Growth in the Canadian Urban System, 2001-2006

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1- Introduction

The 2001 to 2006 period in Canada was, overall, one of sustained growth, notwithstanding the job losses in 2001-2002 due to the dot.com crash. Indeed, this crash, which affected a number of urban areas that connected with high-tech electronics and multi-media industries, was compensated for by three strong effects:

1- the rise in demand and prices for most commodities, including oil, drove growth in Alberta, Newfoundland, but also in many other resource based communities. Even the wood industry did relatively well over this period, although the protectionist stance taken by the US administration with regards to timber exports from Canada muted the effect of high demand (itself a consequence of the US housing boom) in logging towns;

2- the financial services industry expanded rapidly, in part on the back of high-risk mortgages (packaged into opaque investment instruments), and in part, in Canada, on the back of the booming resource sector.

3- decreasing unemployment, rising incomes (partly attributable to points 1 and 2 above) and increasing household debt fuelled a consumption boom.

The booming resource and financial industries did not only have a positive effect: in some cities, particularly traditional manufacturing areas that had benefited from a low dollar in the late 1990s, the high dollar led to job losses and to some company closures. These areas are found particularly around major metropolitan areas in Ontario and Quebec (Polèse & Shearmur, 2002).

Needless to say many things have changed since 2006. The financial meltdown and ensuing recession have been felt not only (again) in the manufacturing sectors, but also in the financial sector – of course – and the resource sector which has suffered from significantly reduced demand and lower prices. The retail sector, which tends to react to these more fundamental trends, has also been stagnating. The geographic consequences of the recession are yet to be fully assessed: given that this recession may usher in some fundamental structural changes to the economy (e.g. Ontario's auto-industry may remain decimated; its financial services sector may not recover to its previous level; there may be a further shift of economic gravity towards western Canada; Newfoundland may become a 'have' province...), the following analysis must not be interpreted as telling us much about the current short-term growth processes. Rather, it illustrates what was happening when the economy was firing on (almost) all cylinders in the early 2000s.

2. Using statistics to understand regional growth

This brief working paper is an update of the Shearmur & Polèse (2007) paper in which the theoretical underpinnings of the growth model that is presented below are developed and explained, and its evolution over a 30 year period is studied. A similar model has also been used to explore income distribution across Canada (Shearmur & Polèse, 2005), and has been augmented in other studies by

detailed infrastructure and accessibility variables (Apparicio et al, 2007). Other work has focussed upon the spatial non-stationarity of certain coefficients (Shearmur et al, 2007).

Rather than go over the way the model is built, certain key points will be made about the way in which such statistical models should be interpreted.

First, as is made clear in Shearmur & Polèse (2007), the parameters and coefficients in this type of model vary over time: growth processes and geo-structures can evolve, and seem to do so particularly rapidly in times of fundamental economic shift, such as during the 1980s when (very schematically) the Canadian economy was undergoing massive tertiarisation, deindustrialisation, and a shift away from employment in the primary sectors. The current recession may be ushering in another such period of change. However, even though the way each factor or structure is related to economic growth can change, a relatively small number general dimensions (e.g. region, industrial structure, market access, human capital…) when combined, can explain (in a statistical sense) a considerable amount of the variability in growth rates across Canadian territories over different periods.

Second, as explained and documented in more detail in Shearmur et al (2007), such growth models are not necessarily stationary across space: in certain contexts the relationship between a given factor and growth may be quite different to that observed across a country as a whole. For instance, in the 1990s the connection between initial wage levels and employment growth was positive in central Canada (Quebec-Windsor corridor), indicating possible agglomeration effects and increasing returns. However, in peripheral regions it was noted that the connection was negative, indicating a tendency for employment to be created in lower wage peripheral regions, presumably in a Weberian cost-saving dynamic.

Finally, it is important to remember that the variables introduced in the model are not introduced haphazardly: each is an indicator (imperfect, as is the wont of indicators, but also of most other types of information gathered during any type of research process) of a theoretically derived growth dimension. There are four generic dimensions hypothesised:

- historic path-dependency: path-dependency and contingency are not limited to the local scale. Large scale paths can also exist, such as the opening and settling of Western Canada which produced a long-term drift westward. This effect seemed to be attenuating over the 1990s. Another wide-scale and possibly historic-geographic trend is growing trade with the US: this may increase the connection between being close to the border and growth (Shearmur et al, 2007).

- accessibility and wider context: theories of agglomeration posit that size (usually taken to be local size, and indicative of information spillovers, interactions and infrastructure) is positively associated with economic growth. Conversely, congestion and high prices – also associated with size - may be connected with slower growth. Another important wide scale contextual variable is the regional (or provincial) context: most rules, regulations and fiscal policy relevant to economic development are implemented at this scale, and broad regions of Canada often share a common economic base with local networks of cities functioning as a system (Pred, 1977; Pred & Tornquist, 1972). Thus cities within each broad region

tend to behave in a similar fashion. If growth is partly *regionally determined* one must be careful about trying to understand growth processes solely from a local perspective.

- local variables: local wages, local human capital, local institutions, etc...: these hark back to endogenous growth theories that posit that certain local factors can influence economic growth.

- industrial structure: regions may grow because sectors within them grow, not because of the regions themselves. Industrial structure (i.e. the 'mix' of sectors found in a region) may be an important factor of growth, the causal effects being sectoral rather than regional. Diversity and/or specialisation are also associated with economic development.

Underlying this model is a certain tension between two views of economic geography. On the one hand the Storper & Walker (1991) view, which has been extremely influential over the last twenty years, is that it is local factors and context that are the primary explanation of economic dynamics. These factors can include institutions, culture, and interactions between the labour force and capital. From this perspective capital becomes embedded in particular regions and is not necessarily responsive to wider 'location factors': rather each region develops its own local brand of capitalism, and one ought, strictly speaking, to speak of 'capitalisms' (Gibson-Graham, 1996) since no two localities share identical economic dynamics. From this perspective regions should develop independently of wider geographic and industrial structures, their performance being solely determined by the way in which their particular institutions and endowments generate internal dynamics and sustain interaction with the outside, globalised, world. The pitfall of this approach is that structures and factors that operate at non-local (but also non-global) scales can easily be forgotten as focus is put almost exclusively on local dynamics and local reactivity: and even if these wider structures are thought not to exist, it is wise to verify this and provide convincing refutations for apparent structural effects if they are uncovered.

On the other hand is the location theory approach to understanding regional growth as classically exposed by Christaller, Weber, and Losch (Dicken & Lloyd, 1990), reinterpreted as the economy evolves and as location factors change (e.g. Polèse & Shearmur, 2004). A related approach is that associated with urban systems theory (Pred, 1977; Pred & Tornquist, 1972) in which cities are understood as being part of wider city-systems: each city evolves certain function that are complementary to those of other cities in the system, and becomes dependent on these other cities. The position and function of cities within the system can become explanatory factors for the location theory approach. The pitfall of this approach is that correlations between explanatory factors and growth, unless strongly backed by theory and qualitative understanding, do not amount to causation, and that results can depend on the time period studied and/or on the sub-sample of observations chosen. This type of approach can not take into account a myriad of local particularities such as institutional context, local culture or the presence of dynamic individuals. Thus, it will never be able to account for all the differences between cities: however, as a practitioner of this type of study, I feel that the results can be quite powerful and can help parse out the particularities of each place by putting each observation into a structural context. It can also identify regularities and structures that are not observable at the local scale.

The ideal approach for understanding regional economies is to move between these two somewhat antagonistic views: neither can provide a complete picture of what is driving the economy in each locality, but each can uncover information that furthers our understanding. Given the recent ascendency of qualitative and context dependent approaches in economic geography (Tickell et al, 2007) it is necessary to emphasise the way in which each approach depends upon the other[1].

2. The model

The basic question being explored in this paper is the extent to which a statistical model based upon the various papers cited above and on the principals just outlined can explain – in a statistical sense - the economic performance of cities in Canada over the 2001-2006 period.

All data are derived from the census 2b tables for 2001 and 2006. The 'urban system' comprises 203 urban units. These are either:

- census agglomerations or census metropolitan areas of over 10 000 people: these are groups of census sub-divisions (usually municipalities) connected by strong commuting ties, and thus forming (approximately) self-contained labour markets.

- free-standing census subdivisions: these are municipalities of over 10 000 people NOT connected to any other municipality by strong commuting ties. These, too, can be approximated to self-contained labour-markets.

Labour markets are often considered to be functional regions and appropriate units of regional economic analysis. This can be debated, since commutes are only one of many different types of economic function (retail, inter-firm contacts, industrial linkages) which operate a different scales or at no particular scale. Thus, the convention of associating functional regions and labour markets areas is questionable, but one that will be adopted in this report. One of the underlying problems that will not be addressed in this report is whether, in fact, it is possible to geographically circumscribe economic activity in any meaningful way.

2.1 Dependent variables

Economic performance – our dependent variable – is taken to be:

- *employment increase :* log (employment in 2006) – log (employment in 2001). Employment is measured as the number of people who had a job during the week preceding the census (usually in May or early June), with no distinction between full and part-time.

[1] See Professional Geographer 36.2 and 36.3 (2009) for a collection of papers on the topic of quantification and qualitative approaches in geography. The importance of mixed methods is increasingly acknowledged but there is still a reluctance to perform data-driven research.

- *increase in work income per worker:* (income in 2006 / income in 2001) – 1, where income is, for each city, 'Total income derived from work / Total number of people declaring a work income'. An increase in work income per worker can be attributed to a variety of factors: increase in full-time positions; increased number of hours worked over the year; productivity increases; decrease in lower paying jobs.

2.2 Independent variables.

The explanatory variables initially placed in the model are as follows:

reg : regional classification, comprising Atlantic Canada, Quebec, Ontario, Prairies (Manitoba, Saskatchewan and territories); Alberta, British Columbia.

class2 : classification of cities into metropolitan areas (those over 1 million people), central (those within 100km of a metro area) and peripheral.

clusname : basic industrial structure in 2001. The 203 observations have been grouped into 6 different industrial profiles based on their location quotients in 23 different sectors. See appendix 1 for list of sectors and the profile of each cluster. The clustering method used is Ward hierarchical clustering with standardised variables. Note that all location quotients greater than 5 are set at 5 in order to limit the influence of outlying values.

lp01 : log of total population in 2001.

lpt01_2 : measure of local accessibilty. This is the sum, across 413 regions that cover the entire Canadian territory, of '*population / distance*^{2} '. Self-potential (potential of an observation to itself) is excluded since it is measured by lp01. Distances are Euclidian distances measured centroid to centroid.

rlpt01_1 : a measure similar to *lpt01_2* is calculated, based upon '*population / distance'*, in order to calculate general national scale accessibility. However, correlations are quite strong between *lpt01_2* and *lpt01_1*, so *rlpt01_1* is the residual of the regression of *lpt01_1 = f(lpt01_2).*

pg_01 : percentage of graduates in local population in 2001.

sp01 : specialization index in 2001. This measures the deviation of the 23 sector industrial structure from the norm, which is taken to be a structure where all location quotients are equal to 1. As *sp01* increases industrial specialization increases (and, conversely, city-wide industrial diversity decreases).

re_01 : local work income per worker in 2001. An indication of local costs for employers.

x_newgeo : east-west coordinate. Decreases as one moves west. Historic drif to the west.

y_newgeo : north-south coordinate. Decreases as one moves south. Effect of US border.

The model is applied as follows.

First, the entire selection of 203 observations is included in an OLS framework. After a first run, observations with undue leverage are identified (Cook's distance >0.025) and excluded, and the model run again on the reduced population. The excluded observations are recorded and presented with the results.

The resulting model (after excluding these observations) is then checked for multicollinearity, and highly correlated variables are excluded (starting with the variable with the highest variance inflation factor

(VIF), and excluding variables until all VIF are beneath 10. In fact, all VIF are below 4 in both of the final models.

Following this, the remaining variables are excluded ONE by one (or as a group if they constitute an effect such as 'regions' (reg) or 'industrial structure' (clusname)), until all remaining variables are significant at the 90% level. As each variable is excluded the whole process is performed, so the number of observations included varies slightly at each iteration. The final model (as presented) is the one where all variables are significant at 90%: it must therefore be remembered that EXCLUDED VARIABLES ARE NOT SIGNIFCANTLY ASSOCIATED WITH ECONOMIC PERFORMANCE AFTER CONTROLLING FOR THE EFFECTS IN THE MODEL.

Although the model presented and can help understand certain growth dynamics, the residuals for the cities studied by the ISRN researchers are of particular interest. These residuals allow us to assess whether, GIVEN THE INDEPENDENT VARIABLES LISTED ABOVE, the cities over- or under-perform during the 2001-2006 period in terms of employment or work income growth.

3. Results

3.1 Employment growth

Altogether 15 of the 203 observations are not included in the regression analysis because they have too much influence on the regression coefficients (table 1). Thus, if we take the regression model to be an approximate description of the way in which growth factors influence an average city, then these 15 cities are not 'average' : the general model described below does not apply to them.

Table 1. Outliers from model for employment growth

class1	region	p01	City	emp. growth	work ic growth	residual	standard residual
C	ON	146950	Barrie	0.21	0.13	0.10	2.10
P	AL	86080	Lethbridge	0.12	0.20	-0.09	-1.88
C	AL	11635	Okotoks	0.44	0.16	0.20	4.10
P	AL	11440	Grand-Centre	0.10	0.22	-0.08	-1.69
P	AL	58315	Grande-Prairie	0.26	0.37	0.11	2.30
P	AL	42475	Fort-McMurray	0.26	0.40	0.14	2.90
C	AL	10805	Wetaskiwin	0.09	0.36	-0.10	-2.12
P	BC	15175	Prince-Rupert	-0.12	0.03	-0.12	-2.50
P	BC	10210	Kitimat	-0.11	0.10	-0.10	-2.03
P	BC	22900	Fort-St-John	0.18	0.25	0.16	3.30
P	PR	21245	Whitehorse	0.10	0.17	0.07	1.43
P	PR	16450	Yellowknife	0.14	0.24	0.10	2.12
C	QC	8870	Ste-Sophie	0.26	0.21	0.08	1.70
C	QC	8175	Prevost	0.26	0.23	0.10	2.10
C	PR	9025	Steinbach	0.18	0.21	0.10	2.00

Note: ON: Ontario; AL: Alberta; BC: British Columbia; QC: Quebec; PR: Prairies
C: within 100km of a large metro area; P: beyond 100km; ic: income; p01: population in 2001.

From table 2 we can see that of the 11 effects originally included in the model, only four appear to be significantly associated with employment growth. The strongest association is observed for market accessibility (*lpt01_2*): being located in an area surrounded by dense settlement – and, in Canada, this means being fairly close to a large metropolitan area – is a strong predictor of employment growth during 2001-2006. It should, however, be noted that LOCAL markets (as proxied by local city size) are not significantly associated with growth: if agglomeration economies occur, it is at a distance and *local* city size is not a factor.

The next strongest predictor of employment growth is the region in which a city is located. In particular cities in Alberta grew considerably faster than cities in Quebec (the base category), whereas cities in Ontario – all else being equal – grew significantly more slowly.

Table 2: Regression results, employment growth

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	12	0.26672	0.02223	14.05	<.0001
Error	175	0.27683	0.00158		
Corrected Total	187	0.54355			
Root MSE	0.0398	R-Square	0.4907		
Mean growth	0.0767	Adj R-Sq	0.4558		
Coeff Var	51.87				

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|	VIF
Intercept	1	-0.119	0.03	-3.73	0.000	0.00
AT	1	-0.003	0.01	-0.26	0.797	1.68
ON	1	-0.033	0.01	-3.90	0.000	2.09
PR	1	-0.007	0.01	-0.48	0.629	1.63
AL	1	0.096	0.02	5.91	<.0001	1.42
BC	1	0.004	0.01	0.33	0.742	1.85
CL11	1	0.021	0.01	2.01	0.046	2.54
CL14	1	0.023	0.01	1.71	0.088	1.68
CL6	1	0.009	0.01	0.88	0.382	1.93
CL7	1	0.055	0.01	5.14	<.0001	2.48
CL8	1	0.047	0.02	2.79	0.006	1.40
reference: CL9						
lpt01_2	1	0.021	0.00	6.40	<.0001	2.22
sp01	1	-0.026	0.01	-2.39	0.02	1.33

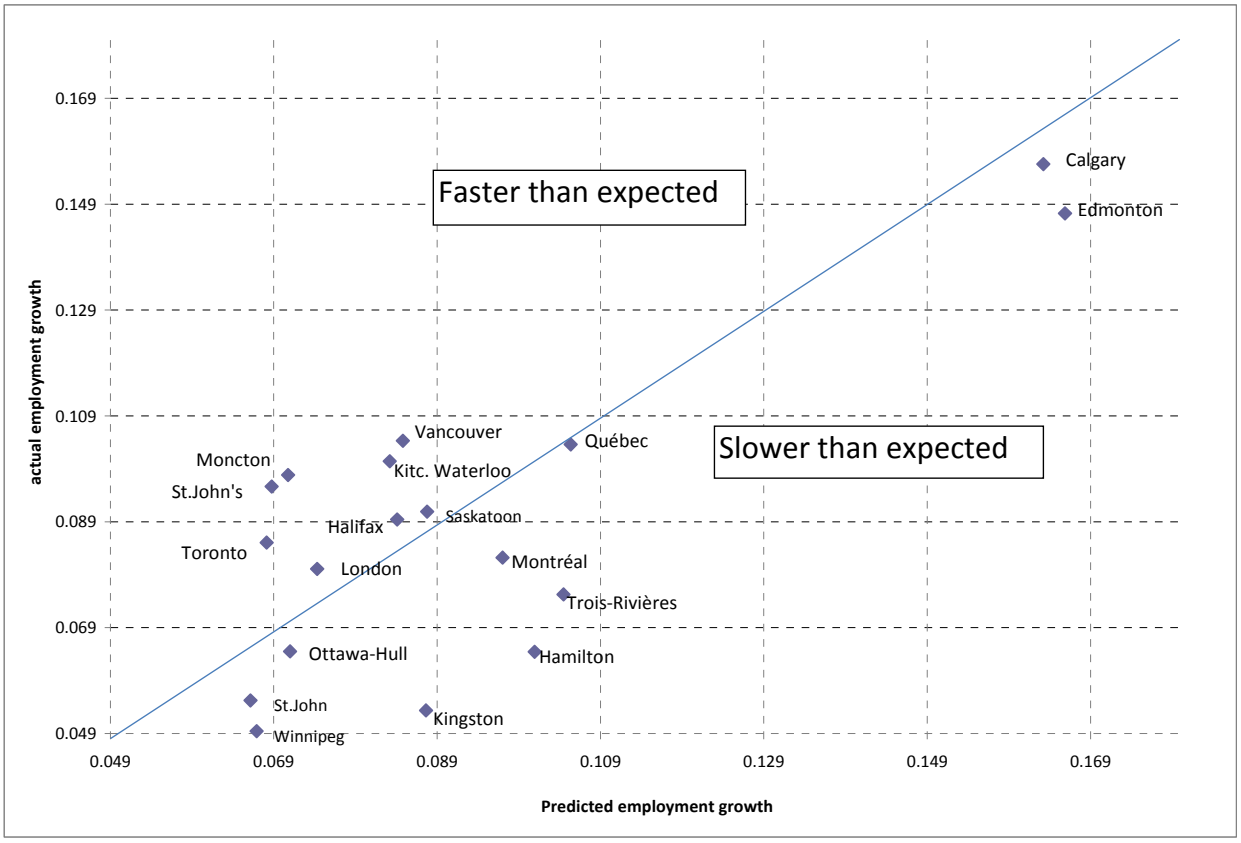
GLM estimates, same model

Source	DF	Type II SS	Mean Square	F Value	Pr > F
region	5	0.13	0.03	16.35	<.0001
CLUSNAME	5	0.06	0.01	7.07	<.0001
lpt01_2	1	0.06	0.06	41.02	<.0001
sp01	1	0.01	0.01	5.69	0.02

Industrial structure (*clusname*) has a moderate association with employment growth. The base category, *CL9*, consists of central cities with a low and medium tech manufacturing specialisation (see appendix 1). This type of city grows more slowly than all other types. In particular *CL7* (small peripheral service centres), *CL8* (administrative centres and seats of government), *CL11* (small peripheral cities dominated by the primary sector) and, to a lesser extent, *CL14* (metropolitan areas and high order service centres) grow faster than *CL9*.

Finally the less specialised (or more diverse) a city, the faster it grows (*sp01*).

Figure 1: Employment growth 2001-2006: actual v. predicted



These four effects provide a powerful framework for understanding some of the wider factors that influence employment growth in individual cities. With 12 degrees of freedom that express only four dimensions the model accounts for 49% of growth variance across 188 cities (adjusted $r^2 = 0.46$). This suggests that the local economic performance of any particular city can only be understood if these supra-local factors are accounted for first.

Figure 1 illustrates where the cities studied by the ISRN group fall when their growth rate as predicted by the model (i.e. the rate that would be found if the characteristics of each city were fed into the model in table 2) are plotted against their actual growth rate. A table with actual and predicted values is available in appendix 2 and, in case of conflict, overrides the illustrations in figures 1 and 2.

The results are sometimes counter-intuitive. Calgary and Edmonton, for instance, notwithstanding their very fast growth, are in fact underperforming given their industrial structure, region, diversity and degree of accessibility. Other underperformers are St.John, Hamilton, Trois-Rivières, Kingston and Montreal. Over-performing cities are Kitchener-Waterloo, Toronto, Vancouver, Moncton and St.John's. Finally, Ottawa-Hull, Halifax, Saskatoon and Québec have employment growth that is almost exactly commensurate with that predicted by the model.

Of course, nothing in the preceding analysis enables one to assert that Québec, for instance, is performing as expected *because* of its endowment in factors identified in the model. However, given the theoretical underpinnings of each indicator and given the fact that Québec's behavior is consistent with that of 187 other observations, it is plausible that the effects identified may have something to do with its performance: in any case, it would be foolhardy to dismiss this possibility without examining it closely.

3.2 Growth in work income per worker

Twelve observations do not fit the general pattern of income growth as identified by the regression analysis below. Most of these are very small cities of around 10 000 people in 2001. However, St.John's (Nfld) is also amongst these outliers: it has a high positive residual from the initial uncorrected model. This suggests that its income growth is considerably above what would be expected if it were behaving commensurately with Canada's other cities and in keeping with its accessibility and other factors included in the model below. Thus, although St.John's is not part of the following analysis, it appears that its mean work income per worker has been growing faster than 'expected' over the 2001-2006 period.

The model for income growth is not dissimilar to that for employment growth. Accessibility and region are, again, the strongest explanatory factors, although this time it is region that has the strongest effect, with accessibility (both local – *lpt01_2* – and continental – *rlpt01_1*) remaining in the model significantly. The regional effect, however, does not play out in exactly the same way: whereas employment growth was lower in Atlantic Canada than Quebec, income growth is faster. Slow employment growth coupled with fast wage growth is a characteristic of resource booms that rest upon highly capitalized industries: productivity is high and wages are not a key factor of production. The problem is that that the high wages may discourage local entrepreneurship in a regional version of

'Dutch disease' – or the 'intrusive rentier' (Polèse & Shearmur, 2006). This also appears evident in Alberta: its employment growth premium relative to Quebec is about 10% ($e^{0.096}$-1) whereas its wage growth premium is 23.5%.

Table 3: Outliers from model for growth in work income

class1	region	p01	City	emp. growth	work ic growth	residual	standard residual
P	AT	171095	St-John's	0.10	0.19	0.08	1.41
P	AT	10455	Bay-Roberts	0.11	0.22	0.17	2.96
P	ON	14395	Petawa	0.07	0.21	0.09	1.59
C	AL	11635	Okotoks	0.44	0.16	-0.12	-2.08
C	AL	10725	Canmore	0.13	0.54	0.21	3.65
P	AL	11440	Grand-Centre	0.10	0.22	-0.08	-1.50
P	BC	24185	Quesnel	-0.04	0.26	0.16	2.67
P	BC	22900	Fort-St-John	0.18	0.25	0.13	2.24
C	ON	11960	Perth-east	-0.01	-0.10	-0.22	-3.65
C	ON	10010	Adjala-Tosorontio	0.09	0.34	0.20	3.41
C	ON	9000	Tiny	0.18	0.38	0.26	4.32
C	AL	7500	Strathmore	0.33	0.14	-0.14	-2.29

Note: see table 1

Industrial structure plays a lesser role in determining inter-city differentials in work income growth: although wages in all types of cluster grow faster than in *CL9* (the coefficients are positive) only cities in *CL6* (small service centers close to metropolitan areas) benefit from significantly faster wage growth than *CL9* (manufacturing cities close to metropolitan areas).

Finally, the initial endowment in human capital (as measured by the percentage of degree holders, *pg01*) is associated with faster income growth, albeit somewhat tenuously (p(t=0)=0.0502). Whilst this may be indicative of a positive effect of human capital in terms of productivity, it may also be connected with the better social capital that degree holders often possess. Given their better social connections, degree holders may be better placed to secure larger shares of the wealth created in the economy than non-degree holders: whilst it is reassuring to call this productivity it is necessary to carefully disentangle productivity from social capital effects (Shearmur, 2007; Wolf, 2002).

Overall this model is slightly more powerful than that presented in table 2 for employment growth: it accounts for 60% of the variance in income growth across the 191 cities that remain in the analysis (adjusted r^2 = 57%), with one extra degree of freedom (13). The main difference between these two models is that diversity appears to be associated with employment growth (but not with income growth), whereas human capital is associated with income growth (and not employment growth).

Turning now to the cities studied by the ISRN, Figure 2 illustrates the degree to which they conform to the model's predictions.

Table 4: Regression results, work income per worker

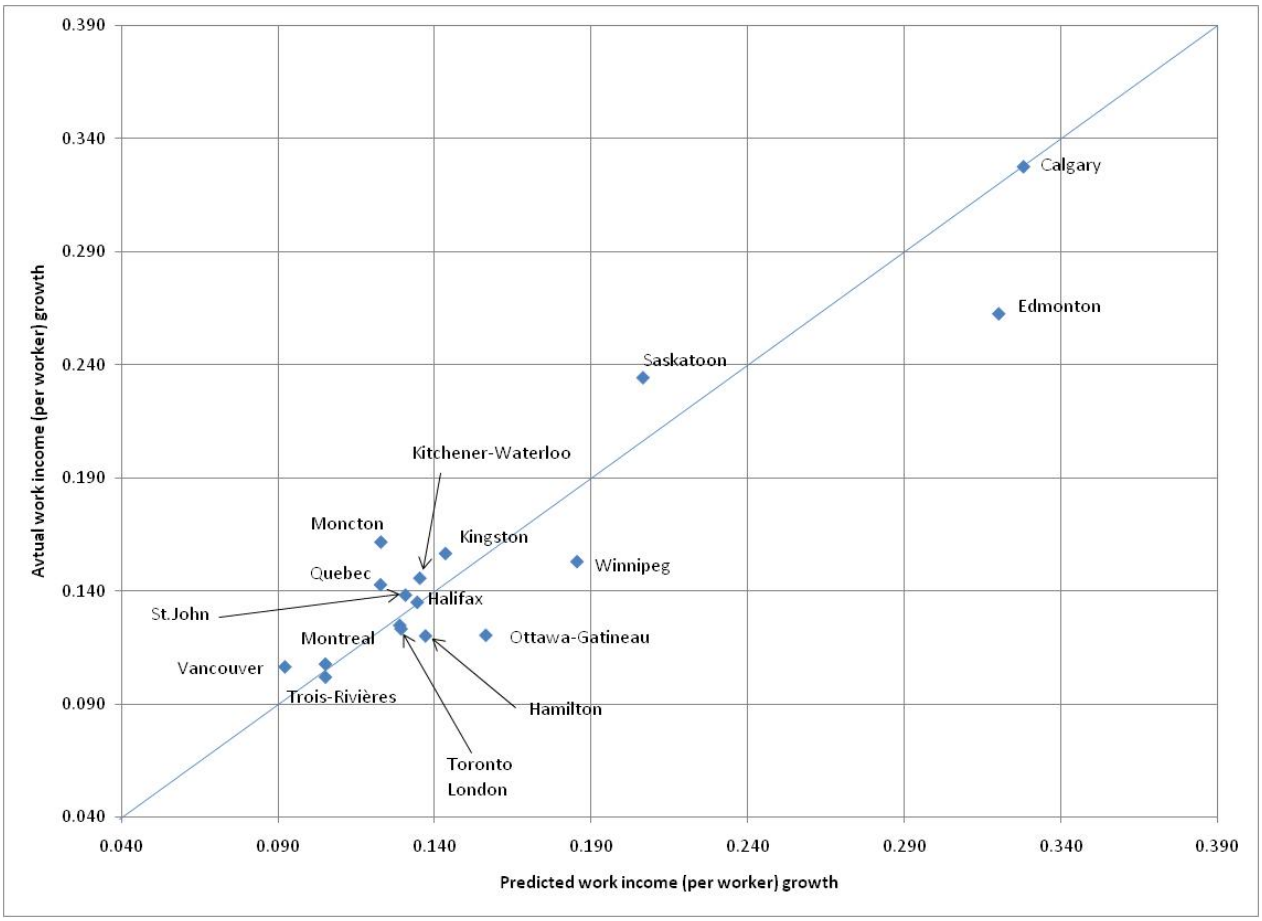
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	13	0.586	0.0451	20.49	<.0001
Error	177	0.390	0.0022		
Corrected Total	190	0.976			
Root MSE	0.047	R-Square	0.6008		
Dependent Mean	0.127	Adj R-Sq	0.5715		
Coeff Var	36.983				

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|	Variance Inflation
Intercept	1	0.008	0.031	0.25	0.805	0.00
AT	**1**	**0.033**	**0.017**	**1.98**	**0.049**	**2.00**
ON	1	-0.001	0.010	-0.13	0.895	2.11
PR	**1**	**0.115**	**0.020**	**5.91**	**<.0001**	**2.69**
AL	**1**	**0.235**	**0.021**	**11.08**	**<.0001**	**2.12**
BC	**1**	**0.033**	**0.019**	**1.67**	**0.096**	**3.73**
CL11	1	0.004	0.012	0.31	0.756	2.35
CL14	1	0.018	0.017	1.03	0.305	1.94
CL6	**1**	**0.036**	**0.012**	**3.1**	**0.002**	**1.97**
CL7	1	0.015	0.012	1.21	0.230	2.30
CL8	1	0.014	0.025	0.57	0.571	2.15
reference: CL9						
rlpt01_1	**1**	**0.107**	**0.032**	**3.36**	**0.001**	**3.38**
lpt01_2	**1**	**0.008**	**0.004**	**2.09**	**0.038**	**2.99**
pg_01	**1**	**0.252**	**0.128**	**1.97**	**0.050**	**2.14**

GLM results for same model

Source	DF	Type II SS	Mean Square	F Value	Pr > F
reg	5	0.403785	0.080757	36.7	<.0001
CLUSNAME	5	0.025727	0.005145	2.34	0.0437
rlpt01_1	1	0.024807	0.024807	11.27	0.001
lpt01_2	1	0.009575	0.009575	4.35	0.0384
pg_01	1	0.008552	0.008552	3.89	0.0502

Figure 2: Growth in work income per worker 2001-2006: actual v. predicted



Wages in Edmonton, Ottawa-Hull, Winnipeg and, to a lesser degree, Hamilton, grew somewhat more slowly than would be expected if the model's predictions were correct, whereas wages in Moncton, Saskatoon, Québec and, to some extent, Vancouver and Kingston, grew faster. It should not be forgotten, that St.John's – omitted because of its undue influence on the model's coefficients – grows faster than predicted by an identical model uncorrected for outliers: its actual wage growth of 19% (see table 3) is the greatest amongst the eastern cities (east of Saskatoon). Trois-Rivières, Montréal, London, Toronto, Halifax, Kitchener-Waterloo, St.John and Calgary saw their wages grow as expected.

4. Conclusions

In order to understand the economic performance of cities across Canada a first step might consist in trying to account for some general growth processes, as put forward in bodies of work that speak of agglomeration economies, endogenous growth, industrial structures and city systems. Once these general processes have been accounted for, then the effect of local context and contingency can be better isolated.

Of course, even if general growth processes appear to account for economic performance, the causal effects are ultimately inferred from a combination of theory and empirical verification by way of

correlations (regression analysis is just a complex form of correlation analysis). Such inferences are often pointed to as a serious limitation to the approach. However, qualitative case studies also have a limited capacity to ascertain causation: when complex stories that associate local outcomes with specific local events and institutions are told, they also, ultimately, rest upon the interpretation by the researcher of simplified information gathered from selected sources. With no possibility of external corroboration, these accounts, too, are open to criticism.

There is probably no ultimate methodology or epistemological approach that can unambiguously demonstrate causal effects and explain outcomes in a complex social systems where a variety of forces act at different scales in changing combinations. This very ambiguity, however, invites a diversity of approaches, and it is in this spirit that statistical results are set out in the current working paper.

I have shown that a basic growth model can account for 50 to 60% of the variance in growth rates across cities in Canada. Furthermore, growth in most of the cities studied by the ISRN is relatively well predicted by the model : where there are deviations, these may indicate powerful local factors that partially override the statistical trend. Where there is no deviation, this may indicate that the city is ‘normal’, or it may indicate that it only appears normal from the outside. The various case studies will no doubt provide shed light upon these questions.

References

Apparicio, P., G.Dussault, M.Polèse and R.Shearmur, 2007, *Transport Infrastructure and Local Economic Development. A Study of the Relationship between Continental Accessibility and Employment Growth in Canadian Communities*, Montréal: INRS-UCS, 94p

Dicken, P. and P.Lloyd, 1990, *Location in Space*, London: Harper & Row

Gibson-Graham, J-K., 1996, The End of Capitalism as We Knew It, Minneapolis: Minnesota University Press (2005 reprinted edition)

Polèse.M. and R.Shearmur, 2002, *The Periphery in the Knowledge Economy*, Montréal: INRS-Urbanisation Culture et Société, et Moncton: ICRDR (237 pages)

Polèse, M. and R.Shearmur, 2004, Culture, Language and the Location of High-Order Service Functions: the Case of Montreal and Toronto, *Economic Geography*, 80.4, 329-350

Polèse, M. and R. Shearmur, 2006, Why Some Regions will Decline: A Canadian Case Study with Thoughts on Local Economic Development *Papers in Regional Science*, 85 (1), 23-46

Pred, A., 1977, *City-systems in advanced economies*, Wiley : New York

Pred, A. and G.Tornquist, 1972, *Systems of cities and information flows. Two essays.* Lund University : Geography working paper series

Shearmur, R. and M.Polèse, 2005, *La géographie du niveau de vie au Canada, 1971 à 2001*, Montréal: INRS-UCS, soumis au Ministère de l'Industrie, 139p (plus résumé de 15p).

Shearmur, R., 2007, The New Knowledge Aristocracy: A Few Thoughts on the Creative Class, Mobility and Urban Growth, *Work Labour, Organisation and Globalisation*, 1.1, 31-47

Shearmur, R., and M.Polèse, 2007, Do Local Factors Explain Local Employment Growth? : Evidence from Canada, 1971-2001, *Regional Studies*, 45.4, 453-471

Shearmur, R., P.Apparicio, P.Lizion and M.Polèse, 2007, Space, Time and Local Employment Growth : An Application of Spatial Regression Analysis, *Growth and Change*, 38.4, 697-722

Storper, M. and R.Walker, 1991, *The Capitalist Imperative: Territory, Technology and Industrial Growth*, London: Wiley-Blackwell

Tickell, A., E.Sheppard, J.Peck and T.Barnes (eds), 2007, *Politics and practice in Economic Geography*, Sage: London

Wolf, A., 2002, Does education really matter? Myths about education and economic growth, London: Penguin

Appendix 1: Cluster profiles

The cluster analysis is performed on location quotients for 23 sectors derived from 3-digit NAICS employment figures as shown below.

A.1 Industrial profile of each cluster

CLUSNAME	CL11	CL14	CL6	CL7	CL8	CL9	
n	52	17	42	48	11	33	
_01lag1	1.41	0.64	2.35	1.05	0.67	0.69	Primary
_01lag2	0.91	1.11	1.30	1.38	0.92	0.84	Construction
_01lag3	1.43	0.88	1.18	0.83	0.32	1.97	First and second transformation manuf.
_01lag4	0.40	1.21	1.06	0.78	0.31	2.07	Medium tech manuf.
_01lag5	0.13	1.01	0.85	0.34	0.43	0.53	High-tech manuf.
_01lag6	0.68	1.21	0.94	0.70	0.56	0.77	Wholesale and warehousing
_01lag7	1.25	0.98	0.97	1.14	0.98	1.06	Retail and personal services
_01lag8	0.91	1.12	1.14	1.03	0.81	0.80	Transport
_01lag9	0.85	1.16	0.76	0.80	0.92	0.71	Support services for transport
_01lag10	0.64	1.04	0.55	0.67	1.05	0.41	Information and cultural industries
_01lag11	0.66	1.01	0.54	0.62	0.67	0.68	Finance
_01lag12	0.62	1.34	0.62	0.71	0.83	0.69	Insurance
_01lag13	0.73	1.05	0.67	1.08	0.84	0.65	Real estate and rental services
_01lag14	0.66	1.04	0.71	0.80	0.80	0.59	non scientific KIBS
_01lag15	0.34	1.02	0.52	0.53	1.06	0.43	scientific and technical KIBS
_01lag16	0.66	1.15	0.79	1.01	0.99	0.72	management support
_01lag17	1.14	0.95	0.83	1.03	1.06	0.94	education*
_01lag18	1.36	0.97	0.87	1.14	1.07	1.06	health and social services
_01lag19	0.70	0.98	0.78	1.38	0.93	0.95	arts, leisure and performance
_01lag20	1.15	0.96	0.90	1.36	1.08	1.06	restaurants and hotels
_01lag21	1.21	1.04	1.44	1.12	0.80	1.15	repair services
_01lag22	1.15	0.96	0.79	0.94	1.11	0.88	religious services and other organizations
_01lag23	1.05	0.85	0.88	0.94	3.13	0.68	public administration

A.2 Type of city in each cluster

class1	CL11	CL14	CL6	CL7	CL8	CL9	
AM1	.	3	.	.	1	.	major metropolitan areas (over 1M)
AM2	.	3	.	.	1	.	smaller metropolitan regions (under 1M)
AC1	1	5	1	2	.	6	central cities, 100K+
AC2	.	.	4	2	.	5	central cities 50-100K
AC3	2	.	3	1	.	9	central cities 25-50K
AC4	5	3	24	19	.	9	central cities up to 25K
AP1	1	3	.	6	3	.	peripheral cities, 100K+
AP2	1	.	2	7	2	1	peripheral cities 50-100K
AP3	13	.	3	5	.	1	peripheral cities 25-50K
AP4	29	.	5	6	4	2	peripheral cities up to 25K

The six cluster solution was chosen based upon the progression of the semi-partial r^2 (i.e. the increase in explanatory power of the cluster solution in explaining the total variance of the data). A relatively small number of clusters was sought in order to make the regression analyses tractable, and the increase in r^2 between the 6 and 7 cluster solutions was small.

Appendix 2: Actual v. predicted 2001-2006 growth rates for selected cities

Given that the labels that identify cities on figures 1 and 2 in this report are manually assigned, a table containing the actual and predicted growth rates is given below. In case of contradiction between figures 1 and 2 and the table, the table should be considered correct.

	Employment			Work income		
	predicted	actual		predicted	actual	
	A	B	B-A	A	B	B-A
St-John's	6.9%	9.6%	2.7%			
Halifax	8.4%	8.9%	0.5%	13.4%	13.5%	0.1%
Moncton	7.1%	9.8%	2.7%	12.3%	16.2%	3.9%
Saint-John	6.6%	5.5%	-1.1%	13.1%	13.8%	0.8%
Québec	10.5%	10.4%	-0.2%	12.3%	14.3%	2.0%
Trois-Rivières	10.4%	7.5%	-2.9%	10.5%	10.2%	-0.3%
Montréal	9.7%	8.2%	-1.5%	10.5%	10.8%	0.3%
Ottawa-Hull	7.1%	6.5%	-0.6%	15.6%	12.0%	-3.6%
Kingston	8.8%	5.3%	-3.4%	14.3%	15.7%	1.3%
Toronto	6.8%	8.5%	1.7%	12.9%	12.5%	-0.4%
Hamilton	10.1%	6.4%	-3.6%	13.7%	12.0%	-1.7%
Kitchener	8.3%	10.0%	1.7%	13.5%	14.6%	1.0%
London	7.4%	8.0%	0.6%	12.9%	12.3%	-0.6%
Winnipeg	6.7%	4.9%	-1.7%	18.5%	15.3%	-3.2%
Saskatoon	8.8%	9.1%	0.3%	20.7%	23.4%	2.8%
Calgary	16.3%	15.7%	-0.7%	32.8%	32.8%	0.0%
Edmonton	16.6%	14.7%	-1.9%	32.0%	26.3%	-5.7%
Vancouver	8.5%	10.4%	2.0%	9.2%	10.6%	1.4%