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Measuring Relative Quality of Life from a Cross-Migration Regression, With an Application to Canadian Provinces

by Stratford Douglas* and Howard J. Wall†

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ABSTRACT

We discuss specification of regression models for using migration data to infer the living standards of different regions, and for observing how much of the standard of living is determined by economic opportunities versus non-pecuniary amenities. We estimate a regression using Canadian data from 1976-95, which results in rankings of the provinces with respect to overall living standards and amenities, with different rankings for different age groups. The regression also uncovers some interesting evidence as to the existence of equilibrium.

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Regression Methods for Estimating Relative Quality of Life

Voluntary migration is the way people express their hope and desire for a better life. People choose to move because they think that the move will make them wealthier, more comfortable, more stimulated, happier. Social scientists have long sought to understand what conditions of society will make people happier; some would say it is our primary mission. Nearly everyone wants to be wealthy, comfortable, and secure, but what else do human beings seek from their environment? Every act of migration emphatically expresses the migrant's preferences, at considerable cost to the migrant. Aggregate migration data therefore contain trustworthy information about the aggregate tendency of human preferences, if we can learn to read it correctly.

Available migration data provide some sketchy facts: the number of people who move, the places they move from and to, a few characteristics of those places, perhaps a few facts about the migrants themselves. We don't know much about each person's decision to move, so we model the decision as a random event, as though migrants choose their destination with a throw of the dice. The dice are "loaded," however, in favor of destinations that offer desirable amenities and economic opportunity. If we can deduce the probabilities of moving to each possible location we can compare the attractiveness of those locations. By subtracting out the component explained by economic opportunity, we can measure the value of non-pecuniary amenities, such as weather, culture, scenery, and recreational opportunities.

In this paper, we briefly review and then apply recent advances in the theory and practice of migration hedonics and measurement to obtain a refined measure of the relative levels of living standards offered in different regions. Using information about the probability of migration flows between pairs of provinces (cross-migration data) combined with income measurements, we apply regression techniques to identify the portion of those flows that is correlated with income opportunities. This technique allows us to rank provinces in terms of their non-pecuniary amenities, and to express the value of those amenities in terms of their income value, or compensating differential. Stratification of the migration data by age allows us some insight as to the evolution of preferences over the life cycle.

I. Inferring Living Standards from Migration Flows

There is a long tradition of theoretical papers attempting to understand the relationship between amenities and migration, and empirical papers attempting to infer relative attractiveness of locations from migration patterns. In the economics literature (as opposed to geography or regional science) Tiebout (1956) is the seminal paper. Tiebout's model depicts a self-sorting process of diverse consumers who vote with their feet, migrating to the community that offers the package of amenities that best suits them as individuals. Rosen (1979), on the other hand, de-emphasizes the sorting process, assuming that people have a common basis for assessing the standard of living. In Rosen's model, migration attracted by high-amenity locations both increases rents and decreases wages, and hence is self-limiting. In equilibrium (defined as "a stable distribution of households across cities") the difference in amenity values among locations just offsets differences in wages and rents, implying uniform standard of living (SOL) across locations. Following Rosen, several authors (e.g., Roback, 1982 and 1988; Hoehn, Blomquist, and Berger, 1987; and Blomquist, Berger, and Hoehn, 1988) have tried to impute relative regional quality of life from relative real wages, assuming equilibrium in Rosen's sense.

Other scholars allow for the persistence of disequilibrium, at least in the short run, and use migration flows to measure the intensity of SOL differences. Tobler (1979), Constantine and Gower (1982), Greenwood, Hunt et al. (1991), and Mueser and Graves (1995), among others, use net migration flows to model attractiveness of a location. Feeney (1973), Mueser (1989), and Porell (1982), among others, use gross migration flows to indicate SOL differences. Ben-Akiva and Watanatada (1981) provide a choice-theoretic model of the individual's decision to migrate, showing how it fits into the framework of McFadden's multinomial logit model. Douglas (1997) discusses how to link this choice-theoretic model to aggregate data.

This paper builds upon Douglas and Wall (1993) and Douglas (1997), which argue that cross-migration rates provide the richest and most reliable source of data on the relative attractiveness of different locations. Douglas (1997) developed an appropriate measure, and estimated rankings of the U.S. states for 1980 and 1990. The patterns observed in these rankings suggest that the opportunity to increase income strongly affects migration, but Douglas (1997) stops short of applying regression techniques to measure the influence of income.

The central concept in the Douglas/Wall model is that the standard of living (SOL)[1] of a possible destination, relative to a person's current residence, is the prime determinant of the

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[1] We will use the term "Standard of Living" (SOL) to refer to the overall attractiveness of a location, including economic opportunity. The term "quality of life" (QOL) refers in this paper to the non-pecuniary aspect of the attractiveness of a location; technically, it is the component of SOL that is orthogonal to income.

probability that the person will move to that location. Thus, holding other things (such as the attractiveness of other locations) constant

$$[\text{SOL}_{\textit{Welsford, NB}} - \text{SOL}_{\textit{Joe Smith in NS}}] \propto \text{Pr}\{\text{Joe Smith in NS moves to Welsford, NB}\} \tag{1.1}$$

where "∝" means "is proportional to"; Joe Smith is an Nova Scotian, and Welsford is a town in New Brunswick.

Equation (1.1) is specific to Joe Smith's decision about moving to Welsford. Generalizing (1.1) so as to compare the overall standards of living in New Brunswick and Nova Scotia will require some assumptions about the relationship of Joe to other Nova Scotians, and of Welsford to the rest of New Brunswick. In the extreme, if Nova Scotia were full of Joe Smith clones and all New Brunswick locations were just like Welsford (and no other provinces existed) we would only need to watch Joe and see if he moves to New Brunswick. If he moves, then New Brunswick's SOL is sufficiently higher than Nova Scotia's to overcome Joe's inertia; if he doesn't, it isn't. Fortunately, we have aggregate data on migration between Nova Scotia and New Brunswick, so the empirical work will not depend on such a strong assumption about how typical Joe or Welsford is. Rather, the validity of the empirical work will depend on the existence of a universal, well-defined central tendency to human preferences, a general consensus that manifests in what we call "the" standard of living SOL. Equation (1.1) expresses the essential relationship between migration and relative SOL, and so we construct our aggregate measure of SOL from equation (1.1).

Construction of the aggregate measure follows the development in Douglas (1997). Assuming sufficient regularity of preferences and of pre-migration SOL among the residents of Nova Scotia, (and a sufficiently large population of Nova Scotia so that the law of large numbers applies), we can multiply the numerator and denominator of the right hand side of (1.1) by the number of Nova Scotians to obtain:

$$[\text{SOL}_{\textit{Welsford,NB}} - \text{SOL}_{NS}] \propto \frac{\text{\#Nova Scotians who move to Welsford, NB}}{\text{\#Nova Scotians}} \tag{1.2}$$

where "#" means "number of," and SOL_{NS} means the standard of living available to a typical resident of Nova Scotia. Assuming sufficient uniformity, or at least a well-defined central tendency, of alternative destination locations in New Brunswick (and a sufficiently large number of New Brunswick locations), we can multiply the numerator and denominator of the right hand side of (1.2) by the number of locations in New Brunswick to obtain

$$[\text{SOL}_{NB} - \text{SOL}_{NS}] \propto \frac{\text{\#Nova Scotians who move to NB}}{\text{\#Nova Scotians} \times \text{\# Locations in NB}}. \tag{1.3}$$

The number of locations available in New Brunswick is, in equilibrium, proportional to the population of New Brunswick (for an explanation of this point see Douglas 1997, Plane 1993, and Feeney 1973); therefore,

$$[\mathrm{SOL}_{NS} - \mathrm{SOL}_{NB}] \;\propto\; \frac{\text{\#Nova Scotians who move to NB}}{\text{\#Nova Scotians} \times \text{\#New Brunswickers}}, \qquad (1.4)$$

which is a fully observable measure. Furthermore, by symmetry

$$[\mathrm{SOL}_{NB} - \mathrm{SOL}_{NS}] \;\propto\; \frac{\text{\#New Brunswickers who move to NS}}{\text{\#Nova Scotians} \times \text{\#New Brunswickers}}. \qquad (2)$$

Because (1.4) and (2) independently express the same SOL differential, it seems reasonable to combine them. Furthermore, we can reduce or eliminate much of the noise contained in expressions (1.4) and (2) by looking at the net flow. Subtracting (2) from (1.4) and linearizing yields

$$[\mathrm{SOL}_{NS} - \mathrm{SOL}_{NB}] = K_{NB,NS}\frac{\text{\#New Brunswickers who move to NS} - \text{\#Nova Scotians who move to NB}}{\text{\#New Brunswickers} \times \text{\#Nova Scotians}} + R_{NB,NS}$$

where $K_{NB,NS}$ is a constant, and $R_{NB,NS}$ is a Taylor series remainder, attributable mostly to asymmetries in moving costs and sensitivity to SOL in alternative provinces (see Douglas 1997, appendix).

In general, therefore, the cross-migration measure

$$\hat{\mu}_{AB} \equiv \frac{\text{\#Migrants from A to B} - \text{\#Migrants from B to A}}{POP_A \times POP_B} \qquad (3)$$

can be calculated between any provinces A and B. Consequently,

$$\hat{\mu}_{AB} = [\mathrm{SOL}_B - \mathrm{SOL}_A - R_{AB}] / K_{AB},$$

yields a mathematical relationship between population flows and SOL difference. Ignoring R_{AB} as small and assuming K_{AB} to be constant across province-pairs,

$$\hat{\mu}_{AB} \approx \mathrm{SOL}_B - \mathrm{SOL}_A$$

which establishes the desired equivalence between relative SOL and the measurable $\hat{\mu}_{AB}$.

How much of the SOL difference, $\hat{\mu}_{AB}$, arises from differences in income, and how much arises from differences in QOL, (i.e., amenities uncorrelated with income)? Previous researchers have attempted to identify these two components of locational attractiveness using regression methods. Greenwood et al. (1991) used net migration data to estimate a regression of the form

$$\bar{\mu}_A = \lambda_A + \gamma \ln\left(\frac{Y_A}{\bar{Y}}\right) + \varepsilon$$

where $\bar{\mu}_A$ is the net in-migration to province A from all provinces as a percentage of A's population, $\bar{Y}$ is national average per capita income, and Y_A is per capita income for province A.[2] Many others have estimated similar regressions, with different versions of the dependent variable. Porell (1982), for example, added a long list of variables such as weather that measure the amenities offered by each locale, and calculated the income equivalent dollar value of each.

Unlike the dependent variable in these previous studies, the pairwise cross-migration measure $\hat{\mu}_{AB}$ is derived from explicit assumptions about the relationship between interprovincial migration flow and relative SOL. Given this methodological advance, we use the more refined measure $\hat{\mu}_{AB}$ to estimate a similar regression equation:

$$\hat{\mu}_{AB} = \lambda_B - \lambda_A + \gamma \ln\left(\frac{Y_B}{Y_A}\right) + \varepsilon \qquad (4)$$

where λ_A and λ_B are the QOL in provinces A and B. Given the estimated QOL vector $\hat{\lambda} \equiv [\hat{\lambda}_A, \hat{\lambda}_B, \ldots \hat{\lambda}_Z]'$ and the marginal utility of income $\hat{\gamma}$, we solve for the income vector $\boldsymbol{Y}^*$ that would equilibrate SOL across all provinces.

II. Data and Estimation

The data set consists of migration flows among the 10 Canadian provinces each year for twenty years, 1976-95, and per capita personal income for each province for each year. Migration data are from the Total Migration Series from Statistics Canada, as calculated from census figures and Family Allowance accounts. These data are evaluated by Vanderkamp and Grant (1988). The migration numbers are broken down into five age groups: 0-17 years of age, 18-24, 25-44, 45-64, and 65+. However, because results for the people less than 18 years old are essentially identical to those for their parents in the 25-44 age group, we do not report them here. Real per capita income is calculated from income and provincial price index data provided by Statistics Canada.[3] There is one observation per year per unique pair of provinces, for a total of $Tn(n\text{-}1)/2$=900 observations.

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2 The dependent variable in Greenwood et al. (1991) is equivalent to $\hat{\mu}_{AB}$ in (3), but with the cross-migration defined as between province A and a region called "everywhere else." It requires stronger regularity assumptions, such as global transitivity of province preferences and that all provinces are small so that "everywhere else" is the same for everyone, and it uses less sample information than the pairwise cross-migration measure $\hat{\mu}_{AB}$.

3 Hausman tests do not reject the null hypothesis that income is exogenous.

Each observation contains the net cross-migration flow $\hat{\mu}_{ABt}$ for year *t*, calculated according to equation (3) from the cross-flows between A and B and their populations. It also contains the relative incomes, and a set of 10 discrete variables d_{jt} where

$$d_{jt} = \begin{cases} 1 \text{ if } j{=}B \\ -1 \text{ if } j{=}A \\ 0 \text{ otherwise} \end{cases}$$

That is, d_{jt} is equal to –1 if the dependent variable $\hat{\mu}_{ABt}$ is the net *outflow* from province *j* to B, equal to 1 if $\hat{\mu}_{ABt}$ is the net *inflow* measure from province A to *j*, and zero if *j* is neither A nor B. (Note that each discrete variable d_{jt} is equal to one or minus one in (*n*-1) observations every year, and equal to zero for the other (*n*-1)(*n*-2)/2 observations for that year.) The coefficient of the discrete variable d_{jt} is therefore the fixed effect attributable to province *j*, and can be interpreted as the estimated relative QOL $\hat{\lambda}_j$ in province *j*.

It is probably unreasonable to expect relative QOL to be constant over the entire period 1976-95, so we allow the QOL coefficients λ_i to change periodically. We accomplish this by subdividing the twenty-year period into τ sub-periods, and estimating a different set of $\hat{\lambda}$'s for each sub-period. We ran regressions using τ = 1, 2, 4, 5, and 10 (all of which are divisors of 20, so as to use all observations). The value of τ determines how often $\hat{\lambda}$ changes, ranging from remaining constant (i.e., τ =1), to changing every 2 years (τ=10). Thus, the regression equation is

$$\hat{\mu}_{ABt} = \sum_{j=1}^{10} \sum_{s=1}^{\tau} \lambda_{js} d_{jst} + \gamma \ln\left(\frac{Y_{Bt}}{Y_{At}}\right) + \varepsilon_{ABt} \qquad (5)$$

To identify the coefficients and force them to center around zero, we impose τ independent restrictions

$$\sum_{j=1}^{10} \lambda_{js} = 0,$$

one for each period $s = 1, \ldots \tau$, and estimate using restricted least squares. The resulting set of 10τ quality-of-life estimates $\hat{\lambda}_{js}$, can be interpreted as the deviation, during period *s*, of the QOL in province *j* from the national average.

To choose a value of τ, we used the Akaike Information Criterion and Amemiya's Prediction Criterion, since allowing λ to vary more often through time is tantamount to adding time dummy variables. Tests based on these criteria in general indicate that perceived relative QOL in Canadian provinces is quite volatile for younger groups, and becomes markedly less so as the population ages. Specifically, for age groups 0-17, 18-24, and 25-44 the criteria favor the model in which QOL stays constant for 2-year blocks (τ=10), though the 5-year block model (τ = 4) fares nearly as well. For older groups, however, the 2-year change model (τ=10) performs the worst, which indicates more stable preferences for those over 45. Migration patterns of 45-64 year olds indicate constant relative QOL for 4-year or 5-year blocks, while 5-year and 10-year blocks provide the best fit for the oldest group (age 65+). Because 5-year blocks (τ = 4) perform well across age groups, for uniformity the empirical results reported below concentrate on model (5) with τ=4, with some reference to other results where pertinent.

Using equation (5), the predicted standard of living in province A in year *t* (which falls within time block *s*), relative to the mean SOL for all provinces in time block *s*, is

$$\text{SOL}_{At} - \overline{\text{SOL}}_s = \hat{\lambda}_{As} + \hat{\gamma}\ln\left(\frac{Y_{At}}{\overline{Y}_t}\right) \qquad (6)$$

To obtain the compensating differential for province *A* relative to the national average in year *t*, set the left-hand-side of (6) equal to zero and solve for relative income

$$\text{RY}^*_{At} = \ln(Y_{At}/\overline{Y}_t)^* = -\hat{\lambda}_{As}/\hat{\gamma}; \qquad (7)$$

which is province A's compensating differential in terms of percentage difference from the average.[4] By the same token, the "actual differential" income measure

$$\text{RY}_{At} = \ln(Y_{At}/\overline{Y}_t) \qquad (8)$$

is the percentage difference of province A's actual per capita income from the national average. A necessary condition for equilibrium is that the compensating differential equal the actual differential, RY* = RY for all provinces.

III. Empirical Results

The coefficient estimates from estimation of equation (5), and the associated compensating differentials calculated from those estimates, appear in tables 1a and 1b. Note that the income coefficient $\hat{\gamma}$ (restricted to remain constant throughout the full 20-year time period), appears at the bottom of the column below the QOL estimates $\hat{\lambda}$. A positive $\hat{\lambda}_{is}$ indicates that the utility-value of province *i*'s amenities (i.e., its QOL) in period *s* exceeds the national average (normalized to zero); a negative $\hat{\lambda}_{is}$ indicates below-average QOL. The *t* statistics in the second column indicate whether or not the difference is statistically significant. The third column of Table 1 contains the

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[4] Using the approximation $\Delta\ln(x) \approx \%\Delta x$.

actual differential RY calculated from equation (8). The compensating differential RY* calculated from equation (7) appears in the fourth column, and the fifth column contains its standard error calculated from a linearization of equation (7).

Tables 1a and 1b show that the influence of per capita income on perceived SOL, $\hat{\gamma}$, is positive and significant for all working-age groups. However, there is a marked variation over the life cycle. Most dramatically, $\hat{\gamma}$ declines monotonically with age, remaining positive and significant but declining in value to zero for the over-65 age group. This makes sense, as retirees generally acquire most of their income from savings, and hence their standard of living does not depend on the general income level within a province. It also suggests that the value of $\hat{\gamma}$ is determined principally by earned money income, rather than the effect of missing variables that are positively correlated with income, such as provincial and municipal parks, landscaping programs, sewer systems, highways. As the importance of provincial income in the individual's utility function declines to zero, the very concept of compensating differential becomes poorly defined, which explains the enormous std(RY*) for retirees.

Tables 1a and 1b also indicate that as the explanatory power of income declines with age, so does the overall explanatory power of the regression, as R^2 declines from a respectable .36 for 18-24 year olds to .15 for retirees. A high R^2 means that migration decisions are well explained by fixed amenity differences among the provinces and economic opportunity; conversely, a low R^2 indicates that migration is driven primarily by individual-specific factors such as family and job tenure. It makes sense that R^2 should decline with increasing age, since individual-specific factors intensify through the life-cycle as people accumulate location-specific human capital in family, job, and community relationships over time.

As mentioned above, much of the SOL literature has started with the assumption that the system of regions is continuously in equilibrium in Rosen's sense. Other authors have assumed that the system is usually out of equilibrium. (The validity of the estimators that we use in this paper depends on the assumption that the system is near, but not quite at, equilibrium.) There are few tests in the literature, however, for the validity of this assumption. Douglas (1997) derived two tests for the existence of equilibrium based on rank correlation statistics, finding that the U.S. was substantially out of equilibrium during the period 1975-80.

We use a slightly different approach in this paper. Equilibrium in Rosen's sense occurs only if each province's actual income differential RY equals its compensating differential RY*. Disequilibrium might occur when an economic, amenity, or preference shock occurs in the presence of migrational impediments or friction. There are many sources of friction in the migration system, including moving costs, poor information flows about opportunities, and location-specific human capital such as friendships, knowledge about school systems, business relationships, and so on. The more friction, the farther the system may stray from equilibrium and the lower the correlation between RY and RY*.

The cross-sectional sample correlation coefficient between RY and RY*, reported in table 2, measures the extent to which equilibrium in Rosen's sense exists at different times and for the different age groups. Correlations are generally high, which supports the assumption that the system is near equilibrium throughout the period and across age groups. The relatively low correlations shown for 1975-80 in table 2, however, suggest that the disequilibrium in the U.S. observed by Douglas (1997) during that period of high energy prices, economic dislocation, and inflation, affected Canada as well.

Presumably younger people have accumulated the least migrational friction, so one might expect the highest correlation between RY and RY* to appear in this age group. This expectation is supported by the high correlations shown in table 2 for young adults, age 25-44. On the other hand, the 18-24 age group's correlations are quite volatile, perhaps because many in this age bracket are in school, many have not yet settled in earnest into the pursuit of income, and the distinct youth culture may give rise to its own set of rapidly changing preference criteria for QOL. The 45-64 age bracket, entrenched in the community and heavily encumbered (or fortified, depending on how you look at it) with location-specific human capital, shows lower correlations and hence greater evidence of disequilibrium. The elderly appear to be the farthest from equilibrium, again probably because the average income level does not affect them much.

Table 3 explores the question of equilibrium from another angle, summarizing the outcome of t tests on the null hypothesis H_0: RY = RY*, which is a necessary condition for equilibrium. These tests used the standard error and relative income data from table 1a and 1b, at a 5% significance level. Table 4 addresses the same issue in more detail, showing which provinces accepted and rejected the null in the columns labeled *Y-Y**. In these columns, a negative one indicates insufficient income ($RY<RY^*$), a positive one indicates more than sufficient income ($RY>RY^*$), and a zero indicates the null was not rejected ($RY=RY^*$). (Note that the null was never rejected for the 65+ age group, not because they were necessarily in equilibrium, but because that age group's low value of $\hat{\gamma}$ rendered the compensating differential estimates meaningless, and inflated the standard error estimates.) Columns in table 4 labeled $\hat{\lambda}$ indicate whether or not amenities differed from the national average (based on a t test of H_0: λ=0), and columns labeled Y-$\bar{Y}$ indicate whether or not income exceeded the average.

Consistent with the previous observations, tables 3 and 4 indicate that the system was farthest from equilibrium in 1976-80, when H_0 was rejected for all but three provinces for the 18-24 and 25-44 age groups, and all but four provinces for 45-64 year olds. In most of these cases, actual income is lower than the equilibrium level (RY<RY*), but in two cases (BC and ALB) actual income was in fact higher. In those years, in fact, Alberta boasted above average levels of both income and QOL for 18-44 year olds, and British Columbia offered the same pair of advantages to those 45 years of age and over. By 1985, however, the system was nearer to equilibrium, with RY=RY* for seven or eight provinces for each age bracket.

In general, in tables 3 and 4 the 18-24 year old group rejects the null most often, while the 25-44's have the fewest rejections, and hence appear to have been nearest equilibrium of the age cohorts. There are relatively few cases in which the overall SOL is significantly above average, RY>RY*, but British Columbia is consistently above average, and Nova Scotia and Alberta are also quite good. Of these, Nova Scotia is especially impressive because it achieves high levels of SOL in spite of a relatively low income level. British Columbia's high SOL, on the other hand, appears to be the result of a high income level rather than a high QOL.

Table 5 highlights QOL comparisons among the provinces by ranking them according to their estimated QOL $\hat{\lambda}$ from table 1. Although the rankings are generally inconsistent from period to period, Prince Edward Island (PEI) and Nova Scotia (NS) are generally perceived as high-amenity locations, whereas Quebec (QUE) and especially Ontario (ONT) consistently rank at or near the bottom. The table also highlights a generation gap in QOL, as the oldest age group's perception of relative QOL diverges sharply from the mainstream. The retirees rank British Columbia, Alberta, and Nova Scotia very highly, while ranking the central provinces of Manitoba and especially Saskatchewan very low, although they like Ontario better than the other cohorts do. The 18-24 age group sends Alberta (ALB) from the top of the ranking in the late seventies to the bottom in the early eighties, while the 65+ group improved its perception of Alberta from middle to high-ranking over the same period.

The generation gap is much smaller (or at least the eldest group is no longer a consistent outlier) in table 6, which ranks provinces according to the standard of living, SOL. In general, the SOL rankings of all groups are similar to the elders' QOL rankings. (This result may indicate that a lack of good income data for the elderly, rather than a lack of responsiveness to income-correlated amenities, is the reason for explains the low $\hat{\gamma}$ for the 65+ group.) Except for a lapse among the younger cohorts in 1981-5, British Columbia ranks the best across age groups and time periods, although Nova Scotia also consistently ranks well. Alberta also has a high perceived SOL, especially among the youngest and oldest cohorts. Low income levels reduce the SOL rankings of the maritime provinces (other than Nova Scotia) below their QOL rankings. Newfoundland's position at the very bottom of the SOL rankings is challenged only by the central plains provinces of Saskatchewan and Manitoba.

IV. Summary and Conclusions

The standard of living varies across regions because the levels of income and amenities varies. As utility-maximizing agents optimally locate, incomes adjust and standards of living equalize, but not without friction. In equilibrium, all regions have the same standard of living, which means that in equilibrium the inverse of a region's relative income measures the relative value of amenities accurately. However, because incomes, amenities, and preferences change, and frictions prevent standard-of-living equivalence from occurring at every point in time, actual relative income is often not an accurate indicator of amenity levels.

This paper discusses the design of a regression to identify the income and amenity (QOL) components of the standard of living (SOL). We conclude that the best measure of relative SOL levels is the net cross-migration flow rate between pairs of provinces $\hat{\mu}_{AB}$, and therefore advocate its use as the dependent variable in the regression. Following the theory developed in Douglas and Wall (1993) and Douglas (1997), we argue that the numerator of this regressand should be the net flow of migrants between the two regions, while its denominator should be the product of their populations.

Finally, using the cross-migration specification on data for Canadian interprovincial migration from 1976 to 1995, we estimate amenity levels and compensating differentials for Canadian provinces in four five-year periods, separately for each of four age groups. These results generally accord well with common sense and expectations. We also use the model to rank the amenities and the overall standard of living of the provinces, finding consistently high living standards (SOL) in British Columbia, Alberta, and Nova Scotia, while the highest consistent amenity (QOL) levels are observed in the maritime provinces.

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Table 1a: Regression Coefficients ($\hat{\lambda}, \hat{\gamma}$), Relative Income (RY = ln(Y - $\bar{Y}$)), and Compensating Differential (RY* = ln(Y^* - $\bar{Y}$))

	<u>**Age 18-24**</u>					<u>**Age 25-44**</u>				
	Coeff	***t***	***RY***	***RY****	***Std***	***Coeff***	***t***	***RY***	***RY****	***Std***
1976-80 $\hat{\lambda}$										
ALB	0.101	5.18	15.1%	-20.5%	7.6%	0.016	3.41	15.1%	-12.7%	5.8%
BC	-0.069	-2.90	20.0%	13.9%	2.7%	-0.010	-1.72	20.0%	7.8%	3.3%
MAN	-0.041	-3.65	-0.9%	8.3%	2.7%	-0.023	-8.40	-0.9%	18.0%	3.8%
NB	0.057	2.74	-19.5%	-11.5%	2.6%	0.012	2.47	-19.5%	-9.7%	2.6%
NFLD	0.070	2.64	-26.2%	-14.1%	3.1%	0.020	3.18	-26.2%	-15.9%	2.7%
NS	0.049	2.94	-14.2%	-9.9%	2.3%	0.016	3.89	-14.2%	-12.3%	2.1%
ONT	-0.144	-5.24	24.1%	29.1%	2.4%	-0.042	-6.32	24.1%	33.0%	2.5%
PEI	0.067	2.68	-24.4%	-13.5%	2.9%	0.030	4.99	-24.4%	-23.6%	2.1%
QUE	-0.077	-4.53	11.4%	15.5%	2.3%	-0.023	-5.57	11.4%	18.0%	2.3%
SASK	-0.013	-1.16	-1.2%	2.6%	2.3%	0.003	1.14	-1.2%	-2.4%	2.2%
1981-85 $\hat{\lambda}$										
ALB	-0.096	-4.13	19.5%	19.4%	2.3%	-0.037	-6.60	19.5%	29.1%	2.6%
BC	-0.084	-4.25	15.4%	17.1%	2.3%	-0.021	-4.42	15.4%	16.7%	2.1%
MAN	-0.021	-1.72	3.1%	4.2%	2.3%	-0.005	-1.87	3.1%	4.3%	2.1%
NB	0.069	3.66	-16.8%	-13.9%	2.3%	0.025	5.47	-16.8%	-19.5%	2.3%
NFLD	0.115	3.93	-29.3%	-23.3%	2.4%	0.028	3.93	-29.3%	-21.9%	2.4%
NS	0.083	5.94	-10.0%	-16.9%	2.8%	0.017	4.94	-10.0%	-13.2%	2.3%
ONT	-0.092	-3.89	20.0%	18.6%	2.3%	-0.023	-3.98	20.0%	17.9%	2.2%
PEI	0.084	3.48	-23.3%	-17.0%	2.5%	0.031	5.34	-23.3%	-24.4%	2.2%
QUE	-0.045	-3.28	6.4%	9.0%	2.3%	-0.011	-3.50	6.4%	9.0%	2.2%
SASK	-0.014	-1.17	1.1%	2.7%	2.3%	-0.003	-0.93	1.1%	2.0%	2.1%
1986-90 $\hat{\lambda}$										
ALB	-0.022	-1.23	13.2%	4.4%	3.0%	-0.017	-3.97	13.2%	13.4%	2.1%
BC	-0.017	-0.98	12.4%	3.4%	3.0%	-0.001	-0.28	12.4%	0.9%	3.1%
MAN	-0.019	-1.71	0.5%	3.9%	2.3%	-0.007	-2.65	0.5%	5.7%	2.3%
NB	0.061	3.69	-13.2%	-12.3%	2.3%	0.018	4.49	-13.2%	-14.0%	2.2%
NFLD	0.057	2.54	-20.4%	-11.4%	2.8%	0.021	3.86	-20.4%	-16.3%	2.2%
NS	0.067	5.31	-6.9%	-13.6%	2.7%	0.013	4.24	-6.9%	-10.2%	2.3%
ONT	-0.080	-3.33	20.8%	16.1%	2.5%	-0.024	-4.18	20.8%	19.0%	2.2%
PEI	0.032	1.82	-14.7%	-6.5%	2.7%	0.017	4.10	-14.7%	-13.7%	2.1%
QUE	-0.037	-2.82	6.3%	7.6%	2.3%	-0.009	-2.90	6.3%	7.3%	2.1%
SASK	-0.042	-3.33	-6.5%	8.5%	3.6%	-0.010	-3.36	-6.5%	8.0%	3.3%
1991-95 $\hat{\lambda}$										
ALB	0.033	1.92	12.5%	-6.6%	4.5%	-0.012	-3.00	12.5%	9.7%	2.2%
BC	0.027	1.55	13.4%	-5.5%	4.5%	-0.004	-1.04	13.4%	3.5%	2.9%
MAN	-0.021	-1.87	-1.0%	4.3%	2.5%	-0.003	-1.27	-1.0%	2.7%	2.2%
NB	0.026	1.86	-9.5%	-5.3%	2.4%	0.011	3.11	-9.5%	-8.4%	2.1%
NFLD	-0.053	-2.66	-17.6%	10.7%	5.9%	0.007	1.52	-17.6%	-5.8%	3.0%
NS	0.052	4.22	-5.5%	-10.4%	2.5%	0.005	1.57	-5.5%	-3.7%	2.2%
ONT	-0.077	-3.67	17.7%	15.6%	2.3%	-0.025	-4.87	17.7%	19.5%	2.2%
PEI	0.044	3.06	-10.0%	-9.0%	2.3%	0.022	6.37	-10.0%	-17.6%	2.6%
QUE	-0.021	-1.80	3.0%	4.3%	2.3%	-0.005	-1.91	3.0%	4.3%	2.1%
SASK	-0.010	-0.70	-9.2%	2.0%	3.1%	0.005	1.61	-9.2%	-4.3%	2.3%
Income $\hat{\gamma}$	0.495	5.09				0.128	5.41			
R^2	0.356		$\bar{R}^2$	0.329		R^2	0.333	$\bar{R}^2$	0.305	

Table 1b: Regression Coefficients ($\hat{\lambda},\hat{\gamma}$), Relative Income (RY = ln(Y - $\bar{Y}$)), and Compensating Differential (RY* = ln(Y^* - $\bar{Y}$))

	Age 45-64					Age 65+				
	Coeff	***t***	***RY***	***RY****	***Std***	***Coeff***	***t***	***RY***	***RY****	***Std***
1976-80 $\hat{\lambda}$										
ALB	-0.001	-0.238	15.1%	1.6%	6.5%	0.003	0.43	15.1%	49.5%	199%
BC	0.009	1.967	20.0%	-16.5%	13.6%	0.036	3.94	20.0%	546.6%	2981%
MAN	-0.010	-4.611	-0.9%	18.4%	7.2%	-0.003	-0.61	-0.9%	-40.1%	241%
NB	0.008	2.052	-19.5%	-15.0%	4.1%	0.009	1.13	-19.5%	136.7%	879%
NFLD	0.004	0.729	-26.2%	-6.8%	7.3%	-0.019	-1.86	-26.2%	-286.4%	1487%
NS	0.011	3.497	-14.2%	-20.6%	4.8%	0.022	3.54	-14.2%	344.9%	2030%
ONT	-0.019	-3.544	24.1%	34.3%	4.9%	0.010	0.94	24.1%	150.8%	713%
PEI	0.016	3.370	-24.4%	-29.6%	4.6%	-0.026	-2.71	-24.4%	-394.5%	2110%
QUE	-0.014	-4.383	11.4%	26.2%	6.0%	-0.013	-1.98	11.4%	-195.5%	1185%
SASK	-0.004	-1.985	-1.2%	7.9%	4.7%	-0.020	-4.74	-1.2%	-312.0%	1774%
1981-85 $\hat{\lambda}$										
ALB	-0.016	-3.506	19.5%	28.7%	4.8%	0.008	0.93	19.5%	126.1%	601%
BC	0.000	-0.107	15.4%	0.8%	6.8%	0.014	1.88	15.4%	218.1%	1144%
MAN	-0.005	-2.099	3.1%	8.9%	4.3%	-0.001	-0.12	3.1%	-8.1%	97%
NB	0.008	2.300	-16.8%	-15.2%	4.0%	0.005	0.74	-16.8%	81.1%	552%
NFLD	0.008	1.437	-29.3%	-14.9%	6.0%	-0.019	-1.69	-29.3%	-289.8%	1488%
NS	0.014	5.032	-10.0%	-24.9%	6.9%	0.008	1.53	-10.0%	125.1%	762%
ONT	-0.012	-2.658	20.0%	22.2%	4.0%	0.005	0.59	20.0%	81.5%	347%
PEI	0.013	2.842	-23.3%	-24.1%	4.0%	-0.006	-0.63	-23.3%	-88.5%	384%
QUE	-0.007	-2.774	6.4%	13.3%	4.4%	-0.005	-0.98	6.4%	-78.0%	491%
SASK	-0.003	-1.300	1.1%	5.3%	4.1%	-0.011	-2.49	1.1%	-167.5%	967%
1986-90 $\hat{\lambda}$										
ALB	-0.010	-2.761	13.2%	17.3%	4.1%	0.013	1.95	13.2%	202.0%	1069%
BC	0.013	3.805	12.4%	-23.0%	13.0%	0.016	2.48	12.4%	247.8%	1332%
MAN	-0.008	-3.696	0.5%	14.8%	6.1%	-0.007	-1.69	0.5%	-112.0%	647%
NB	0.007	2.248	-13.2%	-13.0%	4.0%	0.000	0.02	-13.2%	1.6%	103%
NFLD	0.003	0.644	-20.4%	-5.1%	6.4%	-0.011	-1.30	-20.4%	-169.5%	852%
NS	0.009	3.451	-6.9%	-15.5%	5.1%	0.005	0.98	-6.9%	72.6%	451%
ONT	-0.014	-3.109	20.8%	26.2%	4.3%	0.000	-0.05	20.8%	-7.1%	176%
PEI	0.012	3.615	-14.7%	-22.4%	4.9%	-0.001	-0.09	-14.7%	-9.0%	72%
QUE	-0.006	-2.143	6.3%	10.0%	4.1%	-0.002	-0.48	6.3%	-37.1%	260%
SASK	-0.006	-2.410	-6.5%	10.7%	6.9%	-0.012	-2.59	-6.5%	-189.3%	1044%
1991-95 $\hat{\lambda}$										
ALB	-0.006	-1.844	12.5%	11.1%	4.0%	0.015	2.27	12.5%	225.6%	1208%
BC	0.003	0.913	13.4%	-5.7%	7.8%	0.005	0.81	13.4%	83.6%	400%
MAN	-0.005	-2.253	-1.0%	9.0%	5.1%	-0.005	-1.12	-1.0%	-74.0%	423%
NB	0.004	1.319	-9.5%	-6.6%	4.1%	-0.001	-0.27	-9.5%	-22.2%	100%
NFLD	0.000	0.054	-17.6%	-0.4%	6.9%	-0.005	-0.69	-17.6%	-80.0%	364%
NS	0.004	1.773	-5.5%	-7.7%	4.1%	0.002	0.49	-5.5%	35.3%	238%
ONT	-0.014	-3.526	17.7%	26.2%	4.8%	0.000	0.02	17.7%	2.5%	111%
PEI	0.019	6.569	-10.0%	-33.6%	9.2%	0.001	0.11	-10.0%	9.7%	127%
QUE	-0.004	-1.644	3.0%	6.9%	4.1%	-0.002	-0.50	3.0%	-34.2%	225%
SASK	0.000	-0.180	-9.2%	0.9%	5.1%	-0.010	-1.79	-9.2%	-146.4%	785%
Income $\hat{\gamma}$	0.055	2.917				-0.007	-0.18			
R^2	0.276		$\bar{R}^2$	0.245		R^2	0.149	$\bar{R}^2$	0.114	

Table 2: Sample Correlations among RY, RY*				
Year\Age	***18-24***	***25-44***	***45-64***	***65+***
1976-80	.690	.745	.631	.447
1981-85	.979	.975	.868	.590
1986-90	.803	.876	.544	.542
1991-95	.128	.853	.584	.606

Table 3**: Actual Differential (R*Y*) vs. Compensating Differential (RY*)**

(Number of Provinces with the specified outcome of t-test on H_0:RY=RY, α =.05, 2-tailed.)*

	Reject in favor of		***Accept***
	RY>RY*	***RY < RY****	***RY = RY****
1976-80			
Age 18-24	2	5	3
25-44	2	5	3
45-64	2	4	4
1981-85			
Age 18-24	1	2	7
25-44	0	2	8
45-64	2	1	7
1986-90			
Age 18-24	3	3	4
25-44	1	2	7
45-64	1	3	6
1991-95			
Age 18-24	2	3	5
25-44	2	2	6
45-64	2	2	6

Table 4: Relationship Among Actual Income (Y), National Average Income ($\bar{Y}$), Amenities ($\hat{\lambda}$), and Equilibrium Income (Y^*)

Outcome of 2-tailed t-test on the null hypothesis that the expression equals zero. Significance level is □=.05.
("1" means reject in favor of >0; "-1" reject in favor of <0; "0"means do not reject .)

AGE		***18-24***		***25-44***		***45-64***		***65+***				***18-24***		***25-44***		***45-64***		***65+***		
H_0:	***$Y-\bar{Y}$***	$\hat{\lambda}$	***$Y-Y^*$***	$\hat{\lambda}$	***$Y-Y^*$***	$\hat{\lambda}$	***$Y-Y^*$***	$\hat{\lambda}$	***$Y-Y^*$***		***$Y-\bar{Y}$***	$\hat{\lambda}$	***$Y-Y^*$***	$\hat{\lambda}$	***$Y-Y^*$***	$\hat{\lambda}$	***$Y-Y^*$***	$\hat{\lambda}$	***$Y-Y^*$***	
1976-80										**1981-85**										
ALB	1	1	1	1	1	0	1	0	0		1	-1	0	-1	-1	-1	0	0	0	ALB
BC	1	-1	1	0	1	1	1	1	0		1	-1	0	-1	0	0	1	0	0	BC
MAN	-1	-1	-1	-1	-1	-1	-1	0	0		1	0	0	0	0	-1	0	0	0	MAN
NB	-1	1	-1	1	-1	1	0	0	0		-1	1	0	1	0	1	0	0	0	NB
NFLD	-1	1	-1	1	-1	0	-1	0	0		-1	1	-1	1	-1	0	-1	0	0	NFLD
NS	-1	1	0	1	0	1	0	1	0		-1	1	1	1	0	1	1	0	0	NS
ONT	1	-1	-1	-1	-1	-1	-1	0	0		1	-1	0	-1	0	-1	0	0	0	ONT
PEI	-1	1	-1	1	0	1	0	-1	0		-1	1	-1	1	0	1	0	0	0	PEI
QUE	1	-1	0	-1	-1	-1	-1	-1	0		1	-1	0	-1	0	-1	0	0	0	QUE
SASK	-1	0	0	0	0	-1	0	-1	0		1	0	0	0	0	0	0	-1	0	SASK
1986-90										**1991-95**										
ALB	1	0	1	-1	0	-1	0	0	0		1	0	1	-1	0	0	0	1	0	ALB
BC	1	0	1	0	1	1	1	1	0		1	0	1	0	1	0	1	0	0	BC
MAN	1	0	0	-1	-1	-1	-1	0	0		-1	0	-1	0	0	-1	0	0	0	MAN
NB	-1	1	0	1	0	1	0	0	0		-1	0	0	1	0	0	0	0	0	NB
NFLD	-1	1	-1	1	0	0	-1	0	0		-1	-1	-1	0	-1	0	-1	0	0	NFLD
NS	-1	1	1	1	0	1	0	0	0		-1	1	0	0	0	0	0	0	0	NS
ONT	1	-1	0	-1	0	-1	0	0	0		1	-1	0	-1	0	-1	0	0	0	ONT
PEI	-1	0	-1	1	0	1	0	0	0		-1	1	0	1	1	1	1	0	0	PEI
QUE	1	-1	0	-1	0	-1	0	0	0		1	0	0	0	0	0	0	0	0	QUE
SASK	-1	-1	-1	-1	-1	-1	-1	-1	0		-1	0	-1	0	-1	0	-1	0	0	SASK

Table 5: Ranking by Amenity Value (QOL, $\hat{\lambda}$)

Age	***18-24***	***25-44***	***45-64***	***65+***		***Age***	***18-24***	***25-44***	***45-64***	***65+***
1976-80						**1981-85**				
ALB	1	3	6	5		ALB	10	10	10	2
BC	8	7	3	1		BC	8	8	5	1
MAN	7	9	8	6		MAN	6	6	7	6
NB	4	5	4	4		NB	4	3	3	5
NFLD	2	2	5	8		NFLD	1	2	4	10
NS	5	4	2	2		NS	3	4	1	3
ONT	10	10	10	3		ONT	9	9	9	4
PEI	3	1	1	10		PEI	2	1	2	8
QUE	9	8	9	7		QUE	7	7	8	7
SASK	6	6	7	9		SASK	5	5	6	9
1986-90						**1991-95**				
ALB	7	9	9	2		ALB	3	9	9	1
BC	5	5	1	1		BC	4	7	4	2
MAN	6	6	8	8		MAN	7	6	8	8
NB	2	2	4	4		NB	5	2	3	6
NFLD	3	1	5	9		NFLD	9	3	5	9
NS	1	4	3	3		NS	1	5	2	3
ONT	10	10	10	5		ONT	10	10	10	5
PEI	4	3	2	6		PEI	2	1	1	4
QUE	8	7	6	7		QUE	8	8	7	7
SASK	9	8	7	10		SASK	6	4	6	10

Table 6: Ranking by Overall Standard of Living (SOL = $\hat{\lambda} + \hat{\gamma}RY$)

Age	***18-24***	***25-44***	***45-64***	***65+***		***Age***	***18-24***	***25-44***	***45-64***	***65+***
1976-80						**1981-85**				
ALB	1	1	2	5		ALB	3	10	9	3
BC	2	2	1	1		BC	6	7	2	1
MAN	8	10	9	6		MAN	4	6	7	6
NB	7	8	5	3		NB	8	2	4	4
NFLD	10	9	10	8		NFLD	9	9	10	10
NS	5	5	3	2		NS	1	1	1	2
ONT	6	7	7	4		ONT	2	3	5	5
PEI	9	4	4	10		PEI	10	4	3	7
QUE	4	6	8	7		QUE	7	8	8	8
SASK	3	3	6	9		SASK	5	5	6	9
1986-90						**1991-95**				
ALB	2	5	6	2		ALB	1	3	4	1
BC	1	1	1	1		BC	2	1	2	2
MAN	7	9	8	8		MAN	8	8	8	9
NB	5	4	4	4		NB	7	4	5	5
NFLD	9	8	9	9		NFLD	10	10	10	8
NS	3	2	2	3		NS	3	7	3	3
ONT	4	3	7	6		ONT	4	6	7	6
PEI	8	7	3	5		PEI	5	2	1	4
QUE	6	6	5	7		QUE	6	5	6	7
SASK	10	10	10	10		SASK	9	9	9	10