Quality of life and environmental amenities: a subjective well-being approach

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Abstract

In recent years, economists have started using socio-economic and socio-demographic characteristics to explain self-reported individual happiness or satisfaction with life. Using data disaggregated at the individual and regional level, this paper shows that in addition to these variables, consideration of amenities such as climate, environmental and urban conditions, typically employed in hedonic wage and housing regressions, is critical when analyzing subjective well-being. Location-specific factors are shown to have a direct impact on well-being. Moreover, their effect on quality of life does not seem to be fully captured by compensating differentials in housing and labor markets.

Keywords: subjective well-being; quality of life; happiness; hedonic regressions; amenities; location-specific factors; socio-economic and socio-demographic factors; compensating differentials.

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Over the past decades, in parallel to the widespread recognition that the employment of monetary indicators to measure welfare is far from perfect (e.g., United Nations, 1954; Ng, 1997; Frey and Stutzer, 2002a; Gowdy, 2004), a modern literature combining the disciplines of economics and psychology has emerged. Economists are now widely employing psychological techniques[1] to measure welfare using subjective well-being scores from self-reported happiness and life-satisfaction data as a proxy for utility (e.g., Clark and Oswald, 1994; 2002; Oswald, 1997; Di Tella *et al.*, 2001, or Stutzer, 2004).

Researchers have examined the impact on happiness and personal quality of life of the socio-demographic characteristics of individuals, such as age, gender and marital status, and socio-economic and macroeconomic characteristics, mainly income, unemployment and inflation (e.g., Clark and Oswald, 1994; Gerlach and Stephan, 1996; Oswald, 1997, Di Tella *et al.*, 2001). While they have consistently found a strong, negative link between life satisfaction and unemployment, the link with income is less clear (e.g., Easterlin, 1974; 1995; 2001) and certainly factors such as health and family circumstances tend to show a more marked influence on quality of life than standard economic measures (e.g., Clark and Oswald, 1994; Winkelmann and Winkelmann, 1998). The limited role of income as a determinant of life satisfaction has lead authors to examine income aspirations (e.g., Easterlin, 1995; Stutzer, 2004; Frijters *et al.*, 2004; Gardner and Oswald, 2001; 2004), positional externalities (e.g., Frank, 1997; 2003) and inequality (e.g., Alesina *et al.*, 2004) as further influences. The general result is that some measure of relative income has a significant impact on self-reported life satisfaction (e.g.,

[1] Psychologists have traditionally studied the determinants of subjective well-being and happiness (see Diener, 1984; Argyle, 1987; Myers, 1993 or Diener *et al.*, 1999 for a recent survey).

Easterlin, 2001; Luttmer, 2004). Further refinements include the examination of the effects of institutional factors such as the degree of democratic participation (e.g., Frey and Stutzer, 2000; 2002a).

Despite the impressive development of this literature, and the fact that regional dummies are highly significant in the regressions that do include them (e.g., Clark and Oswald, 1994; Bell and Blanchflower, 2004), the role of location-specific factors in explaining life satisfaction has only recently started being explored. Only in the last few years have authors started analyzing the trade-offs between life satisfaction and specific environmental attributes: aircraft noise (van Pragg and Baarsma, 2005); air pollution (Welsch, 2005); climate (Rehdanz and Maddison, 2005); and commuting time (Frey and Stutzer, 2004a).

The use of location-specific factors has a long tradition in the hedonic pricing literature. Variables such as climate, environmental and urban amenities have for a long time been employed in hedonic wage and housing regressions to account for regional wage and rent differentials, and to construct 'objective' quality of life indices with which to rank quality of life both across and within urban areas (see Rosen, 1979; Roback, 1982 or Blomquist, Berger, and Hoehn, 1988, for seminal contributions). The compensating differentials in labor and housing markets generated by location-specific amenities are often large: in her study of U.S. cities, Roback (1982) found that the average person in her sample would be willing to pay $69.55 per year for an additional clear day, $78.25 per year to avoid an additional cloudy day, and $5.55 per year to avoid an increase of 1 microgram per cubic meter in particulate matter. Blomquist *et al*. (1988) found that the difference in compensation between the most and least desirable U.S. counties in terms of the same bundle of local amenities comprising climate, urban conditions and environmental quality was $5,146. Berger *et al*. (2003) have shown that one standard deviation changes in climate attributes (heating degree days), air quality and crime produce annual

compensation in the Russian housing and labor markets of 7,839, 8,050 and 8,602 rubles respectively, compared to a mean monthly salary of 1,928 rubles.

The hedonic and subjective well-being literatures are motivated by the same key underlying question: what are the determinants of quality of life? However, their approaches are very different and both have limitations. Hedonic models are based on the assumption that housing and labor markets are in equilibrium, which is often violated in real-world applications. The valuation of environmental amenities using the subjective well-being (or, as in Frey *et al*., 2004b, 'life satisfaction') approach, on the other hand, does not require market equilibria. The impact on utility of changes in the level of amenities can be directly estimated. However, to capture the full extent to which amenities affect life-satisfaction, one needs to account for compensation in labor and housing markets (Frey *et al.*, 2004b). Thus, in this case, both approaches can be considered complementary and should not be utilized in isolation.[2]

In this paper we bridge both literatures, both theoretically and empirically using data on life satisfaction scores, location-specific amenities, wages and housing prices for Ireland, and, in so doing, demonstrate that (i) location matters: site-specific factors are important in explaining subjective well-being. The inclusion of climate, environmental and urban amenities, typically used in hedonic regressions, greatly improves our understanding of what determines quality of life; and that (ii) the total impact of location-specific amenities on self-reported well-being is not fully captured through compensating differentials in labor and housing markets suggesting that these markets are not in equilibrium.

The paper proceeds as follows: Section I presents the theoretical model which integrates both the hedonic and subjective well-being approaches and proposes a straightforward test of the

equilibrium assumption implicit in the hedonic approach. The theory is followed by a description of the data and the estimation strategy used in the paper. Section II presents the results and section III concludes.

I. Methodology

A. *Theoretical Model*

In this paper, as in the hedonic models of Roback (1982) and Blomquist *et al*. (1988), we assume that an individual's utility depends on the consumption of goods and services (represented by a composite commodity), on the use of residential land, and on the local amenities associated with that land. Thus, the level of well-being attained by a household in location *k* can be represented by the following indirect utility function:

$$v^k = v(w^k, r^k, a^k) \tag{1}$$

where r^k is the rental price of land, w^k is the wage rate and a^k is an index of local amenities in location *k*. Utility increases in wages ($v_w > 0$) and decreases in rents ($v_r < 0$). The effect on utility of a change in local amenities depends on whether they are consumption amenities ($v_a > 0$) or disamenities ($v_a < 0$).

In hedonic models, wages and rents must adjust *in equilibrium* to equalize utility across locations:

$$v^k = v(w^k, r^k, a^k) = \bar{v} \quad \forall k \tag{2}$$

Totally differentiating (2) we obtain:

$$dv = v_w dw + v_r dr + v_a da = 0 \tag{3}$$

[2] Van Pragg and Baarsma (2005) is the first paper which uses a subjective well-being approach and considers potential compensation in rental markets for differences in exposure to an amenity (noise from Amsterdam's

where the location superindices have been eliminated for notational simplicity.

From equation (3), it is clear that, in equilibrium, changes in the level of amenities are fully compensated in labor and rental markets, so that the net impact of such changes on utility is zero:

(4) $$\frac{dv}{da} = v_w \frac{dw}{da} + v_r \frac{dr}{da} + v_a = 0$$

In the hedonic literature, the implicit price of amenities is derived as $p_a^* = \frac{v_a}{v_w} = -\frac{v_r}{v_w}\frac{dr}{da} - \frac{dw}{da}$, where by Roy's identity, $\frac{v_a}{v_w}$ is estimated as the residential land consumed. However, in the subjective well-being literature, self-reported life satisfaction has successfully been used as a proxy for *v*, and thus, v_a, v_w, and v_r could be directly estimated without relying in the equilibrium assumption. In addition, using self reported life satisfaction as a proxy for *v* allows us to test the prediction in (4).

The use of self-reported well-being introduces measurement error as the respondents may be unable to communicate accurately their underlying utility level. However, as Blanchflower and Oswald (2004a) point out, it is measurement error in the independent variables that would be more problematic in the econometric estimation, and there is a broad consensus among previous studies that self-reported well-being is a satisfactory empirical proxy of individual utility (see, e.g. Stutzer, 2004; Blanchflower and Oswald, 2004b; Ferrer-i-Carbonell and Frijters, 2004).

The empirical specification used in the remainder of the paper is:

(5) $$u_{i,k} = \alpha + \beta' \mathbf{x}_{i,k} + \gamma' \mathbf{a}_{i,k} + \varepsilon_{i,k} \qquad i = 1....I\ ,\ k = 1,\ldots,K$$

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international airport).

where u is self-reported well-being of individual i in location k, **a** is a vector of location-specific factors, some of which (e.g., commuting time, access to services, proximity to a coast) may vary at an individual level, and **x** is a vector of socio-economic and socio-demographic characteristics.

Testing whether full capitalization occurs in labor and land markets is equivalent to testing whether the system is in equilibrium. Thus, if the individual is not fully compensated for differences in environmental amenities through house prices and wages we would expect that, in addition to a lack of equalization of utility across locations,

$$\gamma + v_w \frac{dw}{da} + v_r \frac{dr}{da} \neq \mathbf{0} . \tag{6}$$

B. *Data*

Data on satisfaction with life (u) and on the socio-demographic and socio-economic characteristics (**x**) used in the analysis come from a survey of a representative sample of 1,500 men and women, aged 18 and over and living in Ireland, interviewed in 2001.[3] This is combined with a vector of location-specific factors (**a**) describing climate conditions and environmental amenities, disaggregated at the regional level. Descriptions of the variables and descriptive statistics are outlined in Appendix I.

The use of data collected in Ireland is interesting in its own right. In the last decade, the 'Celtic Tiger' economy grew at a record rate. Between 1990 and 2000, Gross Domestic Product (GDP) doubled with the real annual growth rate at a high of 11 percent in 1999. After Luxembourg, Ireland now has the highest GDP per capita and the lowest unemployment rate in Europe (these and other trends are documented in, for example, Clinch *et al.*, 2002). Meanwhile,

[3] Due to missing observations the final sample consists of approximately (depending on the model specification) 1,467 observations. The effective response rate is 66.6 percent. The margin of error using the entire sample is ± 2.5 percent at a 95 percent confidence level. The 2000 Register of Electors was used as the sampling frame.

the Economist Intelligence Unit (2004) has ranked Ireland as first in its quality of life league table for 2005. Nevertheless, there has been much concern regarding the implications of the pace of economic growth for localized environmental quality and well-being generally (EPA, 2004a) and about increased inequality and persistent relative poverty (Layte *et al*., 2004). This concern has mostly centered on Dublin. Ireland's capital has experienced the most rapid growth – unparalleled in Europe (Honohan and Walsh, 2002). It is the only area to have experienced net internal immigration over the boom and is generally regarded as having suffered the most significant decline in the quality of urban amenities (EPA, 2004a). This makes Ireland an interesting subject for the analysis of the influence of location-specific amenities on subjective well-being and the testing of the hypothesis that variations in such amenities are compensated for through differentials in labor and housing markets.

The well-being indicator (or proxy for individual utility) is based on the answers to the following question (which was preceded by a range of questions regarding various aspects of the respondent's life): 'Thinking about the good and bad things in your life, which of these answers best describes your life as a whole?'. Respondents could choose a category on a scale of one to seven ('As bad as can be'; 'very bad'; 'bad'; 'alright'; 'good'; 'very good'; 'as good as can be').[4] The survey found a high well-being in general in Ireland with an average of 5.5 on the seven-point scale. On the advice of the professional survey unit, this question was considered to be more appropriate in an Irish context than the standard questions used in the life satisfaction literature. However, they are highly comparable and, as a check, additional questions were asked

[4] Some studies treat self-reported life satisfaction data and happiness data interchangeably. Veenhoven (1997) states that "the word life-satisfaction denotes the same meaning and is often used interchangeably with happiness." Di Tella *et al*. (2001) report a correlation coefficient of 0.56. However, Peiro (2002) points to happiness and satisfaction as two distinct spheres of well-being. He concludes that the first would be relatively independent of economic factors while the second would be strongly dependent.

regarding the respondent's mental health. As in the literature using the standard questions, these show a strong correlation with the measure of subjective well-being.

As for the independent variables, the dataset includes an employment-status variable divided into ten separate categories which follow the International Labor Organization classification: employed (self-employed, full-time employed and part-time employed), inactive (student, working on home duties, disabled, retired, those not working and not seeking work, and those on a government training scheme) or unemployed (CSO, 2004b). Unemployment is further divided into two categories of those unemployed having lost or given up their job combined with those not working but seeking work, and those seeking work for the first time.

Additional individual characteristics contained in the dataset and typically employed as controls in the literature are age, gender, educational attainment (primary, lower secondary/junior high school, upper secondary/senior high school and university degree), marital status (single, married, cohabiting, widowed and separated/divorced), gross household income[5] and number of dependent children in the household (1, 2, 3+). The dataset also contains information on whether the respondent is caring for a disabled member of the family, and, as an indicator of health status, the number of times the respondent has visited the doctor in the past year (never or once, two to five times and six or more times a year).

A preliminary analysis of the data revealed that over three-quarters of those surveyed (77 percent) saw the cost of housing as a major problem in Ireland. Thus, variables capturing household tenure (owned outright, mortgaged, renting, or in public housing) were included in the regression analysis. We also know the area in which the respondent lives.

[5] Income is expressed in thousands of euro. Missing values, 23.7 percent of those interviewed, were imputed based on the respondent's socio-demographic characteristics including age, gender, marital status, education level, area inhabited and employment status. The original income variable was divided in 10 categories, so mid-points were

As elements of the vector of location-specific factors, the dataset contains climate (from Collins and Cummins, 1996) and environmental data (from EPA, 2004b) at a regional level, and a variable capturing access to, and quality of, local facilities and services. The climate data consist of mean annual precipitation, number of wet days per annum, mean daily air temperature, mean daily range of air temperature, mean daily air temperature for January and July, January mean daily minimum air temperature, July mean daily maximum air temperature, mean annual duration of bright sunshine, mean daily duration of bright sunshine, mean annual wind speed, and a driving rain index.[6] Air pollution and water quality were considered as indicators of environmental quality but regional variation is minimal (EPA, 2004a). Population density (total population divided by total area in km^2) (CSO, 2003), congestion (number of vehicles (DELG, 2001) divided by the total length of primary roads per local authority[7] area (NRA, 2003)) and average commuting time in each local authority area were also included to capture crowding and congestion effects. As in Blomquist *et al.* (1988), variables capturing whether the respondent lives near the coast, the violent crime rate in the respondent's area - measured as the number of homicides per 100,000 population (Garda Siochana, 2001) and presence of waste facilities in the respondents area - measured as the number of waste facilities per 100,000 population (EPA, 2005) were included.

Except for the access to services variable, all the location-specific amenities are disaggregated at the regional or local authority level. The variable corresponding to local

used (as in Stutzer, 2004). The survey was carried out when Ireland was still using the Irish Pound, so we converted to euros using the fixed rate of IR£1= €1.26974.

[6] Driving rain is a term that describes the combined effects of falling rain and strong winds. It is the product of mean annual wind speed (m/s) and mean annual rainfall (m/year) (Collins and Cummins, 1996).

[7] For governance purposes, Ireland is divided into different regions called Local Authority areas. These generally equate to one body per county and one for the three major urban areas of Galway City, Limerick City and Cork City. Dublin is divided into four areas and Tipperary is divided into two local authority areas.

facilities and services is self-reported, and thus available at the individual level. It is a dummy that takes the value of 1 if the respondent considers access to, or quality of, public transport, educational facilities, shops, healthcare or public services, to be a major problem. We also considered two dummies which capture whether local crime and disorder and rural isolation are major problems for the respondents. As these variables are self-reported, they might introduce a problem of endogeneity. We return to this issue in the estimation strategy and results sections below.

C. *Estimation strategy*

As a first step towards capturing the influence of location-specific factors, in Model 1, we distinguish between those respondents living in Dublin and those living in the rest of the country. This split was considered appropriate in a small (approximately 70,000 m^2) and relatively homogenous country like Ireland where the Dublin area comprises 28 percent of the population in only 1.3 percent of the land area, accounts for 39 percent of the national total of Gross Value Added and, with a population of 1.122 million, is the only urban area with a population in excess of 150,000. This dummy variable is included in addition to the socio-economic and socio-demographic variables (age, age-squared, gender, employment status, educational attainment, health, marital status, income and income squared, number of dependent children and household tenure).[8]

In a model that controls for a broad range of socio-economic and socio-demographic characteristics, a dummy for Dublin might be seen as a rough summary measure of the amenities

[8] Since we know the area in which the respondent lives, we could estimate the models with regional fixed effects (or dummies for the different local authorities), but the problem with this approach is that most of the location-specific attributes included in subsequent models are also measured at the local authority level creating a problem of multicollinearity.

in that area. However, it does not provide much information regarding which specific amenities are most valued by the individuals. In order to determine which site-specific factors are most relevant, Model 2 incorporates location-specific climate and environmental variables, and dummies for the access to, and quality of, local facilities and services, and for local crime and disorder and rural isolation.

As discussed, the last three variables are self-reported. While we do not have the instruments to address directly the potential endogeneity problem they may generate, the robustness of the estimation results to their exclusion was examined.

The climate variables could not all be included together due to multicollinearity, which is a common problem in estimations of this kind (see, e.g., Roback 1982; Rehdanz and Maddison, 2005). This is particularly the case with mean and daily sunshine and annual precipitation and the driving rain index with correlation coefficients over 0.75 (Appendix II). Following the advice of a climatologist, we used mean annual precipitation, mean annual wind speed, July mean daily maximum air temperature, January mean daily minimum air temperature, and mean annual duration of bright sunshine. We also included congestion proxies for each local authority area and a dummy variable for whether the respondent lives near the coast.

Significant coefficients on the environmental and climatic attributes in the estimation of equation (5) would be an indicator of the importance of location-specific amenities to explain life satisfaction.[9] However, according to the theoretical model in Section I.A, to test whether labor and housing markets perfectly compensate for differences in the level of amenities across locations and to measure the total impact of the amenities on well-being when the labor and housing markets are not in equilibrium, we also need to estimate the impact of different amenity

[9] They reflect, in van Pragg and Baarsma (2005) terminology, the "residual" effect.

levels on house prices and wages. Therefore, in addition to equation (5), we estimate hedonic housing and wage regressions to assess this impact.

Finally, because the regressions combine data at different levels of disaggregation (individual vs. local authority level), the standard errors in all the regressions are corrected for clustering (see Moulton, 1990).

II. Results

A. *Model 1 – assessing the importance of location*

Tables 1 and 2 show the results from the estimation of Model 1. Table 1 contains the OLS results and, given the nature of the dependent variable, Table 2 contains the results from ordered-probit regressions. In both cases, the reference groups for the independent dummy variables are in parentheses. For simplicity, given the similarity of the estimates in the two tables, and the more intuitive interpretation of the OLS coefficients, we follow the literature (Frey and Stutzer, 2000), and in what follows we focus on the OLS results of Table 1.

- Tables 1 and 2 about here -

The coefficients on socio-economic and socio-demographic characteristics in Table 1 are, generally, in line with previous findings in the literature. The coefficient on gender is significant and negative indicating that males are less satisfied with their lives than females. Except for the study of Alesina *et al.,* (2004) that finds gender to be significantly related to life satisfaction in the USA, in previous studies, gender tends to emerge as insignificant in life satisfaction regressions (Stutzer, 2004; Frey and Stutzer, 2000; Di Tella *et al.*, 2001). Our results show no significant relationship between life satisfaction and age.

In concordance with previous studies, (e.g., Blanchflower and Oswald, 2004a) the coefficient on being unemployed is negative and significant at the 1 percent level and, everything

else being equal, reduces life satisfaction by three-quarters of a category. The coefficient on the variable not working, not seeking work is also negative and significant at the 1 percent level. Other things being equal, these respondents are over one life-satisfaction category less satisfied on average than the self-employed. There is no evidence of a significant difference between the self-employed and the full-time employed, the retired, the disabled, full-time students, or those looking for work for the first time. The estimates for the employment status variables indicate that respondents engaged in household activities, those part-time employed and those on a government training scheme are less satisfied with life than the self-employed.

Like Frey and Stutzer (2000), we find that those with middle (lower secondary/junior high school) or higher education (upper secondary/senior high school) are more satisfied with life than those with a lower education level. Perhaps surprisingly, having a college education is not emerging as significant. This may be due to its role in raising expectations for one's life (Veenhoven, 1997).

With respect to health, we find that those respondents visiting their doctor two or more times a year were less satisfied with their lives than those not attending or attending only once.

Among the marital status variables, being separated or divorced is significant at the 5 percent level and such respondents are less satisfied with their lives than single respondents. These results are comparable with previous studies such as Clark and Oswald (1994) and Blanchflower and Oswald (2004b). However, these also find that married respondents report being more satisfied with their lives than single respondents and widowed respondents.

In terms of family composition, having three or more children is significant at the 5 percent level and negatively related to life satisfaction. Clark and Oswald (1994) also find that having children is associated with less contentment. However, being the caregiver of a disabled family

member increases life satisfaction. This finding is similar to that of Frijters *et al*. (2004), albeit in a different context.

With respect to household tenure, living in public housing is significant and negatively related to life satisfaction at the 1 percent level with a large coefficient, over half a category.

We find income to be insignificantly related to life satisfaction. This result is not surprising in the light of previous studies that find a weak link between absolute income and life satisfaction (Biswas-Diener and Diener, 2001; Easterlin, 1995) and, more specifically, given the correlation between income, education and housing tenure. In essence, one might expect that income should only be important in terms of what it buys.[10]

The coefficient for Dublin is highly significant (at the 1 percent level) and large; only the coefficients for being unemployed, and a discouraged worker are larger in magnitude. Everything else being equal, those living in all areas outside Dublin have a higher life satisfaction than those in Dublin.

Having controlled for a large number of socio-economic and socio-demographic characteristics, a reasonable hypothesis is that factors related to the size of the settlement and other location-specific factors may be responsible for lower life-satisfaction levels in Dublin. For example, compared to any other area in the country, unparalleled growth rates have resulted in the capital having a much higher population density than other areas and a significant traffic congestion problem (DELG, 2002). To test this hypothesis, we examine the importance of location-specific amenities.

B. *Model 2 – examining location-specific amenities*

[10] Biswas-Diener and Diener (2001) suggest, however, that some individuals feel happier just possessing income in of itself.

Model 2 builds on Model 1 by including variables capturing access to, and quality of, facilities and services, population density, congestion, commuting time and other environmental and climatic variables. This model, the results of which are reported in the third columns of Tables 1 and 2, corresponds to Equation (5).

Of the new variables, the composite variable describing the respondents' perceptions of the provision, quality of, and access to, facilities and services in their area is significant with the expected sign; perceived problems with access to facilities and services decrease life satisfaction. Rural isolation is also associated with a lower life satisfaction. As mentioned previously, it is possible that answers to these self-reported variables are driven by well-being, introducing a problem of endogeneity. Thus, we repeated the regressions excluding these variables in this and subsequent models. The results for the remaining variables are robust.

Of the climate variables, the coefficient on wind speed is negative and significant, while those for mean daily minimum air temperature in January and mean daily maximum air temperature in July have the expected signs, but are both insignificant. The coefficient on the variable capturing whether the respondent lives near the coast is positive and significant at the 5 percent level.

Perhaps the most surprising result is that for rain. The coefficient on mean annual precipitation is significant and indicates that, for Irish people, increased rainfall slightly increases life satisfaction. This result may, however, be driven by a positive correlation between rain and scenic beauty. The most spectacular landscapes in Ireland are found in the wettest counties in the West of Ireland. Rehdanz and Maddison (2005) find very scarce precipitation to reduce happiness, which they hypothesize might reflect the fact that climate could have an indirect effect on happiness through landscape effects.

The coefficient on population density is negative and significant at the 5 percent level. This result contrasts with that of Roback (1982), who finds population density to be an amenity, and it possibly captures an overcrowding effect that decreases life satisfaction. Average commuting time and congestion are also negatively associated with well-being, but insignificantly so.

The dummy variable capturing the presence of waste disposal facilities in the respondent's locale emerges negative and significant at the 5 percent level.

In Model 2 the dummy for Dublin looses its significance. This result suggests that the new variables entered into the model explain an important part of the difference between living in Dublin and other regions of Ireland in terms of well-being. In addition, the explanatory power of the model improves with the adjusted R-squared increasing from 0.2087 to 0.3207.

Results from Models 1 and 2 confirm that location is important in explaining life satisfaction. However, despite rejecting the hypothesis $\gamma = 0$ for several location-specific factors, it is possible that wages and house prices compensate for differentials in environmental and climatic attributes (i.e. higher incomes and lower house prices compensate for lower levels of amenities). When equation (4) holds, compensation is full. To examine the role of the housing and labor markets compensating for different levels of amenities, we estimated housing and wage hedonic regressions, where house prices and wages were regressed against house characteristics and wage earners' socio-economic and socio-demographic characteristics respectively, along with the amenities included in the estimation of equation (5).

C. *Hedonic housing regression*

In order to estimate this regression, we expanded the dataset to include variables capturing house characteristics (number of rooms; type of house – detached, semi-detached, terraced or apartment; location – Dublin or outside Dublin; and a composite index of the quality of the house based on whether the respondent's home has full central heating and is not damp), and house prices.[11] The regression also incorporates the environmental and climatic features included in the happiness function, and variables for population growth, regional unemployment and the crime rate, which are typically employed in the hedonic literature.

As expected, the results in Table 3 show that larger houses and detached houses command higher prices than the semi-detached. We also find that houses located outside Dublin are cheaper (by approx. €80,000).

- Table 3 about here -

None of the climate variables used in Model 2 is statistically significant, suggesting that their influence on well-being is not captured by the housing market. In fact, of the variables significant in Model 2, only population density has a significant impact on house prices. In line with Roback (1982), who finds population density to be an amenity, we find house prices to increase with population density. However, its negative sign in the estimation of equation (5), lowering life satisfaction, suggested that population density in our sample is a disamenity. If this is the case, house prices are not compensating for this effect. Population growth is also significant and influences house prices positively suggesting that we could be capturing demand effects. Finally, the crime rate, which does not directly affect life satisfaction in Model 2, tends to reduce house prices.

[11] We thank Mirko Moro for this dataset.

D. *Hedonic wage regression*

Wages of the respondent were regressed on socio-economic and socio-demographic characteristics, and location-specific variables. Wages were calculated by dividing household income by an equivalence factor (as in Joung *et al*., 1997) to adjust for the number of adults and children living in the household. Additionally, we restrict the regression to those respondents that are employed. Characteristics of the respondent include: age, gender, marital status, education and employment status (we distinguish between the self-employed, the full-time employed and the part-time employed). We also include the environmental and climatic variables included in the happiness regression, and add the variables: population growth, regional unemployment and the crime rate, typically employed in the hedonic literature. Results are shown in Table 4.

- Table 4 about here -

As expected, we find that wages increase with age and education. Of the climate variables, the coefficient on precipitation is positive and statistically significant, indicating that individuals are compensated in labor markets for living in areas that experience more rainfall. This compensation, however, goes in the opposite direction than we would expect for full compensation to exist if rainfall is, as suggested by Model 2, an amenity or associated with one.

Population density and congestion are also significant and positively related to the wage. Compensation through higher wages for higher population density could offset its direct negative impact on well being in Model 2. However, simple eyeballing of the estimates suggests this is not the case once we take into account the adjustment in the housing market.

Overall, the results in this section indicate that the amenities that have a direct impact on well-being fail to be accounted for in wages or house prices in Ireland, so that equation (4) does

not hold This may be explained by the disequilibrium resulting from the rapid growth in the Celtic Tiger economy, a sudden fall in interest rates due to membership of the eurozone, a consequent extraordinary boom in housing demand along with a relatively fixed supply of housing, and a record growth in employment with an associated skills shortage.

III. Conclusions

In common with the existing literature, the results presented in this paper show that socio-demographic and socio-economic variables are important determinants of well-being. Being unemployed is negatively associated with life satisfaction, and its impact is large, reducing life satisfaction by more than one category out of seven. An equally large and negative impact on life satisfaction of being a discouraged worker suggests that it is not easier being unemployed once one has been without work for some time.

In terms of advancing our understanding of the determinants of quality of life, the most significant finding of this paper is that location-specific amenities have a very important influence on well-being. Factors such as population density, access to and quality of facilities and services, environment and climate, are shown to be extremely important determinants of well-being, as important as the most critical socio-economic and socio-demographic factors. Consideration of these variables, typically employed in hedonic wage and housing regressions but generally ignored in the self-reported life satisfaction literature, is thus crucial in understanding what makes us happy and has significant implications for setting priorities for urban planning and economic, environmental and social policy. While these location-specific factors are shown to have a direct impact on well-being, unlike in the hedonic literature, this paper suggests that their effect on quality of life is not fully captured by compensating differentials in housing and labor markets.

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Table 1: OLS Regressions/ Dependent Variable 'Subjective Well-being'

Variable Name		**Model 1**	**Model 2**
Age	Age	0.0153003 (1.44)	0.0002273 (0.02)
	Age-squared	-0.000174 (-1.46)	-0.0000342 (-0.32)
Gender *(Female)*	Male	0.0735565 (-2.39)**	-0.108086 (-1.49)
Employment status *(Self Employed)*	Retired	0.0735565 (0.56)	-0.0111072 (-0.12)
	Engaged in home duties	-0.3046276 (-3.07)**	-0.2651031 (-1.88)*
	Student	-0.1503694 (-1.05)	-0.1712337 (-1.04)
	Seeking work for 1st time	-0.1565822 (-0.54)	-0.1522335 (-0.47)
	Unemployed	-0.7755584 (-4.13)***	-0.62264 (-4.32)***
	Not working, not seeking work	-1.168369 (-3.82)***	-1.248564 (-4.16)***
	Working full-time	-0.0973199 (-1.20)	-0.0907929 (-1.22)
	Working part-time	-0.2963889 (-2.71)**	-0.2172216 (-2.26)**
	Government Scheme	-0.5163553 (-2.41)**	-0.8979072 (-2.72)**
	Permanently unable to work	-0.4205255 (-1.61)	-0.4353945 (-1.89)*
Education *(Primary)*	Lower secondary/Junior high school	0.3366384 (3.53)***	0.1119848 (1.18)
	Upper secondary/Senior high school	0.1525698 (1.69)*	0.0094379 (0.09)
	Degree	0.0497889 (0.49)	0.0246558 (0.25)
Health *(Visited the doctor 0 or 1 in the last year)*	2 – 5 doctor visits	-0.1357126 (-2.55)**	-0.1301745 (-1.92)*
	6 or more doctor visits	-0.3158488 (-3.05)**	-0.2259114 (-2.16)**
Marital Status *(Single)*	Married	0.0034124 (0.04)	0.0580719 (0.75)
	Co-habiting	-0.0614822 (-0.49)	-0.0986785 (-0.74)
	Widowed	0.0712107 (0.56)	0.099347 (0.80)
	Separated and Divorced	-0.3222831 (-1.94)*	-0.2164787 (-1.26)
Income	Income (1000s)	0.0137259 (1.45)	0.0126873 (0.96)
	Income-squared	-0.0000902 (-0.63)	-0.0000774 (-0.37)

Table 1: OLS Regressions *(Cont.)*/ Dependent Variable 'Subjective Well-being'

Variable Name		**Model 1**	**Model 2**
Number of children in the household *(No children)*	1 Child	0.0157647 (0.18)	0.0611425 (0.68)
	2 Children	-0.0844996 (-1.04)	-0.0093309 (-0.12)
	3 or more children	-0.1634833 (-2.08)**	-0.0354429 (-0.58)
Household tenure (Own Outright)	Own with a mortgage	-0.0100895 (-0.17)	-0.0901434 (-1.76)*
	Rent privately	0.0302209 (0.30)	0.0192726 (0.16)
	Public housing	-0.4401924 (-4.83)***	-0.3789678 (-3.99)***
Respondent is a caregiver		0.2587838 (1.69)*	0.3958442 (2.32)**
Dublin Dummy Variable		-0.6210571 (-11.40)***	0.3886977 (1.09)
Access to Services Dummy		No	-0.1068829 (-1.73)*
Increasing crime and disorder			-0.083662 (-1.08)
Rural isolation			-0.1210298 (-2.12)**
Location-specific Variables		No	Yes
Climate Variables	Precipitation	No	0.0011314 (4.70)***
	Wind speed		-0.4297473 (-2.61)**
	January minimum temperature		-0.1741759 (-0.91)
	July maximum temperature		0.1695486 (1.00)
	Average annual sunshine (hours)		0.0003324 (0.35)
Environmental Variables	Waste facilities		-0.0959573 (-3.69)**
	Average commuting time		-0.0141402 (-0.68)
	Respondent lives near the coast		0.6717235 (2.67)**
	Population density		-0.0160794 (-3.07)**
	Congestion		-0.0000623 (-1.04)
	Homicide rate		0.0533899 (1.24)
Number of Observations		1467	1464
Adjusted R^2		0.20876623	0.32077905

Note 1: * Significant at 10% level; ** significant at 5% level; *** significant at 1% level.

Note 2: t-statistics in parentheses computed using White's Heteroskedasticity variance-covariance matrix estimator.

Table 2: Ordered-Probit Regressions/ Dependent Variable 'Subjective Well-being'

Variable Name		**Model 1**	**Model 2**
Age	Age	0.01862 (1.44)	-.0008429 (-0.06)
	Age-squared	-0.0002124 (-1.47)	-.000035 (-0.24)
Gender *(Female)*	Male	-0.1623183 (-2.36)**	-.1417467 (-1.49)
Employment status *(Self Employed)*	Retired	0.0944674 (0.58)	-.0169189 (-0.14)
	Engaged in home duties	-0.3823426 (-3.11)**	-.3680304 (-2.09)**
	Student	-0.1967431 (-1.11)	-.2580313 (-1.18)
	Seeking work for 1st time	-0.1913706 (-0.54)	-.2248413 (-0.52)
	Unemployed	-00.9126505 (-4.22)***	-.7870708 (-4.47)***
	Not working, not seeking work	-1.427273 (-3.92)***	-1.69417 (-4.47)***
	Working full-time	-0.1253172 (-1.24)	-.1303948 (-1.34)
	Working part-time	-0.361767 (-2.74)**	-.3027399 (-2.41)**
	Government Scheme	-0.6417717 (-2.54)**	-1.277082 (-3.05)**
	Permanently unable to work	-0.49291 (-1.61)	-.5736998 (-2.02)**
Education *(Primary)*	Lower secondary/Junior high school	0.4260918 (3.71)***	.1598916 (1.26)
	Upper secondary/Senior high school	0.1800184 (1.71)*	-.007285 (-0.06)
	Degree	0.0513162 (0.43)	.00937 (0.07)
Health *(Visited the doctor 0 or 1 in the last year)*	2 – 5 doctor visits	-0.1566824 (-2.48)**	-.166036 (-1.89)*
	6 or more doctor visits	-0.3863156 (-3.12)**	-.2979683 (-2.10)**
Marital Status *(Single)*	Married	-0.0125823 (-0.13)	.055453 (0.51)
	Co-habiting	-0.1133942 (-0.75)	-.1979237 (-1.15)
	Widowed	0.0803872 (0.52)	.1173099 (0.71)
	Separated and Divorced	-0.3802754 (-2.06)**	-.2673765 (-1.27)
Income	Income (1000s)	0.0160899 (1.38)	.0170457 (0.98)
	Income-squared	-0.0000966 (-0.55)	-.0001026 (-0.37)

Table 2: Ordered-Probit Regressions *(Cont.)*/ Dependent Variable 'Subjective Well-being'

Variable Name		**Model 1**	**Model 2**
Number of children in the household *(No children)*	1 Child	0.0211161 (0.19)	.0934374 (0.80)
	2 Children	-0.0849793 (-0.89)	.0170332 (0.17)
	3 or more children	-0.1790568 (-1.90)*	-.0136703 (-0.17)
Household tenure (Own Outright)	Own with a mortgage	-0.0246205 (-0.34)	-.1397396 (-1.99)**
	Rent privately	0.0333669 (0.27)**	.0212593 (0.13)
	Public housing	-0.5161903 (-4.71)***	-.4769287 (-4.08)***
Respondent is a caregiver		0.3253283 (1.66)*	.5410238 (2.43)**
Dublin Dummy Variable		-0.7516307 (-11.76)***	.5878532 (1.21)
Access to Services Dummy		No	-.1366705 (-1.67)*
Increasing crime and disorder			-.1456831 (-1.26)
Rural isolation			-.1579224 (-1.99)**
Location-specific Variables		No	Yes
Climate Variables	Precipitation	No	.0017537 (4.15)***
	Wind speed		-.6380512 (-2.58)**
	January minimum temperature		-.230691 (-0.85)
	July maximum temperature		.2179983 (0.88)
	Average annual sunshine (hours)		.000695 (0.50)
Environmental Variables	Waste facilities		-.1381128 (-3.45)**
	Average commuting time		-.0171925 (-0.59)
	Respondent lives near the coast		.8949092 (2.64)**
	Population density		-.0199185 (-2.71)**
	Congestion		-.0000884 (-1.00)
	Homicide rate		.0687455 (1.16)
Number of Observations		1467	1464
Likelihood Ratio		-1844.6378	-1709.306
Pseudo R^2		0.0888	0.1543

Note 1: * Significant at 10% level; ** significant at 5% level; *** significant at 1% level.

Note 2: t-statistics in parentheses computed using White's Heteroskedasticity variance-covariance matrix estimator.

Table 3: Hedonic Housing Regression

Variable Name		**Results**
Housing quality		10378.04 (1.12)
Number of rooms		7002.44 (2.99)**
Dwelling type *(Detached)*	Semi-detached	-29552.89 (-2.80)**
	Terraced	-7895.73 (-0.54)
	Apartment	17975.46 (1.15)
Dublin Dummy Variable		80028.24 (2.07)**
Location-Specific Variables		Yes
Climate Variables	Precipitation	19.97093 (0.48)
	Wind speed	17889.76 (0.73)
	January minimum temperature	13365.33 (0.54)
	July maximum temperature	7468.611 (0.28)
	Average annual sunshine (hours)	67.85034 (0.74)
Environmental Variables	Waste facilities	2443.349 (0.60)
	Average commuting time	1442.487 (0.53)
	Respondent lives near the coast	-9652.269 (-0.32)
	Population density	3059.225 (3.92)***
	Congestion	5.546223 (0.66)
	Homicide rate	-9727.991 (-2.12)**
	Unemployment rate	4505.032 (0.91)
	Population change	6164.241 (3.22)**
Number of Observations		1168
Adjusted R^2		.2432

Note 1: Dependent variable; regional house prices.

Note 2: * Significant at 10% level; ** significant at 5% level; *** significant at 1% level.

Note 3: t-statistics in parentheses computed using White's Heteroskedasticity variance-covariance matrix estimator.

Table 4: Hedonic Wage Regression

Variable Name		**Results**
Age	Age	245.5018 (1.71)*
	Age-squared	-2.391937 (-1.40)
Gender *(Female)*	Male	-299.807 (-0.59)
Marital Status *(Single)*	Married	-153.4735 (-0.18)
	Co-habiting	-922.7715 (-0.80)
	Widowed	6123.288 (1.79)*
	Separated and Divorced	-2819.723 (-1.74)*
Employment status *(Self Employed)*	Working full-time	210.0304 (0.20)
	Working part-time	-2382.483 (-2.14)**
Education *(Primary)*	Lower secondary/Junior high school	1804.586 (2.14)**
	Upper secondary/Senior high school	4255.282 (5.93)***
	Degree	7559.773 (7.07)***
Dublin Dummy Variable		-4036.534 (-1.51)
Access to Services Dummy *(Not a major problem)*		-365.8809 (-0.74)
Rural isolation		459.701 (0.82)

Table 4: Hedonic Wage Regression *(cont.)*

Variable Name		**Results**
Location-Specific Variables		
Climate Variables	Precipitation	5.388601 (1.83)*
	Wind speed	-191.2225 (-0.16)
	January minimum temperature	-987.9173 (-0.51)
	July maximum temperature	-1210.822 (-0.81)
	Average annual sunshine (hours)	13.35902 (1.54)
Environmental Variables	Waste facilities	-212.5885 (-0.89)
	Average commuting time	16.83813 (0.08)
	Respondent lives near the coast	-1626.934 (-0.69)
	Population density	114.5995 (2.29)**
	Congestion	1.384332 (3.07)**
	Homicide rate	-327.373 (-1.01)
	Unemployment rate	-145.7988 (-0.42)
	Population change	147.9696 (1.25)
Number of Observations		791
Adjusted R^2		0.1683

Note 1: Dependent variable: equivalized individual income.

Note 2: * Significant at 10% level; ** significant at 5% level; *** significant at 1% level.

Note 3: t-statistics in parentheses computed using White's Heteroskedasticity variance-covariance matrix estimator.

Appendix I

Table A1: Variable Listing – Socio-economic and socio-demographic variables

Variable Name		Description	String
Socio economic and demographic variables			
Self-reported well-being		Thinking about the good and bad things in your life, can you say which of these answers best describes your life as a whole? Answers ranged from 'as good as can be' to 'as bad as can be'.	Discrete (1-7)
	Age	Age of respondent	Continuous
	Age Squared	Age of respondent squared	Continuous
	Gender	Male/ female	Dummy
Employment status			
	Self-employed	Respondent is self-employed	Dummy
	Retired	Respondent is retired	Dummy
	Engaged in home duties	Respondent is a homemaker	Dummy
	Student	Respondent is in full-time education	Dummy
	Seeking work for 1st time	Respondent is seeking work for the 1st time	Dummy
	Unemployed	Consists of those not working, seeking work and those unemployed having lost or given up their job	Dummy
	Not working, not seeking work	Respondent is not working, not seeking work	Dummy
	Working full-time	Respondent works full-time	Dummy
	Working part-time	Respondent works part-time	Dummy
	Government Scheme	Respondent is on a government training/ education/ employment scheme	Dummy
	Permanently unable to work	Respondent is unable to work due to permanently illness or disability	Dummy
Education			
	Primary	Respondent has just primary (no secondary) education	Dummy
	Lower Secondary	Respondent has a lower secondary education (Junior/ group/inter)	Dummy
	Upper Secondary	Respondent has a technical or vocational qualification, or the leaving certificate or both of these.	Dummy
	Third level	Consists of non-degree, primary degree, professional qualification, both of these and post graduate degree	Dummy
Health			
	0-1 doctor visits	In past year, respondent has visited doctor never or once	Dummy
	2-5 doctor visits	In past year, respondent has visited doctor 2 to 5 times	Dummy
	6 or more doctor visits	In past year, respondent has visited doctor 6 or more times	Dummy

Table A1: Variable Listing *(cont.)*

Variable Name		**Description**	**String**
Income			
	Income	Gross household income/ 1000	Continuous
	Income squared	Gross household income/1000 squared	Continuous
Marital Status			
	Single	Respondent is single (never married)	Dummy
	Married	Respondent is married	Dummy
	Cohabiting	Respondent is cohabiting	Dummy
	Separated/ Divorced	Respondent is separated/ divorced	Dummy
	Widowed	Respondent is widowed	Dummy
Number of dependent children			
	No Children	Respondent has no dependent children	Dummy
	1 child	Respondent has 1 dependent child	Dummy
	2 children	Respondent has 2 dependent children	Dummy
	3 or more children	Respondent has 3 or more dependent children	Dummy
Caregiver		Respondent is the care giver of a family member with a disability	Dummy
Dublin dummy variable		Respondent lives in one of the four Dublin local authority areas	Dummy
Local Authority area		Local Authority area in which the respondent lives (of which there are 34).	Dummy

Table A2: Variable Listing – Environmental variables

Variable Name		Description	String
Environmental Variables			
Access to Services		Captures access to, and quality of, local facilities and services. Is 1 if respondent perceives there to be a major problem with access to public transport, access to educational opportunities, access to shops, healthcare and provision of housing for local people. Zero otherwise	Dummy
Increasing crime and disorder		1 if respondent perceives there to be a major problem with increasing crime and disorder in their area. Zero otherwise	Dummy
Rural isolation		1 if respondent perceives there to be a major problem with rural isolation in their area. Zero otherwise	Dummy
Climate			
	Precipitation	Rain fall measured as mm/year	Continuous
	Wind	Mean annual wind speed at 10 meters above ground level	Continuous
	January Minimum temperature	Air temperature in degrees Celsius	Continuous
	January Minimum temperature	Air temperature in degrees Celsius	Continuous
	Average Annual Sunshine	Mean annual total duration of bright sunshine, hours/ day	Continuous
Waste facilities		Number of waste facilities in the respondents local authority area per 100,000 of the population	Continuous
Average commuting time		Measured as the average commuting time in the local authority area in 2002.	Continuous
Respondent lives near the coast		1 if respondent lives in a local authority area which lies on the coast, 0 otherwise	Dummy
Population density		Measured as total population divided by total area in km^2	Continuous
Congestion		Measured as the average number of vehicles in the LA divided by the national road length	Continuous
Homicide rate		Number of homicides in the respondents local authority area per 100,000 of the population	Continuous

Table A3: Descriptive Statistics - Dummy variables

Variable	n	Percent
Well-being		
As good as can be	209	14
Very good	547	37
Good	488	33
Alright	197	13.3
Bad	26	1.8
Very bad	4	0.3
As bad as can be	3	0.2
Gender		
Male	718	47.9
Female	782	52.1
Marital Status		
Single (never married)	518	35
Married	778	52
Co-habiting	36	2.5
Separated or divorced	45	3
Widow	100	7
Children		
No children	927	62
1 child (all)	123	8
3 or more children	218	14.5
Employment Status		
Retired	182	12.2
Engaged in home duties	303	20.4
Student	86	5.7
Seeking work for 1st time	12	1
Unemployed	41	2.7
Not working, not seeking work	7	0.5
Full-time employed	555	37.3
Part-time employed	114	7.6
On a government training scheme	16	1
Disabled	29	2
Self employed	133	9
Education		
Primary	204	14
Lower secondary	279	18.6
Upper secondary	704	47
Degree	259	17.3
Health (Doctor visits)		
Never or once	855	57
Two to five times	502	33
Six or more times	146	10
Tenure		
Own outright	621	42
Own with a mortgage	535	36
Rent Privately	106	7
Rent from the local authority	198	13
Other		
Good housing Quality	914	60
Respondent is the carer of a disabled family member	36	2.5

Table A4: Descriptive Statistics - Location-specific and other continuous variables

Variable	Observations	Mean	Std. Dev	Min	Max
January minimum temperature (degrees Celsius)	1494	2.45	0.561	1.5	3.5
July maximum temperature (degrees Celsius)	1494	19.22	0.67	17.6	20
Precipitation (mm)	1494	1127.12	340	700	1900
Mean annual sunshine (hours)	1494	1385.94	93.65	1200	1500
Mean daily sunshine (hours)	1494	3.7	0.237	3.25	4.12
Population density	1494	8.66	14.36	0.1623	42.15
Total Population	1494	178089.9	135797.1	25799	495781
Average commuting time (minutes)	1494	25.88	5.3	17	36
Congestion	1494	1260.4	1406.5	41.42	4963.1
Waste facilities (per 100,000 of the population)	1494	3.19	1.92	0	7.75
Homicide rate	1494	1.52	1.41	0	5.42
Age	1492	43.6	17.1	18	90
Income	1497	22986	11643	1852	57138

Appendix II – Correlation coefficients

Table A5: Environmental Variables – Correlation Coefficients

	Waste Facilities	Total population	Congestion	Population density	Average commuting time	Coast
Waste facilities	-	-0.1171	**-0.4087**	**-0.2703**	-0.1331	**-0.3402**
Total population		-	**0.2726**	**0.3597**	0.2347	-0.2039
Congestion			-	**0.4779**	0.0879	**0.3703**
Population density				-	0.0791	0.1883
Average commuting time					-	-0.1223
Coast						-

Table A6: Climatic Variables – Correlation Coefficients

	Driving rain	Wind	Mean sunshine	Annual Precipitation	July maximum temperature	January minimum temperature	Mean Daily Sunshine
Driving rain	-	**0.4389**	**-0.5674**	**0.7781**	**-0.6467**	0.2189	**-0.5187**
Wind		-	0.1894	0.1282	**-0.5106**	**0.6064**	**0.3228**
Mean annual sunshine			-	**-0.7144**	**0.4021**	0.1957	**0.8924**
Annual Precipitation				-	**-0.5482**	0.1081	**-0.6823**
July maximum temperature					-	0.2377	**0.2865**
January minimum temperature						-	**0.2665**
Mean Daily sunshine							-

Table A7: Environmental/ Climatic Variables Correlations

	Total population	Congestion	Population density	Average commuting time	Waste facilities
Driving rain	**-0.3172**	**-0.3440**	**-0.2994**	-0.1185	**0.3132**
Wind	0.0332	**0.3610**	**0.3036**	0.0050	-0.1700
Mean sunshine	**0.4390**	**0.6302**	**0.5309**	0.2138	**-0.2961**
Annual Precipitation	**-0.4217**	**-0.5223**	**-0.4456**	-0.1493	0.2469
July maximum temperature	0.0609	0.2200	0.0195	0.0695	0.0539
January minimum temperature	-0.0281	**0.4692**	0.2480	-0.1476	-0.1861
Mean Daily Sunshine	**0.4311**	**0.6463**	**0.5294**	0.2120	**-0.4973**