Inter-Metropolitan Migration and Life Satisfaction in Canada

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TABLE OF CONTENTS

1 Introduction

In recent years, with increased interest in sustainable development and dissatisfaction with GDP as a measure of progress, subjective well-being has become a topic of growing importance for both economists and policy-makers. Examples include the 2009 report of the Stiglitz-Sen-Fitoussi Commission recommending increased use of subjective well-being as a measure of development to the Sarkhosy government of France.

Although a substantial literature now exists on the individual determinants of subjective well-being, and on the comparison of international aggregates (Bonikowska et al 2013, Di Tella et al 2003, Easterlin 1974, 2001), comparatively little research exists on the geographic distribution of subjective well-being within countries. The existing literature, however, does indicate that significant differences exist across cities and regions (Barrington-Leigh 2013, Florida et al. 2013, Morrison 2007, 2011, Okulicz-Kozaryn 2011). These differences have also been found to be spatially correlated and persist after controlling for income and other covariates (Oswald and Wu 2011, Pierewan and Tampubolon 2014).

To date, however, there has been little research on how individuals respond to this geographic heterogeneity in levels of subjective well-being. Although standard theories of migration are based on the maximization of expected utility over different potential locations, it is only possible to estimate these relationships indirectly using observable proxies, most notably expected income. Inasmuch as different locations may affect utility through a variety of difficult-to-measure avenues such as culture, public health, and urban form, and inasmuch as these differences are captured by the differences in average life satisfaction which are observed between different cities and regions, this new subjective data could be expected to help explain domestic migration patterns.

To this end, mean life satisfaction from Canada's thirty-three census metropolitan areas, collected from the Canadian Community Health Survey's cycle 3.1 are combined in this study with economic and demographic data from Statistics Canada's 2006 Census of Population. Building, in particular, on previous research on the role of amenities in domestic migration, both equilibrium and disequilibrium models are estimated in this paper, in order to examine the degree to which differences in local life satisfaction levels influence the relocation decisions of Canadians. Regression results provide strong evidence that movers prefer destinations with higher average life satisfaction. However, this relationship is seen to weaken when the first-differences in average incomes and unemployment rates are included in equilibrium model specifications.

The remainder of this paper will be laid out as follows. Section 2 provides an overview of the relevant literatures. First an overview of the literature on domestic migration will be provided, with particular focus on the differences between disequilibrium and equilibrium models, the role of amenities, and the Canadian context. Subsequently, background will be provided on the more recent economics literature on subjective well-being, with the aim of demonstrating the legitimacy of subjective measures of life satisfaction, as well as their relationships with incomes and other economic variables both at the individual and aggregate levels. In Section 3, the empirical framework will be explained, starting with the McFadden's (1974) conditional logit, and subsequently the Dirichlet-multinomial regression, which extends McFadden's (1974) model to deal with over-dispersion in grouped data. Subsequently, several empirical specifications will be motivated, which will allow for the interaction of subjective measures of well-being with more conventional models. The sources and definition of the variables to be used will be detailed in Section 4. In Section 5, the results of including mean life satisfaction in both disequilibrium and equilibrium inter-metropolitan migration models will be compared. Finally, implications for the role of life satisfaction in inter-metropolitan migration will be discussed briefly in Section 7, before concluding.

2 BACKGROUND

2.1 MIGRATION IN THE CONTEXT OF HUMAN CAPITAL DISEQUILIBRIUM

Early theoretical work on migration largely focused on the problem of human capital disequilibrium (Roy 1951; Sjaastad 1962). In the classic Roy model, individuals are initially distributed identically across regions in terms of unobserved levels of skill and subsequently sort themselves into new regions in accordance with the different levels of returns to skill that they offer. Sjaastad (1962) provides one of the first in-depth analyses of the costs and benefits of migration in which migration is treated as an investment in human capital for which the return is a discounted stream of benefits associated with higher expected income which is weighed against a variety of monetary and psychic up-front costs. In his model, non-monetary benefits of migration are ignored since under perfect competition and resource mobility any such preferences (e.g., for warmer climates) would be captured in factor rents (e.g., land prices). As such, he argues that they should not be seen as influencing wages. This view allows the investigator to ignore such amenities, as seems to have been standard in early empirical studies (Courchene 1970; Foot and Milne 1989; Greenwood 1985; Vanderkamp 1971, 1989).

Early empirical work on migration in Canada in the 1970's followed Sjaastad's (1962) disequilibrium approach in the context of regional adjustment (Courchene 1970; Vanderkamp 1971). Courchene (1970) provides a benchmark study for this period using data from the 1961 Canadian Census of Population. In it, he uses OLS regression to determine the effects of differential levels of income, education, unemployment, and government transfers as well as the distances between different provinces to explain gross migration rates[1,2]. Resulting regression coefficients are statistically significant and intuitive within the context of an equilibrating response to regional differences in earnings potential. Remarkably, this straightforward approach was able to explain ninety percent of the variation in total migration rates from 1956 to 1961. Notably, Courchene (1970) also disaggregates his regressions into age groupings, finding that older individuals were significantly less responsive to income differentials[3].

Vanderkamp (1971) offers another analysis of gross flows between provinces[4], this time using annual Family Allowance Transfers over the period of 1947 to 1966 from the Canadian Department of National Health and Welfare. Unlike Courchene (1970), income levels in both sending and receiving locations are included separately, arguing that although income differentials provide the draw, higher levels in sending locations also provide the means. This contention is borne out in his results, with both receiving significantly positive coefficients, but with a larger magnitude for sending than receiving locations. Notably, Vanderkamp (1971) performs his regressions separately for every year in his sample, finding that the elasticity of migration to income is higher in periods of low unemployment, thus cautioning against putting too much store in compensating differentials estimated from any particular cross-section. Vanderkamp (1971) also

[1] Gross migration rates are defined as the ratio of the gross number of members of the labour force who migrate from one province to the other to the total labour force in the sending province at the start of the period.
[2] Arguing, in line with Sjaastad (1962), that gross flows provide richer information than net flows which can mask large bilateral population movements.
[3] Although Courchene (1970) argues this is likely due to increased costs of migration for the elderly, this will be seen in later literature as a move toward valuing amenities over business opportunities in/near retirement (Brown and Scott 2012; Chen and Rosenthal 2008; Graves and Linneman 1979; Greenwood and Hunt 1989; Mueser and Graves 1995).
[4] Vanderkamp (1971), however, groups the provinces of New Brunswick, Nova Scotia, and Prince Edward Island into a single Atlantic region.

cautions against using employment levels directly in migration equations due to a chicken or egg problem regarding the degree to which migrants bring, or are attracted to jobs[5].

Despite the success of these relatively straightforward models[6], some methodological issues do arise. Foot and Milne (1989) note that, when modelling gross flows between any two provinces, the attributes of any third province should not be left out, given that individuals are choosing from an array of options. This results in a rapid loss of degrees of freedom as right-hand-side variables thus multiply quickly in a traditional OLS framework[7]. Opting instead for a linear simultaneous equations model estimated by full information maximum likelihood, Foot and Milne (1989) estimate a model of gross provincial in-migration as depending on population, distance, unemployment, real wages, and weighted averages of the levels of each within all other provinces subject to a simultaneous "adding-up" constraint[8]. Re-estimating the model using net migration levels, they find results more robust in the model of gross flows, in line with the reasoning of Courchene (1970) and Sjaastad (1962).

2.2 Migration Within an Equilibrium System

Starting in the late 1970's, two major shifts emerged in the study of migration (Greenwood 1985). The first was a shift towards studying the effects of life-cycle and

[5] This will become a point of contention within the jobs versus amenities debate, discussed below.
[6] Vanderkamp (1971) is able to explain roughly half of the variation in gross flows between provinces in each year in his sample using only income and distance as explanatory variables.
[7] This issue, however, can and is dealt with when it is possible to use variants of McFadden's (1974) discreet choice (conditional logit) model.
[8] Since each domestic immigrant must emigrate from a different province, all gross in- and out-migration levels must sum to zero in each period.

family dynamics[9] on individual migration decisions, and the second was a shift towards modeling migration as existing within an equilibrium system (Graves and Linneman 1979; Graves 1979). The seminal work of Graves and Linneman (1979) describes a model in which migration is part of an equilibrium consumption decision by households, who choose an optimal bundle of traded and non-traded goods subject to an income constraint which varies by location. Non-traded goods (e.g., local climate), also referred to frequently as 'amenities', are seen as being provided costlessly, but in different amounts, by each location. Therefore, any shift in underlying preferences results in a change in the equilibrium demand for non-traded goods by the household, who can only satisfy this new demand by migrating to a different location. Examples include the advent of children inducing parents to substitute lower-crime suburban neighbourhoods for higher-crime urban neighbourhoods, or demand for clean air rising with income as with any normal good.

In order to test their theory, Graves and Linneman (1979) estimate a probit model of the probability of a household choosing to migrate. Since households are assumed to have optimized with regards to their prior circumstances and existing differences in locational characteristics, only changes in household circumstances would be expected to induce re-optimization through migration, while neither current levels or past changes are expected to predict migration events. Strongly consistent with these theoretical expectations, they find that regression coefficients on the first-differences of various measures of income or family composition were statistically significant predictors of migration events, while,

[9] Although the pioneering work of Mincer (1978), and later others in this area is of great interest, it will not be discussed in any detail due to considerations of space.

after including the first-differences, both current levels and the lagged first-differences in the same variables tended not be statistically significant.

Graves (1979) provides additional evidence for this view, from a supply perspective, by including measures of climatic amenities in regressions of net migration rates in the United States. They are able to show that effects of income and employment were more robust when measures of climatic amenities were included[10], although regression coefficients on median incomes remained weakly statistically significant for whites (as opposed to non-whites). This is seen to demonstrate that higher incomes in some areas are partially compensating for unattractive amenity bundles. Subsequently, the sample is disaggregated with the regressions run separately, showing that the weak coefficients on income were the result of "washing out" as younger individuals were attracted to high incomes, while older individuals favoured locations with higher amenities but lower median incomes and employment[11]. This result is underscored when similar regressions substitute average rents, seen as capitalizing unpriced amenities as in Sjaastad (1962), for direct measurement of climatic conditions result in significant positive coefficients for all age groups[12] (Graves 1983).

The net migration equations discussed above, however, fail to capture the spatial nature of migration. Given the monetary, psychic, and information costs associated with increasing distance, it may not be plausible to expect any wage distribution to be able to

[10] Graves (1979) uses average humidity and wind speed as well as total heating and cooling degree days measured as the sum over the year of the number of degrees of heating or cooling respectively needed to bring the average temperature that day down to 65 degrees Fahrenheit.
[11] In such regions, lower prices would also increase the real value of fixed retirement incomes.
[12] If migration was largely a response to disequilibrium rental prices rather than a search for amenity bundles which are priced into rents, the opposite would be expected.

maintain locational indifference (Porell 1982; Rappaport 2004). To address this, Porell (1982) performs a multi-stage estimation of a gravity model[13] including composite Quality of Life measures[14] as well as variables for distance and employment opportunities[15], subsequently estimating hedonic wage equivalents. They suggest that, although individual components have small compensating wage differentials, in combination the effect is substantial.

Rappoport (2004) provides a theoretical underpinning, showing that, within a neoclassical growth framework, even small changes in productivity or underlying preferences can generate persistent population flows when even small frictions exist in mobility[16]. This theory was subsequently tested by modelling population growth rates across the United States from 1970 to 2000 in response to changes in preferences over local climate resulting from the advent of air conditioning and rising demand for warm weather, which, as a normal good, were expected to rise with aggregate incomes over time (Rappaport 2007).

2.3 JOBS VS. AMENITIES

The degree to which the search for amenities or jobs dominate the migration decisions of individuals and households has not gone unchallenged (Greenwood and Hunt 1989;

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[13] Much as in physical models of gravitational forces, gravity models of migration model the 'pull' of different destinations on an individual as an increasing function of their population or employment levels and a decreasing function of distance from the individual.
[14] Porell (1982) resorts to principle components analysis to reduce a large number of potentially collinear amenity measures, noting that no one variable can properly capture the overall level of amenities in a location.
[15] Porell (1982) prefers job turnover rates over employment rates as better capturing the likelihood of an incoming migrant finding work within a suitable timeframe.
[16] This could be especially relevant in Canada, where sparse population results in much longer distances between major urban centers than in the U.S.

Greenwood 1985). Notably, Greenwood and Hunt (1989), estimating a simultaneous model of net migration rates similar to Foot and Milne (1989), find that percentage changes in employment levels are powerful in predicting U.S. net migration rates. Variables capturing climatological amenities subsequently cease to be significant[17] when the former are included, suggesting that the results of Graves (1979) and others may be spurious.

However, as cautioned by Vanderkamp (1971), endogeneity of employment growth may present a complication when using employment levels to explain migration. Over the long-run, human capital accumulated because of differential valuations of amenities could underlie job growth which in turn may heavily influence migration in the short-run (Greenwood and Hunt 1989; Greenwood 1985; Mueser and Graves 1995). Direct investigation of this phenomenon has yielded somewhat inconclusive results (Greenwood 1985). In the foundational work of Muth (1971), in-migration is seen to induce employment growth exactly in proportion to the associated increase in the labour force, while employment growth is seen to induce in-migration on a secondary level except for smaller cities. Recent work by Partridge and Rickman (2003) attempts to disentangle the relationship in a structural VAR analysis of migration and employment for the forty-eight contiguous U.S. states and arrives at somewhat ambiguous results. Although it is seen as slightly more likely that individuals are following jobs, they find that, in the short-run, labour supply shocks, comprising both migration and domestic labour participation, were

[17] Those that did remain significant were often intermittent and lost their intuitive sign.

seen to be dominant. Furthermore, the magnitude of these relationships were seen to fluctuate over time, corroborating the earlier findings of Vanderkamp (1971).

More recently, Rosenthal and Chen (2008) attempt to separate the supply and demand aspects of employment and migration using different measures of attractiveness to households and businesses[18]. Using data from the decennial U.S. censuses from 1970 to 2000, they perform fixed-effects regressions of the shares of the national labour force and retiree populations in each region on the two measures. Disaggregating their results by levels of educational attainment, they find that workers are drawn to areas with favourable business environments, while retirees are drawn to areas favourable to households[19].

2.4 JOBS VS. AMENITIES IN THE CANADIAN CONTEXT

Much of the study of the role of amenities in U.S. migration patterns has focused on attributes of local weather (Graves 1979; Greenwood and Hunt 1989; Mueser and Graves 1995; Rappaport 2007). This may be less appropriate in the Canadian context given that most of its population is confined to a relatively narrow east-west corridor, bordering the United States (M. Partridge, Olfert, and Alasia 2007). Partridge et al. (2007) estimate a model of population change between 1981 and 2001, interpreted as arising through net migration in a reduced form depending on population density, distance, agglomeration effects, and natural amenities. Finding significant effects from population and distance to

[18] Variables for the attractiveness of a location to households and businesses are specified as the exponential functions of the difference between normalized levels of rents and wages, and the sum of normalized levels of rents and wages, respectively.
[19] This is consistent with the life-cycle changes outlined in Graves (1979), but also with the results of Greenwood and Hunt (1989) which was restricted to studying workers.

urban centres, they conclude that agglomeration effects are important, while finding that, with sufficient controls in place, the climatic amenity variables are mostly not statistically significant.

In a departure from the analysis of net flows, Brown and Scott (2012) return to modelling gross flows between individual locations but within the equilibrium framework and using an application of the conditional logit model developed in McFadden (1974)[20,21]. Analyzing the choices of individuals in the 2001 Canadian Census of Population, who face a choice among 128 regions[22], significant roles are found for both expected incomes and amenities (Brown and Scott 2012). Given the micro-level nature of the conditional logit model of discreet choice, they are able to include relative levels of income within each individual's industry, as well as accounting for interaction effects of language spoken at the individual level. Using the change in the odds ratio due to interquartile shift, they find that expected industry and occupation incomes tend to be more important than amenities. Although Brown and Scott (2012) provide an excellent starting point for the use of this approach in the context of the role of amenities in Canadian migration, their amenity variables are limited to four climate zones as well as employment in several entertainment or public service industries. This leaves open the possibility that analysis

[20] The discreet choice model outlined in McFadden (1974) will be discussed in more detail below.
[21] Conditional logit regression methods have been used extensively in the recent migration literature, with early examples including the location choices of new migrants to the U.S. (Bartel 1989), the influence of New Deal Grants on migration during the Great Depression (Sorensen et al. 2007), and various applications of the Roy model of immigrant self-selection (Choe and Chrite 2014; Grogger and Hanson 2011).
[22] Regions include census metropolitan areas and census agglomeration areas, as well as census consolidated subdivisions.

using more direct or composite measures could provide a more complete accounting for the role of amenities.

2.5 Subjective Well-Being

In a recent review of the literature on quality of life in cities, Ballas (2013) concludes that there is significant potential for subjective measures of well-being, developed through the more recent interest in the 'science of happiness', to enrich our understanding of the spatial determinants of quality of life. However, despite its obvious relationship to the concept of utility, and possibly due to skepticism of using subjective variables, relatively little research on the topic exists within the economics literature (Helliwell and Barrington-leigh 2010).

Measures of subjective well-being generally fall into two categories: life satisfaction which tends to reflect long-term stable evaluations of mood, and more emotive measures of moment-to-moment happiness or pleasure, which better capture shorter-term conditions. However both have been shown to reflect real variation between individuals which is consistent with external evaluation by others as well as with observed behaviour (Helliwell and Barrington-leigh 2010; Helliwell and Putnam 2004; Diener 1999, 2000; Helliwell 2001).

The relationship between life satisfaction and income has been a source of substantial debate within the economics literature on well-being. Contrary to the assumptions which underlie standard individual utility functions, which rise monotonically in individual income irrespective of the incomes of others, a growing body of research suggests that an individual's income rank relative to a reference group is far more relevant than the absolute level (Easterlin 1974, 1995; Helliwell and Barrington-leigh 2010; Di Tella, MacCulloch, and Oswald 2006). More specifically, in the early work of Easterlin (1974), subjective well-being was found to rise between countries with the log of income per capita, but did not rise over time with gross national product within countries, despite also rising with income at the individual level within countries. Easterlin argued that this indicates that comparisons drive subjective well-being and that within any given group, reference points shift over time with income. Returning to the same question some twenty years later, Easterlin (1995) found his earlier results continued to hold over the intervening period.

It has also been argued that individuals may significantly overestimate the contribution that higher income will make to their well-being. Kahneman et al. (2006) demonstrate that subjective evaluations of life satisfaction are subject to a focusing illusion wherein individuals asked first about one aspect of their life will allow that aspect to disproportionately affect their response to a general life satisfaction question, relative to individuals in the same circumstance who were only asked about that aspect of their lives *after* reporting their satisfaction. They also document that increases in income above threshold levels ($90,000 per year for individuals in the United States, and $12,000 for GDP per capita globally). Also, consistent with the reference-point shifts posited by Easterlin (1974, 1995) and others, they found the impact of increased income on life satisfaction to be transitory. It is worth noting, however, that within the psychological literature there is some consensus that individuals' life satisfaction levels do not completely adapt to changes in circumstances. In the context of migration, however, this still opens up the possibility that individuals' location choices may be maximizing income at least partially at the expense of life satisfaction.

Recent research has also demonstrated that aggregate life satisfaction does respond to changes in macroeconomic variables, at least in the short run. Using self-reports from Euro-Barometer surveys, Di Tella et al. (2001) estimate a social preference function over unemployment and inflation. In a fixed effects panel regression, controlling for country fixed-effects, year effects, and country-specific time trends, they find statistically significant effects for both unemployment and inflation, which imply a marginal rate of substitution of 1.7 (i.e., households would be indifferent between a 1.7 percentage point rise in inflation and a one percentage point rise in unemployment). Di Tella et al. (2006) follow up this analysis using data from several European countries as well as the United States to show, in ordered probit regressions, that individual life satisfaction responds significantly to changes in GDP as well as unemployment, inflation, and the generosity of unemployment benefits in terms of the proportion of prior income replaced. However, consistent with Easterlin (1974, 1995), they suggest that at least some of the effect of increased GDP disappears over time. Aslam and Corrado (2012) have also found in a panel analysis of subjective well-being across European regions that individual life satisfaction evaluations were more responsive to non-economic variables (e.g., trust in people or the legal system, religiosity, health) at the regional level than the individual level. This suggests amenity benefits and spillover effects are accrued to individuals and are captured in their evaluation of life satisfaction.

Although a search of the existing literature has not yielded any studies regarding whether aggregate subjective well-being exerts a pull on migrants, Nowok et al. (2013) have shown that, at the individual level, migration tends to be preceded by a decrease in life satisfaction. In a panel analysis including dummies for the years surrounding migration, they find that moving was preceded by a period of significantly lower subjective well-being scores after which levels were not significantly different from the individual's fixed effect level[23]. This gives some support to the set-point theory of subjective well-being whereby individuals are thought to have an inherent satisfaction level determined by genetics and personality, from which life circumstances induce only temporary deviations. However, it is worth noting that, when the analysis was restricted to one-time migrants (as opposed to those who relocated multiple times), they found that the subjective well-being scores of men remained significantly higher after the move. Although they acknowledge that selection bias may play a role here, this is consistent with the findings of Vanderkamp (1971) who showed that return migration of the 'disappointed' could mask the role of determinants, as well as demonstrating that lasting well-being gains can be achieved by individuals through migration.

[23] Despite economic consequences consistent with Mincer (1978), women identified as tied movers experienced a similar life satisfaction trajectory, receiving a similar boost to their partner, when moving resulted from their partner's job. However, the reverse was true for men, whose life satisfaction did not increase when they were identified as tied movers.

3 MODEL AND EMPIRICAL SPECIFICATION

3.1 EMPIRICAL MODEL

Following Brown and Scott (2012), the migration decision is treated as a two-stage process, with individuals first choosing to move away from their initial location, and subsequently optimizing over the set of potential destinations. Consequently, movers, rather than those who stay in their initial location, will be the primary focus of the models presented. This approach of modeling the choice of *where* to move, rather than *whether* to move, simplifies the estimation process dramatically, since with the exclusion of the initial locations the remaining options can be treated as equivalent from the perspective of movers, aside from their variation in observed characteristics.

We start with the conditional logit model of discreet choice developed in McFadden (1974)[24]. In this setting individual movers maximize their utility by choosing among J_i potential locations. At each location an individual is able to achieve a level of utility which is a function of both observables and a random component which can be seen as capturing variation in preferences, job match quality, and other unobserved benefits specific to that location individual pair as given by

$$U_{ij} = V_{ij} + e_{ij} \tag{1}$$

[24] For a textbook derivation of the conditional logit model, see chapter 11 of Davidson and MacKinnon (2003).

Since individuals are utility maximizing, individual i chooses location j if and only if $U_{ij} > U_{ik}$, $\forall\, k \neq j$. As such, if the e_{ij} are iid and follow a Type I Extreme Value distribution, the probability of choosing location j can be shown to be given by

$$p_{ij} = \frac{\exp(V_{ij})}{\sum_{k=1}^{J_i} \exp(V_{ik})} \tag{2}$$

It follows that the relative odds of choosing location j over location k can thus be written as

$$\frac{p_{ij}}{p_{ik}} = \frac{\exp(V_{ij})}{\exp(V_{ik})} \tag{2.1}$$

And, conveniently, the log odds ratio is given by

$$\log \frac{p_{ij}}{p_{ik}} = V_{ij} - V_{ik} \tag{2.2}$$

If the V_{ij} can be expressed as a linear function of observed characteristics X_{ij}

$$\log \frac{p_{ij}}{p_{ik}} = \beta' X_{ij} - \beta' X_{ik} \tag{3}$$

$$\log \frac{p_{ij}}{p_{ik}} = \beta' x_{jk}^{i} \tag{3.1}$$

where $x_{jk}^{i} = X_{ij} - X_{ik}$ is the vector of differences in the observed characteristics of locations j and k.

Equations 3 and 3.1 also illustrate the interpretation for the magnitudes of regression coefficients, which act as linear slopes with respect to the log odds ratio. It also follows that in order to increase the relative odds of choosing location j by a factor q in the univariate case, x_{jk}^{i} would need to increase by an increment of $\frac{\log q}{\beta}$.

Following Grogger and Hanson (2011), substituting the observed relative probability of migrating to location j versus staying in an initial location i, this becomes

$$\log\frac{m_{ij}}{m_{ii}} = \beta' x_{ij}^{i} + u_{ij} \tag{3.2}$$

Where m_{ij} and m_{ii} are the gross stocks of migrants from i to j, and stayers in i, respectively, and u_{ij} is interpreted as a measurement error arising from the above substitution.

Equation 3.2 provides an empirical specification in which the dependent variable is very similar to that used in Courchene (1971)[25]. If the x_{ij}^{i} are separated, allowing for different parameters on the characteristics of sending versus receiving locations, (3.2) becomes

$$\log\frac{m_{ij}}{m_{ii}} = \beta_i' X_i - \beta_j' X_j + u_{ij} \tag{3.3}$$

[25] Although Courchene (1971) uses the ratio of migrants to the source population, since in any given period nearly all individuals choose to stay, the left-hand side variable is very close to being the log of Courchene's (1971) dependent variable. It has the advantage, however, of not being subject to the degrees of freedom problem highlighted in Greenwood(1985) since the effects of the X_{ij} for all other potential destinations cancel out.

which can be estimated by ordinary least squares, providing a simple way of examining the differing effects of the characteristics of sending versus receiving locations.

Meanwhile, (2) can be estimated by maximizing the associated likelihood function, which is given by

$$L = \prod_{i=1}^{N}\prod_{j=1}^{J_i} {p_{ij}}^{d_{ij}} = \prod_{i=1}^{N}\prod_{j=1}^{J_i} \frac{\exp(\beta' X_{ij})}{\sum_{k=1}^{J}\exp(\beta' X_{ik})}^{d_{ij}} \tag{4}$$

with respect to β, where $d_{ij} = 1$ if individual i chooses location j, and zero otherwise.

Additionally, since individuals can also originate from any of the J locations, and given the complex nature of personal and employment networks, unobserved heterogeneity between origin groups may cause the choices of individuals from the same origin to be correlated. For example, the different concentration of specific firms and industries within origin locations could alter the payoff for individuals. Also large historical population exchanges between any two locations could decrease information costs between that source-destination pair. A reparametrization of McFadden's conditional logit model is offered by the Dirichlet-multinomial regression framework (Guimarães and Lindrooth 2007). To capture the unobserved heterogeneity across sending groups, the utility function from equation (1) is altered to be given by

$$U_{igj} = V_{ij} + \eta_{gj} + e_{ij} \tag{5}$$

where the η_{gj} apply uniformly to individuals who migrate to j from origin g, but vary across the different origin groups. Conditional on the group-level effects, η_{gj}, equation (2) thus becomes

$$p_{igj} = \frac{\exp(V_{ij} + \eta_{gj})}{\sum_{k=1}^{J_i} \exp(V_{ik} + \eta_{gk})} = \frac{\exp(\beta' X_{ij})\exp(\eta_{gk})}{\sum_{k=1}^{J} \exp(\beta' X_{ik})\exp(\eta_{gk})} \tag{6}$$

with the equivalent of equation 3.1 in this model being given by

$$\log \frac{p_{ij}}{p_{ik}} = \beta' x_{jk}^{i} \ + (\eta_{gj} - \eta_{gk}) \tag{6.1}$$

From equation 6.1 it follows that, conditional on the group-level effects, the magnitudes of the β coefficients can be interpreted in the same way as in the standard conditional logit model, discussed above.

And if the $\exp(\eta_{gj})$ are assumed to be i.i.d. gamma distributed with parameters $(\delta_g^{-1}\exp(\beta' X_{ij}), \delta_g^{-1}\exp(\beta' X_{ij})g$, the likelihood function can be shown to be given by[26]

$$L_D = \prod_{g=1}^{G} \prod_{j=1}^{J_i} p_{gj}{}^{n_{gj}} = \prod_{g=1}^{G} \frac{n_g! \, \Gamma(\, \delta_g^{-1}\exp(\beta' X_g))}{\Gamma(\delta_g^{-1}\exp(\beta' X_g) \ + n_g)} \prod_{j=1}^{J_g} \frac{\Gamma(\delta_g^{-1}\exp(\beta' X_{gj}) \ + n_{gj})}{n_{gj}! \, \Gamma(\, \delta_g^{-1}\exp(\beta' X_{gj}))} \tag{7}$$

[26] See Guimarães and Lindrooth (2007) for a derivation of equation 7.

It can also be shown that if the variance of the η_{gj} is zero, equation 7 collapses to to be identical to equation 4, and therefore Dirichlet-multinomial regression would reduce to McFadden's (1974) conditional logit (Guimarães and Lindrooth 2007).

3.2 EMPIRICAL SPECIFICATION

Within the framework of income maximization, individuals maximize the monetary payoff to migration such that the up-front costs are weighed against the expected discounted stream of income available at each location. As such the V_{ij} would be a function of incomes, unemployment (or other measures affecting the expected payoff), and costs of living, as well as distance, which increases both the explicit costs of migration in terms of transportation, but also implicit costs such as those associated with information acquisition and separation from family or other social networks.

When the model is considered purely from the demand side, it may be intuitive that employment or unemployment rates, as opposed to gross levels, would be more important in determining expected incomes or utility. However, excluding level factors would ignore supply-side factors. Even under an equilibrium setup, with no costs to relocation and equal utility levels across locations, we may expect individuals to relocate according to existing population distributions. For example, suppose that turnover and employment rates are equal across all locations, and that, since utility is also equal across locations, individuals simply occupy vacant positions at random. In this setting, the probability of migrating to a given location will be directly proportional to population levels[27]. Thus, a

[27] By way of illustration, one can imagine a hypothetical indifferent individual picking an apartment at random off of a national rental listing website, on which the number of listings for each city is proportional to the size of its housing stock, which is in turn proportional to its population.

regression omitting employment or population levels could find spurious relationships with any correlates of population even if all characteristics of locations are priced into wages and rents.

Given the structure of the conditional logit model, explanatory variables entered in logs are well suited to this type of effect. This follows straightforwardly from equation 2.1.

$$\frac{p_{ij}}{p_{ik}} = \frac{\exp(\beta \log P_j + V_{ij})}{\exp(\beta \log P_k + V_{ik})} = (\frac{P_j}{P_k})^\beta \frac{\exp(V_{ij})}{\exp(V_{ik})} \tag{8}$$

which simplifies in the above situation where $V_{ij} = V, \forall\, i, j$ to

$$\frac{p_{ij}}{p_{ik}} = (\frac{P_j}{P_k})^\beta \tag{9}$$

with $\beta = 1$. A more general specification could capture the presence of agglomeration effects by allowing β to vary. For example, a large city with a demand for highly specialized labourers may recruit more broadly than a smaller city with lower levels of specialization. Given that the distribution of populations across Canadian CMA's include three substantial outliers[28], the use of logs has the added benefit of reducing the influence of high-leverage observations.

Although inter-metropolitan migrants in Canada do not cross national boundaries, they may cross linguistic boundaries between predominantly English-speaking and French-

[28] Vancouver, Montreal, and Toronto, each with populations of 2,000,000 or more in 2006, are dramatically larger in population than the large majority of Canadian cities.

speaking regions. An individual moving to a city in which a different primary language is used may face increased information costs, have more difficulty finding employment, or competing for high-paying jobs, and may not be able to effectively access social and cultural amenities, or government services. These effects may be more or less pronounced for the dominant or minority language group. For example, bilingualism may be more common among members of the minority language group, and it may therefore be easier for individuals to cross from a minority-language city to a dominant-language city than the reverse. Consequently, the effects of crossing the linguistic boundary in different directions will be accounted for separately.

Although in all settings the effect of increasing distance is expected to be negative, the expected coefficients on incomes and costs of living depend heavily on underlying assumptions about the degree to which migration is occurring within an equilibrium or disequilibrium system. As discussed above, if the system is in disequilibrium, then income differentials between cities represent arbitrage opportunities to be pursued whenever the cost of relocation is sufficiently small. However, as argued by Graves and Linneman (1979) and others, if the system is viewed as starting at equilibrium, then migration will respond to changes in the supply or demand for non-traded amenities, and coefficients on income and cost of living, which will compensate for amenities, are expected to be insignificant or even negative (if amenities are not accounted for). Under the equilibrium model, changes in income levels, however, could influence households to re-optimize and induce migration.

Similarly, levels of housing rent and unemployment, which should both be deterrents under a disequilibrium model, may exhibit counterintuitive coefficients under an equilibrium model. Housing rents may be associated with in-migration, or show no association if they price in the value of amenities either partially or completely. Unemployment, which reduces expected earnings, and may be particularly problematic for new arrivals who wouldn't have the benefit of local networks, may also reflect that high quality of life is inducing migration in excess of a location's employment capacity.

If life satisfaction is the sole component of utility, then coefficients on economic variables should not be significant when life satisfaction is included in the regression specification. However, if information about satisfaction levels is imperfect, or if individuals' assessments of their expected utility are subject to focusing illusions as implied by Kahneman et al. (2006), then the effects of economic variables may dominate those of life satisfaction measures. To test these hypotheses, several different specifications of inter-metropolitan migration models will be estimated. First, a standard disequilibrium model including only the levels of economic variables, plus population and language, will be considered. Since differences in the levels of economic variables represent arbitrage opportunities in this model, coefficients would be expected to be positive for incomes and negative for unemployment and housing costs. Second, a pure life satisfaction maximization model, in which only life satisfaction scores, distance, population, and language variables will be considered. If individuals are indeed maximizing their life satisfaction across locations, the coefficient on life satisfaction scores should be significantly positive. Third, a mixed specification including the levels of both economic variables and life satisfaction is estimated. Fourth, an equilibrium specification, similar to the third, but using changes in incomes and unemployment from the period prior to migration instead of their levels is examined. In the third and fourth specifications, the interaction of the economic and life satisfaction variables will be of primary interest.

4 DATA

4.1 DATA SOURCES

Data on migrant flows, populations, incomes, unemployment, and housing rents are collected from Statistics Canada's census tabulations for the 33 census metropolitan areas (CMA's) in the 2006 Census of Population. Unlike census divisions (CD's) and subdivisions (CSD's), which are defined entirely by administrative boundaries, CMA's are designed to represent integrated urban economic areas for the purposes of statistical analysis. Each CMA has a minimum population of 100,000 and comprises an urban core with a population of at least 50,000 in addition to adjoining census subdivisions which are determined on the basis of commuting flows[29]. The relatively large population of CMA's also ensure sufficient gross migration flows, which are dominated by zero cells at smaller geographic levels. Given that any n locations provide $n(n-1)$ source-destination pairs, 1056 gross migration flows are observed, providing a sufficiently large dataset while remaining computationally feasible within the discreet choice framework. Data on migration flows are available as respondents are required to provide the address of their place of residence at the time the survey is collected in January 2006, as well as previous addresses both one and five years prior.

The 2006 Census of Population has the rare advantage of being a mandatory survey, predating the change to voluntary response in the 2011 National Household Survey. The migration data also coincides temporally with the data in the Canadian Community

[29] Specifically, a CSD is included in a CMA if at least 50% of its employed population work within the urban core, or at least 25% of those employed in the CSD reside in the urban core. Additional CSD's which do not meet these thresholds are included as needed to ensure spatial contiguity (Statistics Canada, 2007: 202-211).

Health Survey (CCHS) cycle 3.1, which was collected throughout 2005. This particular cycle of the CCHS is also favourable since it was the last cycle of the CCHS to have the full sample of approximately 135,000 observations, of which around half resided in CMA's, collected during a single year, with the CCHS becoming an annual survey of approximately 65,000 observations starting with the next cycle in 2007. Although the CCHS has a much smaller sample and uses voluntary response, it remains by far the largest survey to include a question on subjective life evaluation. Although Statistics Canada's General Social Survey does include a more extensive module on subjective wellbeing once every five years on rotation, the national sample size of approximately 27,000 is too small for the current application. As part of the CCHS's primary component, each respondent is asked to rate their satisfaction with life on a five-point Likert scale. The question is worded as follows.

How satisfied are you with your life in general?
1 – Very satisfied
2 – Satisfied
3 – Neither satisfied nor dissatisfied
4 – Dissatisfied
5 – Very dissatisfied
(Statistics Canada, 2005: 3)

4.2 VARIABLE DEFINITIONS

The following variables is defined for each 2006 census metropolitan area:

Migrants: The total number of individuals within a given age range identified as residing in the sending CMA one year prior to the collection of the 2006 Census of Population who resided in the receiving CMA as of January 2006.

Income: Mean employment income for the employed aged 15 and over[30] including wages, salaries and net self-employment income, for the calendar year 2005 in thousands of constant 2005 dollars.

IncomeChange: Change in mean employment income for the employed aged 15 and over[31], including wages, salaries and net self-employment income, from the calendar year 2000 to the calendar year 2005, in thousands of constant 2005 dollars.

Unemployment: Proportion of the labour force designated as unemployed as of January, 2006.

UnempChange: Change in the proportion of the labour force designated as unemployed from January 2001 to January, 2006.

MedRent: Median[32] total monthly shelter expenses for tenant households in constant 2005 dollars, including gross rent as well as the cost of utilities and municipal services.

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[30] In life-cycle regressions, where the sample is restricted to those within narrower age bands, mean employment income is likewise restricted.

[31] In life-cycle regressions, where the sample is restricted to those within narrower age bands, the mean employment incomes used to calculate income change are likewise restricted.

[32] Median values are chosen over mean values to reduce the potential influence of outliers in large cities.

LPop: Natural logarithm of the total migrant stock[33] as of January, 2005, prior to migration, who were between the ages of 25 and 64 as of January, 2006.

Distance: Natural logarithm of the approximate[34] straight-line distance[35] between a given pair of source and destination CMA's.

SWL: Weighted[36] average of life satisfaction responses from the CCHS cycle 3.1, collected throughout 2005. The original cardinalisation has been altered so as to be more intuitive, maintaining the same range from 1 to 5, but with the values reversed, such that higher values represent higher life satisfaction.

BothFR: Categorical variable equal to 1 if both sending and receiving CMA's are located in Quebec, including Ottawa-Gatineau[37], and 0 otherwise.

BothEN: Categorical variable equal to 1 if neither the sending nor receiving CMA's are located in Quebec, and 0 otherwise.

[33] Since the analysis is limited to inter-metropolitan migrants, the total migrant stock is equal to the sum of all individuals over aged between 25 and 64 who resided in any CMA as of January, 2006, who resided in a given CMA as of January, 2005.

[34] Time constraints prevented the inputting of exact distances for each of the 1056 CMA pairs. Instead, distances are calculated from the latitude and longitude of each CMA using Pythagoras' theorem. As such, they correspond to the straight-line distances as they would be measured on the Mercator projection. Since Canadian CMA's all lie within a fairly narrow latitude range, the distortion generated by this projection is considered to be sufficiently small.

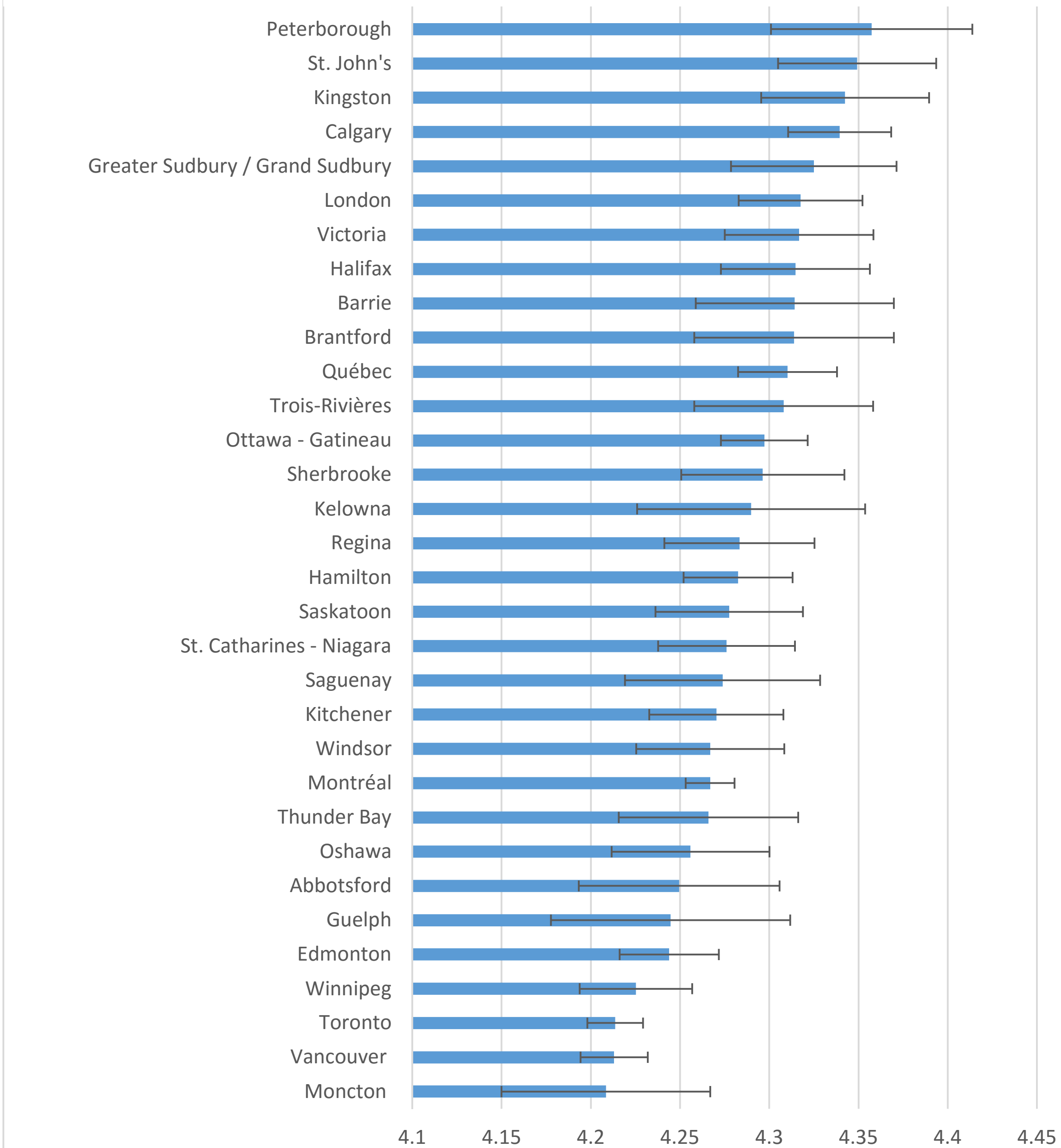
[35] Due to the ubiquity of air travel in the twenty-first century, the compromise in using straight-line distances over road-distances to capture relocation and information costs is assumed to be limited.

[36] The CCHS is a stratified voluntary survey, for which probability weights are computed to account for non-response within each strata.

[37] The Ottawa – Gatineau CMA straddles the border between Quebec and Ontario, and is widely known to be substantially bilingual.

4.3 DESCRIPTIVE STATISTICS

Figure 1: Life Satisfaction in each of Canada's 33 CMA's as of 2005, based on the Canadian Community Health Survey, Cycle 3.1. Error bars represent 95% confidence intervals.



Source: Statistics Canada, Canadian Community Health Survey, Cycle 3.1, 2005.

Variation in average life satisfaction across Canadian CMA's, shown in Figure 1, is much smaller than that across individuals, but a pattern is still discernible, with the rankings being broadly consistent with those found in the CCHS 2.1 in 2003[38] and with subsequent findings published by Statistics Canada using data aggregated from subsequent cycles from 2009 to 2013 (Lu et al. 2015), particularly with respect to the tails of the distribution. For purposes of comparison, the range of roughly .15 is comparable in magnitude to the difference found by Bonikowska et al. (2013) between those who have never been married and those who are separated or divorced in a micro-regression using data from later cycles of the CCHS[39].

Table 1: Correlations of key variables with mean life satisfaction

	SWL
LPop	-.3835
Income	-.095
Unemployment	.2454
MedRent	-.1626

The pairwise correlations between life satisfaction scores and key economic variables, displayed in Table 1, are most consistent with an equilibrium account of migration. A weak negative correlation with employment incomes is consistent with the presence of compensating differentials. Although a relatively strong positive correlation with unemployment suggests that, contrary to expectations under a disequilibrium model, locations with high life satisfaction may be able to sustain higher unemployment levels since the higher level of non-economic amenities could compensate for lost employment

[38] See Figure 2 in Appendix A for mean life satisfaction across Canadian CMA's from the CCHS 2.1.
[39] It bears mentioning that these are averages only. Whether any particular unmarried individual living in an upper tail location like Kingston, Ontario, would be better off in the long run if they lived in Toronto or stayed and went through a marriage and subsequent divorce, is left as a thought experiment for the reader.

income. Although this may seem to contradict the findings of Di Tella et al. (2001), it highlights the difference between levels and changes. Di Tella et al. (2001) estimate a fixed-effects model in which only differences over time are considered. On the other hand, negative correlations with median housing rents and the logarithm of population are less consistent with equilibrium hypotheses. Despite Sjaastad's (1962) assertion that non-economic benefits should be priced into land rents, this is not borne out in the raw correlation[40].

As discussed above, in an equilibrium setup with perfect information and no frictions, utility should be constant across locations. Consistent with the theoretical results of Rappoport (2004) who showed that frictions could result in sustained differences utility across locations, the absolute value of the difference in life satisfaction scores between any two CMA's is positively correlated with the straight-line distance between them[41]. Furthermore, average life satisfaction is also strongly correlated across time, with correlation coefficients between averages from 2003, 2005, and 2009-2013[42] ranging from 0.42 to 0.54, all significant at the $p < .05$ level.

[40] One might speculate that housing prices, and by extension rents, were inflated in the period leading up to the 2008 economic crisis, resulting in housing costs rising above levels that would be consistent with local quality of life, but an in-depth analysis of this topic is beyond the scope of this paper.
[41] The correlation coefficient of .09 is significant at the $p < .05$ level.
[42] Rounded averages for the period 2009-2013 period are taken from Lu et al. (2015), who average responses from the four cycles of the CCHS collected during this period.

5 RESULTS

5.1 DISEQUILIBRIUM VS. EQUILIBRIUM

Table 2: Dirichlet Multinomial Regression Results: Broad Working-Age Sample (25-64)

	Model 1	Model 2	Model 3	Model 4
LPop	0.8754***	0.8680***	0.9779***	0.9468***
	(0.030)	(0.030)	(0.041)	(0.041)
Distance	-0.6156***	-0.5748***	-0.6127***	-0.6607***
	(0.025)	(0.028)	(0.024)	(0.023)
Income	0.0229*		0.0040	-0.0185
	(0.010)		(0.011)	(0.016)
IncomeChange				0.1269***
				(0.024)
Unemployment	-0.2275***		-0.2286***	-0.0050
	(0.026)		(0.026)	(0.030)
UnempChange				-0.2673***
				(0.037)
MedRent	-2.1242***		-1.8172***	-0.1663
	(0.413)		(0.416)	(0.465)
BothFR	1.4107***	1.5457***	1.2980***	1.3109***
	(0.138)	(0.130)	(0.142)	(0.144)
BothEN	2.0006***	1.7863***	2.1336***	2.2256***
	(0.133)	(0.121)	(0.137)	(0.139)
SWL		3.7527***	3.3415***	1.8533*
		(0.871)	(0.872)	(0.830)
Chi-squared	2634.98	2462.10	2663.77	3609.29

Standard errors in parentheses.
+ = p < .1, * = p < .05,** = p < .01, *** = p < .001

Results from estimating the four models described in Section 3.2 by Dirichlet-multinomial regression[43] of gross migration flows of individuals aged 25 to 64 on the characteristics of the destination CMA's are presented in Table 2. This broad age range is intended to reflect the working-age population, who are mostly expected to have completed their education[44]. Effects of the population of the receiving site, distance, and

[43] Regression parameters are estimated using the 'dirmul' command, from the 'GOUPCL' package for Stata version 13.
[44] Those aged 20 to 24 are not considered so as to exclude the University-aged population whose migration decision process may be different from the general population.

linguistic variables are all intuitive and quite stable across specifications. Interestingly, the coefficients on the log of population in the third and fourth models, displayed in columns 3 and 4 of Table 2, are not significantly different from one, which implies that, after accounting for economic and life-satisfaction characteristics migration patterns are not significantly different from random population-weighted relocation patterns described by equation 9. Also, the effect of crossing a linguistic border from English to French is greater than the reverse, consistent with dominant language hypothesis effects discussed above.

Results from the estimation of the basic disequilibrium model, in the first column of Table 2, are consistent with disequilibrium income maximization. The coefficient on mean income of the receiving site, however, is fairly small, implying that, conditional on the group-level random effects, it would require an increase in mean employment incomes of $30,268 in order to double the odds of choosing one location over another otherwise identical location[45]. Also, although the coefficient on mean incomes is significant at the $p < .01$ level in the Dirichlet-multinomial regression, it is still comparatively weak compared to the coefficients on all other variables in the model, which are all significant at the $p < .001$ level.

The results of estimating the basic life-satisfaction maximization model in column 2 of Table 2 provide strong evidence that, after controlling for population, distance, and linguistic factors, higher mean life satisfaction is indeed associated with increased

[45] This quantity, equal to $\frac{\log 2}{.0229}$, is implied by Equation 6.1. See section 3.1 for details.

relative odds of selection as a destination. The effect of life satisfaction is seen to be strongly positive, with a coefficient of 3.75 which is statistically significant at the $p < .001$ level. The coefficient implies that, conditional on the group-level random effects, an increase in mean life satisfaction of 0.185 would be sufficient to double the odds of choosing a particular location. Incidentally, this figure is comparable with the range of average life satisfaction across CMA's[46]. This result is also highly robust to changes in the specification of population changes and the use of life satisfaction variables from different samples[47]. This coefficient also changes little in column 3 with the introduction of the economic variables used in the first model.

Perhaps the most surprising element of results from model 3, in column 3 of Table 2, is that, when mean life satisfaction is added to the basic disequilibrium specification, the effect of employment incomes ceases to be statistically significant. This result admits two primary explanations. First, it could be interpreted as indicating that inter-metropolitan migration in that period occurred as an adjustment to disequilibrium in quality of life between cities with the statistically significant coefficients previously found on income levels being spurious artefacts of life satisfaction maximizing behaviour on the part of migrants. A second interpretation, which is well supported by subsequent results, is that inter-metropolitan migration is better described as part of an equilibrium system in which income levels should not predict migration flows, with higher life satisfaction in some

[46] See Figure 1 in Section 4, or Table 5 in Appendix A.
[47] See Table 6 in Appendix B for results of estimating the model in column 2 of Table 2 when specifying population variables as quadratic or logarithmic, substituting employment levels for population levels, and the use of life satisfaction variables from the CCHS cycle 2.1, conducted in 2003.

areas capturing bundles of traded goods and amenities which have become more desirable as the result of shifts in preferences and economic shocks.

Model 4, in the last column of Table 2, provides very strong support for an overall equilibrium model in which the levels of wages and rents at least partially price in non-traded amenities available at each location and as such do not reflect arbitrage opportunities. Strongly consistent with this interpretation, the coefficients on the levels of housing rents, mean incomes, and unemployment in the receiving location are not found to be statistically significant. Meanwhile, coefficients on the changes in unemployment and mean income from 2000 to 2005, in the receiving location, are found to be highly significant, suggesting that changing payoffs and preferences are inducing *re*-optimization. Intuitively, increased mean incomes and decreased unemployment are seen to increase the odds of choosing a given destination. This result echoes that of Graves (1979) who found that after including the first-differences in income levels in their regression model, the coefficients on current incomes and lagged first-differences were no longer statistically significant.

It also appears that in the disequilibrium model, in column 3 of Table 2, the coefficient on mean life satisfaction was partially picking up the effects of shocks to income and unemployment, shrinking in magnitude and level of statistical significance. Although the coefficient of 1.8533 remains significant at the $p < .05$, level, the statistical significance of the coefficient on the life satisfaction variable are seen to be sensitive to particulars of the specification[48]. Lastly, the equilibrium specification also increases goodness-of-fit dramatically, with the Wald χ^2 statistic rising from 2664 in the disequilibrium specification to 3609 after the inclusion of the change variables.

Graves and Linneman (1979) suggested that increasing incomes would result in increased demand for amenities, and by extension, migration. However, they were referring to increases in income which were available across the entire choice set, whereas in this specification the changes in incomes are location-specific[49] and are therefore not seen as affecting the bundles of goods available at other locations. Consequently, given the role of commuting levels in the delineation of CMA's, rising mean incomes at this level could induce out-migration from low-amenity neighbourhoods even as it attracts migration to the CMA as a whole. Given that the CCHS identifies observations geographically down to the postal codes of respondents[50], this may provide an avenue for further research on the role of life satisfaction in migration.

[48] See Table 7 in Appendix B for results of estimating the model in column 4 of Table 2 when specifying population variables as quadratic or logarithmic, substituting employment levels for population levels, and the use of life satisfaction variables from the CCHS cycle 2.1, conducted in 2003.
[49] Growth in incomes across the system as a whole are differenced out of the estimation procedure.
[50] This detailed geographic information, available only in the confidential micro-data files housed in Statistics Canada's Research Data Centres, allows for aggregation at a variety of sub-metropolitan levels.

5.2 LIFE-CYCLE ANALYSIS

Table 3: Dirichlet Multinomial Regression Results: Disaggregated by Age

	Ages 25-44	Ages 45-64	Ages 65+
LPop	1.0219***	0.9261***	0.8724***
	(0.040)	(0.062)	(0.110)
Distance	-0.6653***	-0.6436***	-0.7442***
	(0.024)	(0.032)	(0.046)
Income	0.0115	-0.0336+	-0.0095
	(0.014)	(0.018)	(0.019)
IncomeChange	0.1484***	0.0756**	0.0065
	(0.028)	(0.026)	(0.019)
Unemployment	-0.0076	-0.0036	-0.0188
	(0.031)	(0.045)	(0.066)
UnempChange	-0.2653***	-0.3686***	-0.3762***
	(0.043)	(0.052)	(0.067)
MedRent	-0.8557+	0.8029	1.3000+
	(0.466)	(0.628)	(0.757)
BothFR	1.2659***	1.1119***	0.9527***
	(0.152)	(0.212)	(0.277)
BothEN	2.3179***	2.2733***	1.7865***
	(0.149)	(0.207)	(0.284)
SWL	2.5215**	3.1409*	2.9736+
	(0.876)	(1.266)	(1.632)
Chi-squared	3126.58	1414.60	698.45

Standard errors in parentheses.
Income variables reflect averages for selected age group.
+ = p < .1, * = p < .05,** = p < .01, *** = p < .001

The final equilibrium model, in the last column of Table 2, is subsequently estimated individually for each of three age groups in the data, with the retirement-age population added as well, in order to capture any life cycle effects. The results appear in Table 3. Overall, the results are consistent with those found in earlier work in the literature (Brown and Scott 2012; Graves and Linneman 1979; Graves 1979; Mueser and Graves 1995; Rappaport 2007). The magnitude of the effect of changes in mean employment incomes decreases monotonically to the point of losing all statistical significance for those aged 65 and over. This result is found even though employment incomes have been disaggregated as well, such that the effect of the mean income of 45 to 64 year-olds on 45 to 64 year-olds is seen to be only half as strong as for those aged 25 to 44. Interestingly, the effects of population size also attenuate as individuals age, potentially reflecting changes in preferences over population density over the life cycle. Although similar results are often interpreted as reflecting the increased importance of amenities through the life-cycle, the effects of life satisfaction levels[51] remain quite stable in magnitude.

Importantly, once the effects of changes in mean employment incomes and unemployment levels are allowed to vary across the life-cycle, the coefficients on life satisfaction return to levels closer to those found in columns 2 and 3 of Table 2, and are also seen to be more robust to changes in the specification of population variables and timing of the life satisfaction measurements[52]. Although their statistical significance decrease across the different samples, this goes along with a substantial decrease in the number of migration events observed in the older samples[53]. This suggests that life satisfaction levels may capture overall quality of life, rather than the importance of specific amenities which may vary across the life-cycle and whose selection may arbitrarily influence the interpretation of results. The results also provides some

[51] Due to sample size considerations, mean life satisfaction levels could not be likewise disaggregated.
[52] See Tables 8, 9, and 10 for life-satisfaction results when re-estimating the model for each of the three age groups, respectively, under different specifications of the population variable, and when mean life satisfaction is taken from the CCHS cycle 2.1, collected in 2003.
[53] It is well documented that younger individuals are much more likely to migrate than older individuals for a variety of reasons (Courchene 1970; Graves and Linneman 1979; Mincer 1978).

confirmation that the observed relationship is not a spurious result of unobserved demographic differences between locations[54].

5.3 PUSH VS. PULL

Table 4: OLS Regression Results: Log Odds of Migration vs. Staying

	Model 1	Model 2	Model 3	Model 4
LPop (Receiving)	0.7432***	0.8314***	0.8203***	0.8070***
	(0.034)	(0.030)	(0.038)	(0.038)
LPop (Sending)	-0.1452***	-0.1958***	-0.1032**	-0.1014**
	(0.033)	(0.030)	(0.039)	(0.038)
Distance	-0.5023***	-0.4580***	-0.5084***	-0.6201***
	(0.024)	(0.023)	(0.024)	(0.023)
Income (Receiving)	0.0218*		0.0081	0.0005
	(0.010)		(0.010)	(0.014)
Income (Sending)	-0.0039		-0.0113	-0.0176
	(0.010)		(0.011)	(0.014)
Unemployment (Receiving)	-0.1369***		-0.1497***	0.0806**
	(0.027)		(0.025)	(0.030)
Unemployment (Sending)	-0.0439+		-0.0521*	0.0313
	(0.025)		(0.025)	(0.029)
MedRent (Receiving)	-0.7742+		-0.6496	0.8623*
	(0.420)		(0.416)	(0.400)
MedRent (Sending)	-0.0014**		-0.0015***	-0.0009*
	(0.000)		(0.000)	(0.000)
BothFR	1.2266***	1.3260***	1.1901***	1.0641***
	(0.149)	(0.152)	(0.147)	(0.143)
BothEN	1.3954***	1.2855***	1.4757***	1.5094***
	(0.110)	(0.087)	(0.114)	(0.110)
SWL (Receiving)		2.5341**	3.0811***	1.2152
		(0.770)	(0.782)	(0.742)
SWL (Sending)		0.6724	1.2705	0.6349
		(0.782)	(0.812)	(0.768)
IncomeChange (Receiving)				0.1304***
				(0.021)
IncomeChange (Sending)				0.0614**
				(0.022)
UnemptChange (Receiving)				-0.2841***
				(0.037)
UnempChange (Sending)				-0.1004**
				(0.036)
R-squared	0.69	0.67	0.70	0.75
Observations	782	782	782	782

Standard errors in parentheses.
+ = p < .1, * = p < .05,** = p < .01, *** = p < .001

As already discussed, the results in Tables 2 and 3 restrict the analysis to individuals who in fact moved, excluding those who stayed in their initial locations. A basic analysis of the difference between the role of sending and receiving location characteristics, or 'push' and 'pull' factors is undertaken in this section by estimating equation 3.3 by ordinary least squares. The dependent variable is now the log odds ratio of migrating to a given 'receiving' CMA versus staying in the initial 'sending' CMA. Coefficients are allowed to vary depending on whether the characteristics relate to the sending or receiving CMA.

Interestingly, coefficients on sending-location variables, when included separately, are rarely significant and always smaller than those on receiving-location variables. This suggests that, at least during the time period in question, migration was induced by the pull of desirable locations rather than by individuals being pushed out of less desirable ones. It is possible that, given the substantial costs associated with migration (Sjaastad 1962), city-level changes sufficient to induce such a push from any given location are not observed in all periods. Considering the findings of Nowok et al. (2013), wherein migration was preceded by decreases in life satisfaction at the individual level, this is consistent with a two-stage decision process in which individuals first decide to emigrate due to individual-level shocks to their utility in a given location, and subsequently optimize over the set of alternative locations in accordance with their aggregate characteristics.

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[54] The "U-shaped" trajectory of life satisfaction over the life-cycle is also well documented (Bonikowska et al. 2013).

6 DISCUSSION: IS INTER-METROPOLITAN MIGRATION MAXIMIZING LIFE SATISFACTION?

The results of the equilibrium model[55] are initially consistent with maximization of life satisfaction in which the remaining coefficient on mean life satisfaction is merely picking up the effects of amenities left over after changes to incomes and unemployment have been accounted for. The magnitudes here are consistent with the results of Greenwood and Hunt (1989) and Brown and Hunt (2012), who found only limited amenity effects. However, the dramatic improvement in goodness of fit achieved by the inclusion of the changes in income and unemployment, when compared to the modest contribution of mean life satisfaction in model 3 of Table 2, suggests that these changes are influencing migration decisions well beyond their implications for life satisfaction. Based on the literature on subjective well-being and the CCHS data-set, three potential explanations are apparent.

First, measurement error could be causing attenuation bias on the life satisfaction coefficient, with a portion of the true effect of life satisfaction being picked up by its correlates. This could result in inflated coefficients on the changes in unemployment and income. The necessary relationships have been demonstrated, with statistically significant negative effects of changes in unemployment (Di Tella, MacCulloch, and Oswald 2001), and statistically significant positive effects of changes in GDP (Di Tella, MacCulloch, and Oswald 2006) on average life satisfaction[56].

[55] See the final columns of Tables 2 and 4, as well as all of Table 3.
[56] These results were discussed more extensively in Section 2.5.

Secondly, a similar problem of measurement error may be affecting individuals if reliable information about levels of life satisfaction in different locations is more difficult for individuals to acquire than similar information about demographics or changes in economic conditions. As such, even if individuals are maximizing life satisfaction only, they may respond more strongly to these more easily accessible signals.

Finally, a more pessimistic interpretation would suggest that, although individuals are responding to variation in life satisfaction, they are over-responding to economic variables in a manner consistent with the focusing illusions documented by Kahneman et al. (2006), and the Easterlin paradox (Easterlin 1974, 1995). Such a circumstance could be captured by an equilibrium migration model like those discussed above, but in which individuals maximize a biased estimate of expected utility. Since such a model would still allow for a solution, albeit a suboptimal one from the perspective of life satisfaction, it is not contradicted by the results of models 3 and 4 in Table 2, since, at equilibrium, income levels would not be associated with increased migration.

All three of these effects may be active to varying degrees in the migration process, and each presents opportunities for better subjective data sets and future research to enrich our understanding of how subjective measures of well-being can help explain economic phenomena.

7 CONSLUSION

Background from a review of the literature, presented in Section 2, has provided a context for this research within the literature regarding the relative roles of amenities and economic factors in domestic migration, and has motivated the use of more recently available subjective measures of the quality of life in analyzing the migration decisions of individuals,

An empirical model of individual location choice based on McFadden's (1974) conditional logit, extended to account for overdispersion in grouped data, summarized in Section 3, provided a useful framework for analyzing the role of average life satisfaction on the destinations chosen by movers. The same section has also outlined hypotheses regarding the effects of including average life satisfaction in both disequilibrium and equilibrium models of location choice.

Several models of migration between Canada's 33 CMA's have been estimated by Dirichlet-multinomial regression, with results provided in Section 5. Robust evidence was found suggesting that variation in life satisfaction is predictive of gross migration flows after controlling for distance and population, as well as linguistic factors. However, results weaken when measures of the changes in average incomes and unemployment are included in an equilibrium model specification. The role of average life satisfaction in migration decisions does appear to be fairly consistent across the life-cycle, however, as evidenced by results presented in the same section.

Ultimately, the effect of mean life satisfaction in explaining gross migration flows is seen to be relatively weak when compared to the roles of changes in the levels of both employment income and unemployment rates in equilibrium models. Several possible explanations for this result are explored in Section 6, including the roles of measurement error, information costs to individuals, and the distortion of individuals' expectations for life satisfaction, such as the focusing illusions documented by Kahneman et al. (2006). Further research will be needed to investigate the roles of each of these factors, and to shed more light on the role of subjective well-being on the migration decisions of individuals.

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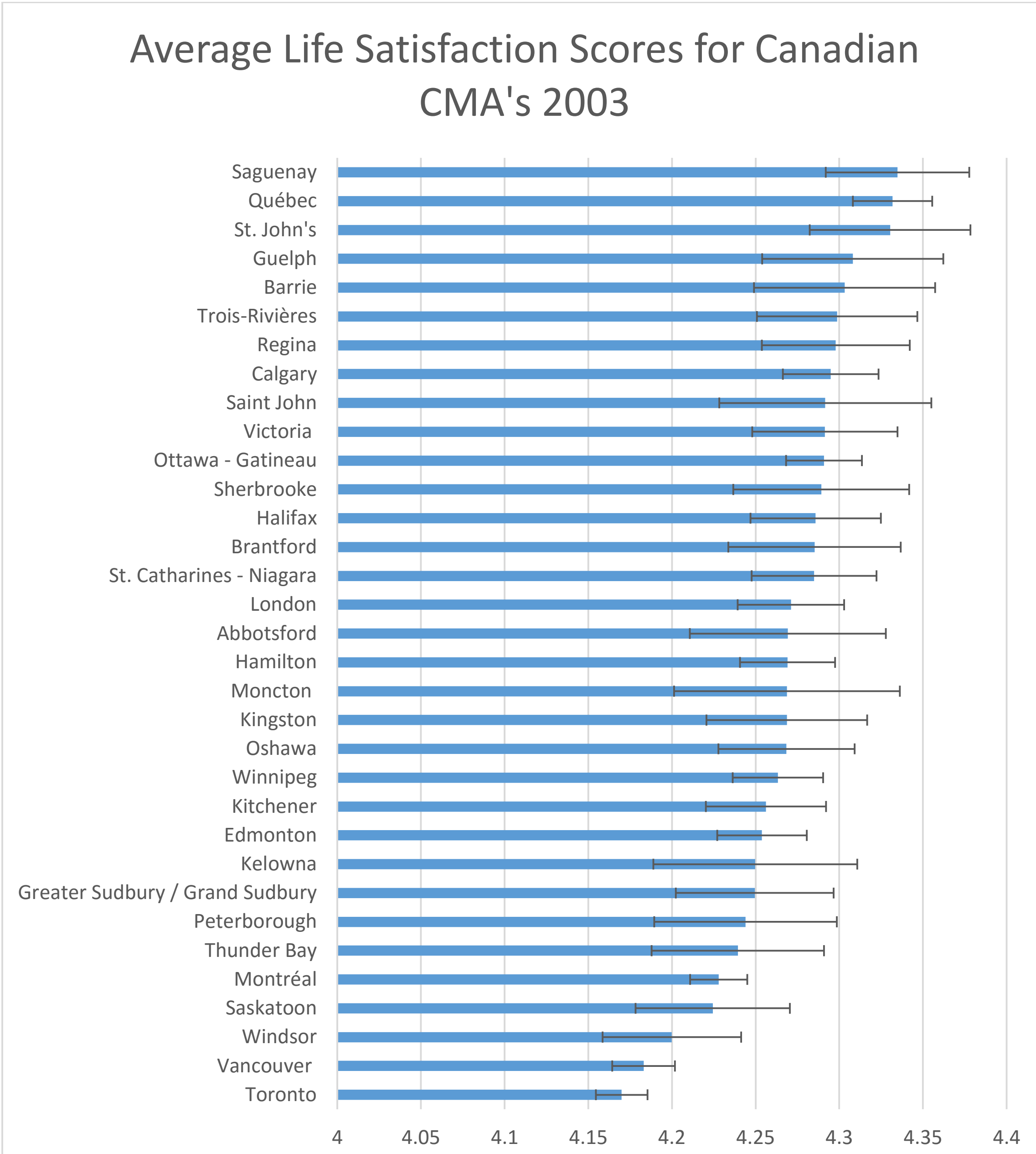
APPENDIX A: SUMMARY STATISTICS

Table 5: Summary Statistics of Variables

	Mean	SD	Min	Max
Migrants (25-64)	158.991	478.529	0.000	5975.000
LPop	12.096	1.026	10.974	14.849
Distance	2.543	1.204	-1.371	4.258
IncomeChange	0.535	1.846	-3.265	7.600
UnempChange	0.630	1.159	-2.000	3.300
Income	35.941	4.074	30.215	48.931
Unemployment	6.245	1.329	4.000	10.000
MedRent	0.694	0.113	0.467	0.926
BothFR	0.028	0.166	0.000	1.000
BothEN	0.716	0.451	0.000	1.000
SWL (2005)	4.287	0.041	4.208	4.363
SWL (2003)	4.270	0.038	4.170	4.335

Source: Statistics Canada, Census of Population, 2006, and Canadian Community Health Survey, Cycles 2.1 - 3.1, 2003-2005.

Figure 2: Life Satisfaction in each of Canada's 33 CMA's as of 2003, based on the Canadian Community Health Survey, Cycle 2.1. Error bars represent 95% confidence intervals.



Source: Statistics Canada, Canadian Community Health Survey, Cycle 2.1, 2003.

APPENDIX B: ROBUSTNESS CHECKS FOR RESULTS IN TABLE 2

Table 6: Dirichlet Multinomial Regression Results for Model 2 of Table 2 Under Different Specifications

	Population Levels				Employment Levels			
	Log	Quadratic	Log	Quadratic	Log	Quadratic	Log	Quadratic
SWL (2005)	3.7527***	2.8609***			3.9215***	2.9266***		
	(0.871)	(0.817)			(0.851)	(0.784)		
SWL (2003)			4.0021***	5.7919***			3.7527***	5.4828***
			(0.858)	(0.984)			(0.839)	(0.949)

Standard errors in parentheses.
Only coefficients on life satisfaction variables are shown.
First column specification is identical to column 2 of Table 2.
+ = p < .1, * = p < .05,** = p < .01, *** = p < .001

Table 7: Dirichlet Multinomial Regression Results for Model 4 of Table 2 Under Different Specifications

	Population Levels				Employment Levels			
	Log	Quadratic	Log	Quadratic	Log	Quadratic	Log	Quadratic
SWL (2005)	1.8533*	1.2131			2.0182*	1.3789		
	(0.830)	(0.860)			(0.834)	(0.861)		
SWL (2003)			0.9883	2.1216+			1.2470	2.2653+
			(1.039)	(1.195)			(1.042)	(1.201)

Standard errors in parentheses.
Only coefficients on life satisfaction variables are shown.
First column specification is identical to column 4 of Table 2.
+ = p < .1, * = p < .05,** = p < .01, *** = p < .001

APPENDIX C: ROBUSTNESS CHECKS FOR RESULTS IN TABLE 3

Table 8: Dirichlet Multinomial Regression Results for Ages 25-44 of Table 3 Under Different Specifications

	Population Levels				Employment Levels			
	Log	Quadratic	Log	Quadratic	Log	Quadratic	Log	Quadratic
SWL (2005)	2.5214**	2.2237**			2.6753**	2.2615**		
	(0.876)	(0.861)			(0.878)	(0.859)		
SWL (2003)			1.7440	3.9130**			2.0328+	3.9100**
			(1.121)	(1.274)			(1.117)	(1.263)

Standard errors in parentheses.
Only coefficients on life satisfaction variables are shown.
First column specification is identical to column 1 of Table 3.
+ = p < .1, * = p < .05,** = p < .01, *** = p < .001

Table 9: Dirichlet Multinomial Regression Results for Ages 45-64 of Table 3 Under Different Specifications

	Population Levels				Employment Levels			
	Log	Quadratic	Log	Quadratic	Log	Quadratic	Log	Quadratic
SWL (2005)	3.1409*	2.5339+			3.3420**	2.7523*		
	(1.266)	(1.315)			(1.272)	(1.315)		
SWL (2003)			2.4023	3.3847+			2.6981+	3.5487*
			(1.560)	(1.758)			(1.565)	(1.761)

Standard errors in parentheses.
Only coefficients on life satisfaction variables are shown.
First column specification is identical to column 2 of Table 3.
+ = p < .1, * = p < .05,** = p < .01, *** = p < .001

Table 10: Dirichlet Multinomial Regression Results for Ages 65+ of Table 3 Under Different Specifications

	Population Levels				Employment Levels			
	Log	Quadratic	Log	Quadratic	Log	Quadratic	Log	Quadratic
SWL (2005)	2.9736+	2.7246+			3.0030+	2.4998		
	(1.632)	(1.585)			(1.627)	(1.563)		
SWL (2003)			-1.0377	0.0925			-0.7884	0.1763
			(2.270)	(2.445)			(2.270)	(2.424)

Standard errors in parentheses.
Only coefficients on life satisfaction variables are shown.
First column specification is identical to column 3 of Table 3.
+ = p < .1, * = p < .05,** = p < .01, *** = p < .001