# A Geographical Perspective on Education and Jobs Employment Growth and Education in the Canadian Urban System, 1981-1994[*]

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It is widely accepted today that, for individuals and for countries, education is of paramount importance in terms of obtaining good employment and of competing in the global market. Reich (1992) and Chapman (1994), for instance, set out the basic arguments for the increasing importance of education for national economies. Lowe and Krahn (1995), the Economic Council of Canada (1992) and Constantinos and West (1991) show how relevant education levels are for individuals who seek employment.

Furthermore, there has been a shift in emphasis on the provision of education over the past two decades. Whereas traditionally this has been an area of national concern, budget cuts have tended to hit education hard, and local areas are now becoming aware of the importance of an educated workforce in terms of attracting and retaining employment (for example, Quorum 1996). A substantial literature has emerged on the subject of local development, and almost invariably education and training feature quite prominently among the policy options available to local areas in order to promote development (Economic Council of Canada 1990; Meyer 1991; Galaway and Hudson 1994). It is also interesting to note that education features quite prominently in the list of location factors given by contributors to real estate magazines (Coffee 1994; Hamer 1993).

The arguments which link the benefits of education to national and to personal development are well rehearsed, and are backed by a certain amount of empirical evidence. (There is little doubt about the benefits which individuals derive from education; the evidence concerning countries is more open to interpretation). However, very little work has been done exploring whether or not these relationships hold at a smaller geographic scale.

It may appear obvious to many observers that education, which benefits nations and individuals will necessarily also benefit localities. However, Openshaw (1981) has pointed out the dangers of making inferences from one geographic scale to another, and Constantinos and West (1991) and Cousineau and Vaillancourt (1987) have already pointed out the problems inherent in assuming that what is good for individuals is necessarily good for the country.

In this paper, I will first briefly review the arguments concerning the benefit of higher education levels to nations and individuals. Although there is some question as to the extent to which each type of entity benefits, there is general agreement that the benefits outweigh the costs in most cases.

I will then turn to the issue of whether these arguments can be extended to regions and localities. The fact that localities are situated within a very fluid labour market (Maillat 1989; Courchene 1986), the fact that education increases personal mobility (Marr et al 1981), and the related question of whether employment will move towards people or vice versa will be considered.

Then, after presenting the data and the analytical approach, the results of an empirical study examining the links between education levels and employment growth within 152 Canadian urban agglomerations will be set out. This study goes beyond the analysis of employment totals, and attempts to identify which economic sectors are the most influenced by local education characteristics. In order to ensure that local characteristics are being considered the effect of population size, proximity to a major metropolitan area[1] and of geographic region within Canada are controlled.

Finally, the conclusion will discuss the results' limitations, further avenues of study, and the policy implications of these preliminary findings.

## Education and Economic Growth

### National Competitiveness and Education

The link between education and economic growth has nearly become self-evident over time, to the extent that there is rarely much lengthy discussion surrounding the nature of the link and its mechanisms. It is important, however, to clearly distinguish two dimensions of the link, and to examine the evidence for each in a little more detail. The first dimension is the geographic one: traditionally, education levels have been compared across international boundaries (for example, Buxton 1994), and some connection has been found between education levels and growth. To a lesser extent, differences in the national distribution of education levels have also been considered (Cousineau and Vaillancourt 1987; Lehnen and McGregor 1994), but rarely at a very disaggregated level. The second dimension is that of the individual: to most people, and to many policy-makers, it is this dimension which carries the most importance. Questions as to whether education is a good financial investment (Constantinos and West 1991), whether it perpetuates class boundaries, and whether it enables young people to obtain jobs

(Marquardt 1995) all relate to the consequences on the individual of receiving certain types of education.

There are obvious problems associated with the comparison of education levels across borders (Buxton 1994). First of all, the education systems are often very different from country to country, and they embody not only different education techniques but entirely different views of society. Thus, in comparing education levels internationally one is necessarily comparing societies and cultures -- and although standardised examination results may provide some clues as to the different levels of attainment, it is doubtful that these can detect anything but the broadest of trends. Second, even if one assumes that the differences between societies are of decreasing relevance in this era of globalisation, the mere fact that syllabuses differ, that different items are taught at different levels, and that different approaches are used to teach the same material renders age-group or school-level comparisons of limited use.

The Economic Council of Canada (1992) writes that Canadians must collectively and individually face the challenge of becoming more qualified or accept lower salaries and the World Bank has said that the future viability of any nation depends on the health of its human resources (Gazette 1997). The rationales behind these statements are numerous -- and sometimes nebulous -- but two themes tend to recur in the arguments emphasising the importance of education to nations. First, there are a set of reasons which are based on the increasing globalisation of the economy. Barnet and Cavanagh (1994), from a series of case studies of major transnational corporations, show how location decisions are increasingly being taken at an international level, with labour-force characteristics (education, wage, labour organisation, etc.) often playing important roles. In such an environment, each country's labour-force is pitted against the other's: the argument goes that it is the countries with the most highly educated workforces that will attract (or retain) the 'best' jobs. Thus, in Reich's (1992) analysis, it is only countries that can provide workforces which include high proportions of 'symbolic analysts' (well educated individuals who can perform complex tasks autonomously -- and who occupy the 'good' jobs) that will be able to fully benefit from the globalised economy. At the other end of the scale, countries with low levels of education will tend to attract low-paid production jobs.[2]

The second set of reasons developed to explain why countries need educated workforces is based on the impact of new technology. Here, there is somewhat less unanimity. One argument is that the introduction of new technology into the workplace has put more emphasis on 'mental' tasks -- so that even workers on the shop floor are now required to understand and perform complex tasks such as programming CAD/CAM machines.

Furthermore, as workers are freed from the drudgery of routine factory work, they will be required to perform a greater variety of tasks. An argument to the contrary is that, far from acceding to a higher plane of work, production workers (and increasingly professionals) will be displaced by technology (Rifkin 1996) and those that remain will see their tasks reduced to the overseeing of robots and computers. Most authors tend to present both arguments (Amirahmadi and Wallace 1995; Muszynski and Wolfe 1989; McMullen 1997) but McMullen (1997), in a recent review of the empirical evidence surrounding the issue, tentatively suggests that the upskilling scenario is beginning to prevail.

**The Benefits of Education to the Individual**

Although the lines of reasoning described above are invoked when putting forward the argument that nations ought to invest in the education and training of their workforce, they obviously have consequences on individuals who often make the ultimate education decisions. Individual education decisions, and education investment taken by a single nation, can be analysed in a more quantifiable way.[3] Constantinos and West (1991) make a detailed analysis of the financial returns on education from the point of view of both individuals and society. They point out that in Canada, bearing in mind the heavy subsidisation of education, there is a divergence between the returns to individuals and those to society. Indeed, whereas individuals, for a fairly moderate financial investment (forgone earnings and low fees) obtain high returns (higher income for the rest of their life), society invests heavily (forgone taxes and cost of education) for smaller returns (increased taxes paid over life-time). They conclude that -- taking a benchmark return of 10% ( the same as used by Cousineau and Vaillancourt (1987), who performed a similar study) -- society gains financial benefits from elementary and high-school education, but not from university education, particularly if the differences due to inherent ability of each individual are taken into account. This approach takes a rather narrow financial view of education: investing in education may have considerable positive externalities, and the returns both to the individual and to society may not be measurable in terms of income and tax revenue alone. However, this type of analysis does raise two important points. First, it underlines the fact that each level of education may not provide the same returns. Second, it clearly points out a mechanism whereby the investment by individuals in education may not actually benefit the nation as a whole.

The Economic Council of Canada (1992) also looks at education from the point of view of the individual and notes that education is a good investment, providing high returns for individuals not only in financial terms but also in terms of job satisfaction and security. The incidence of unemployment is considerably higher amongst people with fewer than nine years of formal

education (Economic Council of Canada 1991), and there is a definite relationship between participation rate and level of schooling. Thus, there is little debate about whether education is beneficial for individuals: a question remains, though, over the precise nature and extent of its benefits to nations.

**Outline of a Counter Argument**

Having briefly outlined the case for the importance of education in terms of national and personal economic development, it is worth considering the matter from a different perspective. Indeed, whereas it appears to be generally accepted that the future wealth of nations is dependent on an educated workforce, it is striking that the literature on corporate location decisions, Barnet and Cavanagh (1994) notwithstanding, attaches relatively minor importance to workforce education levels.[4] Eaton et al (1994a, 1994b), Gunderson and Verma (1994) and Malmberg (1996) in their discussions on business location factors, do not mention education as an important independent factor. Labour force skills form part of a multitude of factors which contribute to agglomeration economies within certain areas (Eaton et al 1994b; Malmberg 1996) and which may provide 'industrialised' countries like Canada with some advantage in attracting high-wage jobs (Gunderson and Verma 1994). However, Gunderson points out that low wage countries are increasingly able to provide pools of highly skilled labour. For nations, education would appear to be a *sine qua non* condition for competition in the global market, particularly for 'good' jobs, but not sufficient in itself to promote growth.

It can be argued that a similar phenomenon is taking place for individuals: there is evidence that there is no shortage of literate people in Canada. Boothby (1993) shows that many qualified people with high levels of numeracy and literacy are employed in jobs which do not require these qualifications and skills.[5] Furthermore, Lowe and Krahn (1995) find in their study that amongst young workers there is a pervasive feeling of overqualification for the jobs being undertaken: it is thus possible that jobs which required lower qualifications a few years ago now require higher qualifications, merely because the overall education levels have risen. If this is the case, it is not the absolute level of education which is relevant but the level relative to the rest of the population, irrespective of the requirements of the job. If the jobs do not really require such high levels of education, it can be concluded that Canada's education system is inefficient in that it is fuelling an 'educational inflation', which ultimately benefits no one. Higher educational achievement may have become, for the individual, a necessary condition for obtaining a job, but one which is unnecessary for the successful performance thereof.

Finally, Myles (1996) introduces an interesting political twist to the arguments concerning education and training. He argues that the current emphasis on education as a tool for economic development in industrialised countries can at least partly be explained on ideological grounds. By shifting attention away from two decades of macroeconomic policy aimed at limiting labour demand and onto individuals who are said to lack the necessary qualifications, governments are performing a useful political exercise. He underlines the fact that there is a tendency for the few most highly qualified individuals to obtain all the rewards from high academic achievement (Reich's (1992) symbolic analysts?), and also highlights the possibility that a substantial segment of any population may simply be unable to achieve 'adequate' levels of literacy and numeracy.

**Education at a Sub-National Level**

On the whole, far less attention has been paid to the effects of differing education levels within countries. That is not to say that education is not regarded as a key determinant of economic growth: the literature on local economic development clearly establishes that this is the case. Education and training is nearly systematically put forward as one of a small set of policy options available at a local level (Coffey and Polèse 1984; Economic Council of Canada 1990; Meyer 1991; OECD 1993; Galaway and Hudson 1994). The large education gaps observed between the various regions of Canada were noted by the Economic Council of Canada (1992), and Cousineau and Vaillancourt (1987) have applied the financial approach described in this paper to assess the efficiency of provincial investments in education. However, there are relatively few studies which go beyond describing the disparities in education levels and which actually determine what economic effect education levels have on regions and localities. Lehnen and McGregor (1994), in their study of education levels across the fifty American states, come to very interesting conclusions in terms of the dimensions of educational achievement which can be used to characterise a state's education level, but conclude that further work is necessary, first of all at a higher level of spatial disaggregation and, second, on the demand side of the equation. In other words, it is necessary, according to them, to look for the relationship between education and employment from a geographical perspective.

Vedder and Gallaway's (1996) study of the spatial variations in U.S. unemployment points to an approach which may usefully be applied to education. After establishing that large and persistent unemployment differentials exist amongst the fifty American states, they seek to uncover some of the determinants of unemployment levels.[6] To do this they perform a series of exploratory regression analyses using variables such as union membership, tax rates and economic structure as explanatory variables. Although education levels are not used in their

study, the relationship between education and unemployment could easily have been analysed in this way.

Coffey and Shearmur (1996, 1998), in their studies of employment across the Canadian urban system, attempt to identify some of the correlates of employment growth across these cities: education levels are found to be significantly correlated with employment growth but the correlations are relatively small and only one education variable is analysed. In the context of these wider studies the matter is not examined further.[7]

Cousineau and Vaillancourt (1987) are amongst the few to have studied the effects of an uneven distribution of education levels within a country. They look at the relationship between incomes and the incidence of university education across Canadian provinces. They observe that, except for Nova Scotia, "a province's average annual labour income varies directly with the education level of its labour force". The education levels used are the highest achieved by the worker: they find that the relationship exists whether the level used is primary education (negative relationship) or secondary and post-secondary education (both of which show positive relationships), and these relationships persist even after controlling for worker experience and different composition of each province's labour force. Thus, although they limit their study to university levels, they note that other education levels could also display similar patterns. However, after examining the financial investment which each province makes in education, Vaillancourt and Cousineau (1987) conclude that

"the efficiency of investment in university as a tool for reducing regional income disparities is ... not clearly established... While the belief of certain low-income provinces that they can promote economic development through investment in university education is false, due to non-profitable private rate of return and/or unfavourable net migration flows, this does not mean that the benefits from these investments are not large for the rest of Canada" (Vaillancourt and Cousineau 1987: 369).

Thus, the evidence and arguments presented at the sub-national level show the same tendency as those presented both at a national and at an individual level: there is a widespread acceptance of the idea that higher education levels lead to economic development, but the evidence -- which is not very voluminous -- is less clear cut. The inclusion of education provisions in local development schemes, whilst an attractive and non-controversial policy measure, is not necessarily beneficial for development.

**Data, Methodology and Comments**

## Data

The data used in this study come from three distinct databases. The data on employment and employment growth for the 1981 to 1991 period have been obtained by special order from the Statistics Canada census division. The data cover the 152 Canadian urban agglomerations of over 10,000 people, including the 25 Census Metropolitan Areas, the 115 Census Agglomerations and the 12 Census Sub-Divisions that had over 10,000 inhabitants in 1991. The data cover employment in 160 economic sectors at the two and three digit SIC level. These sectors have been aggregated into fifteen sectors, corresponding to those used in Coffey and Shearmur (1996): aggregated total, service and goods producing employment have also been analysed (see Appendix 1). Each urban agglomeration has been classified according to region (Atlantic Canada, Quebec, Ontario, the Prairies and British Columbia), to size (over 300,000; 100 to 300,000; 50 to 100,000; 25, to 50,000 and below 25,000) and by proximity to a major metropolitan area (Major metropolitan area (MA): over 300,000 people; central city: within 100km of an MA; peripheral city: over 100km from an MA). This or similar classifications have been used by Coffey et al (1989), Coffey and Shearmur (1996, 1998) and Shearmur (1997). In this study the classification will serve as a means of controlling the effect of education levels on employment growth for region, city size and centrality (RSC).

The data on employment growth between 1991 and 1994 have been obtained by special order from the Statistics Canada labour force survey. The data cover 59 Canadian urban agglomerations, and these tend to be the larger cities. 52 economic sectors are covered at the two digit SIC level, and these have been aggregated into fourteen sectors. Thirteen of these sectors replicate those of the 1981 to 1991 period; one, the "business services" sector, merges the "business services" and "other producer services" of the 1981 to 1991 data (see Appendix 1).

The data on initial education levels and growth thereof have been obtained by special order from the Statistics Canada 2A and 2B census information for 1981 and 1991. These data consist of the percentage of the working age population which has achieved certain education levels. The data cover eight education levels (see Appendix 2), and two aggregated levels have been added.

All geographic boundaries have been adjusted to correspond with the 1991 census definitions.

**Methodology**

In this section, some general methodological considerations will be described, following which a more detailed discussion of the various approaches is given. The analysis which has been conducted is necessarily exploratory in nature, and a variety of approaches to analysing the link between education and employment growth have been used. Broadly speaking, these can be divided in two ways.

A first distinction can be made between an approach driven by theoretical considerations and one which is purely exploratory. There are reasons for suggesting that a particular combination of education variables is more closely related to employment growth than others -- the reasons will be summarised below -- and the first approach therefore tests a model which has been constructed to explore this theory. The purely exploratory approaches make no assumptions as to which education indicators are linked to employment growth. The second approach therefore relies upon statistical criteria to assess which variables are most strongly related to employment growth.

A second distinction can be made between the analyses which explore the education/employment growth relationship over one period of time, and those which explore the changing nature of this relationship over time. Due to data limitations the comparison over different time periods (1981-1991 and 1991-1994) cannot be directly related to the detailed analysis of the 1981 to 1991 period, but some important general points can be made.

These various approaches will be described below, but they all have in common the reliance on regression analysis. The detailed analyses covering the 1981 to 1991 period systematically control for the effect of city size, proximity to a metropolitan centre and region. Indeed, previous studies (Coffey and Shearmur 1998) have highlighted the strong connection which exists between employment growth and the size and location of urban areas. The differences in employment growth across these dimensions, and the differences in education levels, are more readily explained by theories such as those relating to agglomeration economies, national and international trade, shifts affecting regional and/or peripheral economies, and, more generally, business location theories which include labour skills as one of a number of factors, than they are by education alone.[8] If the education variables are statistically significant after controlling for the region, size and centrality variables (RSC), then it can be concluded with somewhat more confidence that education levels have a unique effect on employment growth at the level of urban areas.[9]

In practical terms, it will be seen that analysis of covariance is used, and the results presented are those obtained from using ANCOVA models. These models are identical to regression models except that instead of entering each control effect by inserting dummy variables into the regression equation, the controls can be entered as single variables (or effects). This enables the strength of each control effect to be assessed as a whole and eases the presentation and interpretation of results.

All models have been tested across fifteen different economic sectors, as well as employment aggregates (goods producing, service and total employment).[10] Indeed, it is quite feasible that education levels bear a different relationship to employment growth depending on the economic sector considered. Thus, an important question which underpins the following analysis is whether or not there exists a common model relating education to employment growth across all economic sectors.

The models have been corrected for two sources of possible error. First of all, due to data suppression by Statistics Canada, employment figures are rounded off in a probabilistic fashion to the higher or lower multiple of five. Thus, in cities where there are few employees, large errors can occur when growth rates are calculated. In order to minimise this problem, all cells with less than 100 jobs in the initial year (1981 for the 1981-1991 period, 1991 for 1991-1994) have been set to missing value. Thus the number of observations used for each model varies somewhat according to the sector. Second, all outliers with a standardised residual greater than three have been identified and removed.[11] Note that the analysis has been performed using the REG and GLM procedures of SAS statistical software, version 6.11. The REG procedure has been used for identifying outliers, but the GLM procedure has been used for the final presentation of results.

*Methodological considerations*

It must be made clear at the outset that causality cannot be established by the type of analysis just described. However, there is a large body of literature, some of which is referred to above, which posits that there exists a causal link running from high education levels to faster subsequent employment growth. Thus, if a correlation is found between initial education levels and subsequent employment growth, then the arguments for the causal link will be reinforced. If, however, no link is found, then this will suggest either that other factors have an effect upon the education/employment link (over and above the RSC controls), or that the causal link does not exist at the urban level.

Another point to bear in mind is the possible mediating effect of other factors. For instance, an urban area with a high quality of life may, prior to 1981, have attracted many educated people. Over 1981 to 1991 these same quality of life factors may attract even more people and jobs.[12] In addition, the presence of jobs in 'footloose' sectors -- ones which can move around to locate in pleasant areas -- will have multiplier effects across the rest of the economy. If this is replicated in enough urban areas then an association between higher initial education levels and employment growth in most sectors will be identified, but this will not be a causal relationship -- in this example the underlying cause is 'quality of life'. It is useful to interpret the results for each sector with this eventuality in mind, paying attention to the distinction which can be made between 'basic' and 'non basic' industries. 'Basic'industries are those most likely to produce tradable goods which can contribute to an urban area's export earnings.[13] By virtue of their reliance on exports, such industries tend to be more mobile, or 'footloose', than the non-basic industries which rely solely on local demand to thrive. Education (or other local characteristics) is more likely to have a supply effect for the 'footloose' industries, and an indirect multiplier (or a direct demand) effect on the others.

*Model testing approach*

The first results to be presented are derived from applying an identical model to all sectors of the economy. The model includes the three RSC effects and two education variables. The RSC effects are entered in order to control for some general urban growth theories, and the education variables to test on the one hand the extent to which the effect of education can be distinguished from that of RSC, and on the other hand to test the extent to which the inclusion of education improves the overall explanatory power of the model.

Lehnen and McGregor (1994) have shown that, in the USA, states can be successfully classified according to human capital along two dimensions, "basic skills and abilities" and "complex skills and abilities". In their study they include twelve education variables, including the percentage of the population with various education levels and the scores on standardised exams (such as the SAT) for the beginning and end periods of the study. The Cousineau and Vaillancourt (1987) study, although not as specific on the human capital dimensions, suggests that more than one education level should be included if the effect of education on employment growth is to be understood.

These considerations suggest that a model incorporating two education variables -- each representing a distinctive educational dimension -- may serve to explain employment growth across the urban system in Canada. To begin with, therefore, the educational dimensions inherent within the Canadian urban system are explored. Due to the nature of the variables --

a series of percentage levels summing to 1 for each urban area -- factor analysis of the sort used by Lehnen and McGregor (1994) is inappropriate since any one education variable can be fully predicted by the ones remaining. A useful technique for circumventing this problem is correspondence analysis, which relies on chi-square type techniques to perform a weighted principal component analysis of a contingency table.[14] Since the percentages in the education data set are drawn from a contingency table (by dividing each row by total population) then correspondence analysis can be used to extract the principal components from the education data.

This correspondence analysis serves to confirm whether or not there is reason to assume that the two dimensions identified by Lehnen and McGregor (1994) across the US states also exist across the Canadian urban system. On the basis of the analysis of dimensions in the Canadian 'educational space', a model is then constructed which incorporates one indicator of 'basic skills' -- the percentage of the population having obtained a grade 13 certificate -- and one indicator of 'complex skills' -- the percentage of university degree holders. This model is then tested across all economic sectors for the 1981 to 1991 period.

*Exploratory approaches*

The basic question which the exploratory approaches seek to address is *which* education variable(s) are most closely connected with employment growth across the urban system. As has been made clear above, there is no consensus on this matter. Although there are good reasons to test whether a 'basic skills' / 'complex skills' model possesses explanatory power, it is necessary to bear in mind that Lehnen and McGregor (1994) do not suggest that these are the two dimensions that affect employment growth.

Thus, over the 1981 to 1991 period, each education variable is entered alone into a regression model which includes, by default, the RSC control variables. For each education variable and each economic sector, the F value, significance level, and direction of the relationship is noted. In this way, education variables which have a similar relationship with employment growth can be identified. Economic sectors which display similar associations between growth and education levels can also be identified, and it is possible to identify whether trends observable at an aggregate level are also observable for individual sectors.

*Time periods*

The analyses described above have been performed for the 1981 to 1991 period, but another question which can partially be addressed by the database at hand is the extent to which the link between education and employment growth remains constant over time. However, the

employment growth information for the 1991 to 1994 period only covers fifty nine of the larger cities in the Canadian urban system (mostly those of above 25,000 people).

Due to the small number of observations it has not been possible to introduce the control variables since doing so increases the ratio of independent variables to observations beyond acceptable limits (Tabachnik and Fidel 1996). Thus, a separate analysis has been performed on the 1981 to 1991 data which only covers the 59 observations available for the 1991 to 1994 period, and which does not include control variables. The results presented here are those obtained from an exploratory approach in which each education variable is tested across each economic sector for both 1981 to 1991 and 1991 to 1994. These results provide some interesting insights into the changing nature of the education / employment growth relationship, but the conclusions drawn from this analysis are more speculative than those for the 1981 to 1991 period which cover the entire urban system.

## Results

The results will be presented in four parts. The first part will provide a brief description of the variation of education levels across Canadian regions, across cities of different sizes and cities of varying proximity to metropolitan centres. The different rates of employment growth across these dimensions will also be discussed, and the importance of including -- where possible -- the control variables will become apparent.

The second part will present the results of the model-testing approach. As discussed above, this approach rests upon the existence of at least two educational 'dimensions' in Canadian cities, and the results of the correspondence analysis will be presented in this context. A third section will go over the results obtained from an exploratory analysis, and the final section will describe some of the ways in which the education-employment link varies over time.

### Education and employment growth in the Canadian urban system

Both education levels and employment growth rates vary significantly across regions, cities of different sizes and cities located closer or further away from a metropolitan centre. Table 1 shows the mean employment growth rates and the mean education levels in cities across each of the three RSC dimensions. These results are presented merely as a way of contextualising the regression analyses, and as such are to be viewed as an illustration, and not an analysis, of the variation across the RSC dimensions. With this in mind, results are presented for just three different education variables, the lowest (ED1, less than grade 9), an intermediate level (ED3, grade 9 to 13 with certificate) and the highest (ED8, university degree), and the three aggregate sectors.

Across different city size classes education levels vary significantly. In 1981 the largest cities have the most educated population, with a very high mean percentage of university degree holders. It can be noted that the percentage of degree-holders decreases monotonically across the city size classes. There is a tendency -- though not a statistically significant one -- for this advantage to be reinforced over 1981 to 1991 since it is the larger cities which have faster growth rates. Larger cities also have a lower proportion of the least educated people, and here too a monotonic progression is observed as one moves from the largest to the smallest cities. This pattern is again strengthened over time since there is a tendency in the smaller cities for this proportion to reduce at a slower rate than in the larger ones.

There are also significant variations in education levels across metropolitan, central and peripheral cities. It is the metropolitan cities which have, by far, the highest proportions of university degree holders and the lowest proportions of least educated people. There is little difference, however, between central and peripheral cities in this respect. Across this dimension there is also a tendency for the pattern to be reinforced over time.

Finally, education levels differ across regions as well, but the pattern does not tend to be self-reinforcing. For instance, in 1981 Quebec cities had, on average, the lowest proportion of degree holders but benefited from the fastest rate of growth. Cities in the Prairies, with the highest proportion of degree holders display the slowest growth rates for this indicator. However, although Quebec cities had the highest proportion of least educated people in 1981, they also had the slowest decrease in this proportion over the 1981 to 1991 period, and it is noticeable that the rate of change in Quebec is substantially slower than in all other regions.

Total employment growth rates over 1981 to 1991 differ significantly across city size and centrality, but are surprisingly even across the five Canadian regions. This eveness disguises significant differences within certain economic sectors, most notably in what may be termed the 'basic' or 'export' sectors such as business services, FIRE, and all three goods producing sectors. Across the 'centrality' dimension there is a tendency for employment growth in the service sectors -- both high order and retail -- to vary significantly, as they do to a lesser extent across the city size classes.

TABLE 1 Variation of Education and Employment Growth Indicators Across RSC Dimensions

## TABLE 1 Variation of Education and Employment Growth Indicators Across RSC Dimensions

| | initial 1981 values | % increase 1981 to 1991 | % increase in employment 1981 to 1991 |
|---|---|---|---|

| **Region** | ED1 | ED3 | ED8 | INCED1 | INCED3 | INCED8 | Primary | Manuf. | FIRE | B.serv. | GOODS | SERV | TOTA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Atl | 20.7 | 10.7 | 6.7 | -34.7 | 20.4 | 39.1 | 8.2 | -8.3 | 8.7 | 42.1 | -4.2 | 17.1 | 10 |
| Qc | 27.2 | 17.5 | 5.1 | -20.5 | 0.7 | 41.6 | 10.1 | -3.6 | 31.2 | 65.1 | -1.5 | 21.4 | 13 |
| Ont | 18.8 | 13.4 | 6.3 | -33.2 | 18.6 | 37.9 | -3.0 | -20.0 | 27.5 | 87.3 | -10.8 | 28.8 | 13 |
| Pra | 16.6 | 10.1 | 7.2 | -31.3 | 22.0 | 25.7 | 38.6 | -10.0 | 12.0 | 30.8 | -2.3 | 18.3 | 13 |
| BC | 14.0 | 12.0 | 5.8 | -34.4 | 17.5 | 28.0 | 12.5 | -1.0 | 7.9 | 47.1 | -2.6 | 22.2 | 13 |
| | | | | | | | | | | | | | |
| Chi2 | 78.9 | 106.4 | 21.7 | 51.7 | 52.1 | 21.7 | 19.9 | 17.3 | 22.1 | 25.8 | 7.6 | 10.8 | 0 |
| p(chi2=0) | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.11 | 0.03 | 0.9 |
| | | | | | | | | | | | | | |
| City Size | | | | | | | | | | | | | |
| 300k+ | 15.6 | 13.0 | 10.3 | -32.4 | 14.8 | 37.1 | 17.9 | -7.5 | 26.9 | 70.4 | -0.7 | 28.3 | 19 |
| 100-300 | 18.1 | 12.3 | 7.5 | -33.6 | 18.8 | 39.0 | 8.2 | -8.4 | 24.4 | 81.1 | -2.8 | 29.9 | 20 |
| 50-100 | 18.7 | 13.8 | 6.4 | -31.7 | 15.2 | 33.7 | 27.2 | -12.6 | 25.9 | 80.4 | -4.4 | 27.7 | 16 |
| 25-50 | 20.7 | 13.1 | 5.3 | -28.2 | 15.8 | 34.1 | 13.1 | -10.8 | 17.7 | 45.9 | -6.1 | 21.2 | 11 |
| 10-25 | 21.2 | 13.5 | 5.3 | -28.5 | 13.7 | 35.1 | 1.8 | -9.7 | 17.2 | 45.7 | -6.4 | 18.8 | 8 |
| | | | | | | | | | | | | | |
| Chi2 | 12.0 | 3.6 | 46.6 | 8.9 | 2.4 | 2.7 | 8.9 | 3.8 | 4.1 | 15.3 | 1.9 | 19.4 | 18 |
| p(chi2=0) | 0.02 | 0.46 | 0.00 | 0.06 | 0.66 | 0.60 | 0.06 | 0.44 | 0.39 | 0.00 | 0.76 | 0.00 | 0.0 |
| | | | | | | | | | | | | | |
| Centrality | | | | | | | | | | | | | |
| pop. 300K+ | 15.6 | 13.0 | 10.3 | -32.4 | 14.8 | 37.1 | 17.9 | -7.5 | 26.9 | 70.4 | -0.7 | 28.3 | 19 |
| less 100km | 21.6 | 14.0 | 5.4 | -29.8 | 18.4 | 35.8 | 13.0 | -11.9 | 29.0 | 82.5 | -5.1 | 30.1 | 16 |
| more 100km | 19.5 | 12.9 | 5.9 | -29.5 | 13.4 | 34.7 | 9.4 | -9.5 | 14.8 | 47.9 | -5.7 | 18.2 | 10 |
| | | | | | | | | | | | | | |
| Chi2 | 9.9 | 4.9 | 28.7 | 1.6 | 3.1 | 0.7 | 2.6 | 1.6 | 10.2 | 13.5 | 0.8 | 19.8 | 9 |
| p(chi2=0) | 0.01 | 0.09 | 0.00 | 0.45 | 0.21 | 0.71 | 0.27 | 0.46 | 0.01 | 0.00 | 0.67 | 0.00 | 0.0 |

Notes: 1. The values in this table are mean percentages (value between 0 and 100), except for the $chi^2$ and $p(chi^2)$ rows.

2. The $chi^2$ values are derived from Kruskal Wallis tests.

3. The $p(chi^2)$ row indicates the probability that the education or growth variables do not vary across the dimension (value between 0 and 1).

4. The INCED columns indicate the mean percentage change in the ED variables from 1981 to 1991.

No attempt will be made, in this section, to link the education patterns observed across these various dimensions with the employment growth patterns. However, the significant variation across these dimensions, as well as the theoretical importance of these dimensions in terms of employment distribution and growth (see Coffey and Shearmur 1998), emphasises the necessity of controlling for their effect to the extent possible. Thus, in all the regression analyses except those constructed to explore the changing relationship of education and employment growth across time, the RSC control variables will systematically be included.

**1981-1991: A model testing approach**

Before presenting the results obtained by testing an employment growth model across the fifteen economic sectors, it is important to verify whether our set of education variables can be reduced to two dimensions such as suggested by Lehnen and McGregor (1994). Once the choice of education variables has been justified, the regression results will be presented.

*Educational Dimensions*

Across the Canadian urban system, in 1981, the ten education variables which have been analysed can be summarised by two distinct dimensions (Figure 1). The first dimension, which explains 52.2% of total chi-squared, opposes post-secondary education on the one hand to no post-secondary education on the other. In particular, the results of the correspondence analysis show that the ED1 variable lies along this dimension. Thus, using ED1 as an indicator of 'basic skills' is inappropriate: this is confirmed by referring to the correlation matrix (Table 2) in which the high and negative correlations between ED1 and most post-secondary education indicators can be noted. Ed2 (grade 9 to grade 13, no certificate) tends to be associated with the higher levels of education along this axis.

The second dimension, which accounts for 28.5% of total chi2, opposes ED2 to all other education levels, in particular to ED5 (non-university, post secondary, no certificate), ED3 (grade 9 to grade 13, with certificate), ED4 (trades certificate) and ED8 (university degree).

Although the results are not entirely clear cut, these dimensions correspond to some extent to those identified by Lehnen and McGregor (1994). The first axis can be interpreted as defining a 'complex skills' dimension, with ED1 at one extremity and ED7 and ED8 (both university education variables) at the other. The second axis can be interpreted as a 'basic skills' dimension with lack of skills at one extremity (ED2) and 'skills' at the other (in particular

grade 13 certificate and trades diploma). One could have expected ED1 to define the 'lack of skills' extremity, but this variable is not relevant either way in defining this dimension.

FIGURE 1 Correspondence Analysis of 1981 Education Levels Across 152 Urban Areas

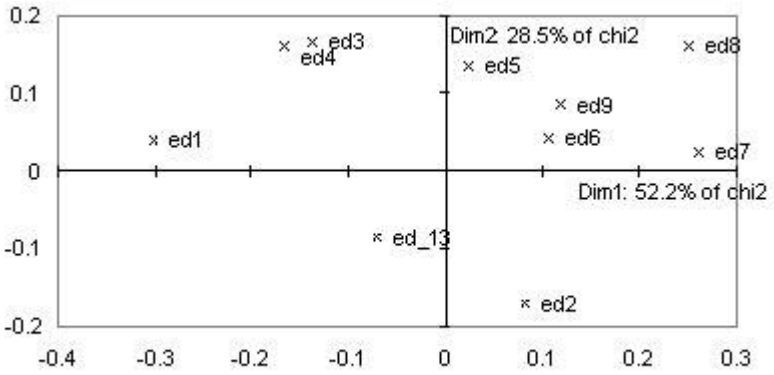


Figure 1 Correspondence Analysis of 1981 Education Levels Across 152 Urban Areas

TABLE 2 Correlation Matrix of 1981 Education Variables

**TABLE 2 Correlation Matrix of 1981 Education Variables**

| | | ED1 | ED2 | ED3 | ED4 | ED5 | ED6 | ED7 | ED8 | ED9 | ED13 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| mean | | 19.85 | 29.79 | 13.25 | 3.91 | 5.61 | 14.44 | 7.00 | 6.15 | 37.11 | 49.64 |
| standard deviation | | 6.16 | 6.13 | 3.13 | 1.25 | 1.21 | 2.41 | 2.23 | 2.29 | 5.62 | 5.80 |
| number of observations | | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 | 152 |
| less than grade 9 | ED1 | 1 | -0.55 | 0.41 | 0.36 | -0.17 | -0.66 | -0.68 | -0.52 | -0.72 | 0.48 |
| 9 to 13, no certif. | ED2 | -- | 1 | -0.73 | -0.54 | -0.38 | 0.12 | 0.26 | -0.08 | -0.08 | 0.47 |
| 9 to 13, certif. | ED3 | -- | -- | 1 | 0.65 | 0.32 | -0.28 | -0.55 | -0.23 | -0.22 | -0.33 |
| trades diploma | ED4 | -- | -- | -- | 1 | 0.21 | -0.15 | -0.57 | -0.36 | -0.17 | -0.18 |
| non univ. post sec., no certif. | ED5 | -- | -- | -- | -- | 1 | 0.17 | 0.02 | 0.22 | 0.43 | -0.59 |
| non univ. post sec., certif. | ED6 | -- | -- | -- | -- | -- | 1 | 0.50 | 0.30 | 0.75 | -0.57 |
| univ., no degree | ED7 | -- | -- | -- | -- | -- | -- | 1 | 0.69 | 0.77 | -0.45 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| univ., degree | ED8 | -- | -- | -- | -- | -- | -- | -- | 1 | 0.78 | -0.63 |
| some post sec. | ED9 | -- | -- | -- | -- | -- | -- | -- | -- | 1 | -0.85 |
| (ED4 to ED8) | | | | | | | | | | | |
| no grade 13 certif. | ED13 | -- | -- | -- | -- | -- | -- | -- | -- | -- | 1 |
| (ED1+ED2) | | | | | | | | | | | |

The dimensions which emerge from this analysis are not as unambiguous as those defined by Lehnen and McGregor (1994), which possessed a wider array of variables, including skills tests as well as formal education variables. But their basic proposition, that there are two dimensions to the measurement of human capital, is confirmed across the Canadian urban system. Despite the limited variety of data used in this analysis, not only the number but also the nature of these dimensions appears to be substantiated.

It is therefore appropriate to test a model of urban employment growth which includes *two* education variables, one representing 'complex skills', the other 'basic skills', since each of these dimensions may affect employment growth in a different way. The variables included in the model have been chosen partly on statistical grounds, partly on conceptual grounds. From a statistical perspective it is necessary to include one variable which is closely associated with each dimension.[15] These variables must not be highly correlated in order that they may be construed as 'independent' variables. From a conceptual perspective, the variables must be easily interpretable, and if possible they must correspond to clearly defined education levels.

The variables retained for the model are therefore ED8, the percentage of population with a university degree, and ED3, the percentage of population with a grade13 certificate. Ed8 (university degree) represents the 'complex' skills dimension, and ED3 (grade 13 certificate) 'basic' skills. These variables are not very highly correlated (r = - 0.23) and can be interpreted unambiguously. From a purely statistical perspective, the choice would have been ED7 (university, no degree) -- a variable associated almost exclusively with the first dimension -- and ED5 (some non university post secondary, no certificate) -- almost exclusively associated with the second dimension. These variables are uncorrelated (r = 0.02), but the resulting model would not be testing well defined levels of educational achievement.

*The model*

The basic model tested across all economic sectors for the 1981 to 1991 period is the following:

$$g_i = \text{region} + \text{size} + \text{centrality} + \%\text{grade13} + \%\text{degree} + \epsilon$$

where

$g_i$ = % employment growth in sector i over 1981 to 1991

region = regional effect (5 regions)

size = size effect (5 sizes)

centrality = centrality effect (2 classes)

%grade13 = proportion of the population aged 15+ with grade 13 certificate as maximum educational achievement

%degree = % of degree holders in the population aged 15 and over

$\epsilon$ = error term

TABLE 3 1981-1991 Model Testing Approach

## TABLE 3 1981-1991 Model Testing Approach

| | Region | Size | MCP | ED3 | ED8 |
|---|---|---|---|---|---|
| Total | 0.46 | 1.54 | 9.46*** | (+)0.39 | (+)14.98*** |
| Goods | 3.19** | 0.31 | 1.2 | (+)0.59 | (+)16.11 |
| Service | 2.49** | 3.94*** | 22.25*** | (+)1.48 | (+)1.40 |
| Primary | 8.40*** | 4.87*** | 5.66** | (+)1.25 | (-)1.34 |
| Manufacturing | 4.08*** | 0.99 | 1.54 | (+)2.24 | (+)8.58*** |
| Construction | 11.83*** | 1.43 | 13.98*** | (+)0.07 | (+)2.97* |
| Transp. & Comm. | 1.41 | 1.63 | 5.37** | (-)1.53 | (+)1.22 |
| Utilities | 1.53 | 0.07 | 0.18 | (-)0.40 | (+)3.04* |
| Wholesale & Storage | 0.73 | 1.2 | 20.78*** | (+)0.03 | (+)1.38 |
| Retail | 0.73 | 1.74 | 6.63** | (+)0.91 | (+)7.94*** |
| Consumer services | 4.98*** | 5.63*** | 10.78*** | (+)0.95 | (-)0.03 |
| Accomm. & restaurants | 0.44 | 0.88 | 10.81*** | (+)1.96 | (+)1.07 |
| FIRE | 2.70** | 0.99 | 5.51** | (-)0.41 | (+)0.40 |
| Business services | 6.75*** | 5.62*** | 9.23*** | (-)0.48 | (+)2.31 |
| Other producer services | 0.78 | 4.67** | 3.39* | (-)0.53 | (+)0.59 |
| Education | 10.66*** | 3.98*** | 8.77*** | (+)13.82*** | (+)2.25 |
| Health & Social serv. | 2.81** | 1.61 | 0.76 | (+)2.22 | (+)4.58** |
| Public admin. | 9.12*** | 3.15** | 16.46*** | (-)0.20 | (+)0.36 |

Notes: 1. Columns ED3 and ED8 contain the F value associated with the education variable in the multivariate regression of sectorial employment growth against the RSC and two education variables.

2. The sign of the regression coefficient associated with the education variable is indicated in parenthesis.

3. The significance levels are indicated as follows: *** = 99%; ** = 95%; * = 90%

4. The F value associated with the RSC effects is indicated in the appropriate column.

It is immediately apparent from observing the results in Table 3 that the RSC effects are systematically significant. For each of the eighteen models tested at least one of the three effects is highly significant in explaining employment growth. Over 1981 to 1991, there is a tendency for the centrality effect to be most closely associated with employment growth -- this is the case for nine of the fifteen sectors, and for total and service employment.

The education variables are also statistically significant for a number of sectors, but 'basic skills' are far less relevant than 'complex skills'. For total employment growth and goods producing growth, the proportion of degree holders in 1981 is very closely associated with employment growth over the 1981 to 1991 period, the strength of this association being greater than that of any of the RSC variables. For service sector growth, however, neither education variable is statistically significant.

This pattern is replicated, for the education variables, in five individual sectors. In particular, employment growth in the manufacturing sector is closely associated with high initial percentages of degree holders. Surprisingly, though, the initial proportion of degree holders is not significant in the models pertaining to growth in the financial and high order business services. On the other hand, the RSC variables are all very highly significant, particularly for employment growth in business services. It is worth noting that this sector is the only one for which growth rates vary significantly across all three RSC dimensions, and the overriding importance of these control effects is in keeping with the study by Coffey and Shearmur (1997) which emphasises the strong tendency that business services have to locate towards the top of the urban hierarchy.

The only economic sector for which the basic skills dimension plays a significant role is the education sector. For this sector, the initial proportion of the population having a grade 13 certificate is the strongest predictor of subsequent employment growth. All variables except for the percentage of degree holders are significant in this model.

Overall, the hypothesis that each educational dimension has a distinct effect on employment growth is not verified. Only one of the two educational dimension appears to play a role, and neither are of any value in explaining employment growth in the aggregate service sector.

Furthermore employment growth in nine out of the fifteen sectors analysed would appear, on the basis of this model, to be entirely unrelated to the initial education levels in urban areas. Thus not only does just one dimension appear relevant, this relevance is almost entirely confined to the manufacturing sector. The pattern which emerges is one in which the manufacturing sector is the only sector for which initial education levels play a role in determining future employment growth. The faster growth in retail and health and social security employment which is also associated with higher initial education levels probably occurs either as a consequence of the faster manufacturing growth, by way of consumption multiplier effects, or as a result of the higher demand which a more educated population may have for these services.

In order to verify whether these tentative conclusions are justified, the results obtained by an exploratory approach will now be presented.

*An exploratory approach*

The database used for conducting the above analysis contains eight distinct education variables, and two further ones have been constructed (see Appendix 2). The proposed model only highlights the relevance of education levels for a small number of sectors, and it may be that other education variables possess better explanatory power for specific sectors. In other words, there may not be one model which is valid across all sectors.

In order to keep the analysis straightforward, and bearing in mind the apparent irrelevance of the second educational dimension, the exploratory analysis will be restricted to analysing each education variable individually, not in combination with other education variables.

Table 4 presents the results for each education variable and each economic sector. The F values for the RSC effects have been shown only for the models in which the 'best' (highest F value) education variable is included. For each sector two $r^2$ values are shown, the value for the RSC effects alone and the value after the 'best' education variable has been added.

TABLE 4 152 Cities, 1981 to 1991 Exploratory Analysis

**TABLE 4 152 Cities, 1981 to 1991 Exploratory Analysis**

| | | | | | | F values for RSC variables | F value for each education variable when adde | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Region | Size | MCP | 'best' education included | $r^2$ with best | $r^2$ only RSC | ED1 | ED2 | ED3 | ED4 | ED5 | ED6 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total | -- | -- | 9.23*** | ED8 | 0.25*** | 0.20*** | (-)14.17*** | -- | -- | -- | -- | 5.69** |
| Goods | 4.03*** | -- | -- | ED8 | 0.18*** | 0.07 | (-)12.22*** | -- | -- | -- | 7.21*** | 5.34** |
| Service | 2.55*** | 3.95*** | 22.98*** | ED1 | 0.32*** | 0.30*** | (-)5.69** | -- | -- | -- | -- | 5.31** |
| Primary | 7.97*** | -- | 4.09** | ED5 | 0.29*** | 0.28*** | -- | -- | -- | -- | 4.29** | -- |
| Manufacturing | 9.50*** | -- | -- | ED1 | 0.26*** | 0.17*** | (-)12.72** | (-)3.40* | 2.83* | -- | -- | 10.93* |
| Construction | 19.00*** | -- | 14.80*** | ED1 | 0.48*** | 0.41*** | (-)5.56** | -- | -- | -- | -- | 5.10** |
| Transp. & Comm. | -- | 2.54* | 6.04** | -- | 0.14** | 0.13** | -- | -- | -- | -- | -- | |
| Utilities | -- | -- | -- | ED4 | 0.20** | 0.14 | -- | (-)3.38* | -- | 7.69*** | -- | 6.06** |
| Wholesale & Stor. | -- | -- | 19.69*** | ED1 | 0.24*** | 0.24*** | (-)4.97** | -- | -- | -- | -3.31* | |
| Retail | 3.27** | 2.19* | 7.01*** | ED6 | 0.22*** | 0.14** | (-)12.38*** | -- | -- | -- | 4.48** | 14.95* |
| Consumer services | -- | 4.65** | 10.97*** | -- | 0.28** | 0.29*** | -- | -- | -- | -- | -- | |
| Accomm. & rest. | -- | -- | 10.82*** | ED1 | 0.14** | 0.11** | (-)4.96** | -- | -- | -- | -- | 3.15* |
| FIRE | 2.50** | -- | 5.61*** | -- | 0.22*** | 0.22*** | -- | -- | -- | -- | -- | |
| Business services | 10.68*** | 5.08** | 6.35** | ED1 | 0.48*** | 0.45*** | (-)5.14** | -- | -- | -- | -- | 4.45** |
| Other prod. serv. | -- | 5.71*** | -- | -- | 0.30*** | 0.27** | -- | -- | -- | -- | -- | |
| Education | 8.98*** | 4.49*** | 5.94** | ED3 | 0.31*** | 0.28*** | -- | (-)6.91*** | 8.97*** | -- | -- | |
| Health & Soc. serv. | 2.79** | -- | -- | ED13 | 0.18*** | 0.12** | (-)6.96*** | -- | -- | -- | 7.48*** | 6.39** |
| Public admin. | 9.35*** | 3.48** | 18.31*** | ED1 | 0.38*** | 0.36*** | (-)3.02* | -- | -- | -- | -- | |

Notes: 1. Columns ED1 to ED13 contain the F value associated with the education variable in the multivariate regression of sectorial employment growth against the RSC and education variables.

2. A negative sign of the regression coefficient associated with the education variable is indicated in parenthesis.

3. The significance levels are indicated as follows: *** = 99%; ** = 95%; * = 90%.

4. The $r^2$ associated with the model including the 'best' education variable (that which displays the highest F value) is in the '$r^2$ with best' column.

5. The 'best' education variable is indicated in the 'best' column.

6. The $r^2$ associated with the RSC model alone is in the '$r^2$ only RSC' column.

It can first of all be noted that if the model is allowed to differ across economic sectors education becomes a significant factor for fourteen of the eighteen sectors (as opposed to eight of the eighteen sectors for the fixed model). This suggests that the link between education and employment growth differs across economic sectors, and one model is not appropriate for all sectors.

Interestingly, although it is the proportion of degree holders which is the most strongly connected to employment growth both overall and in the goods producing sectors, this variable does not emerge as the most significant for *any* of the individual sectors. In six of the fifteen sectors, rather than high proportions of degree holders being positively correlated with growth, it is high proportions of people with little or no formal education (ED1) which are strongly associated with employment decline.

The 'intermediate' education levels are not very significant in terms of employment growth. Higher initial levels of ED1 have a significant depressing effect on employment growth in many sectors (including the three aggregate employment growth indicators), and higher initial levels of ED6 and ED8 have significant positive effects on employment growth in many sectors. This tends to underline not only the deleterious effect of very low levels of education, but also the relevance of formal qualifications -- both ED6 (non university certificates) and ED8 (university degrees) are indicators of the proportion of the population which has completed a post secondary education course.

Higher proportions of ED6 and ED8 do not have the same significance over all economic sectors. For the aggregate service sector, and for business services in particular, it is specifically the proportion of ED6 which enters the model significantly, the proportion of ED8 having no effect. Such a result does not necessarily suggest that the proportion of degree holders is unrelated to business service employment growth; indeed, if the RSC control variables are left out then growth in this sector is closely associated with the proportion of degree holders. Rather, the result shows that the ED6 variable -- the proportion of the population with non-university post secondary certificates -- has an effect on employment growth in the service sectors over and above the effect of the RSC controls.

More specific remarks can be made about the results obtained in some sectors. Employment growth in the education sector, for instance, is faster in cities with higher initial levels of ED3 (grade 13 certificate) and lower initial levels of ED13 (below grade 13). It can also be noted

that analysis of the type presented in Table 1 shows that there is a tendency for employment in the education sector to grow faster in larger cities, in metropolitan areas, and in Ontario, the Prairies and BC -- the three regions with the lowest percentages of population not having achieved grade 9.

This pattern reinforces the remarks made above regarding the cumulative processes which may be at work with regards to education levels. If education employment tends to grow fastest in urban areas which already have relatively high levels of educational attainment then it can be hypothesised that there will be more opportunities for educational improvement in cities which already have an educated population. Conversely, cities which appear in most need of education employment -- i.e. those which have the lowest levels of education amongst the population -- also have the lowest employment growth in the sector. Of course, the faster growth in the education sector may be due to the higher demand for educational services which emanates from a more educated population - but this demand process will feed into the cumulative tendencies which have been observed above.

Overall, three principal conclusions can be drawn from this exploratory analysis. First, there is a general tendency across all sectors for employment to grow more slowly in cities where educational attainment is the lowest (highest proportions of ED1) and to grow in cities where educational attainment is the highest (highest proportions of ED6, ED8 and ED9). Second, although there is not one model which fits all sectors the above holds true in a general way for all sectors in which education levels are found to have a significant effect. Finally, when growth in the education sector is analysed not only as a dependent variable but as one which could potentially have an effect upon education levels, further evidence of a cumulative process is found: higher initial education levels beget faster employment growth in the education sector.

A final conclusion, which echoes that made in the previous section, is the importance of the RSC control variables. Although initial education levels appear to have an independent effect on employment growth in most sectors (the education variables are statistically significant with large F values), centrality, region and, to a lesser extent, city size, are consistently related to employment growth in all but one sector. The addition of an education variable to the 'control' RSC model generally improves the explanatory power of the model, but not to a very great degree. The increase in $r^2$ is small, and this shows that education levels do not add much to the explanatory power of the RSC effects. Rather, the explanatory power of the RSC effects can partly be accounted for by the variation in education levels across the RSC dimensions.

The manufacturing sector stands out in this respect. For this sector, the inclusion of an education variable leads to a very sizeable jump in the proportion of variance explained, from $r^2 = 0.17$ to $r^2 = 0.26$. In this sector, not only do education levels (specifically ED1 and ED6) play a significant role when the RSC dimensions are controlled for, but the role of education levels is to a large extent distinct from the role of RSC. Initial education levels, as growth factors, can be distinguished from factors such as region, centrality and city size, whereas for most other sectors there is a large degree of overlap.

The retail sector behaves in a similar fashion to the manufacturing sector, with education playing a significant and independent role. After including an education variable, the coefficient of variation, $r^2$, jumps from 0.14 to 0.22. Whereas it can be hypothesised that, for the manufacturing sector, higher education levels have a supply effect, in the case of education it is more likely to be the effect on local demand which is most relevant. It is interesting to note, in this respect, that the pattern of education variables which are associated with manufacturing employment growth is very similar to the pattern observed for retail employment growth.

**The 1991-1994 period**

It is unfortunately not possible, on the basis of the data which we have, to perform a comprehensive analysis since only 59 cities are covered for the 1991-1994 period. These cities tend to be amongst the larger ones, and the smallest size category is virtually unrepresented. In order to effect a comparison, the selection of 59 cities is analysed over 1981-1991 and 1991-1994.

The education variables which are most strongly connected with employment growth in the 59 cities from 1981 to 1991 (see Table 5A and Table 5B) differ from those identified in the analysis of the entire urban system (see Table 4). This is not surprising for two reasons: on the one hand, the set of cities analysed is different and has not been randomly selected. On the other hand, the results presented in Table 4 are derived from simple univariate regression analyses with no control for the RSC variables. Bearing in mind the considerable variation of education levels across the various RSC dimensions (see Table 1) the difference in results when these controls are taken out is to be expected.

Having said this, the differences are less remarkable than the similarities. Over the 59 cities, we still find that higher education (university degrees and non university certificates) is associated with employment growth in all three aggregate sectors, and that lower education levels (in particular the percentage of people not having a grade 13 certificate, ED13) are

strongly associated with lower employment growth. The positive effect of higher levels of education is evident in eight of the fifteen sectors, and the depressing effect of low levels of education is also evident in eight sectors (not the same eight). It can be noted in particular that growth in the business service sector is strongly associated with higher proportions of degree holders.

This general pattern disappears over the 1991 to 1994 period. Over these years, initial levels of both low and high educational attainment have no significant association with aggregate employment growth. From a series of results over 1981 to 1991 which suggest the association between employment growth and post secondary diplomas or degrees, we go to a series of results which suggest the opposite: it is ED5 (proportion of the population with some non-university education) and ED7 (proportion of the population with some university education) which are most closely related to employment growth, i.e. the two indicators which highlight non-certified post secondary studies (but also the two indicators most closely associated with the educational dimensions previously identified).

The positive association between ED5 and employment growth is principally evident in the goods producing, and specifically the manufacturing sector while that between employment growth and ED7 only occurs in the construction industry and in some service sectors. The business service sector is the only sector for which there exists a significant association between the initial proportion of degree holders and employment growth. Over the 1991 to 1994 period, employment within the education sector is unrelated to initial education levels -- there is thus no evidence of a cumulative-type process over this period, but there isn't evidence, either, of increased education employment in cities with the lowest levels of attainment.

TABLE 5A Comparison of 1981-1991 and 1991-1994: 59 Cities

**TABLE 5A Comparison of 1981-1991 and 1991-1994: 59 Cities**

| **1981-1991** | max.r2 | best | ED1 | ED2 | ED3 | ED4 | ED5 | ED6 | ED7 | ED8 | ED9 | ED |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total | 0.30*** | ED8 | -3.58* | -- | -- | -- | -- | -- | 5.22** | 23.21*** | 11.74*** | -11. |
| Goods | 0.16*** | ED13 | -- | -7.24*** | -- | -- | -- | 3.09* | -- | -- | 6.96** | -10. |
| Service | 0.27*** | ED8 | -- | -- | -- | -- | -- | -- | -- | 19.90*** | 3.64* | -3.5 |
| Primary | 0.08** | ED1 | -4.60** | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Manufacturing | 0.16** | ED6 | -- | -8.47*** | -- | -- | 6.01** | 9.94*** | -- | -- | 6.34** | -9.0 |
| Construction | 0.08** | ED3 | 3.87* | -3.24* | 4.96** | -- | -- | -3.89* | -3.61* | -- | -- | -- |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Transport & Communication | 0.32*** | ED8 | -6.41** | -- | -- | -5.27** | -- | -- | -- | 24.41*** | 4.34** | -2.8 |
| Utilities | 0.26*** | ED4 | -- | -14.03*** | 6.21** | 17.32*** | -- | -- | -- | -- | -- | -3.6 |
| Wholesale & Storage | 0.10** | ED8 | -- | -- | -- | -- | -- | -- | -- | 6.34** | -- | -4.1 |
| Retail | 0.08** | ED13 | -- | -4.81** | 4.71** | -- | 3.22* | -- | -- | -- | -- | -4.8 |
| Consumer services | 0.20*** | ED4 | -8.28*** | 4.94** | -10.77*** | -13.07*** | -- | 3.24** | 8.51*** | 3.17* | 5.51** | -- |
| Accommodation & restaurants | 0.09** | ED6 | -4.45** | -- | -- | -- | -- | 5.56** | -- | -- | 5.55** | -3.1 |
| FIRE | 0.06* | ED6 | -- | -- | -- | -- | -- | -3.46* | -- | 2.96* | -- | -- |
| Business services | 0.18*** | ED8 | -- | -- | -- | -- | -- | -- | -- | 11.63*** | -- | -- |
| Other producer services | 0.10** | ED5 | -- | -- | -- | -- | -5.21** | -- | -- | -- | -- | -- |
| Education | 0.27*** | ED4 | -8.42*** | 3.84* | -- | -20.14*** | -- | -- | 11.99*** | -- | -- | -- |
| Health & Social serv. | 0.15*** | ED8 | -- | -- | -- | -6.04** | -- | -- | -- | 9.51*** | -- | -- |
| Public admin. | 0.07** | ED6 | -- | -- | -- | -- | -- | -4.29** | -- | -- | -- | -- |

Notes: 1. Columns ED1 to ED13 contain the F value associated with the univariate regression of the education variable against sectorial employment growth.

2. A negative relationship is indicated by a minus sign.

3. The significance levels are indicated as follows: *** = 99%; ** = 95%; * = 90%.

4. The $r^2$ associated with the 'best' education variable (that which displays the highest F value) is in the max. $r^2$ column.

5. The 'best' education variable is indicated in the 'best' column.

Return to article

**TABLE 5B 59 cities, comparison of 1981-1991 and 1991-1994**

| 1991-1994 | max.r2 | best | ED1 | ED2 | ED3 | ED4 | ED5 | ED6 | ED7 | ED8 | ED9 | ED13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total | 0.20*** | ED5 | -- | -- | -- | -4.21** | 13.39*** | -- | -- | -- | -- | -- |
| Goods | 0.18*** | ED5 | -- | -- | -- | -- | 11.80*** | -- | -- | -- | -- | -- |
| Service | 0.08** | ED4 | -- | -- | -- | -5.05** | -- | -- | 3.26* | -- | -- | -- |
| Primary | 0.09** | ED6 | -- | -- | -- | -- | -- | 5.06** | -- | -- | -- | -- |
| Manufacturing | 0.08** | ED5 | -- | -- | -- | 3.53* | 4.81** | -- | -- | -- | -- | -- |
| Construction | 0.24*** | ED1 | - | -- | -3.47* | - | 3.24* | 8.36*** | 9.76*** | -- | 10.00*** | - |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 16.97*** | | | 7.61*** | | | | | | 4.90** |
| Transport & Communication | 0.15*** | ED1 | -9.63*** | -- | -- | -- | 3.45* | -- | -- | -- | 2.85* | -- |
| Utilities | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Wholesale & Storage | 0.06* | ED9 | -- | 3.12* | -- | -- | -- | -- | -- | -- | -3.53* | -- |
| Retail | 0.18*** | ED3 | -- | 3.21* | -12.14*** | -- | -- | -- | -- | -- | -- | -- |
| Consumer services | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Accommodation & restaurants | 0.11** | ED4 | -- | -- | -4.19** | -6.94** | -- | -- | 5.07** | -- | -- | -- |
| FIRE | 0.07* | ED4 | -- | -- | -- | 3.83* | -- | -- | -- | -- | -- | -- |
| Business + prod. services | 0.08* | ED1 | -5.22** | -- | -- | -4.54** | -- | -- | 2.86* | 4.33** | 3.04* | -- |
| Education | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Health & Social serv. | 0.05* | ED3 | -- | -- | 2.85* | -- | -- | -- | -- | -- | -- | -- |
| Public admin. | 0.09* | ED13 | -3.06* | -- | -- | -- | -- | -- | -- | -- | 3.13* | -5.42** |

Notes: 1. columns ED1 to ED13 contain the F value associated with the univariate regression of the education variable against sectorial employment growth.

2. A negative relationship is indicated by a minus sign.

3. the significance levels are indicated as follows: *** = 99%; ** = 95%; * = 90%.

4. the $r^2$ associated with the 'best' education variable (that which displays the highest F value) is in the max. $r^2$ column.

5. the 'best' education variable is indicated in the 'best' column.

TABLE 5B 59 cities, comparison of 1981-1991 and 1991-1994

**TABLE 5A Comparison of 1981-1991 and 1991-1994: 59 Cities**

| **1981-1991** | max.r2 | best | ED1 | ED2 | ED3 | ED4 | ED5 | ED6 | ED7 | ED8 | ED9 | ED |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total | 0.30*** | ED8 | -3.58* | -- | -- | -- | -- | -- | 5.22** | 23.21*** | 11.74*** | -11. |
| Goods | 0.16*** | ED13 | -- | -7.24*** | -- | -- | -- | 3.09* | -- | -- | 6.96** | -10. |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Service | 0.27*** | ED8 | -- | -- | -- | -- | -- | -- | -- | 19.90*** | 3.64* | -3.5 |
| Primary | 0.08** | ED1 | -4.60** | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Manufacturing | 0.16** | ED6 | -- | -8.47*** | -- | -- | 6.01** | 9.94*** | -- | -- | 6.34** | -9.0 |
| Construction | 0.08** | ED3 | 3.87* | -3.24* | 4.96** | -- | -- | -3.89* | -3.61* | -- | -- | -- |
| Transport & Communication | 0.32*** | ED8 | -6.41** | -- | -- | -5.27** | -- | -- | -- | 24.41*** | 4.34** | -2.8 |
| Utilities | 0.26*** | ED4 | -- | -14.03*** | 6.21** | 17.32*** | -- | -- | -- | -- | -- | -3.6 |
| Wholesale & Storage | 0.10** | ED8 | -- | -- | -- | -- | -- | -- | -- | 6.34** | -- | -4.1 |
| Retail | 0.08** | ED13 | -- | -4.81** | 4.71** | -- | 3.22* | -- | -- | -- | -- | -4.8 |
| Consumer services | 0.20*** | ED4 | -8.28*** | 4.94** | -10.77*** | -13.07*** | -- | 3.24** | 8.51*** | 3.17* | 5.51** | -- |
| Accommodation & restaurants | 0.09** | ED6 | -4.45** | -- | -- | -- | -- | 5.56** | -- | -- | 5.55** | -3.1 |
| FIRE | 0.06* | ED6 | -- | -- | -- | -- | -- | -3.46* | -- | 2.96* | -- | -- |
| Business services | 0.18*** | ED8 | -- | -- | -- | -- | -- | -- | -- | 11.63*** | -- | -- |
| Other producer services | 0.10** | ED5 | -- | -- | -- | -- | -5.21** | -- | -- | -- | -- | -- |
| Education | 0.27*** | ED4 | -8.42*** | 3.84* | -- | -20.14*** | -- | -- | 11.99*** | -- | -- | -- |
| Health & Social serv. | 0.15*** | ED8 | -- | -- | -- | -6.04** | -- | -- | -- | 9.51*** | -- | -- |
| Public admin. | 0.07** | ED6 | -- | -- | -- | -- | -- | -4.29** | -- | -- | -- | -- |

Notes: 1. Columns ED1 to ED13 contain the F value associated with the univariate regression of the education variable against sectorial employment growth.

2. A negative relationship is indicated by a minus sign.

3. The significance levels are indicated as follows: *** = 99%; ** = 95%; * = 90%.

4. The $r^2$ associated with the 'best' education variable (that which displays the highest F value) is in the max. $r^2$ column.

5. The 'best' education variable is indicated in the 'best' column.

Return to article

**TABLE 5B 59 cities, comparison of 1981-1991 and 1991-1994**

| 1991-1994 | max.r2 | best | ED1 | ED2 | ED3 | ED4 | ED5 | ED6 | ED7 | ED8 | ED9 | ED13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total | 0.20*** | ED5 | -- | -- | -- | -4.21** | 13.39*** | -- | -- | -- | -- | -- |
| Goods | 0.18*** | ED5 | -- | -- | -- | -- | 11.80*** | -- | -- | -- | -- | -- |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Service | 0.08** | ED4 | -- | -- | -- | -5.05** | -- | -- | 3.26* | -- | -- | -- |
| Primary | 0.09** | ED6 | -- | -- | -- | -- | -- | 5.06** | -- | -- | -- | -- |
| Manufacturing | 0.08** | ED5 | -- | -- | -- | 3.53* | 4.81** | -- | -- | -- | -- | -- |
| Construction | 0.24*** | ED1 | -16.97*** | -- | -3.47* | -7.61*** | 3.24* | 8.36*** | 9.76*** | -- | 10.00*** | -4.90** |
| Transport & Communication | 0.15*** | ED1 | -9.63*** | -- | -- | -- | 3.45* | -- | -- | -- | 2.85* | -- |
| Utilities | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Wholesale & Storage | 0.06* | ED9 | -- | 3.12* | -- | -- | -- | -- | -- | -- | -3.53* | -- |
| Retail | 0.18*** | ED3 | -- | 3.21* | -12.14*** | -- | -- | -- | -- | -- | -- | -- |
| Consumer services | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Accommodation & restaurants | 0.11** | ED4 | -- | -- | -4.19** | -6.94** | -- | -- | 5.07** | -- | -- | -- |
| FIRE | 0.07* | ED4 | -- | -- | -- | 3.83* | -- | -- | -- | -- | -- | -- |
| Business + prod. services | 0.08* | ED1 | -5.22** | -- | -- | -4.54** | -- | -- | 2.86* | 4.33** | 3.04* | -- |
| Education | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Health & Social serv. | 0.05* | ED3 | -- | -- | 2.85* | -- | -- | -- | -- | -- | -- | -- |
| Public admin. | 0.09* | ED13 | -3.06* | -- | -- | -- | -- | -- | -- | -- | 3.13* | -5.42** |

Notes: 1. columns ED1 to ED13 contain the F value associated with the univariate regression of the education variable against sectorial employment growth.

2. A negative relationship is indicated by a minus sign.

3. the significance levels are indicated as follows: *** = 99%; ** = 95%; * = 90%.

4. the $r^2$ associated with the 'best' education variable (that which displays the highest F value) is in the max. $r^2$ column.

5. the 'best' education variable is indicated in the 'best' column.

Finally, some remarks can be made about the total explanatory power ($r^2$) of the models over the different periods. Over 1981 to 1991, growth in two basic industries is quite strongly associated with initial education levels (max. $r^2$ = 0.16 for manufacturing and max. $r^2$ = 0.18 for business services[16]). Apart from growth in consumer services, growth in consumer oriented activities such as retail, accommodation and restaurants and construction are not as closely

connected with initial education levels.[17] Over the 1991 to 1994 period, there is a change in pattern: employment growth in the 'basic' industries is no longer associated with initial education levels (max. $r^2$ = 0.08 for manufacturing and max. $r^2$ = 0.08 for business services), whereas the association has strengthened in the consumer oriented sectors.[18]. It is not possible to draw any conclusions on the basis of this pattern, but an interesting hypothesis is that over 1981 to 1991 initial education levels acted as labour supply factors, and therefore had a stronger effect on employment growth in potentially 'footloose' industries, and that over the 1991 to 1994 period they acted as output demand factors, and therefore had a stronger effect on industries which produce and sell locally.

The comparison made between the 1981-1991 and 1991-1994 periods is instructive because it clearly illustrates that the general pattern identified over the first period is not reproduced over each time period. The reasons for this change are far more difficult to identify. There may be some intrinsic differences between the 1980s and the 1990s. The effect of initial education levels over a ten year period may differ from its effect over a three year period. The 1981-1991 period, which approximately covers a complete economic cycle, is different from the 1991-1994 period which covers a recession and slow recovery. The comparison thus raises more questions than it answers, but it does serve to highlight the fact that the widely held view that higher levels of education are associated with faster employment growth -- a view supported by the findings over 1981 to 1991 -- must be tempered by other, as yet undetermined, considerations.

## Conclusion

### Results

The conclusions will deal principally with the 1981 to 1991 period since the data cover the entire urban system and a complete analysis has been performed for that period. There is no doubt that initial education levels in Canadian urban agglomerations are associated with employment growth, and current theory suggests -- to the extent that it deals with causality -- that the employment growth is at least partly a consequence of the more educated workforce. However, in all sectors except manufacturing and retail, the inclusion of an education variable does not greatly improve the explanatory power of the basic RSC model.

This suggests that, given a city's basic geographic characteristics (size, region and distance from a major metropolitan area), employment growth in most economic sectors is influenced by education levels only to the extent that these co-vary with the RSC dimensions. Variations in employment growth in most sectors would appear to be adequately accounted for by position in the urban hierarchy, region and centrality. The inclusion of education variables

clarifies the situation, by partitioning out the 'education' element from the other dimensions but does not add much to the overall power of the models.

However, two important exceptions are identified. Manufacturing and retail employment growth do seem to occur in cities with higher initial education levels independently from the RSC dimensions. Since manufacturing is one of the basic sectors identified earlier in the paper, this propensity for the sector to grow in cities with a more educated workforce is very significant, particularly in the light of the fact that although very few individual sectors behave similarly, total employment growth and growth in the aggregate goods producing sector are also explained considerably better after the inclusion of an education variable. It can be hypothesised that the growth of the manufacturing sector generates diffuse multiplier effects throughout the economy which become apparent at the aggregate level. These multiplier effects would appear to be particularly significant in the retail industry.

The other basic sectors identified behave in very different, though not unexpected, ways. Primary sector growth is not very strongly related to initial education levels but is strongly associated with the RSC factors. Business services, the distribution and growth of which are strongly connected with the urban hierarchy (Coffey and Shearmur 1997), are likewise shown to be only weakly associated with initial education variables once the RSC dimensions are accounted for. A similar pattern is observed for the FIRE sector. For all three of these basic sectors, initial education levels explain very little of the inter-city variation in growth rates once the RSC variables are accounted for.

The comparative analysis of the 1981-1991 and 1991-1994 periods shows that the relationship between initial education levels and employment growth is not fixed over time. During the latter period, which covers a recession and the beginning of a 'jobless recovery', the overall association between initial education levels and employment growth remained quite strong, but fewer individual sectors stand out as displaying significant relationships. In particular, the strong association between manufacturing employment growth and education has disappeared, and has been replaced by stronger associations in consumer oriented sectors such as construction, retail and hotel and accommodation. If this trend is verified, it may signal that an educated population is increasingly becoming related to employment growth through its capacity to spend rather than through its capacity to create and/or undertake employment which requires skills. Another possibility is that this trend is due to the recession: only cities with more highly educated populations retained the spending power to maintain these consumer oriented jobs, and, when a recovery occurs, these high education levels will once again be conducive to growth in the basic manufacturing sector.

**Policy Recommendations and Further Questions**

This analysis has concentrated on attempting to identify associations between education levels and employment growth in individual urban areas. Just as it is not possible to generalise from the national to the local level, it is also not possible to extend the conclusions of this analysis to the aggregate national level. Thus only local and municipal policies can be commented upon, and, bearing in mind the current trend towards local development, it is principally this type of policy which will be addressed. Having said that, it is worth considering the increasing relevance of local and regional economies to the global economy (Scott 1996). This analysis, which looks at the effect of education levels on small geographic sub-divisions in the fluid national environment, may provide useful pointers for the study of workforce qualifications and employment at an international scale.

Many local development policies place heavy emphasis on the development of human capital -- and whilst it is recognised that formal education is not the only means of doing this, it is also clear that an increase in formal education levels will not detract from the aim. It has been pointed out that the danger of increasing human capital locally is that this type of capital is highly mobile, and local investment therein may not actually benefit the locality (Cousineau and Vaillancourt 1987; Maillat 1989). This study shows that, at a local level, a higher initial level of education may indeed play a role in attracting and/or promoting employment growth, but that its role must not be overstated. Once total employment growth is controlled for region, size and centrality, education variables add a modest but significant element of explanation. In particular they add to the explanation of manufacturing employment growth. Thus policies which seek to attract or promote manufacturing employment on the basis of providing a more qualified and skilled workforce appear to be concentrating on a relevant factor. However, it must not be forgotten that manufacturing employment is declining nation-wide, and localities competing for manufacturing jobs are competing for a shrinking pie. Even in high-tech manufacturing sectors, employment growth between 1971 and 1991 has been below the Canadian national average (Shearmur 1997). Another point worth noting is that the effect of initial education levels on manufacturing employment growth appears to have greatly diminished between the 1980s and the early 1990s, and that the specific education levels which associate with employment growth differ according to the time period analysed.

The high-growth basic industries are principally business services (within which are included computer programming, research and development, management consultancy, etc.). Whereas development at the urban level could be far more effective in terms of job creation if such sectors could be promoted, there is no evidence that high initial education levels are sufficient

to do so. Indeed, it is striking how little effect education levels have upon growth in these sectors once region, size and centrality are controlled for. Thus competition for these high-growth jobs cannot be waged between urban areas on the basis of workforce skills. This does not mean that education levels are not relevant to these industries, only that high education levels must be combined with the geographic and agglomeration advantages that only certain cities possess. Since localities cannot easily overcome handicaps linked to the absence of these advantages, it appears from this analysis that unless they already possess them they will have some difficulty in attracting or promoting employment in high-growth sectors.

Finally, it is important for policy makers to realise that the target may be moving, and may be dependent on phases of the economic cycle. The 1980s data cover a fairly long period, and record the possible long term effects of education on employment growth. The data for the 1990s only cover a fairly short period, one in which very few jobs were created anywhere -- over this period what has been termed higher job growth could in many cases be called lower job loss. This distinction may be important, and higher education levels may have a heightened demand effect during recessionary periods and a heightened supply effect during periods of growth. Alternatively, the effects of education on employment growth may evolve over time.

Far more questions have been raised in this paper than have been answered. These questions are of crucial importance to local policy makers, because the fundamental issue at stake is the extent to which local policies can be based on arguments and rationales developed at a macro level for countries and for individuals. On a theoretical level such extrapolations cannot be justified. Only a fuller development of the theory surrounding the local effects of education on employment will be able to provide underpinnings for local policies, and it is hoped that this paper has provided some insight into the nature of the problems and into possible avenues of investigation.

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*Appendix 1* Economic Sectors

## *Appendix 1* Economic Sectors

### Aggregates

| |
|---|
| a. Total employment = b + c |

| |
|---|
| b. Goods producing employment = sum of 1 to 3<br><br>c. Service sector employment = sum of 4 to 15 |

**Individual sectors**

| | |
|---|---|
| 1. Primary<br><br>2. Manufacturing<br><br>3. Construction<br><br>4. Transport & communications<br><br>5. Public utilities<br><br>6. Wholesale & storage<br><br>7. Retail trade<br><br>8. Consumer services | 9. Accommodation & food services<br><br>10. Finance, insur. & real estate<br><br>11. Business services[1]<br><br>12. Other producer services[1]<br><br>13. Education<br><br>14. Health & social services<br><br>15. Public administration |

Note: 1. For the 1991 to 1994 sectors, there is no 'other producer service' sector. This sector has been aggregated with business services.
2. For the 1991 to 1994 analysis, 11=11+12.

Source: 1. The 1981 to 1991 figures come from Statistics Canada census information, and the sectors have been constructed by aggregating 160 sectors at the 2 and 3 digit SIC level.
2. The 1991 to 1994 figures are from the labour force survey, and the sectors have been constructedby aggregating 52 sectors at the 2 digit SIC level.

*Appendix 2* Education Variables

## *Appendix 2* Education Variables

The variables are from the Statistics Canada 2B census profile and indicate the percentage of the working age (15 years and over) population in each city whose maximum academic qualification is the following:

| | |
|---|---|
| ED1: | less than grade 9 |

| | |
|---|---|
| ED2: | grade 9 to 13, no certificate |
| ED3: | grade 9 to 13, with certificate |
| ED4: | trades certificate or diploma |
| ED5: | non university post-secondary, no certificate |
| ED6: | non-university post-secondary, with certificate |
| ED7: | university, no degree |
| ED8: | university, with degree |
| ED13: | less than grade 13, no certificate (ED1+ED2) |
| ED9: | some post-secondary (ED4+ED5+ED6+ED7+ED8) |

Note: 1. In Tables 1, 2 and 3, EDx signifies initial education levels andiEDx signfies the percentage increase in EDx.