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Talent, Technology and Tolerance in Canadian Regional Development

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Abstract

This paper examines the factors that shape economic development in Canadian regions. It employs path analysis and structural equation models to isolate the effects of technology, human capital and/or the creative class, universities, the diversity of service industries and openness to immigrants, minorities and gay and lesbian populations on regional income. It also examines the effects of several broad occupations groups – business and finance, management, science, arts and culture, education, and healthcare on regional income. The findings indicate that both human capital and the creative class have a direct effect on regional income. Openness and tolerance also have a significant effect on regional development in Canada. Openness toward the gay and lesbian population has a direct effect on both human capital and the creative class, while tolerance toward immigrants and visible minorities is directly associated with higher regional incomes. The university has a relatively weak effect on regional incomes and on technology as well. Management, business and finance, and science occupations have a sizeable effect on regional income; arts and culture occupations have a significant effect on technology; health and education occupations have no effect on regional income.

Keywords: Canada, Human Capital, Creative Class, Occupations, Tolerance, Technology, Income, Regional Development

JEL: O3 R1 R2 J24

Introduction

What are the drivers of regional economic development in Canada? Traditionally, the answer has been jobs: The availability of high-quality, high-paying employment opportunities have long been seen as central to the ability of regions to attract people and raise incomes. With the globalization of manufacturing and the movement of a good deal of manufacturing jobs to lower cost locations, technology and entrepreneurship have come to be seen as increasingly important sources of regional development. The high-tech models of Silicon Valley, California, the Route 128 area around Boston, Massachusetts, North Carolina's Research Triangle, or Waterloo, Ontario have generated increasing awareness of the role of research universities and clusters of innovative entrepreneurial firms in spurring regional growth. Others point to the role of talent in regional economic growth arguing that a key element is the ability of regions to attract and retain highly-educated, highly skilled people. More recent approaches emphasize the roles played by urban amenities, quality of life, energetic artistic and cultural scenes, and openness to diversity in providing a broad "people climate" which works to attract not just people but firms.

To what extent do these factors shape regional development in Canada? Does any one factor dominate, or is regional development a more holistic process requiring a balanced approach and a related bundle of factors?

Canada is a large country with a relatively small, highly urban population. With a recent influx of immigrants it is both culturally and geographically diverse. As a consociational nation, Canada is populated by several distinct cultural groups - Anglophone, Francophone, and Aboriginal,

as well as new immigrants. Stretching from the Atlantic to the Pacific to the Arctic oceans, Canadian regions differ greatly in natural resources and climate. Canada's regions are physically and socially heterogeneous. Thus, understanding economic development in Canada requires understanding the factors that shape growth across Canadian regions.

There is now a long literature on economic growth and development. While most studies focus on the nation-state, there is now growing awareness of the role played by regions in economic growth and development and a growing literature on the factors that shape regional growth. There is a general consensus that two factors shape economic growth – technology and human capital or talent. Solow (1956) long ago identified the central role played by technology in economic development. Romer (1986) later formalized the role of human capital which has been empirically verified in large-scale studies of national economic performance (Barro, 1991) and across regions the US and other advanced countries (Rauch, 1993; Simon and Nardinelli, 1996; Simon, 1998). It is also clear from recent studies that human capital levels are diverging, and the differences are growing larger and more pronounced across regions (Berry and Glaeser, 2005).

There has been recent interest in the factors that shape the ability of nations or regions to generate technology and/ or human capital. Nations vary widely in human capital levels; and recent research (Berry and Glaeser, 2005) documents the divergence of human capital levels across U.S. regions. Three competing theories have been to account for regional differences in human capital. The first argues that universities play a key role in creating initial advantages in human capital, which becomes cumulative and self-reinforcing over time (Berry and Glaeser, 2005). The second argues that

amenities play a role in attracting and retaining highly-educated, high-skill households (Glaeser, 1998; Glaeser et al, 2001; Shapiro, 2006; Clark, 2003). The third theory argues that tolerance and openness to diversity are important (Florida, 2002a, b, c). We suggest that these three approaches need not be seen as mutually exclusive. It is more likely that these factors play complementary roles in the distribution of talent and in regional development.

To shed light on these issues, we present a stage-based general model of regional development. In the first stage, we examine how factors such as tolerance, universities and consumer service amenities affect the location of talent (measured as human capital and the creative class). In the second stage, we look at how the concentration of talent in turn affects technology. And in the third stage, we examine the effects of technology, talent, and tolerance on regional income. This stage-based model structure enables us to isolate the direct and indirect effects of these factors in the overall system of regional development. We use structural equations and path analysis models to examine the independent effects of human capital, the creative class, technology, tolerance and other factors identified in the literature on both regional wages and incomes. We examine these issues via a cross sectional analysis of 46 geographic regions in Canada.

Our modeling approach is designed to address a significant weakness of previous studies of the effects of human capital and the creative class on regional development. Most of these studies use a single equation regression framework to identify the direct effects of human capital and other factors on regional development. The findings of these studies have shown the insignificance of tolerance variables on economic performance. It has also been claimed that the education based human capital measure and the

occupation based creative class measure more or less should be the same (e.g. Glaeser, 2004). Our modeling allows us to test for the importance of different factors at different stages, as well as the interdependencies between them.

Theory and Concepts

Economic development is a vast area of research focused on understanding the mechanism that lead to regional growth. Solow's growth theory (1956) noted the effect of technology. Solow's model treated capital and labor as endogenous variables subject to the marginal rate of substitution varying from one region to the next based on market prices. Technology as exogenous and not affected by the marginal rate of substitution was a major source of growth. As a result, technological development became important to economic development.

Ullman (1958) noted the role of human capital in his work on regional development. Romer's (1986, 1987, 1990) endogenous growth model connected technology to human capital, knowledge, and economic growth making invention endogenous. Technological change is something that happens outside the system: invention becomes an important part of economic growth requiring resources.

Jacobs (1961, 1969) understood and emphasized the role of cities and regions in the transfer and diffusion of knowledge. As cities become larger the diversity of use and work naturally increases so do the connections between economic actors that result in the generation of new ideas and innovations. The generation of new ideas in the city produces new work which is added to

old work requiring greater occupational diversity. Andersson (1985a, b) explored the role of creativity historically in regional economic development, stressing the importance of knowledge, culture, communications, and creativity, while arguing that tolerance also plays a role in stimulating creativity in cities and regions.

The importance of technology and invention led Lucas (1988) to further develop and explicitly identified the role of human capital externalities in economic development. Adding to the work of both Jacobs and Romer, Lucas (1988) highlighted the clustering effect of human capital, which embodies the knowledge factor. Lucas major insight into the importance of cities was the recognition that they are the engines of economic growth. By localizing human capital and information, cities reduce the friction associated with knowledge transfer greasing the wheel allowing for the creation of new knowledge at faster and faster rates.

Empirical studies have documented the role human capital plays in regional growth, Barro (1991), Rauch (1993), Simon and Nardinelli (1996) and Simon (1998), all confirm the relationship between human capital and growth at the national level. Glaeser (2000) provides empirical evidence on the correlation between human capital and regional economic growth. Firms locate to gain competitive advantages, rather than letting suppliers and customers determine location choice. Firms seek out areas of high human capital concentration. Studies by Florida (2002b), Berry and Glaeser (2005), find that human capital is becoming more concentrated and there are strong reasons to believe that this division will continue, affecting not only regional growth levels, but also housing values (Shapiro, 2006; Gyourko et al, 2006).

There is now general consensus regarding the role of human capital in economic growth and development.

Our research keys into two reasonably open questions in the current debate. The first involves how to best measure and account for human capital, Human capital broadly defined includes all investments (education, health, training, migration) made by individuals with a net future benefit to themselves. Traditionally, human capital has been measured as education and training which are perceived to be the most important investments in human capital because they directly influence all other areas that may be potentially invested in by individuals. The conventional measure of human capital is educational attainment – generally, the share of the population with a bachelor's degree and above. It is used to approximate the level of labor productivity, increasing with years of education. The educational attainment measure, it has been pointed out, does not explain the small but incredibly influential group of entrepreneurs, like Bill Gates or Michael Dell who for various reasons did not chose to go to or finish their college education. To say that these individuals are unskilled when they and many others like them have added significant value to the Global economy is a troubling statement to make. Laroche and Merrette (2000) notes that no satisfactory measure of human capital exists for Canada, that education as the measure of human capital fails to capture all the activities related to knowledge acquisition that occur in the country. The broadness of the measure also prevents nations or regions from identify specific types of human capital or talent. Education measures potential talent or skill and does not measure actual skill as it utilized and consumed by the economy.

Occupations, we suggest, provide a potentially more robust measure of human capital capable of capturing that which is missed by the educational measure and important to economic growth – how human talent or capability is absorbed by and used by the economy. Previous studies have shown that education is but one way to improve labor productivity in a region. Smith et al (1984) showed that other factors such as intelligence, on-the-job knowledge, creativity and experience are substitutes for education as agents for improving labour productivity. Education provides an underlying level of capability, a potentiality that such has to be converted into productive work. Thus occupation is the medium through which the potentiality created by education is converted into skill and labor productivity of real economic value.

For these reasons, it has been argued that occupation is a better and more direct measure of skill. Mellander and Florida (2006), and Marlets and Van Woerken (2004)' studies of Sweden and the Netherlands have demonstrated that the occupational measure of human capital significantly outperform educational attainment in accounting for regional development. In addition, using occupations has the advantage that the effects of specific occupations on income and regional labor productivity in terms of wages can be isolated and individually analyzed. The models we develop below enable us to isolate the effects of human capital, the creative class and also of individual creative occupations on regional development.

Our model isolates the effects of human capital and creative occupations –education and skill because there are theoretical reasons to expect that these factors – affect regional development through different channels. Human capital theory postulates that the wages increase with the development of specialized knowledge (Becker, 1964, 1993; Mincer, 1974).

Optimally, wage levels should be in proportion to the stock of human capital, since this affects the value of workers' marginal product. Under ideal conditions wages are determined by the intersection of the marginal product of labor with marginal revenue product of firms. More to the point, as pay for labor inputs, wages are directly related to the regional productivity of the labor force. An increase in the marginal product labor results in an increase in wages. In this context, we use the aggregate for wages synonymously with the knowledge level of workers. On a micro level wages (knowledge) may be distributed unevenly throughout a region. Two regions can reach the same wage levels based on (1) a homogenous labor force or (2) a labor force consistent of high and low knowledge labor that together reach the same result. But at the aggregate level, the regional wage level will reflect the regional labor productivity. Earlier research (Florida et al., 2008) suggests that distribution of talent across regions may affect wages and incomes differently. Income is a composite measure which includes wages plus gains, rents, interest, transfers and the like. As a composite measure that includes wages, income accounts for different incentive and pay structures across occupations. Some occupations may offer lower wages, while having significant stock options or bonus programs. We will therefore include both measures initially in the analysis.

The second key issue in the current debate involves identifying the factors that shape the geographic distribution of human capital or the creative class. Since we know that these sorts of talent are associated with economic development and unevenly distributed, it is important to understand the factors that account for their varied geography. Most economists

conceptualize human capital as a stock or endowment, which belongs to a place in the same way that a natural resource might. But the reality is that human capital is a *flow*, a highly mobile factor that can and does relocate. Gertler (2001) notes the importance that the flow of people has had on shaping the Canadian urban landscape. The flow of people from one region to the next has major policy implication that can only be properly understood from a well rooted theory of individual migration. . In Canada, the flow of people - both native and foreign born - tends to be from the Atlantic and Prairie provinces to Ontario, Alberta and British Columbia (Edmonston 2002). Our research examines the factors that shape this flow and determine the divergent levels of human capital and the creative class - education and skill - across regions.

Three answers to that question have been offered. The first argues that the distribution of education and skill is affected by the distribution of amenities. Roback (1982) expanded the traditional neoclassical model of migration to include not only the response to wages and land rent but to quality-of-life amenities as well. Glaeser et al. (2001) finds that consumer and personal service industries such as restaurants, theatres, and museums tend to be localized and thus demand geographical closeness between producer and consumer. Beyond service and consumer goods, Glaeser highlights the importance of other amenities such as public goods, aesthetics and transportation. Lloyd and Clark (2001) impart a strong emphasis on the role of lifestyle – in the form of entertainment, nightlife, culture, and so on – in attracting talented. Florida (2002c) introduces the "bohemian index" as a measure of the location preferences of producers of artistic and cultural

amenities, find their location choice to be associated with concentrations of human capital and innovation. Shapiro's (2006) detailed study of regional productivity growth finds that "roughly 40% of the employment growth effect of college graduates is due to quality of life", the rest being caused by enhanced productivity growth.

The second approach offered by Glaesar and his collaborators (2005) is that the concentration of human capital builds off itself. Places with an initial advantage tend to build upon that initial advantage seeing increase over time. The presence of major research universities has been found to be a key factor in this set of initial advantages as well in both the production and distribution of human capital. The distribution of education and skill need not be coincident with the distribution of universities as Glaeser suggests. While some regions with great universities have large concentrations of talent, others operate as producers of human capital, serving as unrewarded exporters of highly educated people to other regions (Florida et al., 2006). Florida (2005) argues that the geographic assembly line connection from education to innovation and economic outcomes *in that same locale* may no longer hold. This is a result of the increased mobility of highly-skilled and talented people within countries and even across national borders. The quality of a region's post secondary institutions is no guarantee it can hold on to its educated and skilled people. The university is a necessary but insufficient condition for attracting educated and skilled populations to a region or even holding on to the ones it produces.

The third approach to the factors that influence the flow of talent among regions argues that tolerance and openness to diversity affect the level

and geographic distribution of education and skill. Jacobs (1961) and Beckstead and Brown (2003) have argued that firm-based diversity is associated with economic growth, but Jacobs also argued that diversity of individuals is important as well. Recent research has focused on the role of demographic diversity in economic growth. Ottaviano and Peri (2005) show how diversity among individuals, in the form of immigrants, increases regional productivity. This fits with Page's (2007) work on the importance of different perspectives as useful means to solving economic problems. Immigrants have complementary skills to native born not because they perform different tasks, but because they bring different skills and perspectives to the same task. A Chinese cook and an Italian cook will not provide the same service nor good; neither will a Russian-trained physicist substitute perfectly for a U.S.-trained one. Noland (2005) finds that tolerant attitudes toward gay and lesbians are associated with both positive attitudes toward global economic activity and international financial outcomes. Florida and Gates (2001) find a positive association between concentrations of gay households and regional development. Florida (2002a, b, c) further argues that tolerance – specifically "low barriers to entry" for individuals – is associated with geographic concentrations of talent, higher rates of innovation, and regional development. The more open a place is to new ideas and new people, the larger the net it casts in the global competition for talent - in other words, the lower its entry barriers for human capital – the more talent it will likely capture.

There is considerable debate over the salience of these measures, approaches and findings. Clark (2003) finds that the relationship between the

Gay Index and regional development holds only for regions with large populations. Glaeser (2004) ran linear regressions with human capital, the Gay Index and the Bohemian Index and found that the effects of human capital overpower the effects of these other tolerance measures when looking at change in population between 1990 and 2000, an admittedly crude measure of economic development. Florida (2004a, 2004b) counters that these frameworks and models are crude and do not capture the interactions among the system of factors that act on regional development. He suggests a general model of regional development according to the 3Ts of economic development: technology, talent and tolerance. He argues that each alone is necessary but insufficient in generating regional development: All three must act together with substantial and balanced performance to result in higher levels of development.

It is important to state at the outset that our model does not argue for a mechanistic relationship between regional tolerance (measured as concentrations of artists and or gays) and regional development. Rather, we argue that tolerance or openness to diversity makes local resources more productive and efficient acting through four key mechanisms.

Low Barriers to Entry: High concentrations of bohemian and gay/lesbian populations reflect low barriers to entry for human capital. Such locations will have advantages in attracting a broad range of talent across racial, ethnic and other lines, increasing the efficiency of human capital accumulation. Page (2007) provides the basis for a general economic theory of tolerance and improved economic outcomes. He finds that not only does cognitive diversity lead to better decision-making but that it is associated with identity diversity,

the diversity of people and groups, which enable new perspectives. He finds that diversity broadly understood is linked with higher growth and rates of innovation. Work by Florida et al. on nations such as the US, Sweden and China (2007, 2008), illustrates that the tolerance factor might influence the distribution of talent and technology in different ways. In addition, there is a national subjectivity to what is regarded as tolerance.

Knowledge Spillovers and Human Capital Externalities: Larger bohemian and gay populations signal underlying mechanisms that increase the efficiency of knowledge spillovers and human capital externalities that Lucas (1988) identifies as the primary engine of economic growth. Recent studies (Markusen and Schrock, 2006; Currid, 2006, 2007) note the role of artistic networks as conduits for the spread of new ideas and knowledge transfer across firms and industries. Stolarick and Florida (2006) demonstrate the importance of "spill-a-crosses" - interaction between bohemians and the traditional technology community. Concentration of artists and gays/lesbians thus reflect the regional mechanisms that tend to accelerate human capital externalities and knowledge spillovers.

Signals of Openness and Meritocracy: Artistic and gay/lesbian populations reflect regional values that are open-minded, meritocratic, tolerant of risk, and oriented to self expression. Inglehart et al. (2003, 2005) has noted the correlation between values and GDP growth at the national level, In period research over four decades across more than n 60 countries, Inglehart (2003, 2005) identifies tolerance or what he calls "self expression" to be a core element of a new value systems associated with higher levels of GDP and

economic growth. He notes that openness of people towards gay and lesbian populations is the best indicator of overall tolerance. People in tolerant places are not happier because they themselves are tolerant but due to the general level of tolerance experienced in society. Psychological studies (Amabile, 1996; Stenberg, 1999; Fredrickson, 2001) indicate that this is associated with higher levels of creativity, innovation and entrepreneurial behavior. Lucas (1988) explicitly notes the similarities in values and orientation as "creative" actors between technological and entrepreneurial labor and artistic and cultural populations.

Resource Mobilization: Locations with larger artistic and gay populations signal underlying mechanisms which increase the productivity of entrepreneurial activity. Traditional economic institutions have tended to marginalize bohemians and gays/lesbians thus requiring them to mobilize resources independently and to form new organizations and firms. We suggest that regions where these groups have migrated and taken root reflect underlying mechanisms which are more attuned to mobilization of such resources for entrepreneurship and new firm formation. These four factors, when taken together, improve the efficiency and productivity of regional human capital, innovation and entrepreneurship.

We also note that according to our theory, tolerance, universities and consumer service amenities need not operate exclusively or in competition with each other. Rather, we suggest that they are likely to have complementary effects on the geographic distribution of education and skill. Tolerance, universities and consumer amenities act on regional economic through direct

and indirect channels, as they effect the concentration of talented and skilled people in regions.

Model, Variables, and Methods

A schematic picture of our general model for the system of regional development is outlined in Fig.1. The model allows us to overcome several limitations of previous studies. First, it considers regional development as a system of relationships. It allows us to test the independent effects of human capital, the creative class, technology, and tolerance on regional development. Second, it allows us to test for and more precisely identity the role of educational human capital versus the creative class on regional wages and incomes. Third, it allows us to parse the effects of wages and income, and to identify the factors that act on regional labor productivity and regional wealth. And fourth, it enables us to parse the effects of tolerance, consumer services, and universities in the distribution of human capital and the creative class which in turn act on regional wages and income. The arrows identify the hypothesized structure of relationships among the key variables.

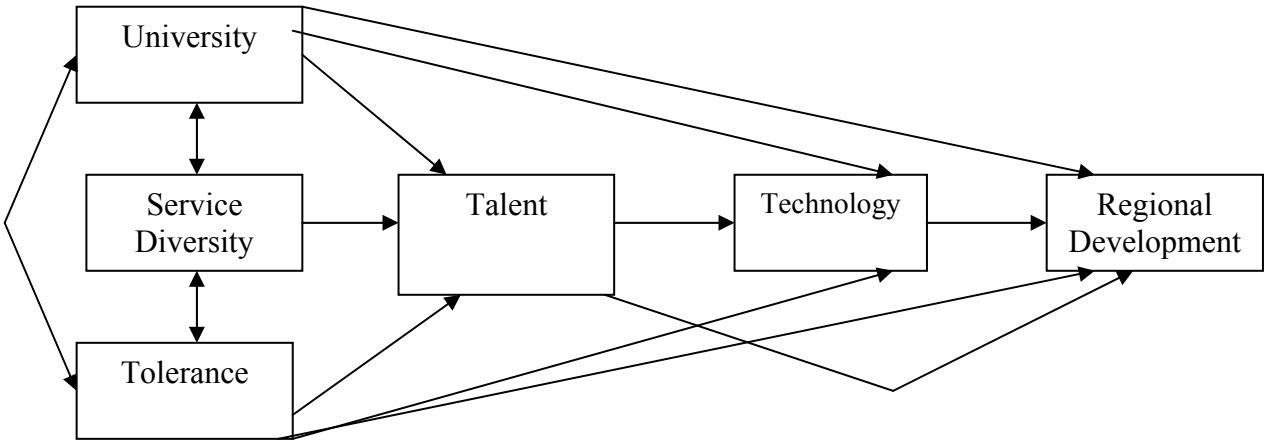


Figure 1: Model of key regional development paths

Variables

We now describe the variables in the empirical model. The variables cover 46 CMAs and CAs in Canada. All variables in equation 1 and 2 are for the year 2001, while the dependents in equation 3 (Regional Development) are from 2006. Earlier research (Florida et al., 2008) has found that the relations may look different for incomes and wages, include both employment incomes and total incomes separately. The reason for those differences in time is that we do not expect the full effect to come in the same year, but rather some years later. Descriptive statistics for all measures and variables are provided in Table 1.

Table 1: Descriptive Statistics – all regions

	Obs	*Mean*	*Standard Deviation*	*Minimum*	*Maximum*
Talent:					
BA or above	46	0.170	0.054	0.097	0.310
Creative class	46	0.302	0.045	0.227	0.449
Supercreative	46	0.162	0.029	0.112	0.270
Creative Professionals	46	0.140	0.019	0.108	0.180
Decomposed Creative Occupations:					
Managers	46	0.064	0.013	0.043	0.100
Business and Finance	46	0.032	0.007	0.022	0.050
Science	46	0.059	0.017	0.034	0.127
Health	46	0.043	0.008	0.027	0.064
Education/Social Science	46	0.079	0.013	0.056	0.111
Arts and Culture	46	0.024	0.007	0.015	0.040
Regional Characteristics:					
University (faculty)/1000	46	2.299	1.973	0	8.445
Self-Expression	27	0.982	0.394	0.494	1.906
Mosaic Index	46	0.126	0.089	0.009	0.437
Visible Minorities	46	0.072	0.979	0.006	0.369
Service Diversity	46	210.93	13.92	186	233
Effects:					
Technology	46	0.831	0.353	0.349	1.788
Avg. Income	46	35,007	3,816	28,823	48,878
Avg. Employment Income	46	35,146	4,060	29,075	48,931

Outcome Variables:

It is common in studies of regional development to use factors like population change or job growth as measures of development. But those measures are quite crude in that they cannot specify the quality of development. Not all jobs are created equal; some pay a good deal more than others. Regions increasingly specialize in different kinds of economic activity, and therefore different kinds of jobs (Markusen, 2004, 2006). When we say regional development, what we really want to know is the overall level of development and living standards of a region. We thus need to know how much people in a region earn and what the total income of the region is. We use two measures of regional development as outcome variables: average income and average employment income.

Average Income: This includes employment income, income from government programs, pension income, investment income and any other money income. In total it includes total wage, net farm income, net non-farm income from unincorporated business and/or professional practice, child benefits, old age security, benefits from employment insurance, other income from government sources, dividends, interest on bonds, deposits and saving certificates, retirement pensions, superannuation and annuities, other money income. The data is from Statistics Canada for year 2006.

Average Employment Income (Wage): This variable refers to total income received by persons 15 years of age. It includes wages and salaries, net income from a non-farm unincorporated business and/or professional practice,

and/or net farm self-employment income. The data is from Statistics Canada for year 2006.

Employment incomes and total incomes are related. For Canada the correlation coefficient between them is 0.974. Still, earlier studies for the US (Florida et al, 2008) have shown a considerable difference between the two across regions. As we noted earlier, wages are a good proxy for regional productivity, while income is a good proxy for regional wealth.

Talent Variables:

The next class of variables concern talent. As noted above, our research uses several different measures for talent.

Human Capital: This variable is the conventional measure based on educational attainment, measured as the percentage of the regional labor force with a bachelor's degree and above. It is from the 2001 Canadian Census.

Creative Class: We use several definitions of the creative class, based on occupation. Each of them is measured as share of the regional labor force. All data is from Canada Statistics for the year 2001. Following Florida (2002a), we examine the effects of the creative occupations or the "creative class," defined as those in which individuals "engage in complex problem solving that involves a great deal of independent judgment and requires high levels of education or human capital." The original creative class measure includes the following major occupational groups: computer and math occupations; architecture and engineering; life, physical, and social science; education, training, and library positions; arts and design work; and entertainment,

sports, and media occupations, as well as other professional and knowledge work occupations including management occupations, business and financial operations, legal positions, healthcare practitioners, technical occupations, and high-end sales and sales management.

Statistics Canada defines occupation according to National Occupation Classifications (NOCS) which is different from the BLS in the US. This creative class measure will be adjusted according to the Canadian definitions. However, they are still defined based on the complex problem solving and independent judgment conditions.

Super-creative Core: Florida (2002a) defines the super-creative core as: computer and math occupations; architecture and engineering; life, physical, and social science; education, training, and library positions; arts and design work; and entertainment, sports, and media occupations. We define the super-creative core as follows

Professional occupations in natural and applied sciences	Referred to as "Science"
Technical occupations related to natural and applied sciences	
Judges, lawyers, psychologists, social workers, ministers of religion, and policy and program officers	Referred to as "Education and Social Science"
Teachers and professors	
Paralegals, social services, workers and occupations in education and religion, n.e.c.	
Professional occupations in art and culture	Referred to as "Arts and Culture"
Technical occupations in art, culture, recreation and sports	

Creative Professionals: Florida (2002a) includes the following professional occupations in the creative class: management occupations, business and financial operations, legal positions, healthcare practitioners, technical occupations, and high-end sales and sales management. We include the following occupations:

Senior management occupation	Referred to as "Managers"
Specialist managers	
Other managers, n.e.c.	
Professional occupations in business and finance	Referred to as "Business and Finance"
Finance and insurance administration occupations	
Professional occupations in health	Referred to as "Health"
Nurse supervisors and registered nurses	
Technical and related occupations in health	

We also analyze key creative occupations separately: managers, business and finance, science, health, education and social science, and arts and culture.

Technology Variables:

Techpole: We include a technology variable to account for the effects of technology on regional development. This technology variable is based on two parts, equally weighted; (1) a location quotient for Canadian High Tech industry employment. The location quotients ranks CMA and CA areas based on: (1) regional high-tech industrial employment as a percentage of regional employment; and (2) the national high-tech employment as a percentage of

national employment. This is based on Canadian Business Patterns data from Statistics Canada for year 2001.

Variables that Effect the Distribution of Talent:

To examine the question of what accounts for the geographic distribution of educated and skilled populations, we include three key variables reflecting the current literature.

Tolerance: We use three measures for tolerance – the self-expression index, visible minorities and the mosaic index.

Self-Expression Index: This variable combines the concentration of gay and lesbian households and the concentration of individuals employed in the arts, design and related occupations. Both are location quotients. The self-expression index is the aggregate of the two, where each is given a 0.5 weight. The data are from the Canadian Census and for year 2001.

Visible Minorities: We will also employ a measure based on the visible minority share of the population. Visible minorities are defined as 'persons, other than Aboriginal peoples, who are non-Caucasian in race or non-white in color according to The Employment Equity Act. This data is from Canadian Census for year 2001.

Mosaic Index: This variable is the share of population that is foreign-born immigrants to Canada. The data is from Canadian Census for year 2001.

Other Variables:

Universities: This variable measures number of university professors per capita. University professors teach courses to undergraduate and graduate students and conduct research at universities and degree-granting colleges. It is based NOCs data for year 2001 from Canadian Census.

Service Diversity: We use the diversity of consumer service firms as our proxy for regional amenities. This variable reflects the number of service industries represented within the metropolitan region that could be regarded as attractive to consumers. It is based on 2001 industry data from the Statistics Canada.

Methods

We use path analysis and structural equations to examine the relationships between variables in the model. In order to analyze the dynamics between this set of variables adequately structural equation modeling is used. Structural equation models (SEM) may be thought of as an extension of regression analysis and factor analysis, expressing the interrelationship between variables through a set of linear relationships, based upon their variances and covariances. In other words, structural equation replaces a (usually large) set of observable variables with a small set of unobservable factor constructs, thus minimizing the problem of multicollinearity (further technical description in Jöreskog, 1973). The parameters of the equations are estimated by the maximum likelihood method.

It is important to stress that the graphic picture of the structural model (Fig.1) expresses direct and indirect correlations, not actual causalities. Rather, the estimated parameters (path coefficients) provide information of the relation between the set of variables. Moreover, the relative importance of the parameters is expressed by the standardized path coefficients, which allow for interpretation of the direct as well as the indirect effects. We do not assume any causality among university, tolerance and service diversity but rather treat them as correlations.

From the relationships depicted in the model (Fig.1) we estimate three equations:

$$lnTalent = \beta_{11} lnUniversity + \beta_{12} lnServiceDiversity + \beta_{13} lnTolerance + e_3 \quad (1)$$

$$lnTechnology = \beta_{21} lnUniversities + \beta_{22} lnTolerance + \beta_{24} lnTalent + e_2 \quad (2)$$

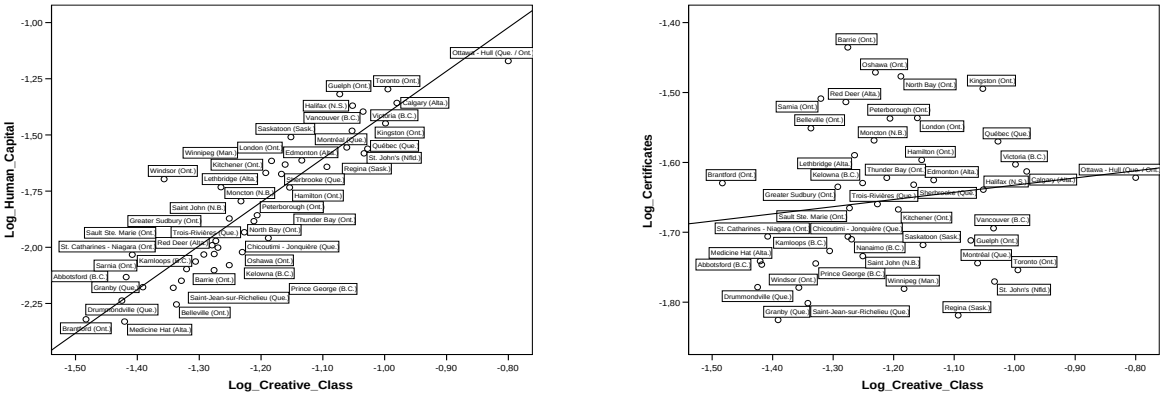
$$lnRegionalDevelopment = \beta_{31} lnUniversity + \beta_{33} lnTolerance + \beta_{34} lnTalent + \beta_{35} lnTechnology + e_1 \quad (3)$$

Findings

We now turn to our findings. We begin by examining the effects of the two primary talent measures – human capital and the creative class income. We then provide the findings for specific occupations.

Figure 2 is a series of scatter-graphs which plot the relationship between the human capital measures – BA and above and the creative class. Table 2 summarizes the results of a correlation analysis across these two key measures and major occupational groupings.

The correlation coefficient between traditional human capital and the creative class is 0.9. The coefficients for human capital certificates are insignificant with both human capital and the creative class.



Creative Class vs Human Capital

Creative Class vs Certificate Human Capital

Figure 2: Creative Class, Human Capital and Certificates

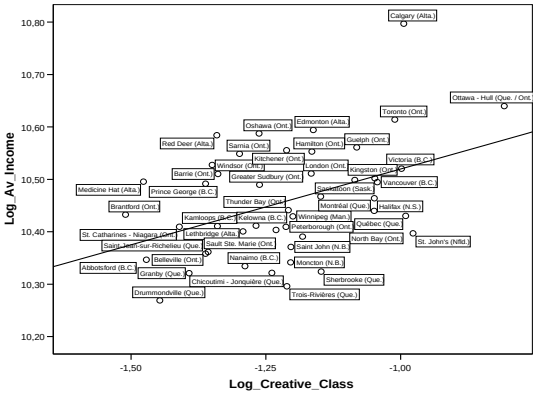
Table 2: Talent and Occupations

	Human Capital	Creative Class	Certificates
Managers	0.679**	0.748**	0.209
Business and Finance	0.609**	0.630**	-0.023
Science	0.732**	0.827**	0.056
Health	0.281	0.320*	0.150
Education and Social Science	0.601**	0.654**	0.129
Arts and Culture	0.830**	0.855**	0.013

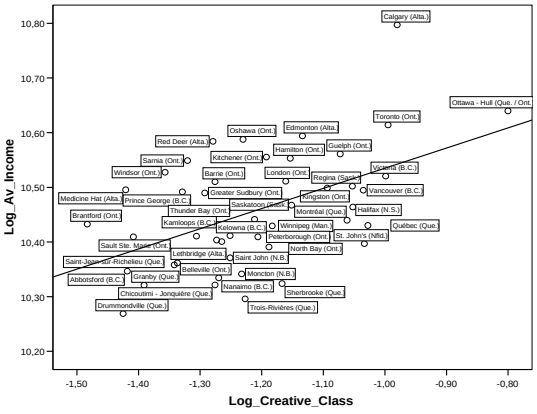
Human capital and the creative class are closely related to most key occupational groups. Both human capital and the creative class have strong relationships to arts and culture occupations (0.830 and 0.855), science occupations (0.732 and 0.827), management occupations (0.679 and 0.748), education and social science occupations (0.601 and 0.654), and business and finance occupations (0.609 and 0.630). Generally speaking, the creative class is slightly stronger than traditional human capital. The certificates variable is generally insignificant.

We now turn to the relationship between various talent measures and regional income. Figure 3 provides scatterplots for income and the major

talent measures – human capital and the creative class. Table 3 summarizes the correlation coefficients.



Human Capital and Income



Creative Class and Income

Figure 3: Talent vs Income

Table 3: Talent and Regional Performance

	High-Tech	Income	Employment income
Human Capital	0.774**	0.512**	0.516**
Creative Class	0.757**	0.507**	0.502**
Certificates	-0.108	0.272	0.199

In earlier studies of the U.S. (Florida et al, 2008), human capital was found to be more closely related to incomes, while the creative class is more closely related to wages. However, as Table 3 shows, this is not the case in Canada. Both human capital and creative class have similar effects on both income and employment incomes. The correlation coefficient for human capital and income is 0.512 and employment income is 0.516. The correlation for the creative class and income is 0.507 and employment income, 0.502. The correlation coefficients for certificates and income are insignificant. The correlation coefficient between human capital and technology is 0.774, while that between creative class and technology is 0.757.

Findings from Path Analysis and Structural Equations

To further gauge the differential effects of human capital and the creative class on regional development, we now turn to the key the findings from the structural equations models and path analysis. We ran separate models for human capital, and the creative class, and the super-creative core.

The models examine the effects of the different measures of human capital and the creative class on income, and also isolate the effects of three key factors – tolerance, service diversity and universities – on the level and geographic distribution of human capital and the creative class as well on income. A path analysis is provided for each model based on the standardized β-coefficients. This standardized coefficient is based upon the regression where all the variables in the regression have been standardized first by subtracting each variable's mean and dividing it by the standard deviation associated by each variable. These coefficients can be used to analyze the relative importance of the explanatory variables in relation to the dependent variable.

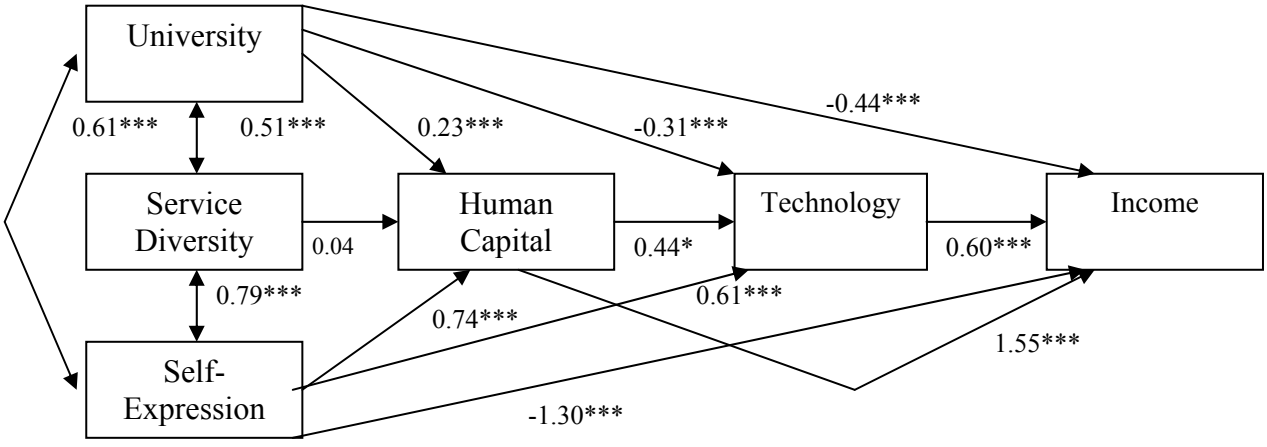


Figure 4: Path Analysis for Human Capital

Figure 4 is the path analysis for human capital. Human capital has a sizeable and significant direct effect on income. It also has a significant direct effect on technology, while technology also has a significant direct effect on income. Looking at the factors which effect the distribution of human capital, tolerance (i.e., the self-expression index) has the largest effect. The university variable is also positive and significant on talent, while service diversity has no significant effect on the distribution of talent. The self-expression variable also has a strong relationship to technology. It is also interesting to notice the negative and significant relationships for both the university and self-expression variables and regional income. The relationship between university variable and technology is also negative and significant in relation to technology. This could be caused by a multicollinearity effect, but in a bivariate correlation with technology it is still only weakly related (0.344 at the 0.05 level). The university variable lacks a significant bivariate relation with income as well. Generally speaking, regional income is positive and significantly explained by human capital and technology.

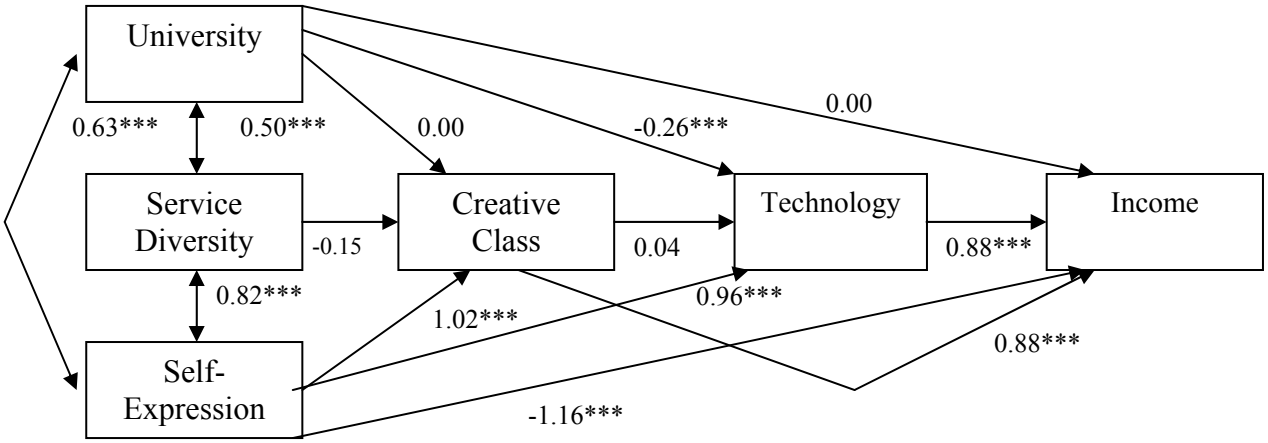


Figure 5: Path Analysis for the Creative Class

Figure 5 summarizes the path analysis for the creative class. Generally speaking the relationships are similar to those for human capital. The creative class has a significant direct effect on regional income, but the relationship between it and technology is insignificant. The relationship between the creative class and self-expression is somewhat stronger than in the human capital model. The university variable is insignificant on the creative class, technology and income.

Table 4 provides the results for SEM models for human capital and the creative class. The R2 values for equation 1 and 2 are between 0.72-0.87. However, those factors together explain less in equation 3 where the R2 value is approx 0.53-0.67 (Table 4).The overall results suggest a strong direct relationship between both human capital and the creative class and income. They also suggest a strong relationship between tolerance (measured by the self-expression index), both talent measures, technology, and regional income.

Table 4: SEM results for Human Capital, Creative Class and Self-Expression

Income	**Human Capital**			**Creative Class**		
	Talent	***Technology***	***Income***	***Talent***	***Technology***	***Income***
Variables	Eq 1	Eq 2	Eq 3	Eq 1	Eq 2	Eq 3
Self-Expression	.508***	2.549***	-0.323***	0.323***	3.937***	-0.282***
Service Diversity	.199			-0.335		
University	.060***	-.495***	-.041***	0.000	-0.422**	.000
Talent		2.672*	.560***		.560	.677***
Technology			.036***			.052***
Observations	46	46	46	46	46	46
R2	0.872	0.722	0.665	0.812	0.740	0.528

Immigrants and Visible Minorities

We now substitute the self-expression index with variables for visible minorities and the mosaic index. Appendix 2 provides scatterplots for all three tolerance measures, human capital, and the creative class.

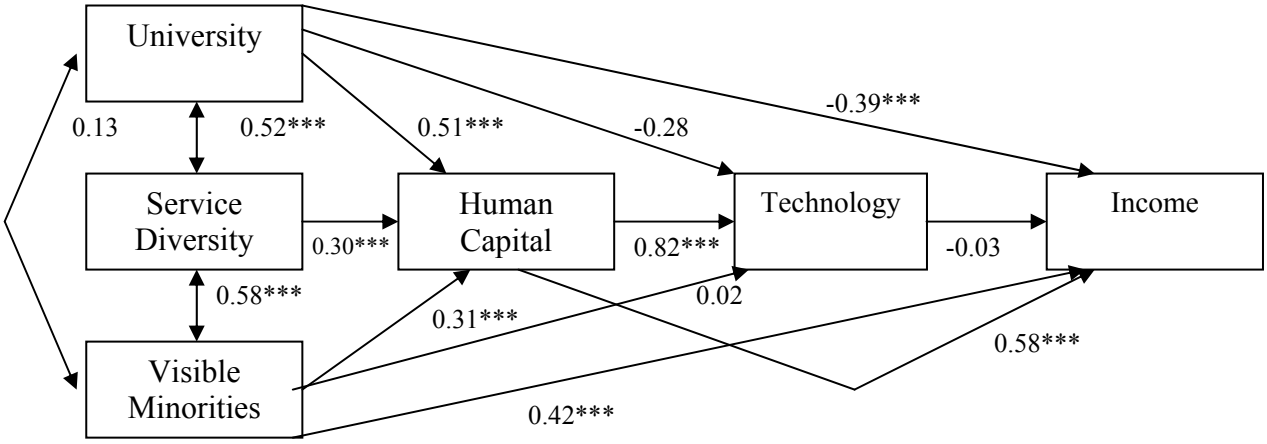


Figure 6: Path Analysis for Human Capital and Visible Minorities

Figure 6 is the path analysis for visible minorities. Human capital continues to have a strong relationship with income, as well as technology. The visible minorities variable performs somewhat differently than self-expression. It is both positive and significant in relation to income. Its effect on human capital is weaker than that for self-expression and it is not significantly related to technology. Both the university and service diversity variables are positively related to human capital in this model.

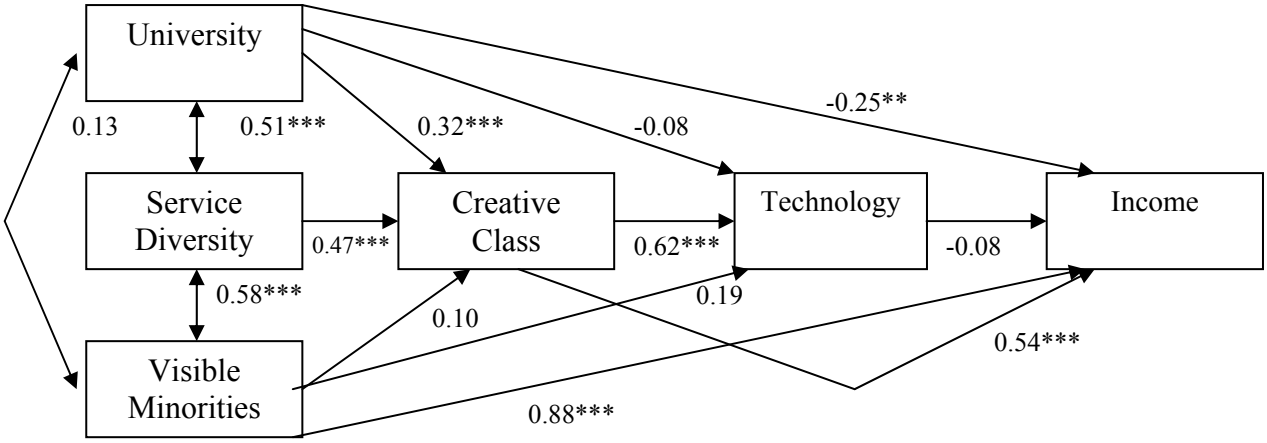


Figure 7: Path Analysis for Creative Class and Visible Minorities

Figure 7 is the path analysis for visible minorities and the creative class. The creative class remains positive and significantly related to income. Visible minorities are significantly related to regional income levels, but not to the creative class. Thus variable appears to work directly on income rather than on or through the creative class. Recall that the visible minority measure is positive and significant in relation to human capital. A possible explanation is that while visible minorities possess higher education, they are relatively concentrated in non-creative class jobs.

Table 5: SEM results including Visible Minorities

Income	**Human Capital**			**Creative Class**		
	Talent	***Technology***	***Income***	***Talent***	***Technology***	***Income***
Variables	Eq 1	Eq 2	Eq 3	Eq 1	Eq 2	Eq 3
Visible Minorities	.094***	.007	.043***	.014	.072	.056***
Service Diversity	1.395***			1.022***		
University	.132***	-.091	-.035**	.039***	-0.027	-.023**
Talent		1.033***	.199***		1.674***	.350***
Technology			-.009			-.021
Observations	46	46	46	46	46	46
R2	0.758	0.439	0.539	0.545	0.463	0.560

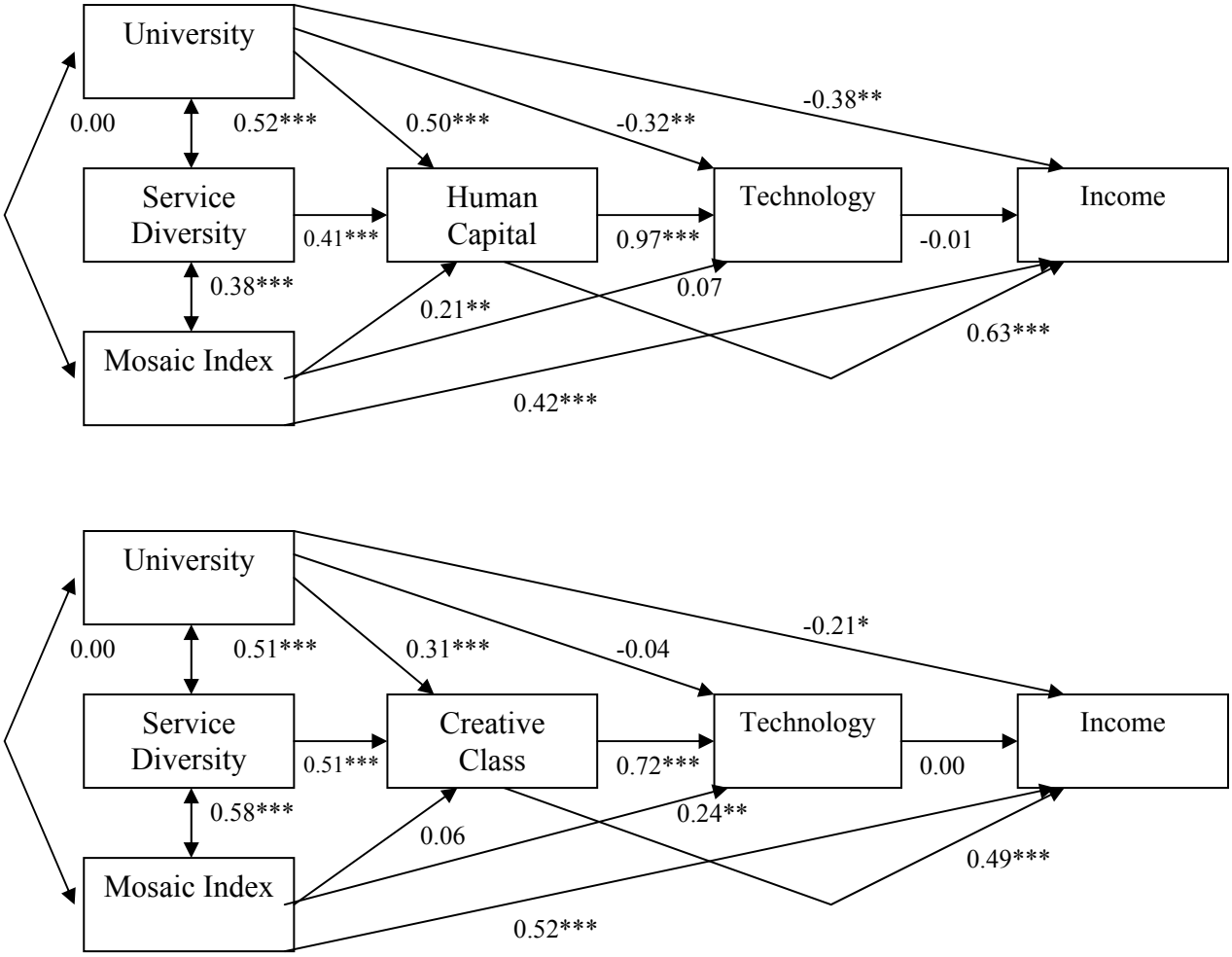


Figure 8: Path Analysis for Human Capital, Creative Class and the Mosaic Index

Figure 8 summarizes the results for the mosaic index. The creative class continues to have a direct effect on income and technology. The mosaic index is positive and significantly related to human capital, technology and income but not the creative class. This suggests that immigrants tend to have direct effects on technology and income but not on or through the creative class.

Table 6: SEM results including the Mosaic Index

Income	Human Capital			Creative Class		
	Talent	*Technology*	*Income*	*Talent*	*Technology*	*Income*
Variables	Eq 1	Eq 2	Eq 3	Eq 1	Eq 2	Eq 3
Mosaic Index	.074**	.151	.051***	.038	.072**	.063***
Service Diversity	1.892***			1.103***		
University	.129***	-.502*	-.051**	.038**	-0.065	-.019*
Talent		5.934***	.216***		9.307***	.360***
Technology			.000			.000
Observations	46	46	46	46	46	46
R2	0.734	0.666	0.569	0.545	0.633	0.577

The Super-Creative Core

We now use our general model to examine the role of the two main groups that make up the creative class - the supercreative core and creative professionals. We then turn to specific occupational groups; managers, business and finance, science, health, education and social science, and arts and culture. We start with the results for the super-creative core. Figure 9 shows the key findings from the path analysis.

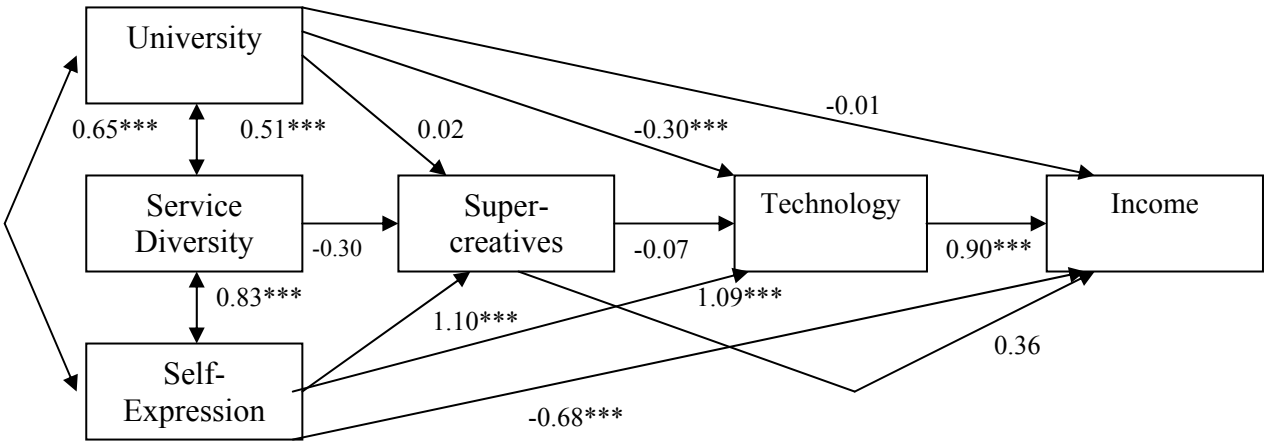


Figure 9: Path Analysis for the Supercreative core

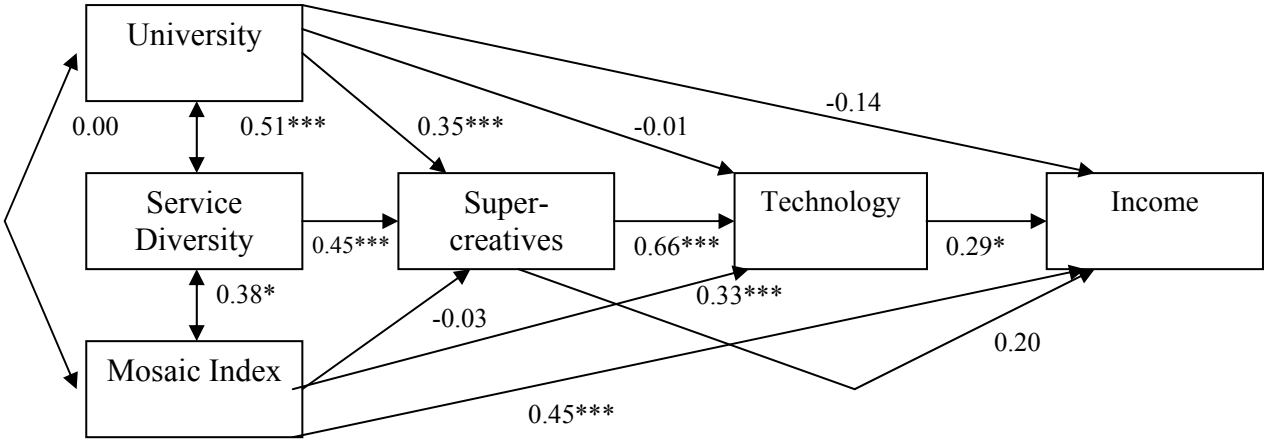


Figure 9 (cont.): Path Analysis for the Supercreative core

The super-creative core has no direct effect on income. It has positive and significant effect on technology in just one of the two models. In turn, it is shaped by the self-expression index but not the mosaic index. The university variable is positive and significantly related to super-creatives in one of the two models.

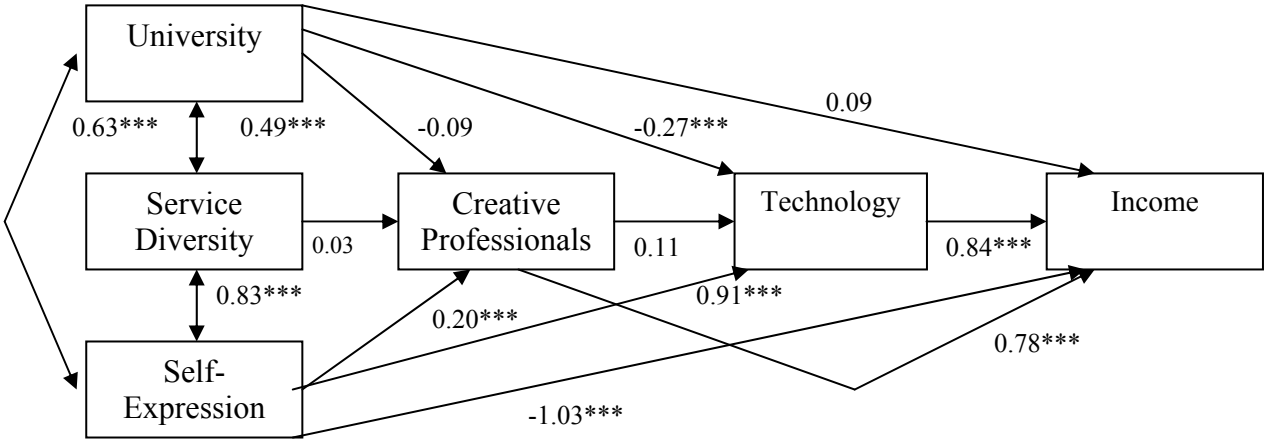


Figure 10: Path Analysis for the Creative Professionals

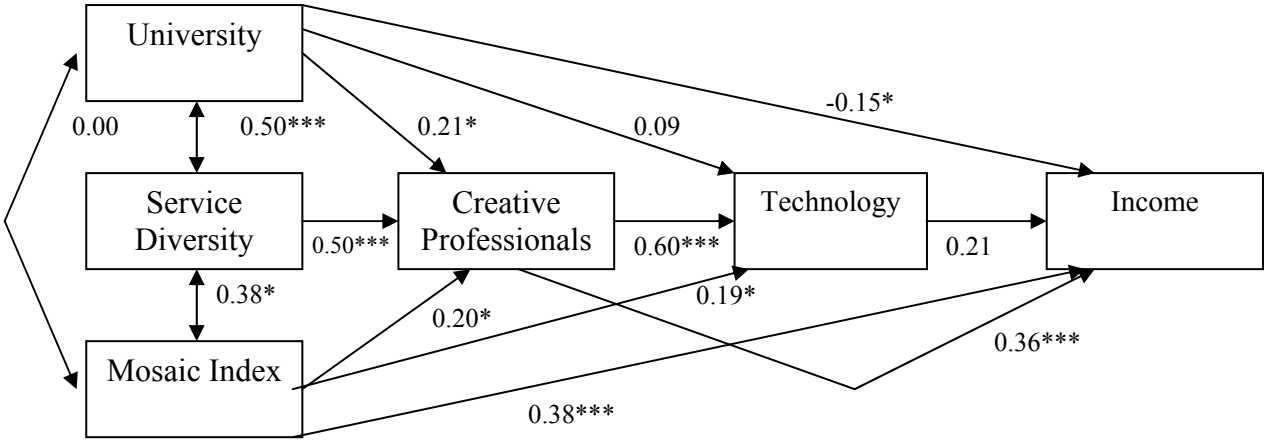


Figure 10 (c0nt.): Path Analysis for the Creative Professionals

Figure 10 provides the path analysis for creative professionals. There is a positive and significant relationship between creative professionals and income and a slightly stronger one between them and technology. In the model with the self-expression index, the relationship between creative professionals and the university is weak. But when we substitute the mosaic index, the university factor becomes slightly significant, and the relationship between creative professionals and technology becomes stronger. The mosaic index has a positive and significant effect on income, while the self-expression index is negative and significant.

Table 7: SEM results for the Supercreative core and Creative Professionals

	Self-Expression			**Mosaic Index**		
	SuperCreative Core			**SuperCreative Core**		
Income	***Talent***	***Talent***	***Talent***	***Talent***	***Technology***	***Income***
Variables	Eq 1	Eq 1	Eq 1	Eq 1	Eq 2	Eq 3
Tolerance	.398***	-.006	-.006	-.006	3.676***	-.242***
Service Diversity	-.781**	1.179***	1.179***	1.179***		
University	.003	.051***	.051***	.051***	-0.433**	-.008
Talent					1.496	.649***
Technology						.050***
Observations	46	46	46	46	46	46
R2	0.774	0.477	0.477	0.477	0.730	0.594

	Creative Professionals			Creative Professionals		
Income	***Talent***	***Talent***	***Talent***	***Talent***	***Technology***	***Income***
Variables	Eq 1	Eq 1	Eq 1	Eq 1	Eq 2	Eq 3
Tolerance	0.236***	0.236***	0.236***	0.031*	.413*	.048***
Service	0.056	0.056	0.056	0.995***		
Diversity						
University	-.010	-.010	-.010	.024*	.138	-.015
Talent					8.430***	.299**
Technology						.013
Observations	46	46	46	46	46	46
R2	0.653	0.653	0.653	0.513	0.543	0.549

Table 7 (cont.): SEM results for the Supercreative core and Creative Professionals

Occupations and Regional Development

We now turn to our findings for more specific occupational groupings "decomposing" the creative class into its constituent occupations and probe for their effects on regional incomes. Below we summarize the results of structural equation modeling and path analyses for each of the major occupational groups, technology and wages. Table 8 provides the key results of the SEM models, while Appendix 4 presents the findings for the path analysis.

Basically, we find positive and significant direct relationships between three of the six occupational groups and income – management occupations, business and finance occupations, and scientific occupations. We find no significant relationship for heath, education or arts and culture occupations on income. However, these three occupations can be said to have an indirect effect on regional incomes working through technology.

The findings suggest that management occupations are most strongly associated with income. The coefficients for management occupations are significant in models with both the self-expression and the mosaic index. The

correlation coefficient between management occupations and income is also high (0.673). Scientific occupations also have a strong association with income. In the model which includes the mosaic index, it becomes slightly stronger than that for management occupations with an R2 value of 0.621, compared to 0.572 for management occupations. Business and finance occupations are also positively associated income in the path structure, but only in models with the self-expression index. Arts and culture occupations are weakly related to income in a bivariate context (0.335, significant at the 0.05 level). Health and education occupations have no significant direct relation with regional average income, and are not even correlated to income in a bivariate context (-0.192 vs -0.004).

The findings also indicate the consistent role played by tolerance in regional talent formation. The self-expression index is closely related to each and every one of the occupational groups, and has its strongest effect on management occupations. The mosaic index is weaker, and is negative or not significantly related to science, health, education, and social science, and arts and culture occupations.

The tolerance variables are also is positively and significantly related to technology. Both the self-expression index and the mosaic index are strongly related to the technology variables, often being stronger than the relationships between occupations and technology.

The tolerance measures play different roles in relation to regional income. The mosaic index is frequently positive and significant, while the self-expression index is either negative or insignificant.

It is also interesting to note the role of the service diversity measure. When used together with the self-expression index it is negative or

insignificant, but when used with the mosaic index it is frequently positive and significant.

The effect of the university variable is relatively weak across almost all occupational groups with the exception of health and education and social science – two groups which are quite closely related to the university as employer. Surprisingly, the university variable is also in general weakly associated with technology. It becomes significant in the cases where talent plays no role. This may be an artifact of a relative overestimation because of the missing talent-technology link.

Table 8: SEM results for key occupational groups

Tolerance	**Self-Expression**			**Mosaic Index**		
Income	**Managers**			**Managers**		
	Talent	***Technology***	***Income***	***Talent***	***Technology***	***Income***
Variables	Eq 1	Eq 2	Eq 3	Eq 1	Eq 2	Eq 3
Tolerance	.319***	2.956***	-0.172***	.068**	.204	.043***
Service Diversity	.388			1.477***		
University	-.063**	-.368**	.021	-.004	.337**	-.006
Talent		2.795**	.407***		6.434***	.258***
Technology			.035***			.007
Observations	46	46	46	46	46	46
R2	0.544	0.776	0.582	0.461	0.621	0.572
Income	**Business and Finance**			**Business and Finance**		
	Talent	***Technology***	***Income***	***Talent***	***Technology***	***Income***
Variables	Eq 1	Eq 2	Eq 3	Eq 1	Eq 2	Eq 3
Tolerance	1.218*	3.280***	-.127*	.070***	.318	.048***
Service Diversity	.178*			1.655***		
University	-.084*	-.481**	.012	-.007	.373**	-.007
Talent		1.803*	.227**		5.083***	.097
Technology			.044***			.019**
Observations	46	46	46	46	46	46
R2	0.484	0.757	0.462	0.513	0.510	0.509

Table 8 (cont.): SEM results for key occupational groups

Income	Science			Science		
	Talent	*Technology*	*Income*	*Talent*	*Technology*	*Income*
Variables	Eq 1	Eq 2	Eq 3	Eq 1	Eq 2	Eq 3
Tolerance	.570***	3.086***	-.120	-.015	.716***	.071***
Service	-.997			1.950***		
Diversity						
University	-.073**	-.445**	-.008	.009	-.268**	-.005
Talent		1.905**	.177**		4.823**	.248***
Technology			.041**			-.005
Observations	46	46	46	46	46	46
R2	0.827	0.671	0.499	0.262	0.703	0.621
Income	**Health**			**Health**		
	Talent	*Technology*	*Income*	*Talent*	*Technology*	*Income*
Variables	Eq 1	Eq 2	Eq 3	Eq 1	Eq 2	Eq 3
Tolerance	.122	3.679***	-.082	-.063**	.744***	.055***
Service	-1.313*			-.270		
Diversity						
University	.083***	-.104	.001	.083***	.769***	-.066
Talent		-3.313***	-.022		-2.447	-.004
Technology			.052***			.025***
Observations	46	46	46	46	46	46
R2	0.294	0.826	0.377	0.340	0.357	0.495
Income	**Education and Social Science**			**Education and Social Science**		
	Talent	*Technology*	*Income*	*Talent*	*Technology*	*Income*
Variables	Eq 1	Eq 2	Eq 3	Eq 1	Eq 2	Eq 3
Tolerance	.212***	4.197***	-.062	-.013	.914***	.054***
Service	-			.136		
Diversity	1.024**					
University	.061***	-4.269***	-.002	.087***	.606**	-.001
Talent		2.716	-.019		-.253	-.061
Technology			.049***			.025***
Observations	46	46	46	46	46	46
R2	0.530	0.803	0.368	0.441	0.321	0.501
Income	**Arts and Culture***			**Arts and Culture**		
	Talent	*Technology*	*Income*	*Talent*	*Technology*	*Income*
Variables	Eq 1	Eq 2	Eq 3	Eq 1	Eq 2	Eq 3
Tolerance	.286***	2.123***	-.043	.027	.427**	.057***
Service	1.301**			2.622***		
Diversity						
University	.000	-.251	-.003	.036	-.054	.001
Talent		2.577**	-.070		4.758***	-.118*
Technology			.052***			.036***
Observations	46	46	46	46	46	46
R2	0.683	0.694	0.375	0.591	0.623	0.524

* The tolerance factor is only proxied by the Gay Index and not the Boho Index in this case to rule out collinearity problems with the talent group of arts and culture.

Conclusion

Our research has provided an empirical examination of the factors that shape regional development in Canada. Specifically, we explored the role of human capital and the creative class, as well as technology, on regional incomes. We also examined a series of factors – universities, tolerance, and service diversity – on talent and on regional income. We provided an analysis of the role of specific occupational groupings on income as well.

Our research generated several key findings. First, our findings shed light on the effects of two different measures of talent on regional development –human capital and the creative class. Generally speaking, our findings show that both measures are strongly associated with regional development in Canada. The findings suggest that human capital measure has a somewhat stronger association with income and also a significant effect on technology. However, the effect of technology on regional income is relatively stronger relation in models which include the creative class. Of the two main groups that make up the creative class, creative professionals are more strongly related to regional income.

Second, our findings show that technology plays an important role in Canadian regional development. The technology variable has a positive and significant effect on income in models with the self-expression index. In these models, this technology effect holds alongside both human capital and the creative class, though it is relatively stronger in models with the latter. However, the effect of technology on income becomes insignificant in models with visible minorities and the mosaic index – variables which have a strong direct effect on income. We are led to conclude that technology effects

regional development in conjunction with the self-expression variables (that is openness to gays and bohemians).

Third, our findings shed light on the role of specific occupations in Canadian regional development - management; business and finance; science; health; education and social science; and arts and culture occupations. Management and scientific occupations have the strongest association to regional income, while business and finance occupations also are associated with regional income. Arts and culture occupations have a strong association to technology, roughly the same strength as for scientific occupations.

However, we find that the effects of these occupational groups on incomes to be weaker compared to the results from comparable studies of the U.S. (Florida et al, 2008) using a similar methodology. This can partly be explained by that the Canadian and the US occupational definitions vary to a certain extent. But it may also be a pattern of lower productivity levels, since wage levels tend to be a reflection of those, and in the Canadian case the wage and income levels are closely related. Human capital theory postulates that wages rise with the level of knowledge or skill (Becker, 1964, 1993; Mincer, 1974). Optimally, wage levels should be in proportion to the stock of human capital, since this affects the value of workers' marginal product. However, wages are thus set by the regional *supply and demand* for labor and in order to increase wage levels based on talent, industry must have a need for this in order to be willing to pay for it. Health and education occupations have no significant relationship to regional income. This is in line with the findings of previous studies of the US (Florida et al, 2008) and Sweden (Mellander and Florida, 2006).

Fourth, our findings shed light on the differential role played by tolerance, universities, and service diversity on regional development. Of the three, our findings indicate that tolerance plays by far the most significant role, acting directly on both talent production and regional income. We also find that different measures – and kinds – of tolerance effect regional development in different ways. The self-expression index is positively associated with both talent variables and with technology. The two other measures of tolerance - visible minorities and the mosaic index - have a direct significant and positive link to income levels.

We thus find that openness to or tolerance of gays and bohemians and visible minorities and immigrants operate on regional development through distinctive channels. The former appears to operate indirectly on income through the channel of regional talent, signaling for regional openness to or attractiveness for talent, as well as through regional technology; while the latter operates more directly on income.

Fifth, our findings indicate that university's role in Canadian regional development is relatively weak. It has a positive and significant relation to human capital but is insignificant in relation to the creative class. The university has little association to technology or regional income. There are several reasons why this may be so. It may reflect the flow of talent between regions. Certain regions may provide research and education which is then exported to other regions which perform more commercial functions. It is a signal that the universities that produce talent may not keep the talent in the region. It might also reflect a university focus on education and talent as opposed to commercially relevant research or startup firms.

In short, our findings shed new light on the ways that Canadian regional development is shaped by the 3Ts of technology, talent and tolerance. Talent in the form of human capital and the creative class is strongly associated with regional income. Technology effects regional income alongside human capital, the creative class and openness to gays and bohemians. The university's role in technology development and regional income is relatively weak. This suggests an ongoing policy challenge to find new and better ways for connecting Canadian universities more directly to the processes of regional talent, technology and income. Tolerance is a strong suit in Canadian regional development providing considerable direct and indirect effects on talent and regional income. Tolerance towards gays and bohemians is strongly associated with both human capital and the creative class, while tolerance in the form of openness to immigrants and visible minorities is strongly related to regional income. The effects of these forms of tolerance on income are greater than that played by technology. This suggests that Canada's experiment in opening up to immigration is paying significant economic development dividends.

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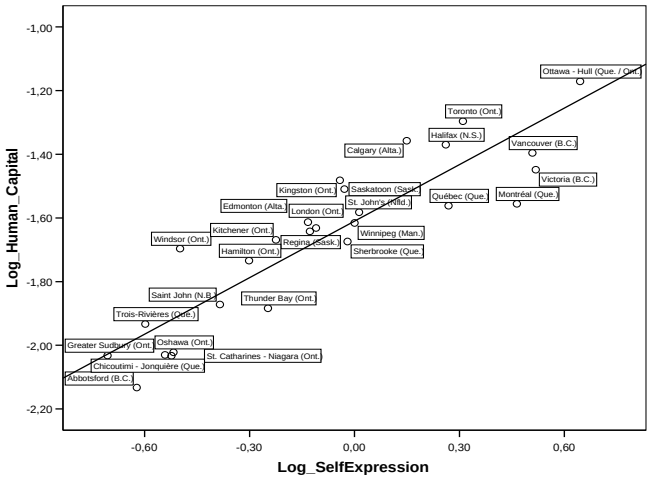
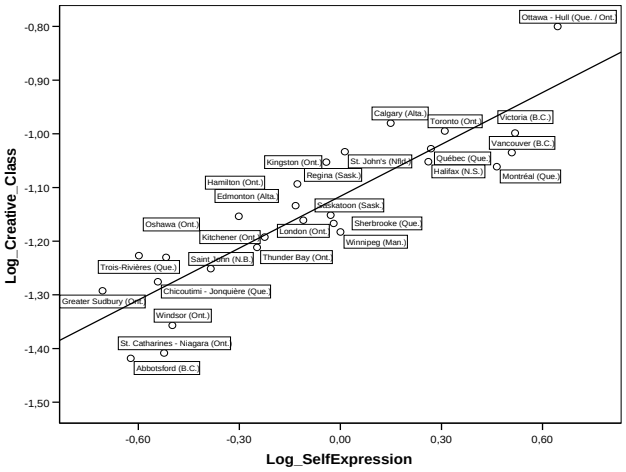
APPENDIX 1: Correlations for Occupations

		High Tech	Av Income	Av Emp Income
Managers	Senior Management	0.768**	0.317**	0.377**
	Specialist Managers	0.741**	0.674**	0.714**
	Other Managers	0.399**	0.557*	0.505*
Business and Finance	Prof. Occ in Business and Finance	0.818**	0.425**	0.466**
	Finance and Insurance Adm.Occ	-0.155	0.339*	0.260
Science	Prof. Occ in Natural and Applied Science	0.812**	0.669**	0.686**
	Tech. Occ. related to natural and applied sciences	0.383**	0.151	0.156
Health	Prof. Occ in Health	0.276	-0.057	-0.105
	Nurse supervisors and registered nurses	-0.266	-0.204	-0.227
	Technical and related occupations in health	-0.252	-0.208	-0.249
Education and Social Science	Judges, lawyers, psychologists, social workers, ministers of religion, and policy and program officers	0.532**	0.298*	0.260
	Teachers and professors	0.018	-0.189	-0.185
	Paralegals, social services, workers and occupations in education and religion, n.e.c.	-0.064	-0.076	-0.122
Arts and Culture	Professional occupations in art and culture	0.759**	0.368**	0.357**
	Technical occupations in art, culture, recreation and sports	0.666**	0.253	0.248

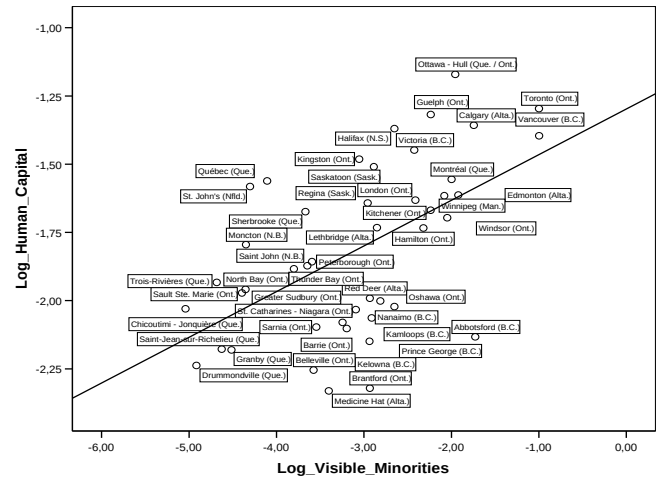
APPENDIX 2: Talent and Tolerance



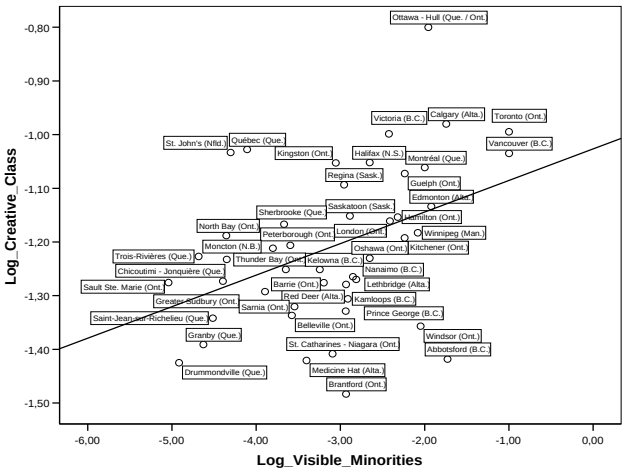
Self-Expression vs Human Capital



Self-Expression vs Creative Class



Visible Minorities vs Human Capital



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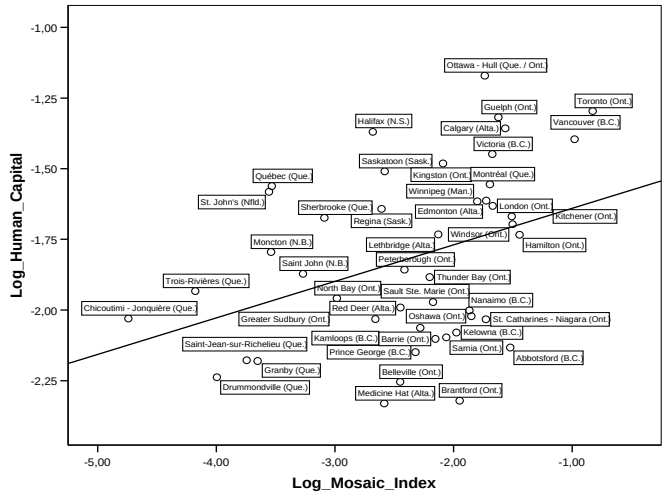
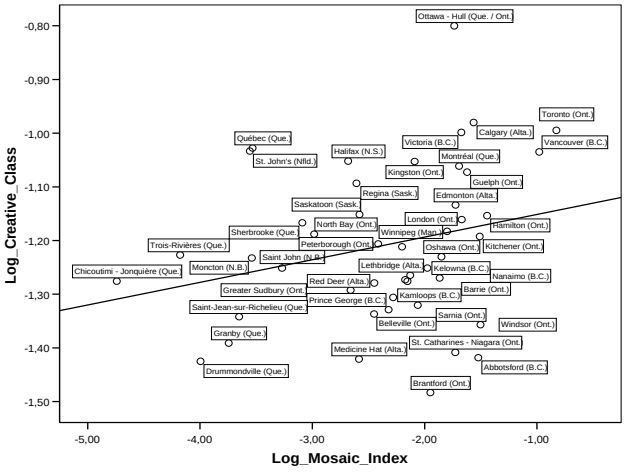
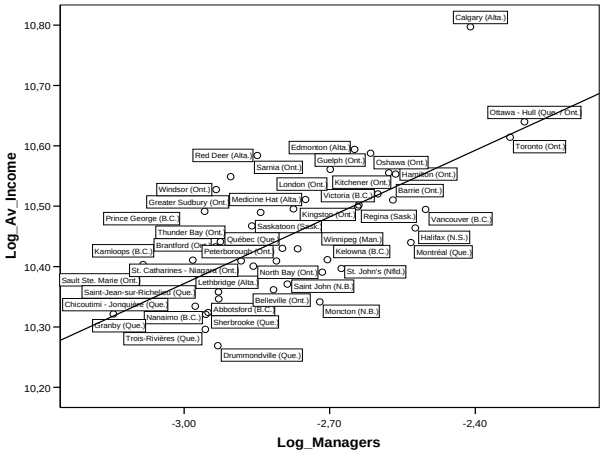


The Mosaic Index vs Human Capital

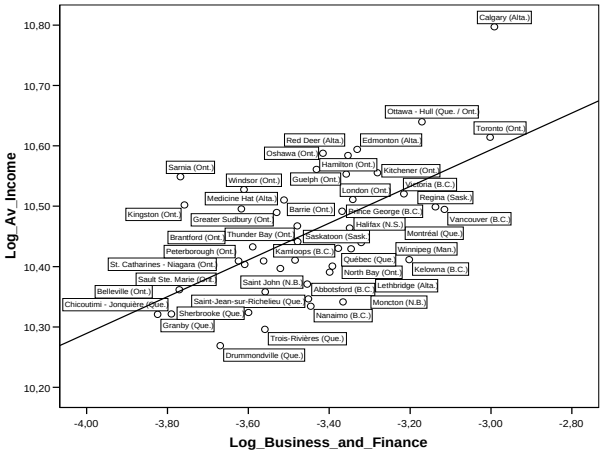


The Mosaic Index vs Creative Class

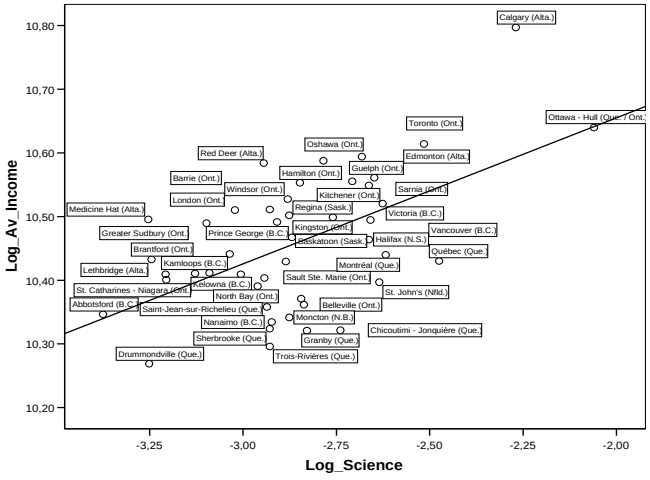
APPENDIX 3: Occupations and Incomes



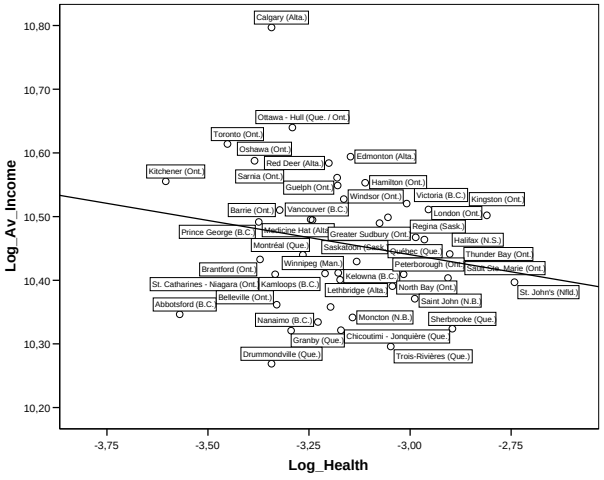
Managers



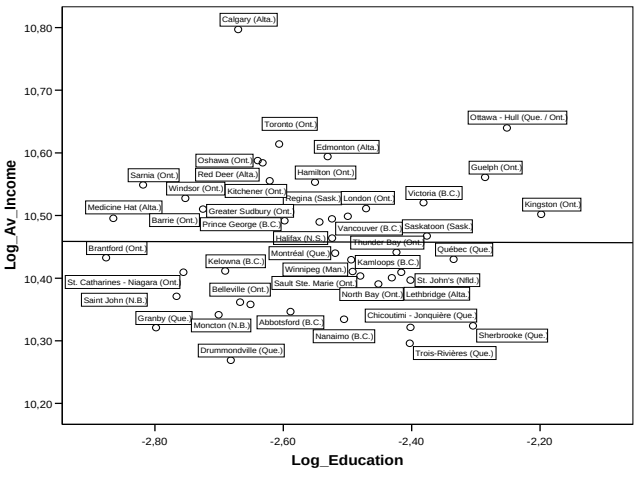
Business and Finance



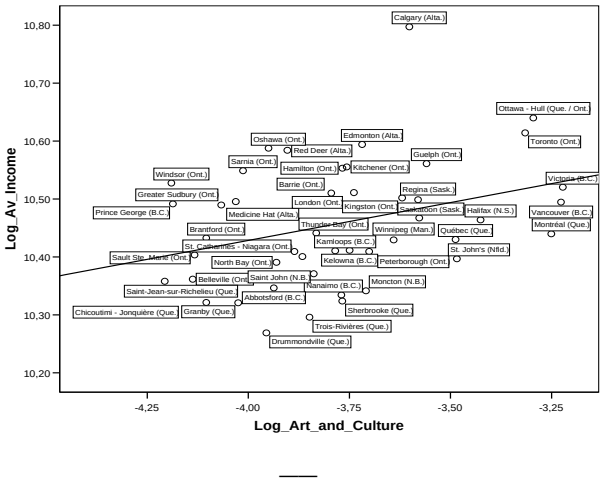
Science



Health



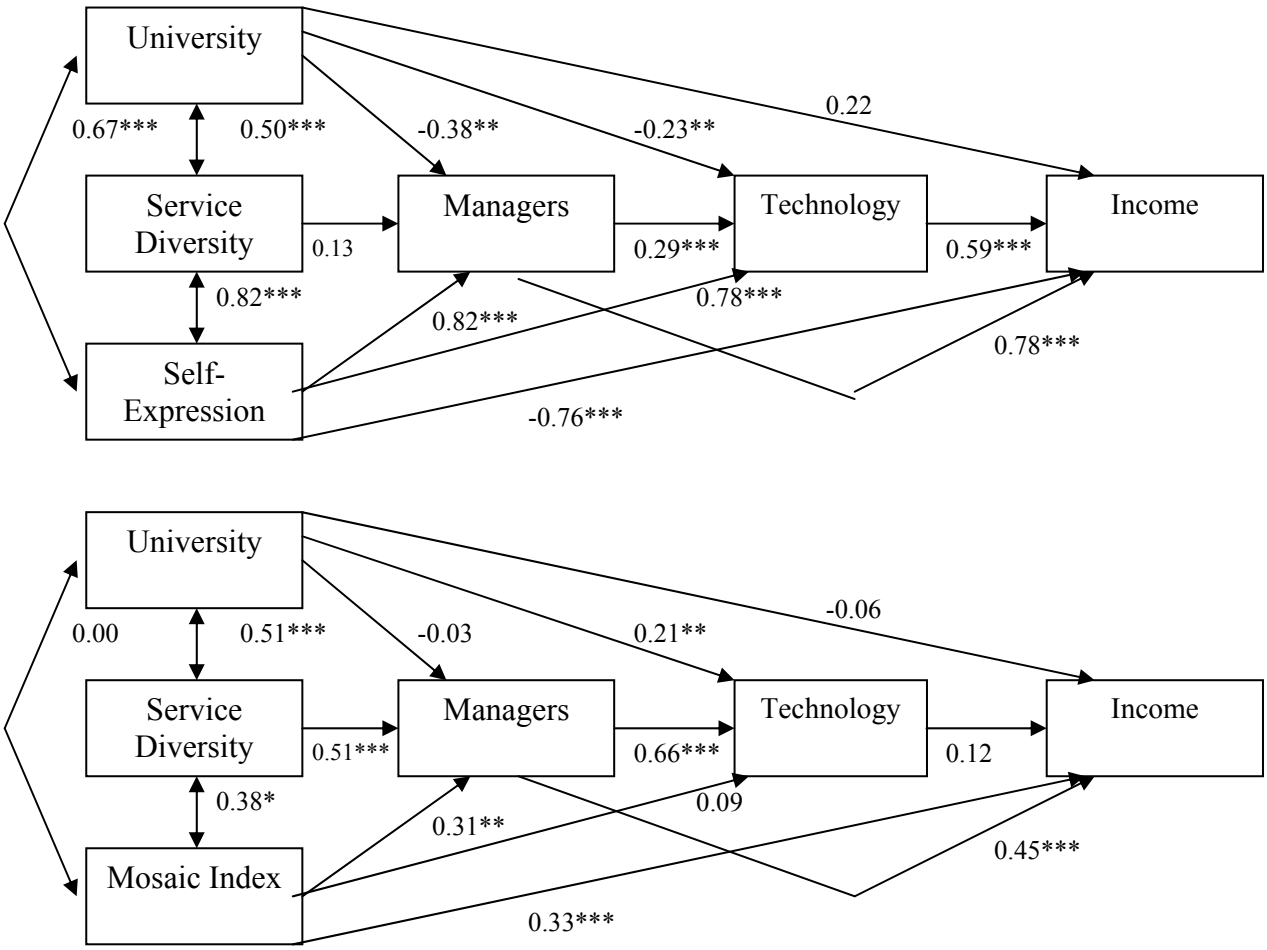
Education and Social Science



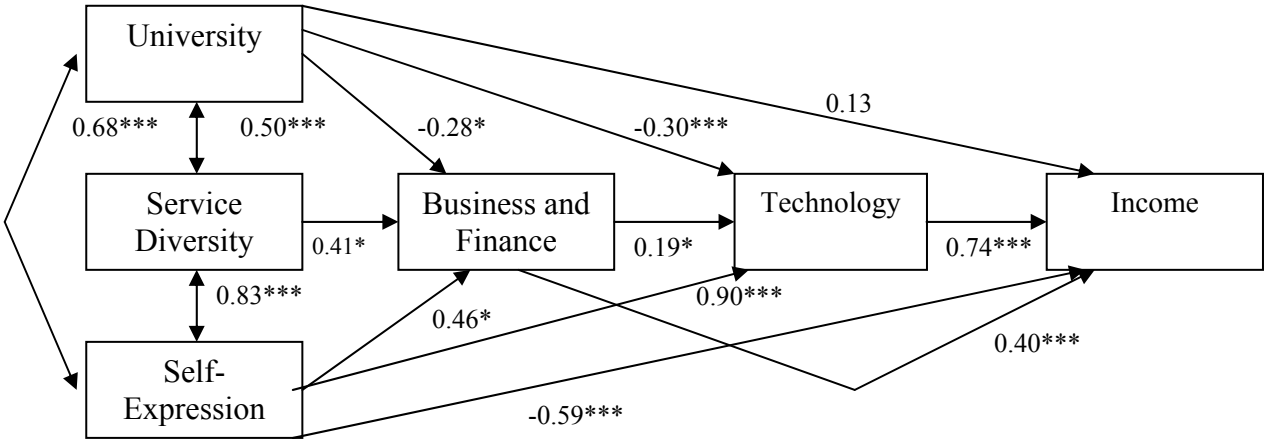
Arts and Culture

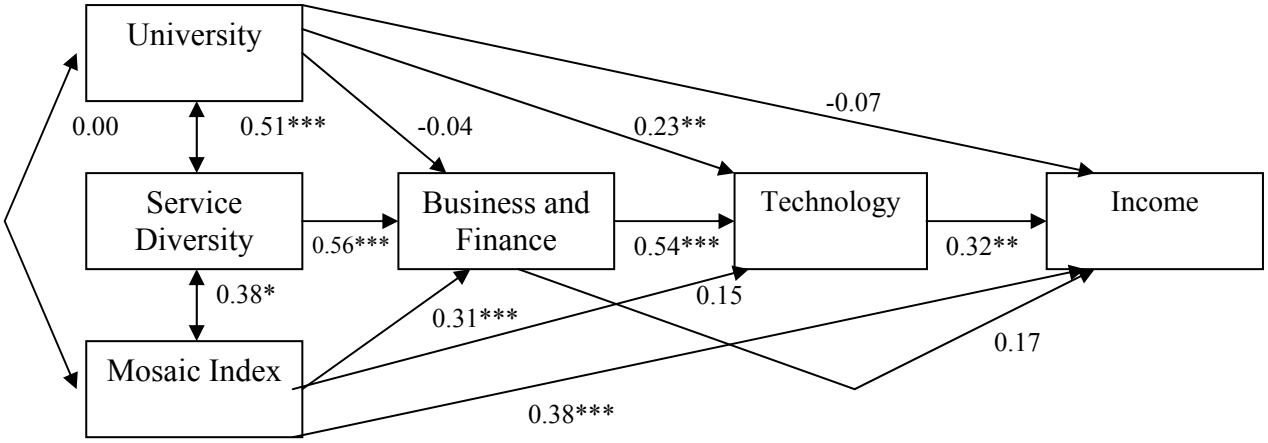
APPENDIX 4: Path structures for key occupations

Managers

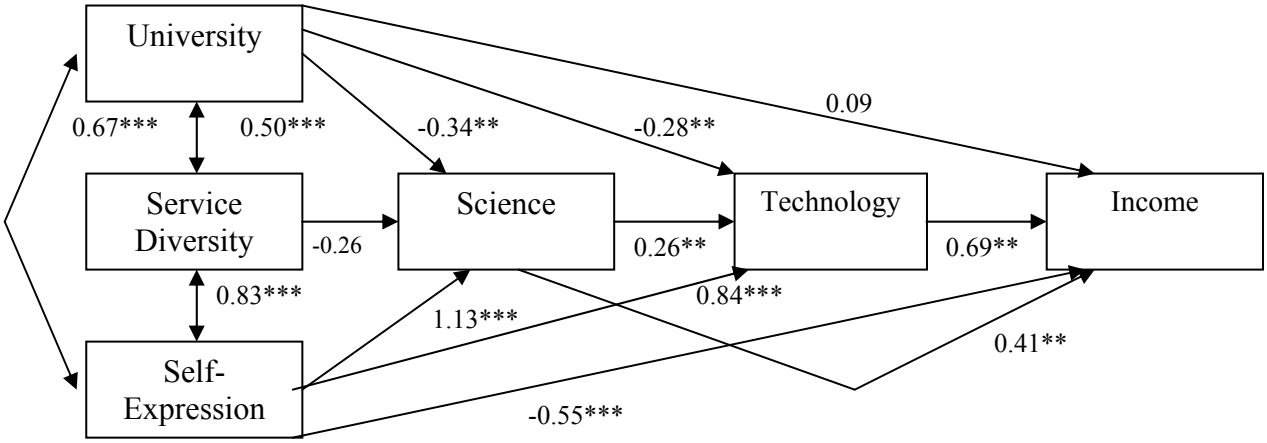


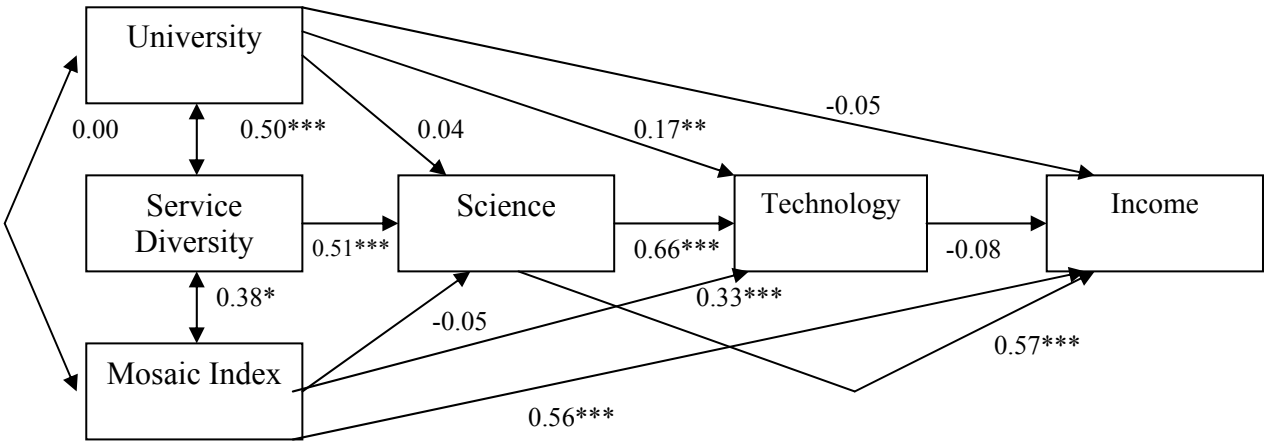
Business and Finance (below)



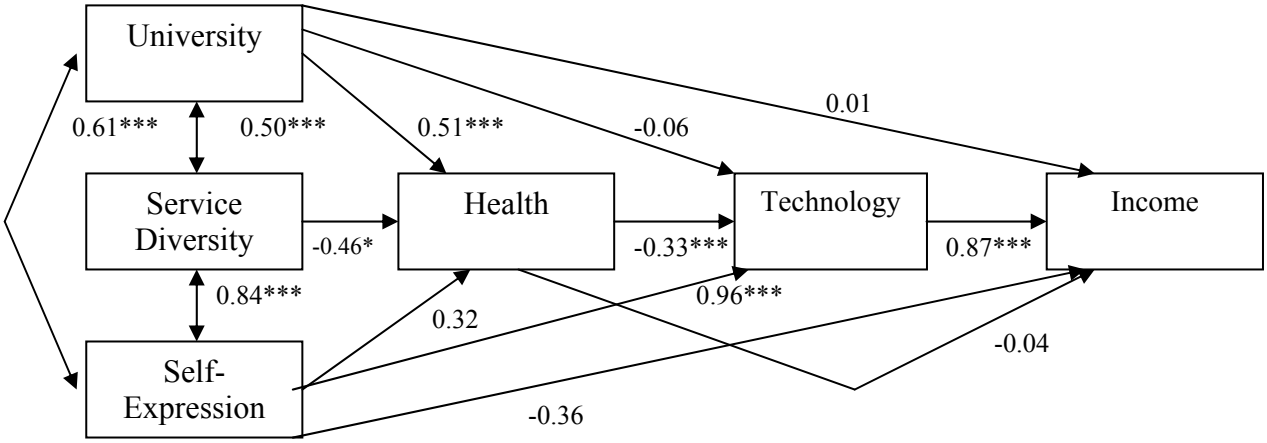

University
Service Diversity
Business and Finance
Technology
Income
Mosaic Index
0.00
0.51***
-0.04
0.23**
-0.07
0.56***
0.54***
0.32**
0.38*
0.31***
0.15
0.17
0.38***

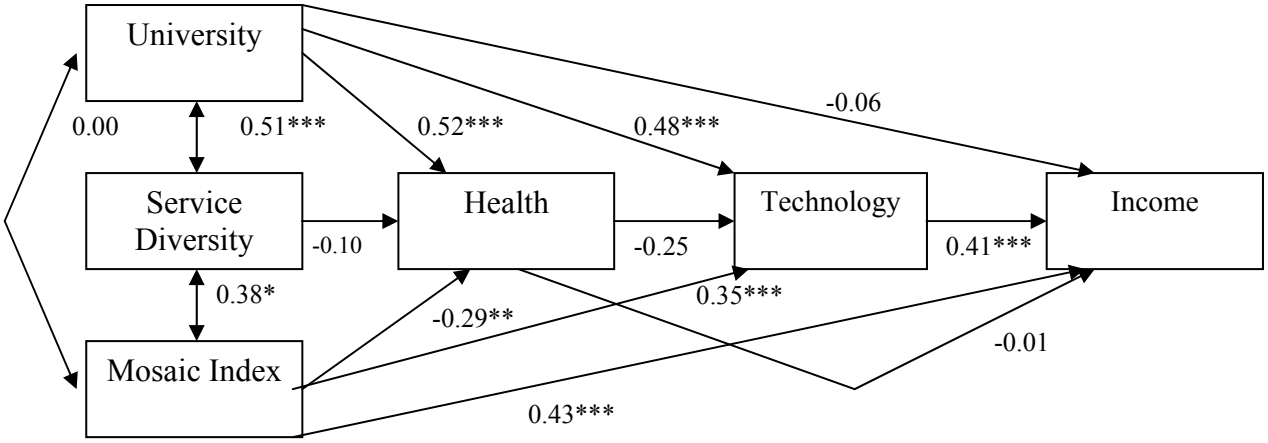
Science


University
Service Diversity
Science
Technology
Income
Self-Expression
0.67***
0.50***
-0.34**
-0.28**
0.09
-0.26
0.26**
0.69**
0.83***
1.13***
0.84***
0.41**
-0.55***

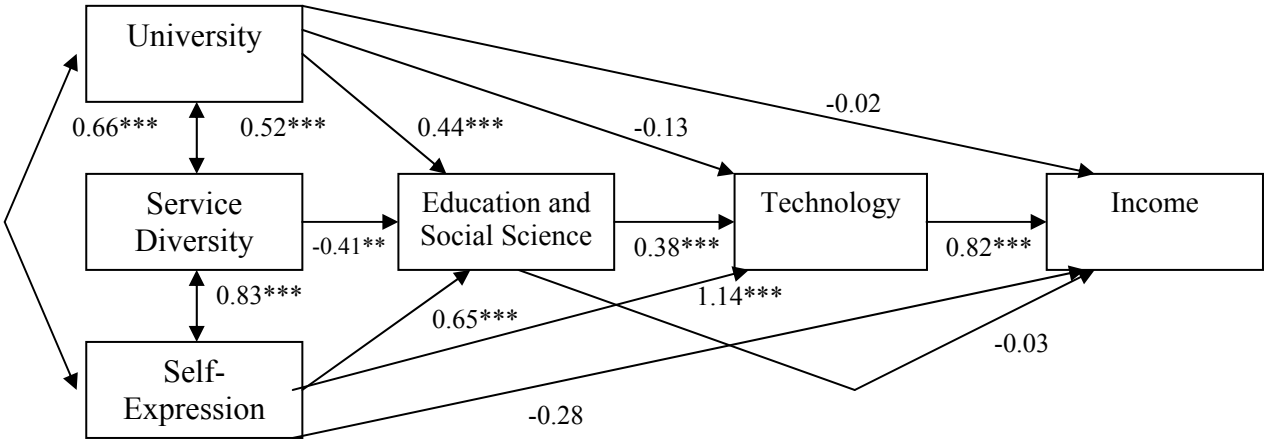

University
Service Diversity
Science
Technology
Income
Mosaic Index
0.00
0.50***
0.04
0.17**
-0.05
0.51***
0.66***
-0.08
0.38*
-0.05
0.33***
0.57***
0.56***

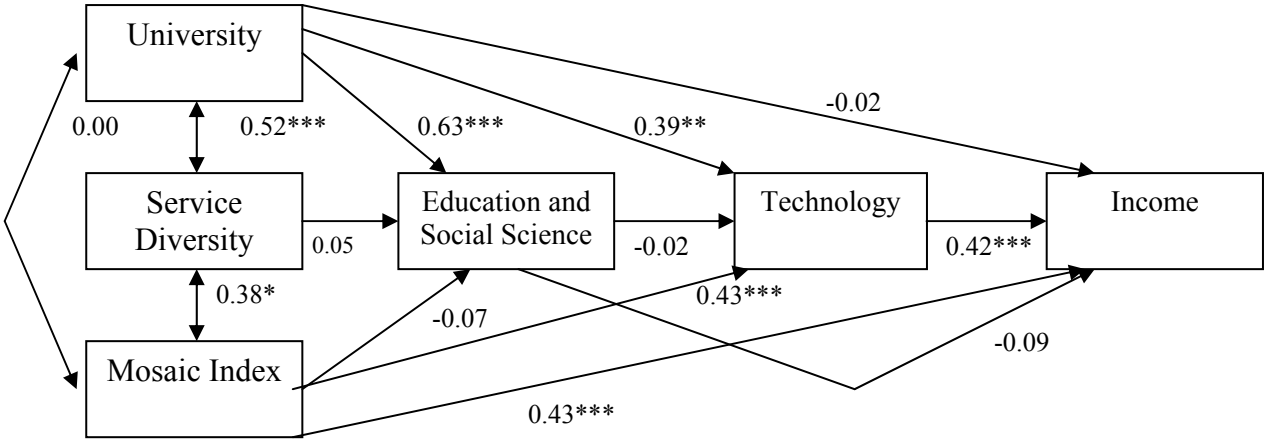
Health



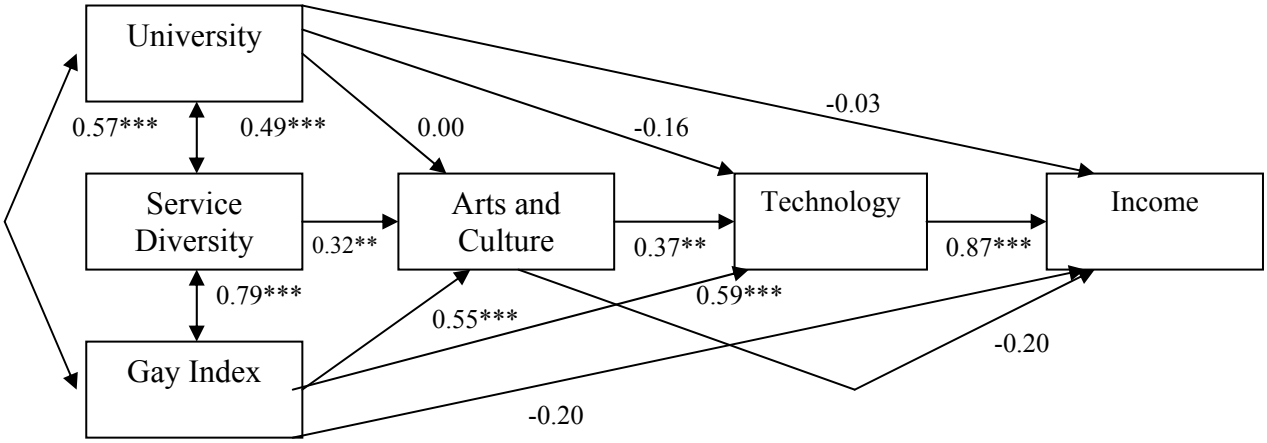


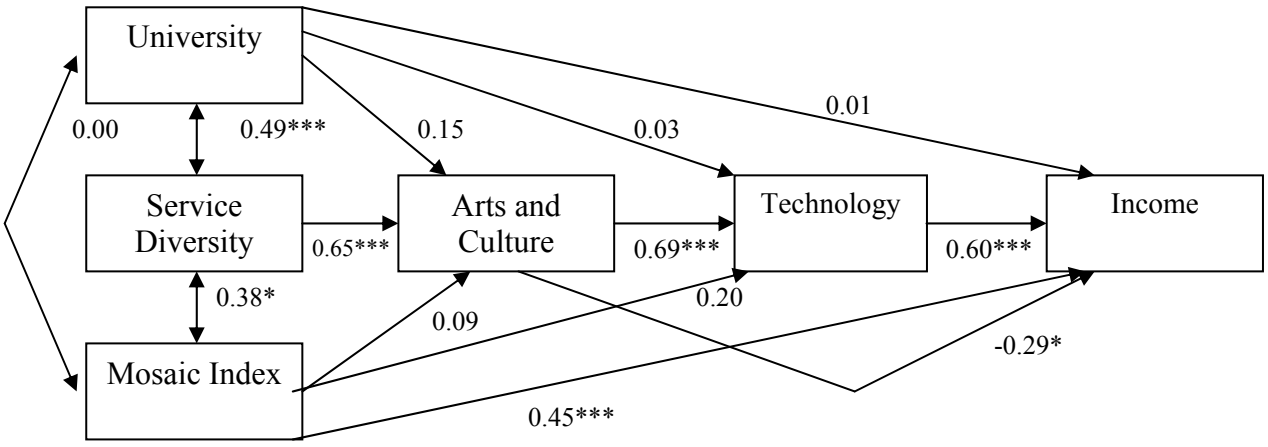
Education and Social Science





Arts and Culture





APPENDIX 5: Policy Directions

Into the Black Box of Regional Development in Toronto and Ontario

1. The overall research questions

The purpose of the report was to analyze the connections between the regional setup of institutions and talent, technology and income levels in Canadian regions, taken together in a regional economic eco-system. The assumed linkages were according to Figure 1 below.

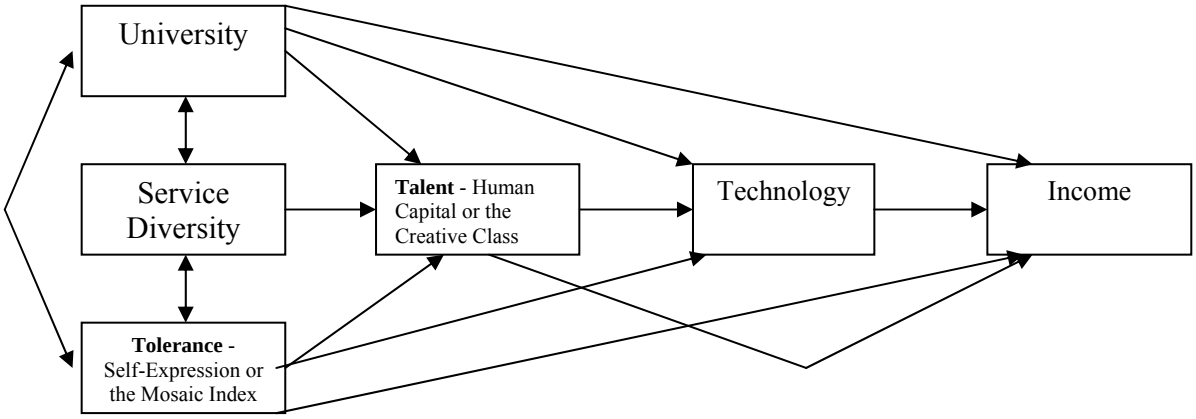


Figure 1: The economic eco-system

From this, we have a situation which can be illustrated in three steps;

(1) The share of talent in relation to the labor force will be affected by the size of the university (if at all existing), the diversity of consumer services supplied and the regional tolerance levels.
(2) The concentration of the technology sector will be affected by the share of talent in relation to the labor force, the size of the university as well as the regional tolerance levels. It is also important to notice the indirect effects from the service diversity via the talent factor.
(3) Finally, the regional economic outcome in terms of income per capita. This factor is affected by the concentration of the technology sector, the size of the university, the share of talent in relation to the labor force, and the regional tolerance levels.

In order to analyze this system we employed a number of different variables.

Regional setup factors; For university we used the faculty per capita. We used two different tolerance factors, measured as the concentrations of gay and lesbian individuals, in combination with concentrations of bohemian occupations, referred to as the Self-Expression Index. We also employed an immigration based measure (share of immigrants in relation to the population), referred to as the Mosaic Index. For service diversity we used the number of different consumer services that we found represented in the region.

Outcome factors; For talent we used both an education based measure – the share of the labor force with a university degree of three years or more, referred to as human capital. Besides this, we also employed an occupation based measure – the share of the labor force with a creative occupation, referred to as the creative class.
For technology we measured the regional concentration of high tech employees, and for the final economic outcome, regional income per capita.

This can be run in a system according to the illustration in figure 1. This will however not let us identify the performance of an individual region. Therefore, we also run this as three individual models instead treating them like a system, in order to identify the over- or underperformance of Toronto, in terms of talent, technology and income, given the levels of service diversity, tolerance and the size of the university.

2. Outcome factors:

Talent Performance and Self-Expression:

- If we let university, service diversity and self-expression explain human capital levels, Toronto over-performs by approximately 14 percent. If we substitute the human capital variable into the Creative Class, Toronto now performs approximately 3 percent above the expected value.

Talent Performance and the Mosaic Index:

- If we let the Mosaic Index substitute the Self-Expression Index, Toronto over-performs by 20 percent in terms of Human Capital and 9 percent in terms of the Creative Class. In both cases Toronto has a talent concentration 10-20 percent above the expected, given the regional institutional set up.

Technology Performance:

- When we check for the actual technology concentration performance of Toronto, no matter if we use self-expression, the mosaic index, human capital or the creative class, Toronto still has a technology concentration more than twice as strong as the expected value.

The Income per Capita Performance:

- While Toronto over-performs both in terms of talent and technology, the income per capita is still under the expected value, given the regional setup of university, tolerance, technology and talent. For all types of combinations, Toronto has an income per capital of approx 1-6 percent under the expected value. Especially given the concentration of human capital, Toronto underperforms (6 percent in this case). For future work, it is important to examine why the technology factor has such a small impact on the regional income levels in Toronto.

3. REGIONAL SETUP FACTORS:

The Tolerance Factor:

- We used several different measures for Tolerance; tolerance towards gay and lesbians in combination with concentrations of bohemian occupations (the Self-Expression Index), as well as concentration of immigrations (the Mosaic Index).
- From the overall Canadian analysis we captured a strong relationship between the Self-Expression Index and Talent and Technology, but in the end a negative relation with income levels, a result that differs from our testing of US regions.
- Immigration related measures on the other hand had a weaker relation with Talent and Technology, but a positive and strong relation with Income levels. The relationship between immigration concentrations and income levels is different from the result for US, where immigration concentrations were negatively related to income levels. This indicates that Canadian immigrants are better absorbed into economic activities. However, these activities are in general not associated with creative occupations (except Managers or Business and Finance).
- For Ontario, the Self-Expression Index scored 1.008 and for Toronto 1.364. This indicates that Ontario has a concentration of homosexuals and bohemians close to the national average, while Toronto has a concentration above the national average. These values can be compared to the lowest regional value in Canada, 0.494, and the highest score, 1.906.
- In terms of The Mosaic Index (immigration concentrations) Ontario scored 0.268 and Toronto scored 0.437. The Toronto score is the highest for Canadian regions, and the lowest Canadian score is 0.009.

Policy Recommendation:

It is interesting to see how Canadian regions have been able to absorb immigration groups and turn their activities into economic value in terms of regional incomes. However, a challenge for the future may be absorbing immigration groups also in more creative occupations. With a change towards

a more creativity based economy, this will be a general recommendation, but our results show that this may concern immigration groups even more.

The University Factor:

In most of our estimations for Canada, the university factor has been strongly related to talent, but weakly or even negative in relation to technology and income per capita. This result is in fact in line with the results in a similar study for the US. However, it is interesting since it implies that the university mainly plays a role as a talent producer, rather than playing an active part in relation to the technology sector. Neither does it have an effect on the overall standards of living in terms of income per capita. One reason for this can be that we measure university as faculty per capita. A lot of faculty may be used for teaching and little research. Using university grants could be an alternative measure that may capture research capacity better. But it is still surprising to find a negative relation to the technology sector as well as the income per capita.

Even though Toronto and Ontario host some of Canada's largest universities, when neutralized by population, the faculty per capita level is slightly below the national average.

Policy recommendation:

We would encourage a strategy for closer contacts between the university and regional industry, so that the university becomes more than a talent producer. The university can play a more efficient role in relation to the university. The innovative ideas from universities need to be commercialized in order to create economic value. Also, having the local industry tap into the university stock of knowledge can increase the knowledge spillovers, and also have an effect on the number of new firm startups.

The Service Diversity factor

The service diversity supply has been proven important in earlier research, since services in general tend to be very place specific. In order to produce and consume a service, seller and buyer need to be in the same locale. The diversity of services supplied in a region can thereby function as a regional attractor. Normally, this is a factor strongly related to city size – the bigger the city, the more services will it supply. In a Canadian context, with a strict hierarchy of city size (e.g. in relation to the US) we can expect some few cities provide a lot of services, while the more sparsely populated regions will supply very few. Our Canadian results showed that concentrations of immigrant groups and service diversity tended to play the same role, and we could assume that different backgrounds can bring diversity to the number of services that are being provided.

For Ontario and Toronto, the number of services provided was close to the maximum level, and far above the national mean.

4. Comparison of Ontario to Canada

For the most part, the metro areas of Ontario look very much like the rest of Canada. So, all the results for Canada, generally apply. There are some differences that are discussed below.

Just a sidebar, but Ontario's CMAs are much smaller in AREA (about ½ the size) then for the rest of Canada. As population doesn't have the same variation - Ontario is more densely packed than the rest of Canada. But, this isn't just the province, this is the metro areas.

Ontario is actually lower on the "self-expression" measures (Boho & Gay Indices) and higher on the Mosaic Index. Since the results showed that the tolerance impact on Technology was higher for "self-expression", Ontario's "Tech boost" from Tolerance is not as great. Higher levels of immigrants are associated with higher wages & incomes, but the income boost from technology is not as great when tolerance is measured using immigrants.

Ontario is already much higher than the average of the rest of Canada on Technology, but only from high levels of High-tech output. Ontario actually has a lower High-tech LQ than the average of the other Canadian CMAs. It does have a higher Tech-Pole. Ontario produces more technology products, but the innovations are created elsewhere.

Ontario is on par with the rest of the country on Creative Class and Super Creative core. The lower Self-Expression scores for Ontario indicate that the Creative and Super Creative should also be lower. However, more broadly, the results of the SEM analysis suggest that for Canada, the University, Service Diversity, and Mosaic/Self-Expression jointly create an "environment of tolerance and diversity" (perhaps a latent variable) that helps to attract the Creative and Super Creative. The impacts on technology and wages/income are not part of this joint-relationship. So with Ontario's slightly higher University presence and slightly lower Service Diversity, the impact of low self-expression on attracting the Creative and Super Creative is somewhat mitigated. It is also possible that the numbers are higher from earlier times when the self-expression scores in Ontario were relatively higher and the Creative and Super Creative should start declining.

Ontario does have more Managers, and has higher technology and wages/income as a result.

Ontario is basically on par with the rest of Canada for the other occupational groups.

APPENDIX 5a:

Descriptive Statistics from the study – all regions including Ontario and Toronto

	Obs	Mean	Standard Deviation	Minimum	Maximum	Ontario	Toronto
Talent:							
BA or above	46	0.170	0.054	0.097	0.310	0.210	0.274
Creative class	46	0.302	0.045	0.227	0.449	0.324	0.364
Supercreative	46	0.162	0.029	0.112	0.270	0.165	0.190
Creative Professionals	46	0.140	0.019	0.108	0.180	0.138	0.174
Decomposed Creative Occupations:							
Managers	46	0.064	0.013	0.043	0.100	0.088	0.105
Business and Finance	46	0.032	0.007	0.022	0.050	0.048	0.032
Science	46	0.059	0.017	0.034	0.127	0.082	0.086
Health	46	0.043	0.008	0.027	0.064	0.046	0.126
Education/Social Science	46	0.079	0.013	0.056	0.111	0.099	0.090
Arts and Culture	46	0.024	0.007	0.015	0.040	0.036	0.029
Regional Characteristics:							
University (faculty)/1000	46	2.299	1.973	0	8.445	1.696	1.560
Self-Expression	27	0.982	0.394	0.494	1.906	1.008	1.364
Mosaic Index	46	0.126	0.089	0.009	0.437	0.268	0.437
Visible Minorities	46	0.072	0.979	0.006	0.369	0.191	0.368
Service Diversity	46	210.93	13.92	186	233	232	232
Effects:							
Techpole	46	2.384	7.048	0.024	40.832	36.513	40.832
Avg. Income	46	35,007	3,816	28,823	48,878	38,687	40,704
Avg. Employment Income	46	35,146	4,060	29,075	48,931	37,945	43,417

Author Bios

Dr. Richard Florida is Professor of Business and Creativity at the Rotman School of Business, and the Academic Director at the Martin Prosperity Institute. Prior to joining the Rotman School, he taught for nearly two decades at Carnegie Mellon University and has been a visiting professor at MIT and Harvard University's Kennedy School of Government. His books include three best sellers: The Rise of the Creative Class (Basic Books, 2002), The Flight of the Creative Class (Harper Collins, 2005), and his newest book, Who's Your City (Basic Books).

Dr. Charlotta Mellander is the research director at the Prosperity Institute of Scandinavia and close collaborator with Professor Richard Florida and Dr Kevin Stolarick at the Prosperity Institute in Toronto. Charlotta earned a Ph.D. in economics at Jönköping International Business School. Her dissertation examined regional attractiveness, the urbanization process, the importance of cities, and the relationship between the service sector and the market. Charlotta began her Ph.D. work in Tema Technology and Social Change, before transferring to Jönköping. She is affiliated with the CESIS (Centre of Excellence for Science and Innovation Studies) under the Royal Institute of Technology, Stockholm, and a collaborator and researcher for the Creative Class Group, Washington DC.

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Working Paper Series

This working paper is part of the *Ontario in the Creative Age* series, a project we are conducting for the Ontario Government. The project was first announced in the 2008 Ontario Budget Speech, and its purpose is to understand the changing composition of Ontario's economy and workforce, examine historical changes and projected future trends affecting Ontario, and provide recommendations to the Province for ensuring that Ontario's economy and people remain globally competitive and prosperous.

The purpose of the working papers in this series is to engage selected issues related to our report: *Ontario in the Creative Age*. The series will involve a number of releases over the course of the coming months. Each paper has been reviewed for content and edited for clarity by Martin Prosperity Institute staff and affiliates. As working papers, they have not undergone rigorous academic peer review.

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