^j$ . The values of  $\phi_{gN}$  are difficult to observe, but using assumption (10), it is possible to estimate land rents from equation (5) from aggregate wage and housing-cost differences by using the definitions  $\phi_L = (s_R - s_x \theta_L)/s_y$  and  $\phi_N = (s_w - s_x \theta_N)/s_y$ . This assumption also permits a feasible estimate of productivity from (6) above. Furthermore, if marginal tax rates for groups are the same, then the total value of amenities is still given by (7).

While it is possible to estimate group-specific QOL and overall productivity differentials using the above equations, is not possible to separate the relative productivity of different factors using only price information when factors types are imperfect substitutes for each other. A solution lies in incorporating information on relative factor usage in the traded sector. Using the labor-demand equations for the traded sector, it is possible to show that the relative demand for labor depends on relative wages and relative productivity levels:

$$\hat{N}_1^j - \hat{N}_2^j = -\sigma_{12}(\hat{w}_1^j - \hat{w}_2^j) + (\sigma_{12} - 1)(\hat{A}_1^j - \hat{A}_2^j) \quad (11)$$

where  $\sigma_{12}$  is the elasticity of substitution between type-1 and type-2 labor. Solving and using proper substi-

tution it is possible to show that the productivity of one particular type is given by

$$\hat{A}_2^j = \frac{\theta_{N1}}{\theta_{N1} + \theta_{N2}} \frac{\hat{N}_2^j - \hat{N}_1^j + \sigma_{12}(\hat{w}_2^j - \hat{w}_1^j)}{\sigma_{12} - 1} + \hat{A}^j \quad (12)$$

This formula implies that the greater the elasticity of substitution between the two labor types, the more important wage differences are relative to employment differences in determining the productivity differences. When labor types are strong substitutes, wages must offset the productivity differences of different types. But when substitution possibilities are more limited, firms are less able to bid up the relative wage of more productive labor, and information on relative factor usage becomes more important.

### 3 Empirical Implementation

To evaluate the empirical predictions of the model when applied to Canadian cities, we estimate the city-specific price differentials using Canadian Census micro-data for the reference year 2005 and calibrate the cost, income, expenditure, and tax parameters from other sources.

#### 3.1 Data and the Estimation of Wage and Housing-Cost Differentials

Wage and housing-cost differentials are estimated using the 20 percent sample of Canadian Census data from the 2006 Masterfile Microdata Files. Cities are defined at the Census Metropolitan Area (CMA) level, which consist of municipalities located around an urban core with a population of at least 100,000. Non-CMA areas are grouped by province. This results in a total of 33 CMAs and 13 non-CMA areas. More details are provided in Appendix B.

##### 3.1.1 Wage Differentials

Inter-urban wage differentials are calculated from the logarithm of hourly wages for full-time workers, ages 25 to 55. These differentials control for skill differences across workers to obtain an analogue of the representative worker in the model. Thus, log wages are regressed on city-indicators ( $\nu_w^j$ ) and on extensive controls ( $X_w^i$ ) – fully interacted with gender – for potential work experience, education, field of study, occupation, industry, and immigrant status, in an equation of the form  $\ln w^{ij} = X_w^i \beta_w + \nu_w^j + \varepsilon_w^{ij}$ . The values of  $\nu_w^j$  are our estimates of the wage differentials, and are interpreted as the causal effect of city

characteristics on a worker's wage. Identifying these differentials requires that workers do not sort across cities according to their unobserved skills.<sup>4</sup>

Unionization rates in Canada are high and differ substantially across CMAs, with coverage rates varying from 18 percent in Calgary to 46 percent in Chicoutimi-Jonquière. If unions raise the wages of workers without bidding up the local cost-of-living, then real incomes in highly unionized areas may be high relative to the local QOL, and QOL estimates in highly unionized areas will be biased downwards. At the same time, if unions do not raise wages without making firms more productive, then the productivity estimates in these areas will be biased upwards. Unfortunately the Census data do not contain information on union coverage, although we were able to obtain CMA level unionization rates from the Labour Force Survey. We then eliminated inferred union-wage premia by multiplying these rates times a union-wage premium of 7.7 log points, taken from Fang and Verma (2002) and subtracting them from the original estimates of  $\nu_w^j$ , renormalizing them to have an average value of zero.

### 3.1.2 Housing-Cost Differentials

Both housing values and gross rents, including utilities, are used to calculate housing costs. Following previous studies, imputed rents are converted from housing values using a discount rate of 7.85 percent (Peiser and Smith 1985), with utility costs added, to make the imputed rents comparable to gross rents. To avoid measurement error from imperfect recall or rent control, the sample includes only units that were acquired in the last ten years. Housing-cost differentials are calculated in a manner similar to wage differentials, using a regression of housing costs on flexible controls ( $X_w^i$ ) – interacted with renter-status – for number of rooms and bedrooms, type and age of building, and state of repair. This regression takes the form:  $\ln p^{ij} = X_p^i \beta_p + \nu_p^j + \varepsilon_p^{ij}$ . The coefficients  $\nu_p^j$  are our estimates of the housing-cost differentials. Proper identification of housing-cost differences requires that average unobserved housing quality does not vary systematically across cities.<sup>5</sup>

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<sup>4</sup>This assumption may not hold completely: Glaeser and Maré (2001) argue that up to one third of the urban-rural wage gap could be due to selection, suggesting that at least two thirds of wage differentials are valid, although this issue deserves greater investigation. At the same time, it is possible that the estimates could be too small, as some control variables, such as occupation or industry, could depend on where the worker locates.

<sup>5</sup>This issue may not be grave as Malpezzi et. al. (1998) determine that housing-cost indices derived from the Census in this way perform as well or better than most other indices.

### 3.1.3 Separation by Mother Tongue

The wage and housing-cost differentials are also calculated by mother tongue, in the latter case using the mother tongue of the household head. When controlling for location, Francophones earn wages 1.8 percent higher, on average, than Anglophones, while their housing costs are 14.6 percent lower.<sup>6</sup> For Allophones the wages are 6.5 percent lower than Anglophones, while their housing costs are 1.2 percent lower. The wage differential within-city may be due to a variety of reasons, such as school quality or discrimination (Albouy 2008b). The lower housing costs of Francophones may reflect that Anglophones may live in more amenable areas within CMA or non-CMA areas, such as within the Montreal CMA or non-CMA Ontario. Anglophones may also face a more restricted housing market or enjoy better housing quality than the observable measures can control for.

## 3.2 Calibration

The calibration is currently based on a calibration for the United States in Albouy (2009), amended to deal with slight differences in the Canadian economy. In Canada, a smaller share of income is received by labor, while a smaller proportion of expenditures is spent on home goods.

$$\begin{aligned} s_x &= 0.67 & \theta_L &= 0.025 & \phi_L &= 0.25 & s_R &= 0.10 \\ s_y &= 0.33 & \theta_N &= 0.775 & \phi_N &= 0.55 & s_w &= 0.70 \\ \theta_K &= 0.20 & \phi_K &= 0.20 & s_I &= 0.20 \end{aligned}$$

Information on income and expenditure share differences between language groups is lacking, and thus is assumed to be uniform. It would be surprising if differences were large and this simplification allows us to use assumption (10) for our estimation purposes.

Although federal tax differences are included in the analysis, federal transfer and spending differences are not. There are three ways that these spending differences could manifest themselves. To the extent that they benefit households, they contribute to  $\hat{Q}^j$ ; to the extent that they benefit firms, they contribute to  $\hat{A}^j$ ; to the extent that they are wasted, they show up nowhere. Since it is not theoretically clear where they belong, they are reported separately in Section 6.1.

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<sup>6</sup>Although these differentials control for what official languages the worker speaks, the Census does not indicate how proficient respondents are in their languages. It seems likely that self-reported bilingual Anglophones speak English better than self-reported bilingual Francophones do, and vice versa.



The elasticity of substitution between different labor types is unknown. Ottaviano and Peri (2006) estimate the elasticity of substitution between immigrants and non-immigrant workers to be about 6.5. It would seem that the elasticity of substitution between workers of different language groups is even higher than this elasticity, given that the workers were often born and raised in Canada, and thus have even more similar skills.<sup>7</sup> Thus, three potential values are used for  $\sigma$ : 10, 40 and  $\infty$ .

Both federal and provincial tax rates are used to calculate tax differentials. These include direct taxes on income as well as indirect taxes on consumption: since this is a static model without an intertemporal savings decision, the two are equivalent as taxes on consumption reduce the buying power of labor. Provincial differentials are determined using wage differences within province only. Across provinces, the average marginal tax rate on labor income is 28 percent. See the Appendix for more details.<sup>8</sup>

## 4 Quality-of-Life and Productivity Estimates

### 4.1 Main Estimates

Columns 2 and 3 of Table 1 report the estimated wage and housing-cost differentials by CMA or non-CMA areas of provinces. These are graphed in Figure 1, which provides intuition for how overall QOL and productivity differentials, reported in columns 4 and 5, are inferred. This involves graphing the average mobility condition from (4a), with  $\hat{Q}^j = 0$ , and the combined average zero-profit conditions from (6), with  $\hat{A}^j = 0$ . The average mobility condition demonstrates the housing costs households are willing to pay for a given wage: any premium above that is inferred to be payment for consumption amenities, and thus the vertical distance from that condition indicates overall QOL. The combined zero-profit condition demonstrates the rate at which land rents, inferred through housing costs, must fall as wages rise: any premium over this is inferred to be payment for production amenities, and thus the vertical (or horizontal) distance from that condition indicates overall firm productivity in the traded sector. Through a change in the coordinate system, the two conditions in Figure 1 provide a set of axes for the new coordinate system in Figure 2, which is in the space of productivity and QOL. Since productivity is constant across the average zero-profit condition, and QOL is increasing with the distance upwards along this curve, it corresponds to the

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<sup>7</sup>We include immigrant controls to capture differences in immigrant/Canadian born earning outcomes. See the Appendix for more detail.

<sup>8</sup>Many workers report receiving little income other than labor income. However, given the static nature of the model, a worker's choices should be modeled to account for a worker's permanent income, which includes a large non-labor component, particularly if implicit rental earnings from one's own home are included.

vertical axis for QOL. Given that QOL is constant across the average mobility condition, and productivity increases with the distance rightward along this curve, it corresponds to the horizontal axis for productivity.

Interestingly, Canada's five largest CMA's – Toronto, Montreal, Vancouver, Ottawa-Hull, and Calgary, all have above-average productivity and QOL, as they lie above the average mobility-condition, and to the right of the average zero-profit condition. The smaller cities of Halifax, Kelowna, and Sherbrooke, all have above-average QOL but much lower productivity, which is commensurate with their reputations as charming tourist destinations. Hamilton, Oshawa, and Windsor have less-than-average in QOL, but are quite productive given their size, although this may have much to do with their proximity to Toronto and Detroit. Finally, a large number of smaller cities, including Moncton, Regina, St. John's, Thunder Bay, and Trois-Rivières fall in the category cities with below-average productivity and QOL, but do have the compensating benefit of being affordable. All of the non-CMA areas of provinces also fall in this category, suggesting that neither firms nor households find remote areas to be exceptionally attractive. Interestingly, firms in the Territories appear to quite productive, perhaps in their extraction of natural resources, and are able to pay workers well to compensate them for the lack of consumption amenities

The rankings of the cities in terms of overall QOL, productivity, and combined value are given in Table 2. Victoria has the highest QOL, followed by Vancouver, Kelowna, and Toronto. Rounding out the top ten are are Calgary, Abbotsford, Montreal, Sherbrooke, Ottawa-Hull and Halifax. Saint John, Windsor, and Thunder Bay fill the bottom three spots. This list contrasts significantly with Giannias (1998), which places Edmonton and Winnipeg in the top 4 of 13 cities, which here are ranked 16 and 24 out of 33.

From the second column of Table 2, we see that Toronto is the leader in productivity, which is not surprising given that it is the largest city in Canada, with a population of 5 million. Second is Oshawa, as it is 50 kilometers from Toronto, with a strong base in automobile manufacturing. Calgary, Vancouver, and Ottawa-Hull round out the top five. All of these cities pay a disproportionate share of federal taxes per capita, as seen in column 7, as a result of being so productive. Despite being the second largest CMA in Canada, Montreal is only in tenth place, possibly because of its language barrier with the rest of Canada and the United States.

The land-rent and total-value differentials are reported in columns 6 and 8 in Table 1, with their difference caused by the tax differentials in column 7, and the ranking in column 3 of Table 2. Their calculation is made visually transparent in Figures 1 and 2 through the average iso-rent and iso-value curves: cities above these lines have above-average rents and total values, respectively. From these we see that Victoria has the

highest private value of land, although Vancouver has the highest social value, as its higher wage levels lead to greater positive tax externalities.

## 4.2 Estimates for Separate Language Groups

QOL measures broken down by mother tongue are presented in Table 3. A CMA is included in the ranking if the number of residents with the mother tongue is at least 100,000 and makes up at least 10 percent of the population. Calculating QOL measures for cities where a smaller number of individuals have a certain mother tongue raises difficult econometric issues.<sup>9</sup> The QOL rankings for Anglophones are not much different than those obtained when pooling all groups together. For Francophones, the top city is Montreal, while the worst is Chicoutimi-Jonquière. Allophones prefer Canada's three largest cities, Vancouver, Toronto, and Montreal, over all other ones, supporting the notion that Allophones will prefer to live in areas with the greatest number of like-tongued speakers.

The individual productivity of different language groups is given in Table 4 for just a few cities where the supply of each group is large. Panel A considers the productivity differences between Francophones and Anglophones in Montreal and Ottawa-Hull. In Montreal, average productivity is 2 percent above the national average, and Francophones are better paid and much more heavily employed than Anglophones. If both types of workers are perfect substitutes, then Francophones from Montreal are 3 percent more productive than the average Francophone, while Anglophones are 3 percent less productive, making them about as productive as Anglophones in Peterborough. If Anglophones provide special skills that cannot be easily substituted for by Francophone labor, then the productivity differences are even larger: with an elasticity of substitution of 10, an Anglophone worker in Montreal provides only two-thirds of the amount of effective labor that she would provide in a typical Canadian labour market. The results for Ottawa-Hull are much less extreme since their national wage and employment differentials are roughly the same: if Anglophones and Francophones are perfect substitutes, then Francophones are only slightly more productive than Anglophones there, although this increases with the amount of imperfect substitution.

Panel B considers the productivity differences between Anglophones and Allophones in Toronto and Vancouver. In both CMAs, Allophones earn less of a premium than Anglophones do, but are hired in

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<sup>9</sup>In places where a linguistic group is in a small minority, the calculated wage differentials tend to be relatively low and the housing-cost differentials language groups relatively high. This would seem to suggest that these groups find places where the mother tongue are very amenable. Instead, it is likely that these individuals have idiosyncratic attachments, such as spouses, that cause them to sacrifice real income in order to live in these places.

a greater proportion, relative to the national average. Thus, the less substitutable Allophone labor is for Anglophone labor, the closer their relative productivity differentials.

## 5 Relationship with Popular Rankings and Amenities

There are a number of popular rankings of Canadian cities according to their "livability." Two of the most popular sources are the *Places Rated Almanac* and *Cities Ranked and Rated*, whose rankings are compared with the hedonic rankings here. While the popular measures are grounded on no particular theory and appear to be largely ad-hoc, they reflect popular perceptions of what cities are the "nicest" to live in. Unlike the rankings based on willingness-to-pay, the popular rankings also incorporate low cost-of-living and good job-market opportunities as "amenities." In the hedonic framework, including these factors should make all of the cities equally good, although in fact the popular rankings put less weight on cost-of-living and job-market opportunities than the hedonic framework implies.<sup>10</sup> Thus, the correlation with the economic QOL estimates should still be positive despite the bias.

Table 5 reports the correlation coefficients between the rankings in these reports and the overall QOL ranking shown in Table 1. The correlations are all strongly positive, with the correlation between the two popular rankings being somewhat stronger than that between either popular ranking and the economic one. The general consistency of the rankings seems to be mutually reinforcing to both the hedonic and popular measures.

Table 6 estimates the relationship between the economic QOL estimates and various indices given to cities by *Places Rated*. These indices are all given equal weights when determining the popular ranking, but hedonic estimates based on the economic measures indicate that only the indices for climate and arts and culture have a significant relationship with households' willingness-to-pay. With only 24 cities in the sample, this test does have low power, and indeed other factors, such as those related to health, crime, and education, may be very important in households' location decisions. But according to how *Places Rated* has measured them, it appears that households do not value all of the amenities they claim to measure equally. Canadians, understandably, care tremendously about climate, and apparently quite a bit about arts and culture, too, or other amenities that are correlated with those measures.

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<sup>10</sup>For instance, in *Places Rated*, cost-of-living and employment opportunities, are counted as 2 among 9 amenities, all of which receive equal weight.

## 6 Additional Considerations

An advantage of the model presented here is that it requires only limited data and is intuitive to explain graphically. Yet, additional considerations should be raised which may affect the estimates, in particular with regards to the role of non-housing costs, differences in non-tax federal fiscal benefits, and the use of rents instead of housing prices. Given that it is not clear whether or not these considerations should be incorporated into the estimation of QOL and productivity differentials, and given that they would be also based on incomplete data available only at the provincial level, they are presented apart in Table 7, which also summarizes the preceding results at the provincial and regional levels.<sup>11</sup>

### 6.1 Intergovernmental Transfers

An adjustment for intergovernmental transfers and provincial source-based tax revenues is made in column 9. Recall that if these payments benefit households, they should be subtracted from QOL; if they benefit firms, they should be subtracted from productivity: in either case they should be subtracted from the total value. On the other hand, if these payments benefit neither households nor firms, then they should be ignored altogether. Assuming that the payments do affect the total value in some form, they raise the value of Ontario and Quebec, while the Atlantic and the Prairie provinces are seen as less valuable. As analyzed in greater detail in Albouy (2010), this is mainly driven by equalization payments, except for Alberta and Saskatchewan, which receive large fiscal benefit by retaining the revenues from taxes on natural resources, rather than sharing them federally.

### 6.2 Non-Housing Costs

According to intercity estimates of the Consumer Price Index, non-housing cost differences are not always proportional to housing-cost differences, as we assume in the model. If non-housing costs in an area are high relative to housing costs, then the cost-of-living measure approximated by housing costs is biased downwards in that area. This causes QOL measures in areas with high non-housing costs to be biased downwards. This may be the case in more remote areas of Canada, such as the Territories, where housing is relatively cheap, but some other goods are expensive because of transportation costs.<sup>12</sup>

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<sup>11</sup>CMA-level adjustments, assuming that the total value affects only households, are presented in Tables A1 and A2.

<sup>12</sup>Unfortunately, the intercity CPI estimates do not reliably measure housing costs as they rely on a subsample of new housing generally built on the urban fringe. "The sample of builders for each metropolitan area is determined through the use of local

Unfortunately, only one city per province has detailed CPI information, which means that adjusting the estimates requires the assumption that provincial cost differences are reflected by its representative city, typically the provinces largest. These adjustments, in column 10, suggest that values may be underestimated in the Atlantic provinces, especially Newfoundland, and overestimated in Quebec.

### **6.3 Housing Rents**

Our main analysis measures housing costs by combining actual rents with imputed rents for owner-occupied units. There may be reason to doubt the accuracy of these imputed rent measures, especially during our time period, as housing prices in some markets rose considerably up until 2006. Alternate measures can be constructed using housing costs using only rented units, which are shown in Appendix Figure A1 against our overall estimate of housing costs. As seen in column 11 of Table 7, using rents alone tends to reduce the differences in total value across provinces, without having much of an effect on the overall rankings. We believe rent-only measures as less accurate since the majority of Canadians own their homes, and as the home ownership rate varies significantly across smaller and larger metropolitan areas. Using the overall housing-cost measure helps to avoid problematic selection issues, such as where a unit is located within a city, in how measured housing rents reflect typical housing costs in each area.

## **7 Conclusion**

This paper presents the first hedonic estimates of QOL and local productivity differences for Canada, accounting for heterogeneity in mother tongues. These estimates seem to be quite sensible and intuitive, with the QOL measures exhibiting a strong positive correlation with popular rankings. We found that Victoria leads the QOL ranking among Anglophones, followed closely by other cities in British Columbia, and Toronto, Calgary, and Montreal. Montreal leads the ranking among Francophones, followed by Ottawa-Hull and Sherbrooke. Allophones appear to prefer Canada's three largest cities: Vancouver, Toronto, and Montreal. The local productivity ranking is led by Toronto, followed by Oshawa, Calgary, Vancouver, and Ottawa-Hull. It is somewhat surprising that Montreal, despite its size and former glory as the "Metropolis of Canada," finds itself in 10th place.

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market intelligence and verified against relevant building permit data. Where possible, prices are collected from builders who develop entire subdivisions, usually on large tracts of land." The Census sample is more reliable as it samples all housing. For example in Vancouver, the CPI estimates that housing is only 10 percent over the national average, as opposed to 43 percent according to the Census data.

Overall, the measures speak to the economic importance of Canadian cities, not only in producing the goods that households value, but also in delivering the amenities that households want. Most Canadians seem to prefer living in large metropolitan areas and willing to consume less in order to live in them. If Canadians truly are mobile, then it may be worth reconsidering federal tax and transfer policies, which put a heavy burden on more urbanized areas, and subsidize Canadians to live in remote, less attractive, and less productive areas that they might otherwise leave.

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TABLE 1: PRICES, ATTRIBUTES, AND VALUES ACROSS CANADIAN CITIES

City/Area Name	Population	Observed Prices		Attribute		Value Capitalization		Total Value
		Wages	Housing Costs	Quality of Life	Productivity	Land Rent	Tax Burden	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>Panel A: Census Metropolitan Areas</i>								
Vancouver	2,047,650	0.03	0.45	0.13	0.07	1.72	0.007	0.179
Victoria	320,920	-0.04	0.46	0.17	0.02	1.91	-0.012	0.179
Toronto	4,966,660	0.08	0.29	0.06	0.09	0.97	0.016	0.114
Calgary	1,053,840	0.07	0.24	0.05	0.07	0.82	0.016	0.098
Kelowna	159,490	-0.06	0.24	0.10	-0.02	1.07	-0.016	0.091
Montréal	3,534,850	0.01	0.14	0.04	0.02	0.53	0.004	0.057
Ottawa-Hull	1,106,380	0.07	0.13	0.01	0.07	0.38	0.018	0.056
Abbotsford	154,830	0.00	0.12	0.04	0.01	0.50	0.000	0.050
Hamilton	676,780	0.06	0.05	-0.01	0.05	0.09	0.012	0.021
Guelph	125,070	0.03	0.05	0.00	0.02	0.15	0.004	0.020
Oshawa	326,890	0.11	0.02	-0.04	0.08	-0.16	0.028	0.012
Edmonton	1,013,400	0.02	-0.01	-0.01	0.01	-0.09	0.003	-0.006
Kitchener	441,420	0.04	-0.02	-0.02	0.02	-0.15	0.007	-0.008
Québec	701,420	-0.03	-0.02	0.01	-0.02	-0.02	-0.008	-0.010
Barrie	174,420	0.02	-0.03	-0.02	0.01	-0.17	0.004	-0.012
Kingston	147,230	-0.05	-0.05	0.01	-0.04	-0.06	-0.017	-0.023
Peterborough	114,580	-0.03	-0.05	-0.01	-0.03	-0.16	-0.010	-0.025
Sherbrooke	182,330	-0.08	-0.06	0.01	-0.06	-0.06	-0.023	-0.029
St. Catharines-Niagara	381,170	-0.01	-0.12	-0.04	-0.02	-0.47	-0.003	-0.050
Brantford	122,420	0.00	-0.13	-0.04	-0.02	-0.51	-0.002	-0.053
Halifax	366,790	-0.12	-0.16	0.01	-0.10	-0.37	-0.021	-0.058
London	447,310	0.00	-0.15	-0.05	-0.01	-0.62	0.000	-0.062
Windsor	316,170	0.10	-0.21	-0.11	0.05	-1.06	0.026	-0.080
Sudbury	155,990	0.03	-0.23	-0.09	0.00	-0.98	0.007	-0.091
Trois-Rivières	138,160	-0.02	-0.26	-0.08	-0.04	-0.99	-0.003	-0.103
Chicoutimi-Jonquière	149,440	0.02	-0.28	-0.10	-0.02	-1.17	0.008	-0.109
Winnipeg	677,500	-0.09	-0.29	-0.05	-0.09	-0.98	-0.016	-0.115
Saskatoon	228,080	-0.10	-0.30	-0.05	-0.10	-0.97	-0.021	-0.118
Regina	190,790	-0.04	-0.34	-0.09	-0.06	-1.26	-0.002	-0.129
Moncton	123,580	-0.13	-0.35	-0.05	-0.13	-1.12	-0.026	-0.137
Thunder Bay	120,720	0.01	-0.39	-0.13	-0.03	-1.57	0.003	-0.154
St. John's	178,170	-0.13	-0.44	-0.09	-0.14	-1.50	-0.026	-0.175
Saint John	119,800	-0.10	-0.49	-0.11	-0.12	-1.74	-0.016	-0.189
<i>Non-CMA Areas</i>								
BC	1,327,040	-0.03	-0.05	0.00	-0.02	-0.13	-0.005	-0.017
NWT	40,770	0.20	-0.06	-0.12	0.14	-0.68	0.040	-0.028
YT	29,960	0.06	-0.12	-0.07	0.03	-0.59	0.012	-0.047
AB	1,153,770	-0.02	-0.16	-0.05	-0.03	-0.60	-0.006	-0.066
ON	2,530,520	-0.02	-0.20	-0.06	-0.04	-0.75	-0.007	-0.083
QC	2,386,520	-0.07	-0.30	-0.07	-0.08	-1.05	-0.017	-0.122
PEI	133,830	-0.24	-0.48	-0.04	-0.22	-1.37	-0.048	-0.186
NUN	29,270	0.25	-0.55	-0.31	0.12	-2.74	0.050	-0.225
NB	473,080	-0.18	-0.59	-0.11	-0.19	-1.95	-0.038	-0.233
NS	532,270	-0.20	-0.60	-0.10	-0.20	-1.94	-0.042	-0.236
MB	445,220	-0.17	-0.63	-0.13	-0.19	-2.13	-0.037	-0.250
SK	529,430	-0.18	-0.75	-0.16	-0.21	-2.59	-0.039	-0.298
NL	320,930	-0.17	-0.95	-0.23	-0.22	-3.42	-0.034	-0.375
Canada	30,896,860	0.08	0.30	0.07	0.06	0.73	0.017	0.082

Wage and housing cost data are taken from the Census 2006 Masterfiles. Wage differentials are based on the average logarithm of hourly wages for full-time workers ages 25 to 55, controlling for observable skills. Housing cost differentials based on the average logarithm of rents and housing price, controlling for observable housing characteristics. Quality-of-life, productivity, land rent, tax burden, and total value differentials are based off of formulas explained in Section 2.2.1 in the text for the one household-type case. Fuller details on the data are in the Appendix

TABLE 2: CENSUS METROPOLITAN AREA RANKINGS

	<u>Quality-of-Life Ranking</u>	<u>Productivity Ranking</u>	<u>Total Value Ranking</u>
1	Victoria	Toronto	Vancouver
2	Vancouver	Oshawa	Victoria
3	Kelowna	Calgary	Toronto
4	Toronto	Vancouver	Calgary
5	Calgary	Ottawa-Hull	Kelowna
6	Abbotsford	Windsor	Montréal
7	Montréal	Hamilton	Ottawa-Hull
8	Sherbrooke	Guelph	Abbotsford
9	Ottawa-Hull	Kitchener	Hamilton
10	Halifax	Montréal	Guelph
11	Kingston	Victoria	Oshawa
12	Québec	Barrie	Edmonton
13	Guelph	Edmonton	Kitchener
14	Peterborough	Abbotsford	Québec
15	Hamilton	Sudbury	Barrie
16	Edmonton	London	Kingston
17	Barrie	Brantford	Peterborough
18	Kitchener	Chicoutimi-Jonquière	Sherbrooke
19	St. Catharines-Niagara	St. Catharines-Niagara	St. Catharines-Niagara
20	Brantford	Kelowna	Brantford
21	Oshawa	Québec	Halifax
22	Saskatoon	Peterborough	London
23	Moncton	Thunder Bay	Windsor
24	Winnipeg	Trois-Rivières	Sudbury
25	London	Kingston	Trois-Rivières
26	Trois-Rivières	Sherbrooke	Chicoutimi-Jonquière
27	St. John's	Regina	Winnipeg
28	Regina	Winnipeg	Saskatoon
29	Sudbury	Halifax	Regina
30	Chicoutimi-Jonquière	Saskatoon	Moncton
31	Saint John	Saint John	Thunder Bay
32	Windsor	Moncton	St. John's
33	Thunder Bay	St. John's	Saint John

Rankings based off of data in table 1.

TABLE 3: WAGE, HOUSING-COST, AND QUALITY-OF-LIFE DIFFERENTIALS BY MOTHER  
TONGUE

Rank	Name	Population Size	Fraction of Total	Wages	Housing Cost	Quality-of Life
<i>Panel A: Anglophones</i>						
1	Victoria	275,930	0.86	-0.04	0.48	0.175
2	Vancouver	1,215,480	0.59	0.05	0.52	0.147
3	Kelowna	136,450	0.86	-0.06	0.25	0.109
4	Toronto	2,823,580	0.57	0.11	0.38	0.072
5	Abbotsford	111,720	0.72	-0.01	0.17	0.063
6	Calgary	805,620	0.76	0.07	0.28	0.062
7	Montréal	448,710	0.13	-0.02	0.12	0.048
8	Guelph	101,260	0.81	0.01	0.08	0.021
9	Ottawa-Hull	561,760	0.51	0.06	0.14	0.015
10	Kingston	130,340	0.89	-0.06	-0.04	0.009
11	Halifax	338,550	0.92	-0.12	-0.17	0.006
12	Hamilton	521,760	0.77	0.06	0.09	0.003
13	Edmonton	795,610	0.79	0.02	0.02	-0.004
14	Peterborough	106,690	0.93	-0.03	-0.05	-0.008
15	Kitchener	337,780	0.77	0.03	0.02	-0.012
16	Barrie	155,420	0.89	0.03	-0.02	-0.020
17	St. Catharines-Niagara	309,680	0.81	-0.01	-0.11	-0.033
18	Brantford	108,240	0.88	0.00	-0.12	-0.039
19	Oshawa	285,270	0.87	0.11	0.03	-0.041
20	Winnipeg	515,180	0.76	-0.09	-0.27	-0.042
21	Saskatoon	198,190	0.87	-0.11	-0.29	-0.044
22	London	366,120	0.82	0.00	-0.13	-0.046
23	Regina	170,940	0.90	-0.05	-0.33	-0.082
24	St. John's	174,350	0.98	-0.13	-0.44	-0.085
25	Windsor	234,100	0.74	0.09	-0.19	-0.101
26	Sudbury	101,230	0.65	0.00	-0.31	-0.101
27	Saint John	111,370	0.93	-0.11	-0.51	-0.107
28	Thunder Bay	101,930	0.84	0.00	-0.38	-0.125
<i>Panel B: Francophones</i>						
1	Montréal	2,359,840	0.67	0.05	0.21	0.050
2	Ottawa-Hull	366,230	0.33	0.09	0.21	0.030
3	Sherbrooke	165,740	0.91	-0.07	-0.03	0.018
4	Québec	672,750	0.96	-0.03	-0.01	0.008
5	Trois-Rivières	134,530	0.97	-0.02	-0.25	-0.074
6	Chicoutimi-Jonquière	146,680	0.98	0.02	-0.28	-0.097
<i>Panel C: Allophones</i>						
1	Vancouver	806,880	0.39	0.00	0.32	0.108
2	Toronto	2,080,620	0.42	0.03	0.15	0.033
3	Montréal	726,300	0.21	-0.10	-0.13	0.007
4	Calgary	231,480	0.22	0.05	0.06	-0.005
5	Ottawa-Hull	178,380	0.16	0.05	-0.09	-0.053
6	Hamilton	144,830	0.21	0.04	-0.12	-0.057
7	Edmonton	195,240	0.19	0.02	-0.18	-0.068
8	Winnipeg	132,890	0.20	-0.11	-0.49	-0.106

Wage and housing-cost differentials are calculated by language group according to the component orthogonal to observable characteristics but related to the CMA indicators interacted with language-group indicators.

TABLE 4: RELATIVE PRODUCTIVITY OF SPECIFIC MOTHER TONGUES IN SELECTED CITIES

<i>Panel A: Francophones and Anglophones</i>				Mother-tongue-specific productivity					
CMA	Relative Log Ratio		Total Prod	$\sigma = \infty$		$\sigma = 40$		$\sigma = 10$	
	Wages	Employ ment		Franco- phone	Anglo- phone	Franco- phone	Anglo- phone	Franco- phone	Anglo- phone
Montréal	0.063	2.802	0.022	0.031	-0.032	0.040	-0.096	0.072	-0.309
Ottawa-Hull	0.024	0.560	0.065	0.079	0.055	0.088	0.049	0.117	0.029
<i>Panel B: Allophones and Anglophones</i>				$\sigma = \infty$		$\sigma = 40$		$\sigma = 10$	
CMA	Relative Log Ratio		Total Prod	Allo- phone	Anglo- phone	Allo- phone	Anglo- phone	Allo- phone	Anglo- phone
	Wages	Employ ment							
Toronto	-0.078	0.878	0.086	0.042	0.120	0.054	0.111	0.092	0.082
Vancouver	-0.058	0.643	0.068	0.032	0.090	0.041	0.084	0.072	0.065

Wage and employment ratios expressed in logarithms relative to the national log ratio (i.e. subtracting the national log ratio). Productivity levels are relative to others in the same language group and are calculated

TABLE 5: CORRELATION OF HEDONIC QUALITY-OF-LIFE AND  
PLACES RATED ALMANAC "LIVABILITY" & CITIES RANKED AND  
RATED RANKINGS

	Places Rated Almanac (1)	Cities Ranked & Rated (2)
Hedonic QOL Rank	0.68	0.72
Places Rated Almanac		0.84

TABLE 6: QUALITY OF LIFE, PRODUCTIVITY, AND  
INDIVIDUAL AMENITIES

	Quality of Life (unweighted) (1)	Quality of Life (pop weight) (2)
Arts & Culture	0.08 (0.04)	0.13 (0.05)
Climate	0.20 (0.06)	0.17 (0.05)
Crime	0.06 (0.06)	0.05 (0.05)
Education	0.08 (0.07)	0.07 (0.08)
Recreation	-0.01 (0.07)	-0.03 (0.05)
Health	0.06 (0.07)	0.07 (0.06)
Transportation	-0.03 (0.07)	0.02 (0.07)
Constant	-0.23 (0.06)	-0.26 (0.06)
Adjusted R-squared	0.61	0.66
Number of Observations	24	24

Robust standard errors in parentheses. Regressions in the second column are weighted by the sum of individuals in each metro area.

TABLE 7: PRICES, ATTRIBUTES, AND VALUES ACROSS CANADIAN REGIONS AND PROVINCES WITH ADDITIONAL ADJUSTMENTS

City/Area Name	Population	Observed Prices		Attribute		Value Capitalization		Total Value	Adjusted Total Values		
		Wages	Housing Costs	Quality of Life	Productivity	Land Rent	Tax Burden		Transfer Differ	Non-Hous Cost	Housing Rents
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
<i>Panel A: Provinces</i>											
BC	4,009,930	0.00	0.24	0.08	0.02	0.97	-0.001	0.096	0.090	0.071	0.028
ON	11,873,140	0.04	0.04	-0.01	0.03	0.07	0.007	0.014	0.041	0.039	0.017
AB	3,221,010	0.02	0.02	0.00	0.02	0.03	0.004	0.007	-0.069	0.001	0.009
QC	7,373,310	-0.02	-0.07	-0.01	-0.02	-0.22	-0.005	-0.027	-0.007	-0.059	-0.026
NWT	40,770	0.20	-0.06	-0.12	0.14	-0.68	0.040	-0.028	-0.233	-0.028	-0.051
YT	29,960	0.06	-0.12	-0.07	0.03	-0.59	0.012	-0.047	-0.236	-0.047	-0.036
NS	899,060	-0.16	-0.39	-0.05	-0.15	-1.19	-0.032	-0.151	-0.180	-0.102	-0.075
MB	1,122,720	-0.12	-0.41	-0.08	-0.13	-1.38	-0.023	-0.161	-0.200	-0.139	-0.104
PEI	133,830	-0.24	-0.48	-0.04	-0.22	-1.37	-0.048	-0.186	-0.221	-0.125	-0.100
NB	716,460	-0.15	-0.52	-0.10	-0.16	-1.74	-0.030	-0.204	-0.241	-0.204	-0.116
SK	948,300	-0.13	-0.53	-0.11	-0.14	-1.83	-0.025	-0.208	-0.265	-0.160	-0.115
NUN	29,270	0.25	-0.55	-0.31	0.12	-2.74	0.050	-0.225	-0.506	-0.225	-0.303
NL	499,100	-0.15	-0.70	-0.16	-0.18	-2.48	-0.030	-0.278	-0.347	-0.186	-0.165
<i>Panel B: Regions</i>											
West	7,330,940	0.01	0.12	0.04	0.02	0.48	0.002	0.050	0.007	0.039	0.017
Central	19,246,450	0.01	-0.01	-0.01	0.01	-0.06	0.002	-0.003	0.020	-0.003	-0.001
Prairie	2,071,020	-0.12	-0.47	-0.10	-0.13	-1.61	-0.024	-0.185	-0.233	-0.150	-0.109
Atlantic	2,248,450	-0.16	-0.50	-0.09	-0.17	-1.64	-0.032	-0.196	-0.236	-0.156	-0.108

Calculation of differentials in columns 1 through 8 explained in table 1. Transfer differential based on federal intergovernmental transfers and province-level source-based revenues, described in Albouy (2010). Non-housing cost adjustment based on CPI data for principal city for province. "Housing Rents" uses only housing-cost measures based on rental units, as opposed to all units.

Figure 1: Housing Costs versus Wage Levels across CMAs, 2006

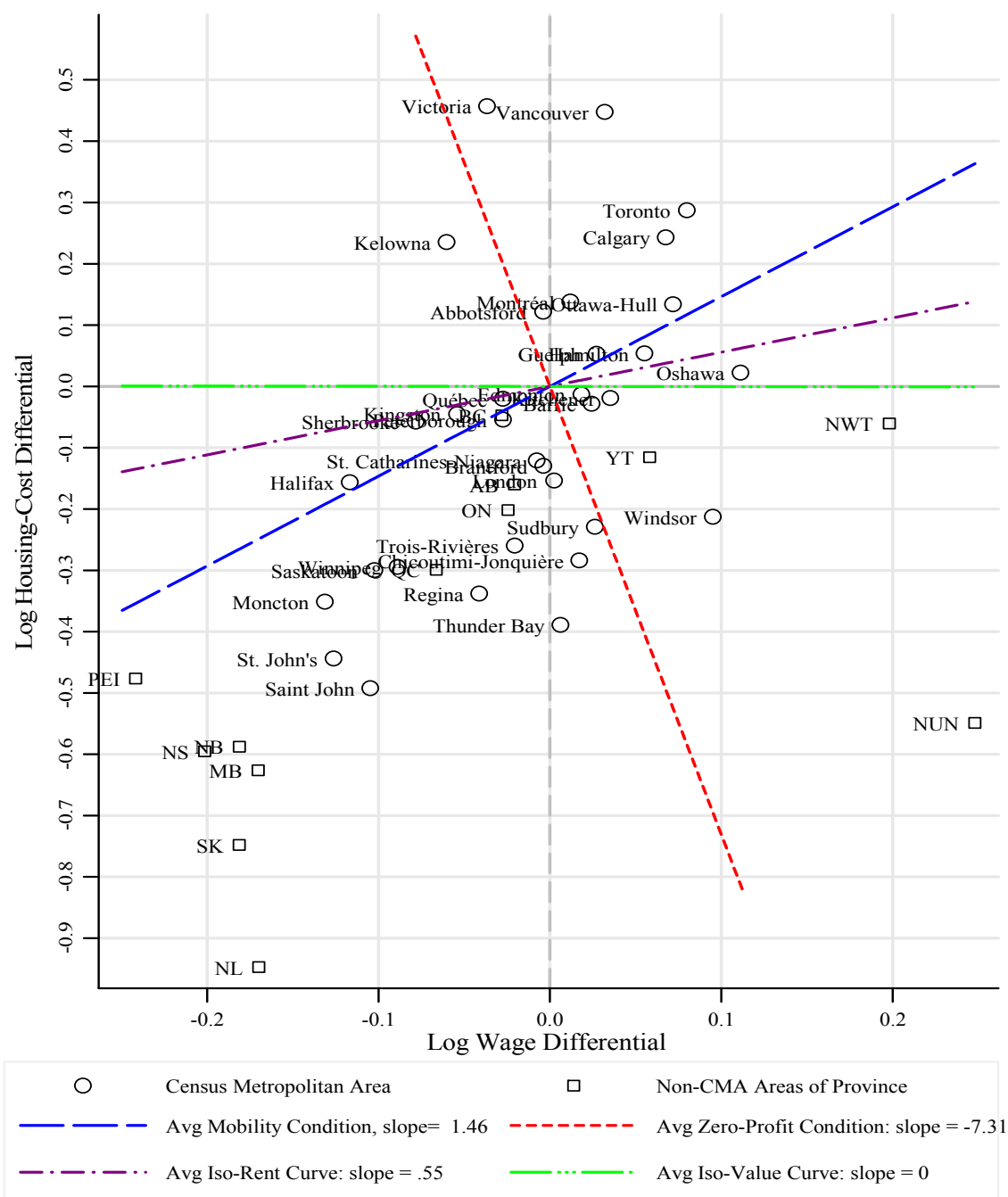
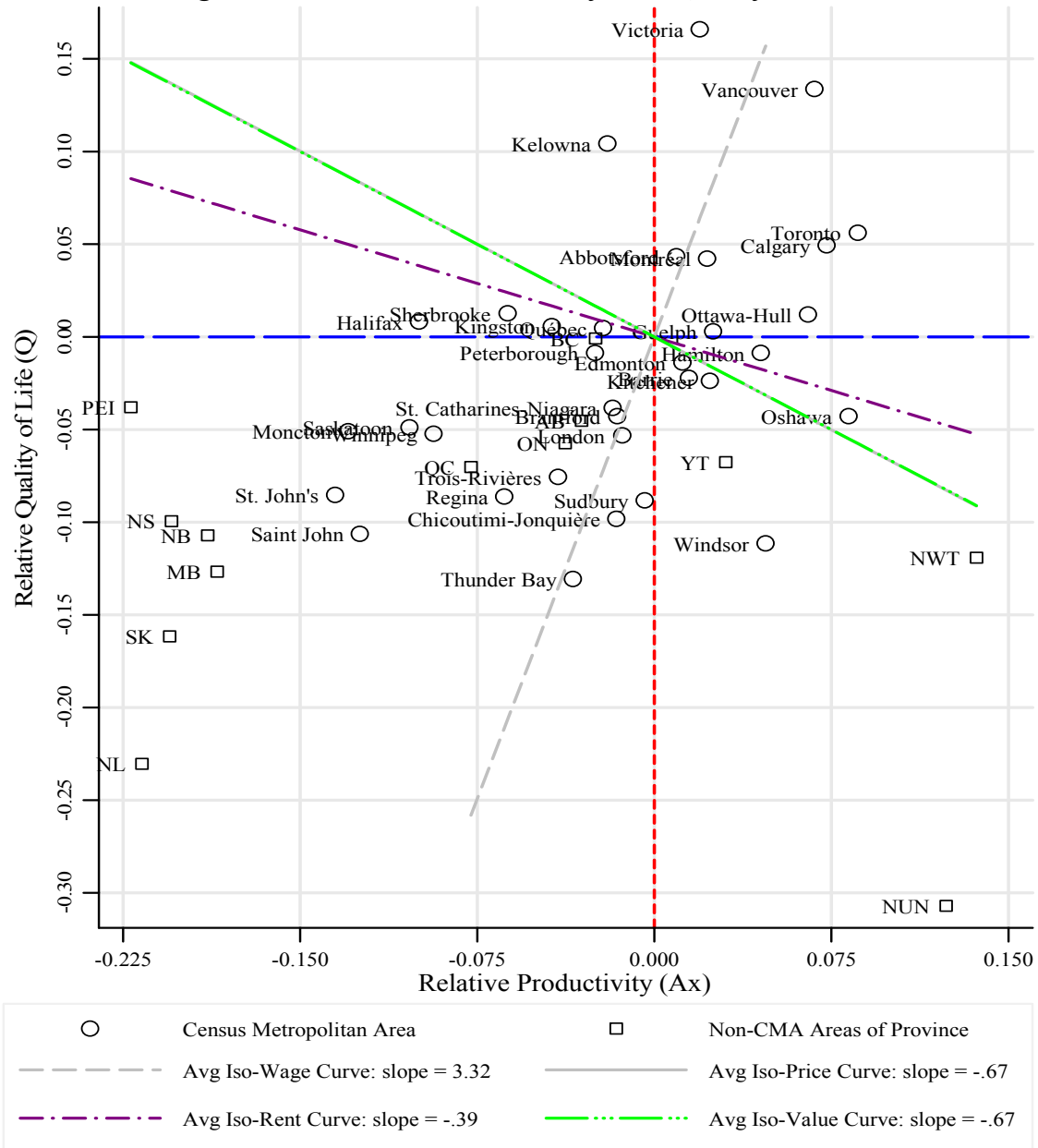


Figure 2: Estimated Productivity and Quality of Life





# Appendix

## A Additional Theoretical Details

### A.1 Multiple Household Types

Now the rent estimate is over-determined, but the cost-shares are typically unknown:

$$\hat{r}^j = \frac{1}{\phi_{gL}} (\hat{p}_g^j - \phi_{gN} \cdot \hat{\mathbf{w}}^j)$$

Adding up the land rent:

$$\begin{aligned} s_R \hat{r}^j &= \hat{Q}^j + s_x \hat{A}_X - \tau' s_w \hat{w}^j \\ &= s_y \hat{p}^j - \sum_g (\mu_g s_{wg} - s_x \theta_{Ng}) \hat{w}_g^j + s_x \theta_L \hat{r}^j \end{aligned}$$

Solving again

$$\hat{r}^j = \frac{1}{s_R - s_x \theta_L} \left[ s_y \hat{p}^j - \sum_g (\mu_g s_{wg} - s_x \theta_{Ng}) \hat{w}_g^j \right]$$

Now if  $\theta_{Ng}/\theta_N = \mu_g s_{wg}/s_w$ , then

$$\hat{r}^j = \frac{s_y}{s_R - s_x \theta_L} \left[ \hat{p}^j - \frac{s_w - s_x \theta_N}{s_y} \hat{w}^j \right] = \frac{1}{\phi_L} [\hat{p}^j - \phi_N \hat{w}^j]$$

So each type just needs to be weighted by their share of income when producing rent and productivity estimates.

Factor-specific productivity differences do have first-order effects on quantities in the model. For example, in the case where partial elasticities of substitution across factors within sectors are equal, the relative employment of 1-types relative to 2-types is given by

$$\hat{N}_1^j - \hat{N}_2^j = -\sigma_{12}(\hat{w}_1^j - \hat{w}_2^j) + (\sigma_{12} - 1) (\hat{A}_1^j - \hat{A}_2^j)$$

Now if we assume that

$$\hat{A}^j = \theta_{N1} \hat{A}_1^j + \theta_{N2} \hat{A}_2^j + \sum_{g=3}^G \theta_{Ng} \hat{A}_g^j + \theta_L \hat{A}_L^j + \theta_K \hat{A}_K^j = \theta_{N1} \hat{A}_1^j + \theta_{N2} \hat{A}_2^j + \theta_- \hat{A}_-^j$$

then

$$\begin{aligned} \hat{A}_1^j &= \frac{1}{\theta_{N1}} (\hat{A}^j - \theta_{N2} \hat{A}_2^j - \theta_- \hat{A}_-^j) \\ \hat{A}_1^j - \hat{A}_2^j &= \frac{1}{\theta_{N1}} [\hat{A}^j - (\theta_{N1} + \theta_{N2}) \hat{A}_2^j - \theta_- \hat{A}_-^j] \end{aligned}$$

Substituting back in

$$\hat{N}_1^j - \hat{N}_2^j = -\sigma_{12}(\hat{w}_1^j - \hat{w}_2^j) + (\sigma_{12} - 1) \frac{1}{\theta_{N1}} [\hat{A}^j - (\theta_{N1} + \theta_{N2}) \hat{A}_2^j - \theta_- \hat{A}_-^j]$$

which implies

$$\hat{A}_2^j = \frac{\theta_{N1}}{\theta_{N1} + \theta_{N2}} \frac{\hat{N}_1^j - \hat{N}_2^j + \sigma_{12}(\hat{w}_1^j - \hat{w}_2^j)}{\sigma_{12} - 1} + \frac{\hat{A}^j - \theta_- \hat{A}_-^j}{\theta_{N1} + \theta_{N2}}$$

Making the assumption that all of the other factors have the same relative productivity levels, i.e.  $\hat{A}_-^j = \hat{A}^j$  it follows that

$$\hat{A}_2^j = \frac{\theta_{N1}}{\theta_{N1} + \theta_{N2}} \frac{\hat{N}_2^j - \hat{N}_1^j + \sigma_{12}(\hat{w}_2^j - \hat{w}_1^j)}{\sigma_{12} - 1} + \hat{A}^j$$

This normalization gives  $\theta_{N1}\hat{A}_1^j + \theta_{N2}\hat{A}_2^j = \hat{A}^j$ . Also note that when  $\sigma_{12} = 0$ ,  $\hat{A}_2^j = \frac{\theta_{N1}}{\theta_{N1} + \theta_{N2}}(\hat{N}_1^j - \hat{N}_2^j) + \hat{A}^j$  while if  $\sigma_{12} \rightarrow \infty$  then  $\frac{\theta_{N1}}{\theta_{N1} + \theta_{N2}}(\hat{w}_2^j - \hat{w}_1^j) + \hat{A}^j$

## A.2 Provincial and Federal Taxes Combined

Individual provinces may not only have significant tax rates on income, but also significant wage differences within them. This means that the tax differentials faced by households in different cities consist of two components: a federal component and a provincial component. Let the tax burden be given by two components, a federal  $F$  and a provincial,  $P$ :  $\tau(m) = \tau_F(m) + \tau_P(m)$ . Assuming that federal revenues are distributed evenly across the country, and provincial revenues are distributed even within the province, the federal tax differential is

$$\frac{d\tau^j}{m} = \frac{d\tau_F^j}{m} + \frac{d\tau_P^j}{m} = s_w \tau_F' \hat{w}^j + s_w \tau_P' (\hat{w}^j - \hat{w}^P) = s_w (\tau_F' + \tau_P') \hat{w}^j - s_w \tau_P' \hat{w}^P$$

where  $\hat{w}^P$  is the wage differential of the province on average. At the provincial level, the provincial burden is even and so we may easily calculate

$$Q^P = s_y \hat{p}^P - (1 - \tau_F') \hat{w}^P$$

While for a given city the formula is slightly more complicated.

$$\hat{Q}^j = s_y \hat{p} - s_w [(\tau_F' + \tau_P') \hat{w}^j - \tau_P' \hat{w}^P]$$

## B Data and Estimation

We use Canadian Census data from the 2006 Master 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 assigned to a worker is determined by their place of residence. 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. The covariates consist of

- 12 indicators of educational attainment;
- a quartic in potential experience (years of school are calculated using the 2001 Master Microdata Files for the highest level of education);
- 18 indicators for major field of study;
- 15 indicators of industry (2002 NAICS);
- 25 indicators of occupation (2006 NOC-S);

- An indicator for married/common-law;
- An indicators for immigrant status, and controls for time since immigration and citizenship status;
- 5 indicators of minority status (Black, Chinese, South Asian, Aboriginal and other) interacted with immigrant status;
- Indicators for bilingualism interacted with mother tongue – French, English, or other – and for other mother tongue interacted with speaking only French and only English;

All covariates are interacted with gender.

We first run the regression of log wages on the individual covariates and CMA indicators using census-person weights. From the regressions a predicted wage is calculated using individual characteristics alone to form a new weight equal to the predicted wage times the census-person weight. The new weights (which have only a small effect) are then used in a second regression, which regresses the residuals from the first regression on mother tongue and CMA indicators. The coefficients on the CMA indicators are taken as the overall wage effect. For the mother-tongue specific wage effects, the residuals from the first regression are regressed on CMA indicators interacted with mother tongue indicators, using the coefficients on these interactions.

Housing-cost differentials are calculated using the logarithm of housing costs, which are either reported gross rents or imputed rents derived from housing values. The differential housing cost of a CMA is calculated in a manner similar to wages, except using a regression of rent on a set of covariates at the unit level. The covariates for the adjusted differential are

- 9 indicators for the number of rooms, 5 indicators for the number of bedrooms, number of rooms interacted with number of bedrooms, and the number of rooms per household member;
- 7 indicators for the type of building;
- 9 indicators for when the building was built;
- 2 indicators for the condition of the dwelling;
- an indicator for condominium status (owned units only).

All of the variables are interacted with indicators for rental status and among owner-occupied units, an indicator for the presence of a mortgage. Housing-cost differentials are calculated to a series of regressions similar to the ones above, with the mother tongue of the housing unit determined by the household head.

To calculate the marginal tax rates faced by a nationally representative agent in each of the provinces, we first divide the total population into 17 income groups (from 1-10,000 to 250,000+). We then use Income Statistics (Table 2A, Taxable Returns by Income Class) from Canada Revenue Agency Data to calculate the share of the total population in each of the income groups. Subsequently, we obtain the marginal income tax rate (federal plus provincial) that applies to each income group and each province, using the midpoint of each income group as the income of the group. The marginal tax rates for year 2006 are obtained from Walter Harder.

Non-housing cost data are taken from CANSIM and averaged over 2006. They cover the cities of St. John's, NL; Charlottetown-Summerside, PEI; Halifax, NS; Saint John, NB; Montreal, QC; Ottawa, ON; Toronto, ON; Winnipeg, MB; Regina, SK; Edmonton, AB; and Vancouver, BC. Federal transfer differentials are calculated using the total federal intergovernmental transfers data in 2005-2007 from CANSIM Table 384-0011. CMA level unionization rates are calculated using the 2005 Labour Force Survey Master File. It is the proportion of unionized workers to the number of workers.

TABLE A1: ALTERNATIVE QUALITY-OF-LIFE MEASURES USING ADJUSTMENTS

	<u>Base QOL</u>		<u>Transfer-adjusted</u>		<u>Non Housing Cost-</u>		<u>Rent-adjusted QOL</u>	
	<u>QOL</u>		<u>QOL</u>		<u>Adjusted QOL</u>		<u>QOL</u>	
	Value	Rank	Value	Rank	Value	Rank	Value	Rank
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Victoria	0.166	1	0.160	1	0.112	1	0.055	3
Vancouver	0.134	2	0.128	2	0.081	2	0.042	4
Kelowna	0.104	3	0.098	3	0.080	3	0.055	2
Toronto	0.056	4	0.082	4	0.047	4	0.033	6
Calgary	0.049	5	-0.026	20	0.014	10	0.007	14
Abbotsford	0.044	6	0.038	6	0.034	7	-0.010	20
Montréal	0.042	7	0.063	5	-0.017	20	0.014	11
Sherbrooke	0.013	8	0.033	8	-0.021	21	0.009	12
Ottawa-Hull	0.012	9	0.036	7	-0.001	16	0.015	10
Halifax	0.008	10	-0.021	19	0.037	6	0.063	1
Kingston	0.006	11	0.032	9	0.041	5	0.024	8
Québec	0.005	12	0.025	11	-0.034	25	0.021	9
Guelph	0.003	13	0.029	10	0.025	9	0.000	16
British Columbia, non-CMA	-0.001	.	-0.007	.	0.012	.	-0.033	.
Peterborough	-0.009	14	0.017	12	0.028	8	0.008	13
Hamilton	-0.009	15	0.017	13	0.013	11	-0.019	24
Edmonton	-0.014	16	-0.089	27	-0.015	18	-0.001	17
Barrie	-0.022	17	0.004	14	0.011	12	0.024	7
Kitchener	-0.024	18	0.002	15	0.008	13	-0.007	19
Prince Edward Island	-0.038	.	-0.073	.	0.022	.	0.048	.
St. Catharines-Niagara	-0.038	19	-0.012	16	0.007	14	-0.016	22
Brantford	-0.043	20	-0.017	17	0.004	15	-0.027	27
Oshawa	-0.043	21	-0.017	18	-0.017	19	-0.022	26
Alberta, non-CMA	-0.045	.	-0.121	.	-0.027	.	-0.011	.
Saskatoon	-0.049	22	-0.106	30	-0.031	24	0.006	15
Moncton	-0.051	23	-0.088	26	-0.051	28	0.036	5
Winnipeg	-0.052	24	-0.091	28	-0.045	26	-0.001	18
London	-0.053	25	-0.027	21	-0.004	17	-0.018	23
Ontario, non-CMA	-0.057	.	-0.031	.	-0.001	.	-0.043	.
Yukon Territory	-0.068	.	-0.256	.	-0.068	.	-0.056	.
Quebec, non-CMA	-0.070	.	-0.049	.	-0.071	.	-0.048	.
Trois-Rivières	-0.076	26	-0.055	22	-0.082	31	-0.041	28
St. John's	-0.085	27	-0.154	33	-0.028	22	-0.020	25
Regina	-0.086	28	-0.143	31	-0.063	30	-0.013	21
Sudbury	-0.088	29	-0.062	23	-0.029	23	-0.050	30
Chicoutimi-Jonquière	-0.098	30	-0.077	24	-0.101	32	-0.062	31
Nova Scotia, non-CMA	-0.099	.	-0.128	.	-0.031	.	-0.005	.
Saint John	-0.106	31	-0.143	32	-0.106	33	-0.042	29
New Brunswick, non-CMA	-0.107	.	-0.144	.	-0.107	.	-0.007	.
Windsor	-0.112	32	-0.085	25	-0.054	29	-0.072	33
Northwest Territory	-0.119	.	-0.324	.	-0.119	.	-0.142	.
Manitoba, non-CMA	-0.127	.	-0.165	.	-0.075	.	-0.056	.
Thunder Bay	-0.131	33	-0.104	29	-0.050	27	-0.068	32
Saskatchewan, non-CMA	-0.162	.	-0.219	.	-0.084	.	-0.037	.
Newfoundland, non-CMA	-0.230	.	-0.300	.	-0.106	.	-0.073	.
Nunavut Territory	-0.307	.	-0.589	.	-0.307	.	-0.385	.

TABLE A2: ALTERNATIVE TOTAL VALUE MEASURES USING ADJUSTMENTS

	Base Value		Transfer-adjusted Value		Non Housing Cost-Adjusted Value		Rent-adjusted Value	
	Value	Rank	Value	Rank	Value	Rank	Value	Rank
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Vancouver	0.179	1	0.173	1	0.126	1	0.087	2
Victoria	0.179	2	0.173	2	0.125	2	0.068	3
Toronto	0.114	3	0.140	3	0.105	3	0.091	1
Calgary	0.098	4	0.022	11	0.063	5	0.056	5
Kelowna	0.091	5	0.085	4	0.066	4	0.042	6
Montréal	0.057	6	0.078	6	-0.002	15	0.029	9
Ottawa-Hull	0.056	7	0.080	5	0.043	7	0.058	4
Abbotsford	0.050	8	0.044	9	0.040	9	-0.004	15
Hamilton	0.021	9	0.048	7	0.043	6	0.011	11
Guelph	0.020	10	0.046	8	0.042	8	0.017	10
Oshawa	0.012	11	0.038	10	0.038	10	0.033	8
Edmonton	-0.006	12	-0.081	23	-0.007	18	0.007	13
Kitchener	-0.008	13	0.018	12	0.024	11	0.008	12
Québec	-0.010	14	0.011	14	-0.048	23	0.007	14
Barrie	-0.012	15	0.014	13	0.021	12	0.034	7
British Columbia, non-CMA	-0.017	.	-0.023	.	-0.004	.	-0.049	.
Kingston	-0.023	16	0.003	15	0.012	13	-0.005	17
Peterborough	-0.025	17	0.001	16	0.011	14	-0.009	18
Northwest Territory	-0.028	.	-0.233	.	-0.028	.	-0.051	.
Sherbrooke	-0.029	18	-0.008	17	-0.062	24	-0.032	21
Yukon Territory	-0.047	.	-0.236	.	-0.047	.	-0.036	.
St. Catharines-Niagara	-0.050	19	-0.024	18	-0.005	16	-0.028	20
Brantford	-0.053	20	-0.027	19	-0.007	17	-0.037	22
Halifax	-0.058	21	-0.087	25	-0.029	21	-0.004	16
London	-0.062	22	-0.036	20	-0.013	19	-0.027	19
Alberta, non-CMA	-0.066	.	-0.141	.	-0.047	.	-0.032	.
Windsor	-0.080	23	-0.054	21	-0.023	20	-0.040	23
Ontario, non-CMA	-0.083	.	-0.056	.	-0.026	.	-0.068	.
Sudbury	-0.091	24	-0.065	22	-0.031	22	-0.053	25
Trois-Rivières	-0.103	25	-0.082	24	-0.109	29	-0.069	29
Chicoutimi-Jonquière	-0.109	26	-0.088	26	-0.112	30	-0.072	30
Winnipeg	-0.115	27	-0.153	28	-0.108	28	-0.064	28
Saskatoon	-0.118	28	-0.175	30	-0.100	26	-0.063	27
Quebec, non-CMA	-0.122	.	-0.101	.	-0.123	.	-0.099	.
Regina	-0.129	29	-0.185	31	-0.106	27	-0.056	26
Moncton	-0.137	30	-0.174	29	-0.137	32	-0.051	24
Thunder Bay	-0.154	31	-0.127	27	-0.073	25	-0.091	31
St. John's	-0.175	32	-0.245	33	-0.118	31	-0.110	32
Prince Edward Island	-0.186	.	-0.221	.	-0.125	.	-0.100	.
Saint John	-0.189	33	-0.226	32	-0.189	33	-0.125	33
Nunavut Territory	-0.225	.	-0.506	.	-0.225	.	-0.303	.
New Brunswick, non-CMA	-0.233	.	-0.270	.	-0.233	.	-0.133	.
Nova Scotia, non-CMA	-0.236	.	-0.265	.	-0.168	.	-0.141	.
Manitoba, non-CMA	-0.250	.	-0.289	.	-0.199	.	-0.179	.
Saskatchewan, non-CMA	-0.298	.	-0.355	.	-0.221	.	-0.174	.
Newfoundland, non-CMA	-0.375	.	-0.444	.	-0.251	.	-0.218	.

TABLE A3: UNION COVERAGE  
RATES BY CMA, 2005

CMA	Rate
St. John's	0.330
Newfoundland, non-CMA	0.355
Prince Edward Island	0.288
Halifax	0.281
Nova Scotia, non-CMA	0.274
Moncton	0.254
Saint John	0.293
New Brunswick, non-CMA	0.275
Chicoutimi-Jonquière	0.462
Québec	0.431
Sherbrooke	0.415
Trois-Rivières	0.455
Montréal	0.319
Ottawa-Hull	0.384
Quebec, non-CMA	0.388
Ottawa-Hull	0.384
Kingston	0.376
Peterborough	0.318
Oshawa	0.356
Toronto	0.204
Hamilton	0.280
St. Catharines-Niagara	0.276
Kitchener	0.246
Brantford	0.252
Guelph	0.263
London	0.278
Windsor	0.352
Barrie	0.215
Sudbury	0.400
Thunder Bay	0.421
Ontario, non-CMA	0.297
Winnipeg	0.351
Manitoba, non-CMA	0.294
Regina	0.357
Saskatoon	0.355
Saskatchewan, non-CMA	0.247
Calgary	0.179
Edmonton	0.232
Alberta, non-CMA	0.184
Kelowna	0.191
Abbotsford	0.251
Vancouver	0.275
Victoria	0.303
British Columbia, non-CMA	0.286

Figure A1: Housing Costs versus Wage Levels across CMAs, 2006

