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Abstract

Rich resource endowments can be a mixed blessing, spawning a literature on the 'resource curse' and associated Dutch Disease: high exchange rates driven by resource rents undermining the competitivity of national economies. This paper provides evidence that similar mechanics apply to local economies, examining 135 Canadian urban areas over time. A positive relationship is found between resource specialization and wages and negative with labour demand and education levels. Evidence of a crowding-out effect for non-resource manufacturing is weaker. The negative relationship with growth holds primarily for resource transformation rather than for resource extraction per se. Local economies dominated by large plants and high-paying blue-collar jobs face particular challenges.

Key Words:

Regional Development; Natural Resources; Regional Economics; Resource Curse; Dutch Disease

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Résumé

Malédiction des ressources naturelles et développement régional : *Le Mal néerlandais s'applique-t-il aux économies locales? Le cas du Canad*a

Historiquement, les dotations en ressources naturelles ont amenées des impacts mitigés aux économies nationales, donnant naissance à une littérature importante sur la Malédiction des ressources naturelles et le Mal néerlandais : Augmentation du taux de change poussé par les rentes provenant des ressources, entraînant une diminution de la compétitivité des économies nationales. Cet article met en évidence le fait que des dynamiques similaires s'appliquent aux économies locales en examinant 135 aires urbaines canadiennes sur plusieurs décennies. Une relation positive est observée entre la spécialisation dans le secteur des ressources naturelles et les salaires élevés. En contrepartie, une relation négative est observée entre cette spécialisation et la demande de main d'œuvre et le niveau d'éducation de la population locale. Cependant, les données témoignent d'un effet d'éviction faible pour le secteur manufacturier. Une relation négative est aussi observée entre la présence d'industries de première transformation et la croissance à long-terme, et de manière moindre dans le cas de l'extraction des ressources naturelles. Les économies locales dominées par des usines de grande taille offrant des salaires élevés font face à des défis particulièrement importants.

Mots clés :

Développement régional; Ressources naturelles; Économie régionale; Malédiction des ressources naturelles; Mal néerlandais

INTRODUCTION

An abundant literature has emerged on the so-called 'resource curse' (Boyce *et al* 2011, Buite and Damania 2005, Freeman 2009, Sachs and Warner 2001). Although definitions vary, the resource curse generally refers to the negative impacts of an abundance of natural resources on the long-term development of national economies. One of the mechanisms by which this occurs is the 'Dutch Disease', a term first coined by *The Economist* (1977) following the discovery of large natural gas deposits in Dutch territorial waters, driving up the value of the Dutch currency, in turn undermining the international competitivity of Dutch manufacturing. The term has since been applied generically to the economic modelling of the interplay between resource abundance and manufacturing (Beverelli and Del'Erba 2011, Krugman 1987). The question explored here is whether similar reasoning – high wages essentially replacing exchange rates - can be applied to local economies, looking at 135 urban areas in Canada over a thirty-five period. With the possible exception of Australia, no other large developed economy is as dependant on natural resources, which provide the principal economic base for a significant proportion of Canadian communities.

NATURAL RESOURCES AND LOCAL ECONOMIES: OVERVIEW

Systematic examinations of the impact of natural resource specialization on local economies are rare. Boyce *et al* (2011), looking at panel data for US states for the period 1970-2001, conclude that resource abundance is negatively correlated with growth rates but positively correlated with income levels. Also for US states, Freeman (2009) finds evidence that crowding out of the manufacturing sector contributes to the slower growth of resource-based economies. But, why should natural resources (a priori a source of wealth) hamper growth or crowd out industries at the *local* level? Exchange rate variations, at the heart of the Dutch Disease model, do not apply between regions within the same country (or monetary union). Among the more obvious answers are the ephemeral nature of 'resources' and the volatile nature of demand, often subject to booms and busts. Oil was not a 'resource' before the invention of the internal combustion engine. A resource advantage may disappear overnight as technology changes, as witnessed by the abandoned coal mines across North America and Europe as steam gave way to other forms of energy.

An adaptation of the Dutch Disease model to local economies is the 'Intrusive Rentier Syndrome' (Polèse 2009, Polèse and Shearmur 2006), which focuses the economic rents generated by resources and their possible disruptive effects. Gylfason (2001) also stresses the risks of rent-seeking, although his study focuses on national economies. The core question is: who captures the rent? Owners and shareholders, of course; governments may also take a share via royalties and taxes[1]. But, so can local workers by way of higher wages, consistent with Boyce's *et al* (2011), findings for US states. Polèse and Shearmur (2006) also observe a positive wage effect for resource-based communities in the province of Quebec. A related determining factor, they suggest, is the technology associated with resource extraction and transformation, which can facilitate high wages.

The dominant resource sectors in Canada have traditionally been logging and mining with attendant pulp and paper mills, smelters, and primary metal transformation (notably copper, iron ore, and alumina) and more recently oil and natural gas. A central feature of much resource transformation is large plant size together with capital intensive technologies where labour costs comprise only a fraction of total costs. The production of aluminium, for example, involves a costly process called electrolysis requiring vast quantities of electricity, far outweighing wage costs. In this case, the preponderant input is hydro-electric power, plentiful in many parts of Canada. Because of size, aluminum plants, smelters, and paper mills often come to dominate the economy of smaller communities, setting labour relations and wage expectations. The story of single industry resource towns is a recurring theme in Canadian local development literature (Barnes and Hayter 1994, Hayter 2000, Lucas 1971, Slack *et al* 2003).

The reasoning underlying the Intrusive Rentier model is fairly straightforward. The combination of resource rents *and* high capitalization allows firms to pay wages above what 'normal' market conditions and economic geography would predict. Large plant size also facilitates unionization. Labour unions, aware of the economics of the situation, will succeed in negotiating advantageous wage packages. One of the basic empirical regularities in economic geography is the positive correlation between urban size and wages. Polèse and Shearmur (2006) observe that the relationship breaks down in Canada for peripheral[2] cities in the 10,000-50,000 population range, with smaller cities exhibiting higher or equivalent wages to larger ones. The authors also note the apparent contradiction between high net out-migration and high wages for some resource communities, suggesting a global downward effect on local labour demand.

Several authors have considered the possible social and economic effects of rentier economies, which go beyond high wages. Rentier economies discourage young workers from looking elsewhere, specifically from starting up a business. Gaudreault (2011), looking at ninety-nine peripheral communities in Canada, finds a negative correlation between the rate of business start-ups and wage rates plus resource specialization. Starting up a business involves a choice (Glaeser *et al.* 2010), which will in part depend on the perceived returns to entrepreneurship compared in

1 If owners and shareholders reside outside the community, which is often the case for large resource corporations, then resource rents (in the form of profits and dividends) will have little effect on local demand. The same reasoning applies to revenues collected by senior levels of government.

2 The definition of 'peripheral' (i.e. distant from a major metropolitan area) is the same as that used in the present analysis, defined further on.

this case to going to work for a large well-paying plant. The presence of large and well-paying firms can also act as a disincentive for smaller firms to train young workers; for once trained they may leave for a better paying position in the larger firm (Polèse 2009). At a more pervasive level, Gylfason (2001) argues that natural capital may crowd out human capital. For nations, Gylfason (2001) observes a negative relationship between the share of natural capital in national wealth and various measures of educational attainment. Although not related to resources, Crofton and Anderson (2009), looking at Maryland counties, observe a link (although a weak one) between higher real minimum wages and higher school dropout rates both cases. Generalizing to the local level, it can be argued that the presence of well-paying blue-colour jobs that do not require post-secondary schooling acts as a disincentive to local youth to go on to college or to university. Whatever the causal process at work, the end result is a comparatively less educated and less skilled workforce. Agrawal *et al.* (2010) also argue that company towns may thwart innovation. Large firms tend to be more inward-looking than smaller ones.

Summarizing, the possible negative effects of large, highly capitalized, resource-based plants on local economies play out at two levels. *First*, they push up wages beyond what ‘normal’ market conditions warrant, making the community less competitive for export-oriented industries in non-resource sectors, crowding out industries that might otherwise have emerged. *Second*, they can produce labour markets and mindsets that discourage local entrepreneurship and act as a disincentive to higher education. The outcome, taking the worst-case scenario, is a skewed labour market with a restricted number of high-paying jobs, but with fewer jobs overall, a generally less educated population, and below average growth.

To end this section, our overview suggests that the Resource Curse is not solely a matter of resource rents and, indeed, that Resource Curse may not be the appropriate term at the local level. The culprit is not such much the presence of resources as the technology associated with their extraction and transformation, where the former is perhaps less of a ‘curse’ than the latter. Panning for gold or diamonds is not normally associated with big plants, nor is it necessarily inimical to entrepreneurship. Freelance lumberjacks and family sawmills are not unknown. Paper mills, however, are a different story, where technology imposes high capitalization and size. Technology also affects the ease with which the primary resource can be transported, determining whether the resource will give rise to transformation activities nearby. Where the production process is weight-losing (i.e. from ore to metal, logs to paper, etc…) primary transformation will normally take place close to the resource[3], but not necessarily the case for more transportable resources such as crude oil.

3 A basic principle of industrial location theory, enunciated more than a century ago by Alfred Weber (1909).

In the analysis to follow, we distinguish between resource industries per se (extraction) and primary (first stage) transformation, where the former is classified as being in the primary sector and the latter in manufacturing.

DATA AND METHODOLOGY

The data are drawn from five censuses of Canada (1971, 1981, 1991, 2001, 2006), based on special Statistics Canada tabulations. To ensure comparability over time, urban areas only are examined, defined as urban places with a population of at least 10,000 in 2006[4]. These are either Census Agglomerations or Census Metropolitan Areas as defined by Statistics Canada, distinct labour markets delineated by commuting patterns. Smaller spatial units are excluded because boundary changes make direct comparisons impossible. Boundary changes, generally minor, do not significantly affect values for urban areas. The urban dataset has 135 observations, accounting for 81% of Canadian employment in 2006.

Industry classes are standardized over time. In 1997, Canada introduced NAICS (North American Industrial Classification System), changing from the previous SIC (Standard Industrial Classification). The initial pre-1996 dataset contained 141 SIC-coded industry classes. The updated dataset has 126 industry classes, recoded to match NAICS. Minor discrepancies undoubtedly remain. We are confident, however, that the industry classes used here are consistent over time.

The first task is the definition of industry classes in the resource sector. Two classes are defined. The basic datum is employment (i.e. total employment in the industry). Precise industry definitions and NAICS codes are given in Appendix 1. The first class identifies *Extractive* industries as such: mining, logging, drilling, etc. Agriculture and fishing are not included although also in the primary sector because not generally considered in the Resource Curse literature, in part because less prone to boom and bust and associated with different life styles and work cultures. The second resource class identifies *Primary Transformation* manufacturing industries; specifically, the transformation of trees into lumber, pulp and paper, and other basic wood products and the transformation of metallic ores (including alumina) into ingots and other basic metal products. The wood products class includes saw mills. Oil refining and petrochemicals are excluded because, as noted earlier, they are not necessarily subject to Weberian weight-loss constrains. Much of the oil refined in Eastern Canada is imported from abroad, while the majority of crude oil produced in the West, specifically in Alberta, is exported to the US and overseas.

4 There are two exceptions to this rule: Kitimat, BC, and Kapuskasing in Northern Ontario with populations, respectively, of 8,950 and 8,350 in 2006. Both are in the historical dataset; both had populations above 10,000 in 1971, but have declined since.

Appendix 1 also identifies a third class named *Footloose Manufacturing*. These are industries whose location is not necessarily tied to the presence of nearby resources. They cover a broad range of manufacturing, going from low-tech industries such as clothing to more high-tech industries such as pharmaceuticals and optical equipment. However, the majority fall into the middle range, with the automotive sector a major player. Such industries, generally large consumers of space and not necessarily in need of a university-educated labour force, are typically drawn to mid-sized cities where land and labour costs are lower (Henderson 1997, Polèse and Shearmur 2006a). By the same token, such industries, we may assume, are most prone to being crowded out by high-wage resource industries. We would thus expect employment in this footloose group to be negatively correlated with employment in resource industries.

The methodology employed here is fairly straightforward, emphasizing facility of interpretation and conceptual coherence[5]. Five standard OLS regression models are applied to test for the impacts of resource specialization on local economies. Each model focuses on a specific posited impact (the dependant variable), respectively: relative wage rates, local labour demand, educational levels, crowding-out, and employment growth. If the Intrusive Rentier behaves as expected, then resource specialization should push up relative wage rates, depress local labour demand, depress educational levels, crowd out footloose manufacturing, and depress growth. Each model is applied to census years between 1971 and 2006. In each, the two resource industries enter as independent variables together with a set of control variables. The two resource variables are expressed in relative terms, using location quotients[6]. The sole exception is model 4 (Crowding-out Model), where the dependant variable is the location quotient (LQ) for footloose industries, raising problems of endogeneity and colinearity; the value of one LQ is necessarily affected by the value of others. In Model 4, the resource variables are thus expressed in total employment terms.

The five models are the outcome of numerous iterations; notably, to eliminate colinearity or multicolinearity problems where possible. The two resource variables were found to be weakly correlated (not statistically significant), allowing for their entry into the models as separate variables[7]. This result is surprising at first sight, suggesting that although resource extraction and transformation may be linked, they do not necessarily occur in the same locations, which a priori runs counter to Weberian weight-loss reasoning. One explanation, specifically for aluminum smelting, is that the location of the primary resource input – hydroelectric power generated by large dams – falls outside our study universe, since only rarely (if ever) located within the

5 The authors are not econometricians, necessarily staying within the bounds of statistical models with which they feel sufficiently at ease.

6 We assume that the reader is familiar with the location quotient measure. In a nutshell, the quotient is the ratio of the % of employment in industry x locally over the % of employment in industry x at the system level.

7 Thus, in Model 1 (Wage Model) was also run twice with each resource variable entered without the other. The impact on beta coefficients was barely visible.

confines of urban areas. Also, as noted earlier, oil refining was excluded from the primary transformation sector, meaning that there is no a priori reason why oil extraction should co-locate with the former.

For other variables, some level of colinearity is unavoidable, a reflection of the intertwined nature of relationships, but does not invalidate the models. Thus, on Model 1(Wage Model), the urban size variable (TOTAL) shows no significant relationship with urban size (except barely in 1971), which at first sight is counter-intuitive as one would normally expect average wage rates to be a positive function of size. However, the attributes of urban size are in part subsumed in other variables, notably the wage and centre-periphery variables. On the other hand, the absence of strong link with size is consistent with Polèse and Shearmur (2006) who, let us recall, found the wage-urban size relationship to be weak in Canada, precisely because of the interference of the resource industries.

In each model, the purpose of the other independent variables is to act as control variables for the two resource variables. The inclusion criterion is the variable's posited causal relationship with the dependant variable. Thus, in Model 5 (Growth Model) one would normally expect employment growth to be a positive function of education levels, given the literature on the positive relationship between education and growth (Glaeser 1994, Glaeser and Saiz 2003). The east-west and the centre-periphery dummies are in the model to account for, respectively, the continuing westward shift in the Canadian population and the draw of central locations in and near the largest urban areas (Shearmur and Polèse 2007). Accessibility to US markets has equally been found to be associated with growth; thus the introduction of an accessibility variable borrowed from Apparico *et al*. (2007).

The five models are by no means exhaustive, being largely limited by the availability of data. We would have liked to introduce variables on establishment size and on business start-ups, but neither is systematically available over the thirty-five period examined. The variables used in the five models are defined below with additional explanations where appropriate:

- TOTAL: *Urban Size Variable.* Total employment of the urban area for the given year.
- CP: *Centre-Periphery Dummy*. Urban areas are classified as 'peripheral' if located more than a ninety-minute journey (by road) from a major urban with a population over 500,000. Major urban areas and smaller urban areas within a ninety-minute journey are classified as 'central'.

- WAGE. *Wage Rate Variable*. Average yearly earnings per employed worker for the given year, expressed each year as an index compared to the system average.
- LFPR. *Labour Market Variable*. Labour force participation rate in the given year: total employment over total population aged 15 to 64, expressed as an index compared to the system average.
- UN. *Education Variable*. % population aged 15 and over with at least a Bachelor's degree for the given year, expressed as an index compared to the system average
- EW. East-West Dummy. All observations east of the Manitoba / Ontario boundary are classified as 'East'; those to the west as 'West'.
- GW. *Growth Variable*. Employment growth (in %) in the subsequent or the previous period, depending on the model. Thus, in model 2 (Labour Market Model), we posit that LFPR in t1 is positively influenced by employment growth in the previous period (GW t-1).
- ACC. *Accessibility variable*. This variable is taken from Apparico *et al*. (2007), to which the reader is referred for a detailed explanation. Using a gravity-model approach, continental market potential is calculated for Canadian spatial units based on road travel-time distances (primarily) and population data (2001) for all US counties and Canadian equivalents. Note that the North American road and highway networks have not notably changed over the period studied.
- LQTFL. *Footloose Manufacturing*. Location quotient (LQ) for employment in footloose industries, defined in Appendix 1, for the given year.
- LQEXTR. *Extractive Industries.* Location quotient (LQ) for employment in extractive industries, defined in Appendix 1, for the given year.
- LQTRAN. *Primary Resource Transformation.* Location quotient (LQ) for employment in primary resource transformation manufacturing, defined in Appendix 1, for the given year.
- The last two variables are also expressed as employment totals, respectively EXTRAC and TRANSF, in Model 4.
- AUT *Automotive Industry*. Location quotient (LQ) for employment in the automotive sector: NAICS codes 3361, 62 and 63 in Appendix 1. AUT is entered as an alternative variable where the base model shows heteroskedasticity, further explained below.

The principal methodological limitation is the presence of endogeneity in Models 1 and 3 (Wage and Education models). In each case, the dependant variable – WAGE, UN – is also in part implicit in the two independent resource variables, LQEXTR and LQTRAN. If workers in TRANSF or EXTRAC have higher wages on average they will necessarily drive up WAGE for the entire community. In Model 4 (Crowding-out Model), the risk of endogeneity was eliminated by expressing TRANSF and EXTRAC in total employment terms rather than location quotients, while including TOTAL as a control variable. This is not possible for Models 1 and 3. However, we are confident endogeneity does not fundamentally invalidate the two models, given the small weight of the two resource sectors in total employment. Employment in EXTRAC and TRANSF accounted for, respectively, 1.3% and 1.5% of total system employment in 2006; the respective medians were 1.1% and 2.0%.

Finally, White's test for heteroskedasticity (White 1980) was applied to the residuals of the five models (always for the most recent year) and found to be un-problematic for models 2, 4, and 5. After an examination of residuals for Models 1 and 3 new regressions were undertaken with AUT as alternative variable; results are shown on the appropriate tables. However, in neither case did this invalidate the conclusions drawn from the base model. In both cases, the beta coefficients for the two resource variables are stronger, as we shall see, and largely unchanged for the control variables.

Table 1 – Models 1 and 2

Model 1 - Wage Model	**1971**	**1981**	**1991**	**2001**	**2006**	*Alt 2006*
Dependant Variable = WAGE	Adjusted R^2					
	**0.393	**0.559	**0.553	**0.478	**0.609	***0.679*
Inddependant Variables	*Standardized beta coefficients*					
Population (TOTAL) / ***replaced by AUT in Alt 2006***	*0.193	*0.131	0.10	0.08	-0.02	***0.292*
Centre-Periphery Dummy (CP)	0.13	0.04	0.12	*0.204	**0.213	*0.114*
B.A. Degree or Higher (UN)	*0.225	*0.173	**0.410	**0.535	**0.589	***0.602*
LQ Extractive Industries (LQExtr)	**0.478	**0.362	**0.583	**0.541	**0.710	***0.743*
LQ Primary Transformation (LQTrans)	**0.441	**0.468	**0.586	**0.479	**0.347	***0.376*
East-West Dummy (EW)	-0.02	**-0.282	0.013	-0.090	-0.068	*-0.109*
Employment Growth in Previous Peried (GwT-1)	N.D.	**0.220	*0.151	-0.048	0.060	*0.034*
Model 2 - Labour Market Model	**1971**	**1981**	**1991**	**2001**	**2006**	
Dependant Variable = LFPR (Labour Force Participation Rate)		Adjusted R^2				
		**0.442	**0.521	**0.501	**0.439	
Inddependant Variables		*Standardized beta coefficients*				
Wage Rate (Wage)		-0.169	**0.286	**0.247	**0.261	
Centre-Periphery Dummy (CP)		**0.285	**0.218	**0.257	**0.234	
Population (Total)		*0.180	0.040	-0.028	-0.052	
Extractive Industries (LQExtr)		-0.077	**-0.341	*-0.166	*-0.203	
Primary Transformation (LQTrans)		*-0.189	**-0.424	**-0.403	**-0.261	
Employment Growth in t - 1 (GwT-1)		0.040	*0.171	**0.293	**0.290	
East-West Dummy (EW)		**-0.583	**-0.402	**-0.237	**-0.314	

**Significant at 0.00, * at 0.05

RESULTS

Results are presented in stages, moving from Model 1 to Model 5 (Tables 1-5).

Wage Model

The results for the Wage Model are consistent with expectations. The most significant relationships (beta coefficients) hold over the entire thirty-five year period. When controlling for education and geography variables[8], resource specialization has a consistently strong upward impact on local wages. This holds for both resource-based industries, but is generally stronger for extractive activities, especially for the most recent period. The first condition of the Dutch Disease is thus fulfilled. Resource specialization drives up wages (recalling, however, the presence of endogeneity).

The control variables generally behave as expected. Education is positively associated with wage rates over the entire period, with an increasingly strong positive association since the 1980s, a reflection we may reasonably assume of the shift in labour demand towards more knowledge-intensive industries. The relationships for the two geography variables are less systematic. The East-West dummy generally exhibits a negative coefficient, mirroring the continuing shift west in the Canadian economy (including well-paying jobs), but is rarely significant. The positive coefficients for the two most recent periods for the centre-periphery dummy (CP) also come as no surprise, a reflection of the concentration of high-order services and high-tech industries in large and mid-sized cities, notably in the greater Toronto-Montreal-Ottawa triangle (Bourne 2011).

To test for possible biases or missing values, residuals were examined for the most recent model (2006). The application of White's test revealed a low but nonetheless significant level of heteroskedasticity. An inspection of the residuals revealed two patterns (Appendix 2), neither of which is surprising given the social and economic geography of Canada. Among the nineteen urban areas with (standardized) residuals one standard deviation *below* unity, eleven were in Québec and one a largely French-speaking city in New Brunswick. Francophones are, on average, geographically less mobile than the rest of the Canadian population, with Quebecers specifically exhibiting lower rates of inter-provincial migration (Coulombe 2006, Coulombe and Tremblay 2007), producing a captive labour market with a predicable downward pressure on wages.

On the positive side, of the eighteen observations registering residuals of more than one standard deviation *above* unity, nine were industrial cities in Southern Ontario, many with strong specializations in the automotive sector, among which Windsor, Oshawa, and Barrie (Bourne *et*

8 The accessibility variable was introduced in other iterations of the model, but never significant.

al. 2011). The first lies across from Detroit and the second is home to the largest General Motors plant in Canada. The automotive industry, like TRANSF, is characterized by large plants, intermediate-level skills and, as the positive residuals suggest, also by high wages (and high unionization). Resource industries, in sum, are not the only blue collar sector of the economy that drives up wages. To test whether these two missing variables affect the beta coefficients for LQEXTR and LQTRAN, three alternative regressions were undertaken, one in which a French-English dummy[9] replaces TOTAL, a second with AUT as an alternative variable, and a third with both in the model. The introduction of both brings up the r-square to 0.728; but, the second alternative was found to be more effective in bringing down heteroskedasticity. The results for the second alternative model are shown on table 1[10]. More to the point, in all three cases the introduction of new variables reinforces the beta coefficients for LQEXTR and LQTRAN, evidence of a *distinct* upward impact on wages. The AUT variable also exhibits a positive sign, as expected, but not as strong.

Labour Market Model[11]

The labour market model is, statistically speaking, the 'cleanest' with no revealed endogeneity or heteroskedasticity, and also the most central to our argument. If, as posited, resource specialization drives up wages above what 'normal' market conditions warrant, then we should observe a negative relationship with labour force participation rates (LFPR). High wages for some should drive down the overall ability of the local economy to absorb workers. The results on Table 2 suggest that that is indeed what is happening. The beta coefficients for LFPR are consistently negative and significant over the entire period (barring one observation) for both resource industries.

The negative relationship is considerably stronger for primary transformation manufacturing than for extractive industries, suggesting a more complex relationship than that posited, purely, via high wages. The principal factor depressing local labour absorption is not, it appears, resource extraction *per se* – even with a high wages - but other industry attributes. Plant size naturally springs to mind, recalling the literature on company towns and associated impacts on career choices and on labour relations. As suggested earlier, the technology of resource transformation, as distinct from extraction, tends to favour large plants, certainly in the case pulp and paper

9 Majority French-speaking cities (2006 Census) were given the value 1; all others 0.

10 The EW and the French-English dummies are positively correlated (0.445), as one might expect; this also argues against keeping both in the model.

11 The education variable (UN) is excluded due to high colinearity with the wage variable. When introduced, the wage variable ceases to be significant.

production and smelting. We lack data on establishment size by detailed industry class. However, average establishment size for the Canadian manufacturing sector as a whole is considerably higher than for the primary sector (CIS 2011)[12].

The coefficients for the control variables are again generally consistent with expectations. Higher wages are *positively* associated with LFPR since 1981; that is, once the effects of resource-based industries are controlled for. The coefficients for central locations are consistently positive, and also for employment growth in the previous period after 1981. The overall picture, in sum, is generally coherent: once resource industries are controlled for, labour force participation rates are generally higher in urban areas that are central (which include the largest), exhibit higher wages, and where employment has grown more rapidly.

However, the strongest consistent beta coefficients are for the East-West dummy; systematically negative, which tell a different story. Western Canadians are traditionally more geographically mobile than Easterners; a legacy of the more recent colonization of the West, compared to the generally older settlements in East where language divisions further reduce mobility. When job opportunities decline, Westerners are more inclined to move, driving up labour force participation rates. The negative coefficients for EW also suggest a parallel process at work. The West is generally more specialized in extraction and the East in manufacturing. It may well be that workers in mining, oil and gas exploration, and logging are ‘naturally’ more mobile, a legacy of resources that are more often non-renewable and more prone to booms and busts. ‘Fly-in fly-out’ mining, drilling, and logging camps are not uncommon. Long-distance commuting, often by air, is part of the industry work culture; very different from the work culture in large primary transformation manufacturing plants with high (sunk) capital investments. We should thus expect career expectations to be different in the former and the latter. If so, this may in part explain the lower coefficients for the extraction sector. In short, where labour is geographically mobile, the posited negative local effects of the Dutch Disease on labour force participation (and thus also on unemployment) will be reduced and perhaps even eliminated.

12 Manufacturing, establishments with one hundred employees or more accounted for some 7% of total establishments, compared to 3.8 % for mining and oil and gas extraction, and 0.5% for fishing, forestry, and agriculture: 2010 figures (CIS 2011).

Table 2 – Labour Market Model (2006) Standardized Residuals

Residuals above 1 Standard Deviation					Residuals below 1 Standard Deviation			
East-West (EW)	*Centre-Periphery*	Urban Area	*Standard Residuals*		East-West (EW)	*Centre-Periphery*	Urban Area	*Standard Residuals*
West	*Periphery*	Swift Current	2.49		East	*Periphery*	Cape Breton	(3.44)
West	*Periphery*	Estevan	2.40		East	*Periphery*	Elliot Lake	(3.39)
East	Central	Sainte-Marie	2.14		East	*Periphery*	Grand Falls	(3.00)
East	*Periphery*	Huntsville	1.66		East	*Periphery*	Corner Brook	(2.21)
East	Central	Stratford	1.59		West	Central	Chilliwack	(1.98)
East	*Periphery*	Moncton	1.49		East	*Periphery*	Campbellton	(1.82)
East	Central	Saint-Georges	1.45		East	*Periphery*	Gaspé	(1.81)
East	Central	Saint-Hyacinthe	1.44		East	Central	Windsor	(1.55)
East	*Periphery*	Bracebridge	1.39		East	Central	Cornwall	(1.40)
East	*Periphery*	Kenora	1.32		West	Central	Abbotsford	(1.33)
East	*Periphery*	Fredericton	1.28		West	*Periphery*	Terrace	(1.32)
East	*Periphery*	Baie-Comeau	1.24		East	*Periphery*	La Tuque	(1.24)
East	Central	Québec	1.20		West	*Periphery*	Courtenay	(1.23)
West	*Periphery*	Victoria	1.17		West	*Periphery*	Prince Rupert	(1.20)
East	Central	Thetford Mines	1.16		West	*Periphery*	Duncan	(1.16)
East	*Periphery*	Halifax	1.16		East	Central	Oshawa	(1.12)
East	*Periphery*	Charlottetown	1.12		East	Central	Barrie	(1.04)
West	*Periphery*	Regina	1.11		West	*Periphery*	Portage la Prairie	(1.00)
East	*Periphery*	Edmundston	1.10		West	*Periphery*	Prince Albert	(1.00)
East	*Periphery*	Owen Sound	1.09					
West	*Periphery*	Brandon	1.03					

Inspection of residuals (2006) and White's test found no evident bias, although the three most negative residuals did stand out. Table 2 shows the urban areas with the highest and lowest residuals (standard deviations greater then unity) with their 'centre-periphery' and 'East-West' status. No obvious geographic pattern emerges. On the positive (residual) side, the five highest observations are, respectively, a small agricultural Prairie town (with also some extraction), a another small Prairie town, specialized in coal and potash mining, a small industrial city south of Quebec City, a resort town in Toronto's cottage country, and finally a small Ontario city best known for its Shakespeare festival. Note also that the sixth in line - Moncton- is a mid-sized city in the Maritime Provinces, a regional communications and distribution hub (Bourne *et al*. 2011). A fairly mixed lot, in sum.

The negative residuals are more revealing, bringing home the role of specific shocks, difficult to integrate into a general model. The first two, Cape Breton and Elliott Lake, are mining towns, respectively in coal and uranium, both of which have seen mines close over the last decades. In both cases, the labour market effects of those closures seem to linger long after the mines have closed. Pulp and paper mills provide the main economic base for the next two, Grand Falls and Corner Brook. The mill has closed in the former and the latter has witnessed important lays-offs. Both are on the Island of Newfoundland. Cape Breton is also an island community. All have a reputation of being communities with a strong sense of place, recalling our earlier point on the impact of geographic mobility. All are in Eastern Canada. However, Chilliwack, the fifth most negative residual, does not fit the mould, a chiefly agricultural community in British Columbia, for which we found no obvious explanation.

The majority of the remaining observations on the negative side of Table 2 are urban places specialized in one or both of the two resource sectors, reinforcing the negative relationship with labour force participation, even beyond what the model predicts. The negative side of table 2 also includes three industrial cities in Southern Ontario which we met earlier: Windsor, Oshawa, and Barrie. Their presence on Table 2 again demonstrates that resource rents are not the sole possible culprit. What matters, it would appear, is a combination of factors: high wages, large plants, and comparatively low skill levels, which opens the door to Model 3.

Table 3 – Models, 3, 4, and 5

Model 3 - Education Model	**1971**	**1981**	**1991**	**2001**	**2006**	*Alt 2006*
Dependant Variable = UN (% of Population 15 Years and over with at least a Bachelor's Degree)			Adjusted R^2			
	**0.271	**0.300	**0.481	**0.536	**0.613	**0.639
Independent Variables			*Standardized beta coefficients*			
Population (Total)	**0.290	**0.341	**0.292	**0.322	**0.335	**0.291
Centre-Periphery Dummy (CP)	0.05	0.004	-0.138	*-0.176	**-0.200	*-0.134
Wage Rate (Wage)	**0.269	**0.289	**0.533	**0.476	**0.592	**0.662
Extractive Industries (LQExtr)	**-0.243	*-0.218	**-0.430	**-0.398	**-0.583	**-0.651
Primary Transformation (LQTrans)	**-0.302	**-0.374	**-0.527	**-0.482	**-0.399	**0.429
East-West (EW) / ***replaced by AUT in Alt 2006***	-0.14	-0.037	-0.045	0.031	0.005	*0.189

Model 4 - Crowding-out Model	**1971**	**1981**	**1991**	**2001**	**2006**
Dependant Variable = LQFTL (Location Quotient: Footloose Industries)			Adjusted R^2		
	**0.521	**0.547	**0.519	**0.538	**0.527
Independent Variables			*Standardized beta coefficients*		
Centre-Periphery Dummy (CP)	**0.621	**0.584	**0.640	**0.652	**0.655
Population (Total)	0.101	0.086	0.137	0.184	0.164
Extractive Industries (Extrac)	-0.089	-0.08	-0.094	-0.090	-0.089
Primary Transformation (Transf)	-0.066	-0.056	-0.143	-0.212	-0.196
Wage Rate (Wage)	-0.052	**-0.218	-0.059	-0.034	-0.037
East-West Dummy (EW)	**0.226	*0.134	**-0.194	**0.218	**0.203
B.A. Degree or Higher (UN)	-0.104	-0.091	-0.69	-0.080	-0.062

Model 5 - Growth Model	**1971**	**1981**	**1991**	**2001**	**2006**
Dependant Variable =GwT+1 (Employment Growth [%] in Subsequent Period)			Adjusted R^2		
	**0.224	**0.306	**0.174	**0.448	
Independent Variables			*Standardized beta coefficients*		
Population (Total)	-0.046	-0.154	-0.069	-0.069	
Centre-Periphery Dummy (CP)	-0.111	0.088	0.187	*-0.187	
East-West Dummy (EW)	**-0.390	0.055	**-0.338	-0.116	
B.A. Degree or Higher (UN)	0.020	**0.319	0.018	-0.061	
Extractive Industries (LQExtr)	*0.209	-0.117	-0.130	**0.334	
Primary Transformation (LQTrans)	*-0.160	**-0.241	-0.146	**-0.363	
Continental Market Accessibility (ACC)	*0.192	**0.321	0.143	**0.584	

**Significant at 0.001, *at 0.05.

Education Model

For the education model - Model 3 – the results are again largely as expected, although the negative impacts of resource specialisation are now much stronger (recall however the risks of endogeneity). The results are very robust, significant for all periods for both resource sectors with a general tendency for stronger relationships for more recent years. Simply put, an increase in relative resource specialisation drives down the share of college graduates in the local population relative to other places.

Before commenting this result further, let us rapidly review the control variables. The size variable is now systematically positive, while the centre-periphery variable ceases to be significant in earlier years and turns negative in more recent years. This is consistent with other work on the Canadian urban system (Bourne *et al*. 2011; Polèse and Shearmur 2006a). The dual positive relationship with size and peripherality (corollary of the negative sign for CP) is a reflection of Canada's vast territory, federal nature, and the workings of central place theory. Mid-sized regional central places, often provincial capitals and / or home to large regional universities, will have above average shares of college graduates. Examples are Fredericton NB, Halifax NS, and Victoria BC. Summing up, the share of B.A. holders is positively associated with urban size, regional central places, and wage rates. Once these (and the resource) variables are accounted for, the East-West split no longer matters.

The examination of residuals and White's test revealed only mild heteroskedasticity; largely eliminated once AUT is introduced, replacing EW. Again, the outcome is a strengthening of the negative relationship with the two resource variables. The strength of the relationship supports the hypothesis, discussed earlier (Gylfason 2001), that the impact of resource specialization on education levels may be more pervasive than the direct labour demand effect: where high wages can be earned with low levels of education, the incentive, generally, to study or stay in school is reduced. The results for the alternative model again show that the negative relationship is necessarily not limited to the resource sector. The coefficient for AUT is also negative, but again weaker than for the two resource sectors.

Crowding-out Model[13]

The results for the crowding-out model reveal no statistically significant relationship between employment in footloose industries, as defined above, and the two resource sectors. This holds over the entire period. The signs go in the expected direction (always negative), but never fulfil the significance criterion. The existence of a specific industry crowding out-effect cannot be rejected; but is largely swamped, it seems, by other factors. For footloose manufacturing, location

13 Model 4 revealed no significant sign of heteroskedasticity. AUT is necessarily excluded as already contained in the dependant variable.

visibly trumps all other considerations. The centre-periphery variable is systematically strongly positive, followed by the East-West variable. This, again, is consistent with work on the location of economic activity in Canada (Bourne *et al*. 2011, Polèse and Shearmur 2006a). Manufacturing in Canada, as elsewhere, tends to cluster in medium-sized cities within easy reach of large metropolitan areas and, specifically in and near Toronto and Montreal with the highest concentrations in Southern Ontario and Southern Quebec.

The weakness of the posited crowding-out relationship with resource industries is less surprising once the geography of footloose industries in Canada is considered. In many cases, the two are not competing in the same market. Resource industries are more often present in peripheral locations distant from major metropolitan markets. For such locations, it is difficult to argue that they are crowding out (footloose) industries that in any case would not have chosen to locate there. Crowding-out only applies where the two industry groups are in competition for the same locations. Such competition cannot be ruled out, but does not uniformly apply across Canada, given the vastness of its inhabited space. The two resource industries are as one would expect negatively correlated with the centre-periphery dummy, but the relationship is not strong[14], signifying that these industries are not totally absent from central locations. That is where the two industry groups are truly competing.

An alternative, complementary, explanation is possible for the weakness of the crowding-out relationship with footloose manufacturing. As in the case of education, it may well be that the true crowding-out effect is more pervasive, not simply limited to what we have termed footloose manufacturing. The negative indirect effects on entrepreneurship, innovation, and business start-ups suggested in the literature apply to all sectors of the local economy. By the same token, the wage and education effects observed above are not necessarily limited to footloose manufacturing, affecting the competitivity of the local economy as a whole, including the resource sector, which bring us to the last model.

Growth Model

The results for the growth model demonstrate the difficulties of explaining local employment growth with a limited number of variables but also, and more to the point, the difference between extractive industries and resource-based manufacturing. The relatively low and fluctuating r-squares over the four time periods, although always significant, reflect the weight of small communities (of the 135 urban areas, 79 had populations below 50,000 in 2006 and 45 below 25,000), naturally more prone to employment fluctuations; but also the exposure of Canada's resource-based economy to booms and busts. Thus, the oil-led resource boom of 1970s,

14 For LQEXTR and LQTRAN the correlation coefficients (2006) with CP were respectively -0.373 and -0.214, both statistically significant.

following the first major oil shock, is reflected in the negative coefficient for East-West dummy and the positive coefficient for LQEXTRC. The following decade shows almost the opposite relationship.

The two resource sectors affect local employment growth differently. For extractive industries the relationship apparently boils down to boom and bust. The beta coefficient is positive for two periods (and significant) and negative for two others (but below the required significance level). The picture for primary transformation manufacturing is different. The coefficients are systematically negative, suggesting that the effect is also structural, going beyond resource demand cycles. Resource extraction sometimes delivers above-average growth (that is, during periods of high resource demand)…but resource-based manufacturing seldom does. Whether this is the outcome of the interplay between high wages, large plants, intermediate skill levels, and the behavioural impacts posited in earlier discussions, we can only speculate. Finally, the introduction this time of AUT was not significant[15], suggesting that the negative relationship with growth is a distinct attribute of primary transformation manufacturing.

Conclusion

Looking at 135 Canadian urban areas over a thirty-five year period (1971-2006) we find evidence that the Dutch Disease also holds for local economies; but with important caveats. As in national economies with rich resource endowments where resource rents drive up exchange rates, so in local economies resource specialisation may drive up local wages. In local economies, high wages replace high exchange rates as the first conduit by which competitivity is impacted. We found a strong positive relationship, controlling for other variables, between wages and specialization in resource extraction (drilling, mining, forestry, etc.) and in primary resource transformation (paper mills, aluminum and metal ores smelting, etc.). The first condition of the Dutch Disease thus holds for local economies as well.

The Dutch Disease postulates that high costs, whether mediated through exchange rates or wages, in turn reduce competiveness (specifically, in other export sectors), crowding-out such industries, depressing overall labour demand, and jeopardizing long-term growth. All three effects are visible in resource-dependant Canadian urban areas, but with varying intensities. The relationship between resource specialisation and depressed labour demand (as measured by lower labour force participation rates) was found to be strong. The evidence for a crowding-out of ‘footloose’ manufacturing was weak, but with the relationship nonetheless going in the expected direction. In both cases, the relationship was generally found to be stronger for primary resource transformation manufacturing than for resource extraction per se. A strong negative relationship

15 Given the fluctuating nature of results for Model 5, AUT was introduced for all years. The beta coefficient was never significant.

with local education levels was also observed, a sign that these are generally low to middle-level skill sectors. Finally the negative relationship with employment growth was confirmed, but held only for primary resource transformation manufacturing.

The difference between the observed impacts of resource *extraction* and of resource-based *manufacturing* suggests two different processes at work. The strongest negative effects are associated with primary transformation (manufacturing). What matters, this suggests in turn, is not so much the presence of rich resource endowments – producing high rents and high wages - but the technology associated with resource extraction and transformation, including transportation. Where unit transport costs for the primary resource are low (oil, natural gas, etc.), little transformation will take place locally. The disruptive local impacts will be limited to a pure price (wage or exchange rate) effect posited by the Dutch Disease. At the local level, the evidence for Canada suggests that this produces classical boom and bust economies, but with no necessary systematic effect on long-term growth. In addition, if labour is geographically mobile, the disruptive effects on local labour markets are reduced.

However, the outcome will be different, our findings suggest, where the resource is associate with large scale, highly capitalized, installations with high sunk costs, typical of much resource-based manufacturing and mining. If these are low-to-middle skill industries, as is often the case, the combination of high wages and low educational levels can produce a work culture and outlook inimical to growth in more indirect ways. High value-added / high wage industries are a priori a good thing for local economies (certainly for the workers so favoured), but where these are significantly above what the local economy would otherwise warrant, they can act as a disincentive to pursuing higher schooling and to business start-ups. For budding firms in other (export) industries, finding and holding on to skilled employees becomes a major challenge. This, we argue, is where the *local* effects are potentially the most damaging, different from the pure price effect posited by the Dutch Disease. They are also more difficult to remedy.

REFERENCES

AGRAWAL, A., COCKBURN, I. and C. ROSWELL. 2010. Not Invented Here? Innovation in company towns. *Journal of Urban Economics*, 67 (1): 78-89

APPARICO, P., DUSSAULT, G., POLÈSE, M. and R. SHEARMUR. 2007. *Transport Infrastructures and Local Economic Development. A Study of the Relationship between Continental Accessibility and Employment Growth in Canadian Communities, 1971-2001*. INRS, Montreal: http://projetic.ucs.inrs.ca/

BARNES, T. J. and R. HAYTER. 1994. Economic Restructuring, Local Development and Resource Towns: Forest Towns in Coastal British Columbia. *Canadian Journal of Regional Science,* 17: 289-310

BOURNE, L. S., BRUNELLE, C., POLÈSE, M. and J. SIMMONS. 2011. Growth and Change in the Canadian Urban System in BOURNE, L. S. *et al* (eds.), *Canadian Urban Regions. Trajectories of Growth and Change*, Oxford University Press

BOYCE, J. R. and J. C. H. EMERY. 2011. Is a negative correlation between resource abundance and growth sufficient evidence that there is a "resource curse"?, *Resources Policy*, 36 (1): 1-13

BEVERELLI, C., DELL'ERBA, S. *et al*. 2011. Dutch disease revisited. Oil discoveries and movements of the real exchange rate when manufacturing is resource-intensive, *International Economics and Economic Policy*: 1-15

BULTE, E. H., DAMANIA, R. *et al*. 2005. Resource intensity, institutions, and development, *World Development*, 33(7): 1029-1044

CIS. 2011. *Canadian Industry Statistics-Establishments by Employment Size Category and Sector*, Industry Canada, Ottawa : www.ic.gc.ca/eic/site/cis-sic.nsf/eng/h_00012.html#est3

COULOMBE, S. 2006. Internal Migration, Asymmetric Shocks, and Interprovincial Economic Adjustments in Canada, *International Regional Science Review*, 29 (2) 199-223

COULOMBE, S., and J.-F TREMBLAY. 2007. Skills, Education, and Canadian Provincial Disparity, *Journal of Regional Science*, 47.5: 965-991

CROFTON, S. O., ANDERSON, W. L. *et al*. 2009. Do higher real minimum wages lead to more high school dropouts? Evidence from Maryland across races, 1993-2004. *American Journal of Economics and Sociology*, 68(2): 445-464

ECONOMIST, The. 1997. The Dutch Disease, *The Economist*, November 26: 82-83

FREEMAN, D. G. 2009. The 'Resource Curse' and regional US development, *Applied Economics Letters*, 16(5): 527-530

GLAESER, E. L. 1994. Cities, Information, and Economic Growth, *Cityscape*, 1 (1): 9-77

GLAESER, E., ROSENTHAL, S. and W. STRANGE. 2010. Urban economics and entrepreneurship, *Journal of Urban Economics*, 67 (1): 1-14

GLAESER, E. and A. SAIZ. 2003. The Rise of the Skilled City, *Discussion Paper No. 2025*, Harvard Institute of Economic Research, http://post.economics.harvard.edu/hier/paper_list.html

GAUDREAULT, S. 2011. *Le syndrome du renier encombrant: Une évaluation de la situation au Canada* (The intrusive rentier syndrome: An evaluation for Canada), Master's Thesis, Department of Economics, University of Quebec at Montreal

GYLFASON, T. 2001. Natural resources, education, and economic development, *European Economic Review*, 45(4-6): 847-859

HAYTER, R. 2000. Single Industry Resource Towns, in SHEPPARD, E. and T. J. BARNES (Eds) *A Companion to Economic Geography*, pp. 290-308. Blackwell, Oxford.

HENDERSON, J. V. 1997. Medium sized cities. *Regional Science and Urban Economics*, 27: 583-612

KRUGMAN, P. 1987. The narrow moving band, the Dutch disease, and the competitive consequences of Mrs. Thatcher. Notes on trade in the presence of dynamic scale economies, *Journal of Development Economics*, 27(1-2): 41-55

LUCAS, R. A. 1971. *Minetown, Milltown, Railtown. Life in Canadian Communities of Single Industry*. Toronto University Press, Toronto

POLÈSE, M. 2009. The Intrusive Rentier Syndrome, *The Wealth and Poverty of regions. Why cities matter*, pp. 18-23. The University of Chicago Press, Chicago

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

POLÈSE, M. and SHEARMUR. 2006. Growth and Location of Economic Activity: The Spatial Dynamics of Industries in Canada 1971-2001, *Growth and Change,* 37 (3): 362-395

SACHS, J. D. and A. M. WARNER. 2001. The curse of natural resources. *European Economic Review* 45(4-6): 827-838

SHEARMUR, R. and M. POLÈSE. 2007. Do Local Factors Explain Local Employment Growth? Evidence from Canada 1971-2001, *Regional Studies*, 41 (4): 453-471

SLACK, E., BOURNE, L. S., and M. GERTLER. 2003. Small, Rural, and Remote Communities: The Anatomy of Risk, *Research Paper Series*, RP (18), Panel on the Role of Government, Government of Ontario, Toronto

WEBER, A. 1909. *Über den Standort der Industrien*, Tübingin. English translation: Alfred Weber's Theory of the Location of Industries, Chicago University Press, Chicago

WHITE, H. 1980. A Heteroskedasticity-Consistent Covariance Matrix Estimator and a Direct Test for Heteroskedasticity, *Econometrica*, 48(4): 817–838