THE LONDON SCHOOL OF ECONOMICS AND POLITICAL SCIENCE

Economic History Working Papers No: 279/2018

Power to the Periphery? The failure of Regional Convergence in Canada, 1890-2006

Chris Minns
London School of Economics

Joan R. Rosés
London School of Economics, UK and CEPR

Economic History Department, London School of Economics and Political Science, Houghton Street, London, WC2A 2AE, London, UK. T: +44 (0) 20 7955 7084. F: +44 (0) 20 7955 7730

LONDON SCHOOL OF ECONOMICS AND POLITICAL SCIENCE
DEPARTMENT OF ECONOMIC HISTORY
WORKING PAPERS
NO. 279 – MARCH 2018

Power to the Periphery? The failure of Regional Convergence in Canada, 1890-2006[1]

Chris Minns
London School of Economics

Joan R. Rosés
London School of Economics, UK and CEPR

Abstract

Economic historians have long signalled the importance of location-specific resource booms in the Canadian development experience, but a full analysis of the dynamics of Canada's internal income dynamics is conspicuously absent. This article presents comprehensive estimates of regional inequality in Canada from 1890 to 2006 and assesses the sources of convergence and divergence across Canadian provinces. Our convergence decompositions support the central role of resource booms in accounting for regional income dynamics, and show that structural change contributing relatively little to the development process. Our findings are in sharp contrast to the historical experience of other countries, including the United States.

JEL Codes: N91; N92; R12.
Keywords: Regional Inequality; resource booms; structural change; random growth theory; Canada.

[1] We are grateful for comments from Alfonso Herranz, Marc Badia-Miro, James Fenske, seminar participants at the University of Barcelona and Royal Holloway (London), and conference participants at the 2015 CNEH, 2016 Vienna FRESH, and 2018 Oxford-Warwick-LSE meetings. We also thank Marvin McInnis for sharing data.

Power to the Periphery? The failure of Regional Convergence in Canada, 1890-2006

1. Introduction

Recent research on long-run regional development has uncovered two main stylized facts. First, regional inequality tends to follow a distinctive pattern in many countries. Inequality is typically high and increasing during the early phases of industrialization and the creation of national markets, declining with the spread of industrialisation within economies, then rising again in recent decades. Second, structural change is a major driver of regional income and inequality trends. When regional inequality is high, it reflects the concentration of the most productive activities in certain locations, with periods of reduction over time explained by labour reallocation towards more productive activities in less developed regions.[1] More specifically, the major determinant of regional inequality during the early phases of industrial development was the high concentration of modern manufacturing in a few locations,[2] while the recent upsurge in spatial inequality is closely associated with the unequal spatial distribution of knowledge-intensive services.[3]

Was the Canadian experience with regional inequality different from other industrialized economies? Economic historians have long signalled the importance of primary produces in the Canadian development experience and the relative unimportance of industry and services. Debates surrounding the contribution of 'staple' production to Canadian growth, whether through agriculture or resource-based production, have featured in both classic and contemporary accounts.[4] While recent accounts suggest the aggregate Canadian experience with resource-based production was relatively positive,[5] the full regional implications are largely untested.[6] Did Canada experience distinctive patterns of regional specialisation, and if so, how did these patterns influence the evolution of spatial inequality over time? What was the role of

---

[1] The seminal contribution is Williamson (1965). Recent research confirming this tendency in regional inequality include, among others, Badia-Miro et al. (2012); Caselli and Coleman (2001); Combes, et al. (2011); Felice (2011); Geary and Stark (2016); Kim and Margo (2004); Rosés et al. (2010): and Martinez-Galarraga et al. (2015).

[2] Crafts and Mulatu (2005); Felice (2011); Rosés (2003): and Rosés et al. (2010).

[3] See on this recent trend, for example, Berger and Frey (2016); Breinlich et al. (2014); Glaeser and Saiz (2004); and Glaeser et al. (2014).

[4] Innis (1930); Innis (1954); Watkins (1963); Chambers and Gordon (1966); and Keay (2007).

[5] Keay (2007); Olewiler (2017); Hamilton, Keay, and Lewis (2017).

[6] An ample literature exists discussing the long-run negative consequences of resource booms and busts (the so-called 'resource curse'). See, among others, Allcott and Keniston (2017), Auty and Mikesell (1998), Caselli and Michaels (2013), Domenech, (2008), Jacobsen and Parker (2016); Papyrakis, and Gerlagh (2007), Sachs and Warner (2001) and van der Ploeg (2011).

structural change in an economy where commodity price movements can have large economic effects? Are there broader implications that can be drawn for other settler economies from Canada's experience with regional inequality in the long run? Despite the existence of a considerable literature on long-run regional development in Canada,[7] these questions are yet to be answered.

In this paper, we assemble new estimates of real provincial income per worker by economic sector for the period from 1890 to 2006 (section 2) to study these important questions. Section 3 delineates the levels and long-run tendencies of Canadian regional income inequality by tracing patterns of income convergence between Canadian provinces. The following sections show the patterns of regional specialization (section 4), and how the dynamics of specialization and structural change account for growth and convergence among Canadian provinces (section 5). Our decomposition of Canadian regional convergence shows that almost all of the changes in relative labour productivity between Canadian regions can be explained by within-industry labour productivity convergence.[8] In particular, the evolution of relative labour productivity in the agriculture and resource sectors were the major drivers of relative regional productivity movements, with structural change unable to fully counterbalance local, sector upsurges in labour productivity. Sections 6 and 7 illustrate the changing contribution of these two sectors to the evolution of regional inequality before and after the mid-point of the twentieth century. Finally, section 8 concludes with a discussion of the implications of this research.

Our results make important contributions to the literature describing patterns of Canadian economic growth, and to the broader international literature on the comparative geography of economic development. This article contributes to the existing narrative of long-run Canadian development, as our findings strongly suggest that resource booms and factor abundance dominate any other explanation of the path of income convergence and/or divergence between provinces. While booms in resource and agriculture were key drivers in Western growth, we find little evidence of implied spill-overs from the primary sector to other activities, or of a large scale net reallocation of employment towards high output sectors. This finding challenges the view that the resource sector had important linkage effects to other parts of the economy that raised incomes, either at the regional or national level.[9] Our findings also suggest extremely limited arbitrage between sectors in the Canadian economy, in particular when compared to other large, developed economies where similar data is to hand.[10] This study therefore contributes to

[7] Green (1971); McInnis (1968); Coulombe and Lee (1995); Helliwell (1996); DeJuan and Tomljanovich (2004); and Brown and MacDonald (2015).

[8] This model was developed in Enflo and Rosés (2015), inspired in Caselli and Coleman (2001) and Caselli and Tenreyro (2006).

[9] Emery and Kneebone (2008); Keay (2007); and Watkins (1963).

[10] It is particular striking the differences between Canada and US. See, on US Caselli and Coleman (2001) and Kim and Margo (2004).

debates about the extent of integration in the Canadian economy, whether in terms of labour markets[11] or interprovincial trade patterns.[12]

While the Canadian experience of regional development appears strikingly different from many other countries, the features identified here could be present in other resource-abundant countries.[13] First, almost no regional income convergence has occurred in Canada, with similar regional inequality in 2006 as in 1890. Second, per capita income rankings among Canadian provinces are extremely unstable. Finally, the main driver of changes in Canadian regional inequality has not been structural change, but productivity trends in primary product sectors (agriculture and resources) across provinces. This pattern corresponds with the postulates of the random theory of growth[14] rather than the arguments of models associated with neo-classical growth or increasing returns.

2. Canadian regional output per worker by sector, 1890-2006

To assess patterns of Canadian regional development, we have assembled a database of output per worker by sector for Canadian provinces over the period 1890-2006. For 1890 to 1956, we take the numbers directly from Green's (1971) seminal contribution. This provides evidence on nominal output, in the form of Gross Value Added, and the size of the labour force for each province, coded consistently for five sectors (agriculture, construction, manufacturing, resources,[15] and services) for four years (1890, 1910, 1929, and 1956). Post-1956, we use data available through Statistics Canada and CANSIM (Canadian Socio Economic Database) to generate figures as comparable as possible to those available in earlier years. We use the same sectors as in 1890 to 1956, and produce data on output and employment for 1971, 1981, 1997, and 2006. These dates are dictated by data availability and our attempt to put together figures that are as close as possible to Green's, as it is not practical to recalculate the figures prior to 1956. As one would expect, we do not have provincial-level data for territories prior their becoming a province of Canada. Hence, Alberta and Saskatchewan are separate provinces only from 1910, and Newfoundland first has data in 1971.[16]

---

[11] Coe and Emery (2004).

[12] Helliwell and Verdier (2001).

[13] Patterns of Canadian regional inequality show similarities to those in Australia (Cashin, 1995; Neri, 1998), Brazil (Azzoni, 2001) and Chile (Badia-Miró, 2015) but are different to Sweden (Enflo and Rosés, 2015).

[14] See, the seminal contribution of Simon (1955) and two recent applications of this theory in Gabaix (1999) and Davis and Weinstein (2002).

[15] The resources sector comprises Fishing, Trapping, Forestry and Mining.

[16] Newfoundland became a province in 1949 but is not included in Green (1971).

A difference between our Canadian estimates and similar calculations for other countries is that we compute output per worker in constant terms. Therefore, we have adjusted nominal values with a regional price index. As a suitable long-run provincial GDP deflator is unavailable we have used consumer price indices (CPI) to deflate nominal GDP. This could produce some bias in our results as CPI only takes into account the prices of goods and services purchased by consumers. Full details of how we adjust for provincial price levels are outlined in the Appendix, where we also provide calculations in nominal terms.

An important consideration in this exercise is whether changes in how provincial incomes were computed and/or the size of the labour force counted are likely to generate noise that we could mistake as shocks or trends in labour productivity. We are particularly worried about this in the transition from 1956 to 1971 and following years, where there were frequent changes in methodology that make it hard to generate numbers that should be strictly comparable to Green's original approach. We are confident that our evidence is consistent within each cross-section, which is crucial for the relative-to-benchmark approach we take in what follows.

An obvious use of this newly assembled data is to describe long-run patterns of the regional composition of Canadian income (see table 1). In Canadian case, this is particularly important since the country has experienced a considerable reallocation of population and economic activities during the period covered by this study.

[TABLE 1 HERE]

Table 1 shows that the most populous province, Ontario, enjoyed the lion's share of Canada's output, though its relative importance declined substantially from 1890 to 2006, with the sharpest period of decline being 1890 to 1929. The second province, in terms of total gross value added is Quebec, who produced about one fourth of national income in 1890 and about one fifth in 2006. The decline of Quebec's share of the economy is more recent than in Ontario since it has mainly happened from 1981 on. This timing fits well with well-known demographic changes in Quebec, with much lower birth rates from the 1960s and lower net immigration from the 1970s and 1980s resulting in a smaller labour force and reduced overall economic size.[17]

In contrast with the core provinces of Central Canada, the Western part of the country has become increasingly important. British Columbia has expanded from 2 percent of national GDP in 1890 to over 13 per cent by 2006. Expansion in British Columbia was particularly fast between 1890 and 1910 with a tripling of its share in the Canadian economy. The three Prairie Provinces (Alberta, Manitoba and Saskatchewan) have also experienced a relative expansion. Alberta has seen its share of Canadian GDP

[17] Quebec accounted for about 29 percent of the population of Canada in 1951, but less than 24 percent in 2001. Ontario's share of Canadian population rose from 33 to 38 percent over the same time period.

grow from 4 per cent in 1910 to 18 per cent in 2006. Its expansion was particularly fast between 1971 and 1981 when its contribution to the national output grew from about the 9 percent to 15 percent. Manitoba and Saskatchewan have similar histories. Departing from relative low levels, their participation in national GDP peaked by 1929 and has declined since then. Finally, the three Maritimes provinces (New Brunswick, Nova Scotia and Prince Edward Island) have experienced declines which were evident before 1929. For example, New Brunswick represented the 7 per cent of Canadian income in 1890 and only the 1.9 per cent in 2006.

3. The long-run evolution of regional labour productivity

Estimates of Canadian regional labour productivity from 1890 to 2006 are presented in Table 2. These figures summarize gross (real) value added per worker, set against a benchmark where Canada is equal to 100 in 2006.

[TABLE 2 HERE]

As one would expect, Canadian gross (real) value added per worker has grown considerably over the 116 years' time span, and was about eight times higher in 2006 than in 1890. However, overall rates of growth varied widely between different provinces and within provinces over time. The fastest growing province on the whole period is Saskatchewan (2.56 per cent per year) while the slowest annual growth rates are observed in Ontario and Prince Edward Island (1.59 per cent). Like in many OECD economies,[18] the fastest growth period took place from 1956 to 1971 when yearly growth rates peaked at 3.22 per cent, followed by sluggish growth in the next decade (1971-1981). The most striking pattern in the data is the phenomenal temporal variation in growth rates across Canadian provinces: for example, the steepest growth rate is observed in Alberta from 1929 to 1956 (4.20 per cent) while the most negative growth rate happened in Newfoundland from 1971 to 1981 (-1.29 per cent).

Using the information collected in the previous table, we estimate regional convergence among Canadian provinces. We approach the issue through two frequently used approaches to the study of convergence. First, we estimate β convergence, which is measures the tendency of the poorer provinces to grow faster than richer provinces. We complement this with estimates of σ-convergence, which is the reduction of income dispersion across locations.[19] Convergence is only present when both β and σ convergence take place. To estimate β convergence, we use the classical equation:[20]

[18] See, for example, Dowrick and Nguyen (1989).

[19] There is an ample literature on this methodology. See, for example, Barro and Sala-i-Martin (1995).

[20] Barro and Sala-i-Martin (1995).

$$(1)\ \frac{1}{T}\ln\left(\frac{GVA_{i,t}}{GVA_{i,t-1}}\right)=\alpha+\Theta\ln\left(GVA_{i,t-1}\right)+\varepsilon,$$

where *T* is the number of years considered, and $GVA_{i,t}$ is Real Gross Value Added per worker in for region i at year t. From this estimation, the yearly convergence rate β is computed as - (1/T) ln(ΘT + 1), where Θ is the regression coefficient computed on $\ln(GVA_{i,\ t-1})$. In the regression described in equation (1), a negative coefficient on initial levels is taken to indicate convergence. Estimates of β convergence for Canadian provinces between 1890 and 2006 are presented in table 3.

[TABLE 3 HERE]

Estimates of the neo-classical Solow model, akin to equation (1), typically generate rates of convergence of about 2 percent per year.[21] Clearly, Canada experience does not fit with the predictions of the Solow model. Over the entire period (1890-2006), overall convergence rates were about one percent (half of the expected values). Interestingly, periods of strong convergence were frequently followed of periods of no convergence or even divergence. Convergence near or above the predicted values is observable in 1910-1929, 1956-1971 and 1981-1997. Instead, sluggish convergence is seen from 1890 to 1910 and 1929-1956 and divergence took place from 1971 to 1981 and during the last period (1997-2006).

[FIGURE 1 HERE]

Figure 1 reports estimates of σ convergence using an unweighted Gini index.[22] Canadian trends in σ-convergence do not follow the patterns predicted by either the Solow model or the existing literature on the evolution of regional inequalities over the late 19th century to the present day. Lower Gini indices in 1971 and 1996 are temporary departures that return quickly to the long run trend, which shows no evidence of long run convergence in labour productivity. The starkest evidence for the lack of convergence over the long run is that the Gini index was greater in 2006 than in 1890.

The lack of convergence in Canadian provincial value added per worker will be familiar to those who have examined trends in personal income and other measures over the long run.[23] However, the data also show several interesting historical patterns that emphasize the unique conditions Canada experienced over the course of the 20th century. A modest rise in the Gini index from 1890 to 1956 was followed by forty years of strong instability: the index decreases from 1956 to 1971; increases again from 1971 to 1981;

[21] See, for a review, Abreu et al. (2005).

[22] Here, we follow the recent recommendation of Gluschenko (2017) against the use of population-weighted indices to measure regional inequality.

[23] Brown and MacDonald (2015); see also Norrie, Owram, and Emery (2008; p. 397) for a textbook discussion of this fact.

decreases in the subsequent period (1981-1997) but rose sharply again from 1997 to 2006. These patterns are strongly suggestive of the presence of large region- and/or sector-specific shocks and sluggish reallocation of production factors across Canadian provinces in response.

[TABLE 4 HERE]

The presence of these specific shocks and the enormous variation in growth rates across Canadian provinces has led to substantial changes in provincial rankings of output per worker over time (see table 4). For example, in 1890, the richest province in per worker terms was Ontario, which occupied the seventh position of ten provinces by 2006. In sharp contrast, by this measure Saskatchewan was the poorest province in 1890 and the third richest in 2006. As with the evidence presented before, these changes in rankings are hard to reconcile with either a neo-classical Solow model of growth or alternative models based on increasing returns.[24] Greater urbanization and population density in the 'core' provinces of Ontario and Quebec have not resulted in this region reinforcing its role as the powerhouse of the Canadian economy.[25] The pattern we find of highly variable regional income rankings is more akin with the random theory of growth, under which growth can be attributed to random events, such as the discovery of new resources, or rapid, unforeseen, changes in the ability to exploit existing ones.[26]

4. The regional distribution of economic activities

Canada's distinctive pattern of regional development should be reflective of structural change and patterns of sector growth since 1890. Table 5 documents national trends in the structure of Canadian economic activities by dividing GDP into five key economic sectors.

[TABLE 5 HERE]

At this level of analysis, we can identify two clear phases of Canadian economic development. Before 1956, we observe a process of industrialization when manufacturing activities replace agrarian production as the main source of income. Since 1956, Canada demonstrates the typical process of tertiary sector expansion with the growth of services. This pattern is fairly similar to what is observed in other economies over the course of their development.[27] The contribution of the resource sector follows a

[24] These models do not predict rapid ranking changes but substantial and cumulative ranking stability as a consequence of the presence of Increasing Returns. See, for example, Krugman and Venables (1995).

[25] A similar pattern is present in Chile, where incomes in Santiago are below the national average despite the high concentration of Chilean economic activity in the city. (Badia-Miro, 2015)

[26] See, the seminal contribution of Simon (1955) and two recent applications of this theory in Gabaix (1999) and Davis and Weinstein (2002).

[27] See, for example, Syrquin (1988).

somewhat different path – it declined in aggregate importance up to 1971 but has risen since, particularly from the 1990s. Despite these trends, resource production always accounts for less than 10 per cent of Canadian GVA[28].

These aggregate figures, however, can conceal important trends in regional specialization. To illustrate how sector change has evolved over the long run, we estimate location quotients (LQs) for each of the five sectors considered in this paper. Location quotients are calculated according to equation (2),

$$(2)\ LQ_{GVA} = \frac{GVA_{ji}}{GVA_{i}} \Big/ \frac{GVA_{jCAN}}{GVA_{CAN}},$$

where GVA_{ji} is Real Gross Value Added in industry (j) for region i, and GVA_i is the total Real Gross Value Added for region i. $GVA_{j,CAN}$ and GVA_{CAN} are comparable Canada-wide figures. Location quotients above one therefore indicate the disproportionate concentration of industry in a given region, whereas location quotients below one indicate the contrary.

[FIGURE 2 HERE]

The complete set of location quotients are reported in Appendix Table A1. Figure 2 presents a series of maps for Canadian provinces over time to illustrate patterns of sector specialization over time, with leading sectors and estimates location quotients for each province in each year. Unsurprisingly, agriculture and resources emerge as the most regionally specialised sectors. Saskatchewan, Manitoba, and Prince Edward Island are the focus of agricultural specialisation across the period, while Alberta switches from agriculture to resources between 1929 and 1956. The pattern of location quotients over time show that these provinces were more specialised in primary product-based sectors after 1950 than before. Early specialisation in resources in British Columbia, Nova Scotia, and New Brunswick declines after 1929. A major prediction in the 'resource curse' literature is that non-tradable production (services and construction) are largest in the most abundant in resource-abundant regions.[29] This prediction finds only modest support in the Canadian evidence. Services exhibit minimal patterns of regional specialisation, with Alberta (where the resource sector is the largest of mainland provinces) having one of the smaller service sectors in relative terms. Construction was more concentrated in Alberta and to a lesser extent Newfoundland, but changes in concentration in this sector elsewhere appear relatively insensitive to the changing important of resource production.[30]

[28] This is a somewhat smaller share than that reported in Keay (2007).

[29] This is the well-known Dutch disease. See, for example, Torvik (2002).

[30] See Appendix Table A1 for the full set of coefficients for all sectors in each province.

Manufacturing was concentrated in Ontario and Quebec, though the location quotients indicate that the degree of specialisation was much less intense than in other activities.[31] In many countries, regions with greater concentration of manufacturing had the highest income levels for much of the 20th century, but the data reported in Table 4 shows that Canada defies this trend, with Ontario and Quebec classed firmly among middle-income provinces from the 1950s forward.

The highest location quotients are observed in the resource sector. For example, in 2006, Newfoundland has a quotient of over 4, while Saskatchewan and Alberta were over 2. While localization indices are less stable in this sector, several regions were consistently oriented towards resource-intensive production: Alberta was resource-intensive from 1910 to 2006; British Columbia, New Brunswick and Nova Scotia from 1890 to 1956; and Newfoundland and Saskatchewan from 1971 to 2006.

5. The determinants of regional labour productivity convergence

To provide a more formal analysis of the contribution of changes in economic sectors to the broader picture of regional inequality, we use the methodology developed by Enflo and Rosés (2015) to decompose relative provincial income growth into three components: 1) within-industry convergence, 2) labour reallocation, and 3) between-industry convergence. Ontario is used as a benchmark for all other provinces.[32] Equation (3) illustrates the decomposition (a full development of this decomposition is available at the appendix 2):

$$(3)\ \text{Relative Labour Productivity}_{i,O} = \text{Within-industry Convergence}_{i,O} + \text{Labour Reallocation}_{i,O} + \text{Between-Industry Convergence}_{i,O}$$

in equation (3), the subscript i denotes province i and relative productivity growth against the Ontario baseline subscripted by O. We use Ontario as baseline because it was the richest province in 1890 and has the largest share of Canadian GDP over the entire period. Our choice of benchmark province has implications, however, for how we talk about convergence; Ontario lost its leadership position in terms of Real Gross Value Added per worker in 1956, and was below the national average from 1981 onwards.

Within-industry Convergence captures changes in relative productivity (convergence, or possibly divergence) of each sector, weighted by the average labour share. What are the likely channels for within-industry convergence identified in the literature? Under perfect completion and full employment,

[31] This was not the case in the US, where manufacturing has modified its location in the last century. See, for example, Kim and Margo (2004).

[32] Contrary to Enflo and Rosés (2015), we divide each of the estimates by the number of years in the previous window to make the results homogenous and interpretable as a decomposition of growth rates and we use real values (not nominal).

equalisation of regional factor ratios – capital/labour and human capital/labour – and technological flows between regions are two candidates to cause provincial convergence. In scenarios where perfect competition does not hold, greater factor intensity, and changes in composition within sectors will also to contribute to within-industry convergence. This implies that convergence in output per worker due to greater hours per worker, or due to a shift towards higher labour productivity industries, will also be captured by the first term in the decomposition.

Labour reallocation refers to convergence caused by labour mobility between sectors. As convergence is relative to a benchmark region, the implication is that positive values for this term are observed when labour is reallocated to more productive sectors at a faster rate than in Ontario. Finally, between-industry convergence measures the contribution of convergence in productivity between sectors. Convergence of this type would occur when lagging sectors experience productivity convergence with leading sectors within provinces and regions at the same rate than in the benchmark regions (in this case, Ontario). In other words, it measures the importance of arbitrage across sectors for convergence.

[TABLE 6 HERE]

Table 6 presents the results of the decomposition exercise over the entire span from 1890 to 2006. The decomposition shows that Canadian 'convergence' towards Ontario is strongly dominated by within-sector relative productivity growth. Both labour reallocation and between-sector convergence have negative terms in the national aggregate. That suggests that within province changes in employment were over the long run dominated by movement into lower productivity activities, and that there was little convergence in productivity between high and low output per worker sectors in aggregate. Focusing on the sectors that make the largest contribution to within-sector relative growth, two stand out: agriculture and resources. Rising relative output per worker in primary-sector based activities can account for almost all of national trend in relative growth versus Ontario. This finding is reinforced when we look at explaining developments within each province over the long span. Agriculture is a consistent contributor to convergence, while resources mattered a lot in British Columbia, Nova Scotia and Saskatchewan. The same was true in Alberta were we to being the long span analysis in 1910, as we will see in subsequent tables. British Columbia experiences sharp negative contributions from labour reallocation and between-sector convergence; this likely reflects the low of value added per worker in 1890. The theories of growth and development that explain regional income patterns in the United States and Europe appear to have little weight in Canada. Manufacturing, construction, and services are for the most part relatively unimportant in explaining convergence, which shows that the classic lines of argument related to technological transfer and relative factor endowments in industry were of limited importance.[33] The provinces with the strongest growth record in output per worker were those that benefitted the most from strong demand for primary

[33] See, for example, Sweden (Enflo and Rosés, 2015) or the US (Caselli and Coleman, 2001).

products both in the early and late 20th century, the discovery of new resource extraction possibilities, and innovations affecting agricultural production prior to 1930.

6. The first wave (1890-1956)

To flesh out the empirical narrative of Canadian regional growth since the late 19th century, we use the techniques from the previous section to account for regional growth for the pre- and post- Second World War sub-periods. These are the period for which there were clear distinctions in the path of σ-convergence (Figure 1), and the split roughly corresponds with the rise of the energy sector in Western Canada.[34] Figure 3 presents the evolution of Real Gross Value Added per worker, using Ontario's values as denominator, in the different Canadian provinces between 1890 and 1956.

[FIGURE 3 HERE]

By 1956, the westernmost provinces (British Columbia, Alberta and Saskatchewan) achieved convergence, equalling if not surpassing Ontario in terms of labour productivity by 1956. Manitoba and Quebec followed a similar pattern than Ontario and enjoyed similar levels of aggregate labour productivity. Finally, the Maritimes (New Brunswick, Nova Scotia and Prince Edward Island) experienced divergence to 1929, with partial recovery to 1956.[35] The comparison with Figure 2 and the location quotients in Appendix Table A1 confirms that there is little obvious connection between specialisation and convergence in labour productivity. The most productive provinces (British Columbia, Alberta and Saskatchewan) were specialized in primary products, whether resources (British Columbia and Alberta) or agriculture (Alberta and Saskatchewan). However, among the least productive provinces two were specialized in agriculture (Manitoba and Prince Edward Island) and two in resources (New Brunswick and Nova Scotia).

For a more formal analysis of convergence in labour productivity during this first period, Table 7 repeats the decomposition exercise of equation 3 for the period 1890-1956 (further decompositions are available at the appendix).

[TABLE 7 HERE]

[34] The first major oil strikes in Alberta were in 1947 and 1948.

[35] One would expect these figures to fall in line with Green's original analysis, and this is the case after 1910. Prior to 1910 we do not find the prairie divergence reported in Green, though there is little convergence against Ontario and income per person in the west are lower than anywhere else in Canada. We suspect that our differences from Green (1962; Table II-9) derive from our decision to work with real income per worker in constant dollars rather than a current dollar version.

At first sight, the evidence in Table 7 does not differ substantially from those presented in Table 6: the main source of labour productivity convergence is within-sector convergence at the resources and agricultural sector while structural change lessened this tendency towards convergence. However, a detailed (disaggregated) analysis of the evidence offers interesting and new insights. Four provinces converged with Ontario and the remaining three diverged. The Western take-off was strongly linked to developments in primary products. Agriculture in Saskatchewan and Alberta[36] (but not Manitoba where construction convergence predominates) is the leading component of convergence, while the resource sector does likewise for British Columbia. It is interesting to note that the within-industry convergence in agriculture comes well after the beginning of the classic Canadian Wheat Boom (see evidence collected at the appendix about the different sub-periods), and only in two of the three affected provinces.[37] Quebec also converged with Ontario but in this case convergence was mainly due to the manufacturing sector.

Decline in the Maritimes (New Brunswick, Nova Scotia and Prince Edward Island) is connected to poor performance in services after 1910, but also negative contributions of between-industry convergence. At first glance, this suggests that structural factors may matter for lagging development in Eastern Canada rather than the poor productivity performance of particular sectors, as suggested by several articles on Maritime development in the 19th Century.[38]

[TABLE 8 HERE]

What accounts for the rise in labour productivity in Western agriculture after 1910? One potential explanation for the timing and location of these effects are mechanisation or biological innovations in agriculture that allowed farmers to operate more successfully in the westernmost Prairie Provinces (Alberta, Manitoba and Saskatchewan). A story along the first lines, that the rise of the West reflects the rise of capital-intensive, mechanized agriculture, better suited to Prairie agriculture than more mixed farming patterns present in Ontario, is difficult to square with existing evidence on capital intensity and the use of new technologies. For instance, evidence on the use of tractors on the Canadian Prairies suggests slow diffusion up to 1929.[39] Data on tractor usage shows that stocks in the Prairie provinces was higher than in Ontario in 1911 (Table 8). By 1931, the regions were roughly equal in tractor intensity, and by 1956 Ontario had about three times the tractor intensity of the Prairie Provinces (10799 per thousand improved

[36] Evidence on Alberta (which has no data for 1890) is available in the Appendix Table A2.

[37] It also helps reconcile this result with McInnis's (1986) estimate of modest labour productivity growth of roughly one percent per annum in the early 20th century – the gains are concentrated in two particular provinces.

[38] Inwood (1991) and Chernoff (2014).

[39] Lew (2000).

acres against 3630).[40] More general measures of capital intensity present a similar story, with Ontario moving from near parity in 1911 to being well ahead in 1956.[41]

An alternative to greater mechanisation that has seen recent emphasis in studies of American agriculture are biological innovations, in the form of new hybrid corn and better pest resistance that had particular implications for grain farming in the West and Midwest (Olmstead and Rhode 2008). Indeed, many of the examples of biological innovation come from Canadian-based experimental stations, and Olmstead and Rhode show rising yields around 1940 that they argue draw heavily on the emergence of better crop types reinforced by resistance to insects, fungi, and the like (Olmstead and Rhode, 2008). For this argument to have merit for the Canadian Prairies, however, one would expect yields in Western wheat to rise in response to agricultural innovations. Data on wheat yields, however, do not support the view that there was a relative productivity shift in wheat (or in other crops) favouring Alberta or Saskatchewan. Table 8 shows yields per acre for spring wheat in Manitoba, Saskatchewan, and Alberta relative to Ontario. Yields were initially higher in Alberta and Saskatchewan (1911), declining sharply by 1929 before showing some recovery by 1956. These comparisons should be read with caution; changes in use of marginal farmland may obscure the effects of changing productivity for land of similar quality in each region. That said, on the basis of these figures it is difficult to argue that changes in relative yields account for convergence and then divergence in agricultural productivity. Rather, the explanation appear to lie in a more simple source – a large scale expansion of area under cultivation, which lead to divergence in land per capita in agriculture. While acreage classified as farmland in Ontario hardly changed between 1911 and 1956, it more than doubled in the Prairie Provinces. This expansion was supported by a rise in the share of farmland improved for agriculture from 40 to 60 percent, with the second figure being about the share improved in Ontario throughout (Table 7). Given the absolute number of workers in agriculture in the West declined from 1929, the implication is that a large increase in cultivated land area per worker explains the trend in output per worker. Hence, increasing factor intensity, in this case in terms of agricultural land per capita in the Western Prairie provinces, is arguably the key determinant of within-industry divergence and overall economic convergence between provinces to 1956.

[40] Calculations based on figures for 1911, 1931, and 1956 in Historical Statistics of Canada, Series L7-L14 on agricultural land use; series L318-329 on farm tractor stocks.

[41] The figures are $89 of capital per acre in 1911 in Ontario versus $78 in the Prairies, rising to $218 in Ontario against $66 in Ontario in 1956. Current value of capital from Historical Statistics of Canada, series L15-38, acreage as in footnote 3.

7. The second wave (1956-2006)

Figure 3 presents the evolution of provincial Gross Value Added per worker (relative to Ontario) from 1956 to 2006. The data support a convergence interpretation for eastern and central Canada, with the major exception of Alberta and to a lesser extent, Saskatchewan. All the remaining provinces have Real Gross Value Added per worker between 0.8 and 1.2 times the level of Ontario.[42] It is also important to note the presence of several large booms: Alberta in 1981 and 2006; Newfoundland in 2006: Nova Scotia in 1981: and Saskatchewan in 1981 and 2006.

[FIGURE 3 HERE]

As in the previous period, the typical connections between sector specialisation and levels of labour productivity are absent (compare information from Figure 1 with Figure 3). The most productive region, Alberta, is not specialized in services but in resources, agriculture and construction. Similarly, Newfoundland, which experienced exponential growth rates during the last decade, is specialized in resources and, sometimes, in construction. The third region, British Columbia, is specialized in construction during the whole period and in resources in 1971 and 1997. In a sharp contrast, the least productive province, Prince Edward Island, is specialized in agriculture and services. Once again, we do not observe the pattern of manufacturing and later services specialisation in high-income and high-productivity regions seen in other countries.[43]

[TABLE 9 HERE]

Table 10 decomposes labour productivity growth from 1956 to 2006.[44] The main source of convergence during this period is within-industry convergence in the resource sector, which accounts for about the 60 percent of overall convergence, while structural change (labour reallocation and between-industry) plays a minor role. Interestingly, in all Canadian provinces (except Alberta), productivity in the services sector grow slower than in Ontario, which is an indication of the concentration of the most knowledge-intense industries due more extensive urban agglomeration in that province.[45] However, in a closer inspection, the different Canadian provinces have disparate patterns and sources of convergence.

---

[42] These differences in labour productivity among provinces are larger but broadly supportive of the trends in personal income reported by Brown and Macdonald (2015), who also find divergence led by Alberta and Saskatchewan from the 1980s forward.

[43] For example, Berger and Frey (2016); Breinlich et al. (2014); Glaeser and Saiz (2004); and Glaeser et al. (2014).

[44] Fine levels of decomposition are available in the Appendix Table A3.

[45] Several studies have documented the concentration of knowledge-intensive industries in Canadian metropolitan areas. See Polèse and Shearmur (2006).

Consider first western provinces that also experienced the fastest rates of growth. From 1956 to 2006, in Alberta we find substantial labour reallocation and between industry effects, but within-industry changes remain crucial. One interpretation of this pattern for Alberta is that changes in global prices for extracted resources underlie much of the observed changes in output per worker in this province and that in response to these changes, labour reallocates towards the most productive activities. In particular, the data shows how the share of employment in agriculture decreased from 30 percent in 1956 to only the 3 percent in 2006 while the share of employment in services grew from 48 to 73 percent. Despite these employment changes, however, the reallocation of labour is insufficient to bring about convergence with Ontario and other provinces in Central Canada. In Saskatchewan, we also see this switch from being agriculture-led to resource-led with an important labour reallocation effect. In a sharp contrast, British Columbia diverged during this period due to the negative within-industry factor in construction and the also negative labour reallocation, which is consequence of a decrease of the relative employment in manufacturing and resource sectors.

The two provinces closest to Ontario, Manitoba and Quebec, obtained modest convergence thanks to a myriad of factors (including within-convergence in several sectors and structural change). Finally, the same pattern of broad-based convergence is also observable in the three Maritimes provinces (New Brunswick, Nova Scotia and Prince Edward Island) that converged with Ontario at faster rates than Manitoba and Quebec. In 2006, New Brunswick and Nova Scotia have completed their catching-up with Ontario's labour productivity but Prince Edward was still well below.

[TABLE 10 HERE]

The results above beg an obvious question: why was labour reallocation towards booming provinces not more widespread? One might account for the lack of labour reallocation into agriculture due to the large costs of entering farming, both in terms of financial and human capital. Such as story is less compelling for the resource sector, especially with resource-rich parts of Alberta seen magnets for internal migrants from across Canada in the post-World War II period. But the modest labour market adjustments seen make sense if output per work trends are not fully reflected in wages on offer to potential workers. Table 11 lists wages relative to Ontario for mining and resource extraction, and manufacturing from 1911 to 2000. The wage patterns appear to be quite distinct, at least up to 1961, relative to patterns in output per worker in Figures 2 and 3. Up until the 1930s, manufacturing workers in Western Canada earned a noticeable premium relative to Eastern counterparts. In mining and resources, we find no evidence of a Western premium in wages until 1961 – if anything, wages were lower for those working in resource activities in the West, sometimes much lower once differences in living costs are accounted for. This is in sharp contrast to the patterns in output per worker, where the resource sector in Alberta generated significant additional returns. While the decomposition of relative labour productivity show that labour was

responsive to economic conditions, workers could not migrate or change sectors as quickly in response to price changes as the real value of output.[46]

8. Conclusions

Most recent studies of regional development find that structural change account for a significant share of convergence within nations. Our results show Canada defying this pattern – regional convergence was fairly limited over the long run, particularly within economic sectors, and the changes in output per worker observed are mostly accounted for by within-industry changes. The sector leading the charge in both convergence and divergence of labour productivity since 1890 is resource-based production, with agriculture playing an important supporting role before the 1950s. Manufacturing and services, so often the major sectors elsewhere, play a surprisingly small role in accounting for Canadian regional income dynamics.

The lack of structural changes to accompany primary product based development implies that: a) productive spill-overs from agriculture and resources to sectors such as manufacturing were small, and b) employment flows within Canada did not serve to fully arbitrage differences in economic opportunities. In agriculture, entry would require human and financial capital that would limit possibilities for many migrants. In the resource sector, it appears that wage differentials fell well short of differences in output per worker, with resource rents accruing elsewhere. This outcome is in stark contrast to predictions of many economists writing in the 1970s and 1980s, who raised the issue of "rent-seeking mobility" in response to sharp increases in global energy prices.[47] More broadly, these findings imply that in the Canadian case, resources do not appear to be a 'curse', but neither is there is strong case to be made for factor intensity having significant effects outside of primary product based production.

How does Canada compare to other resource abundant countries? The United States and Sweden have experienced strong processes of regional income convergence lead by a substantial amount of structural change.[48] But Australia, Brazil and Chile have followed a pattern similar to that of Canada in with strong regional variation in income and sluggish regional convergence.[49] In Chile, the most industrialized regions, like in Canada, do not enjoy the highest levels of income per capita. It seems plausible that a

[46] It is also worth noting that incomplete structural adjustment across provinces in the resource sector long predates the National Energy Policy initiated in 1980, which redistributed a share of royalties from provinces and their governments to the federal government.

[47] Courchene (1981).

[48] On the US, see Caselli and Coleman (2001) and, on Sweden, see Enflo and Rosés (2015).

[49] On Australia, see Cashin (1995) and Neri, (1998); on Brazil, see Azzoni (2001); and on Chile see Badia-Miró (2015).

decomposition exercise similar the one produced here for other settler economies would also reveal a large role for primary production and a relatively small role for the classic forces of structural change.

What do these findings imply for understanding Canadian development in the long run? The main message is that factor intensity dominates changes in regional development, with expansion of arable land (per worker) in the early 20th century, and the discovery of resources throughout the 20th century. Out findings run counter to the predictions of some staple-based explanations of development – output per worker in affected sectors rose, but the arbitrage and adjustment process through which other sectors (and regions) converged appears to be striking in its absence, and an important subject for future research.

References

Abreu, M., De Groot, H., and Florax, R. 'A Meta-Analysis of β-Convergence: the Legendary 2%', *Journal of Economic Surveys*, 19 (2005), pp. 389-420.

Allcott, H., and Keniston, D., 'Dutch Disease or Agglomeration? The Local Economic Effects of Natural Resource Booms in Modern America', *Review of Economic Studies*, forthcoming (2017).

Auty, R., and Mikesell, R., *Sustainable Development in Mineral Economies* (Oxford, 1998).

Azzoni, C.R., 'Economic growth and regional income inequality in Brazil', *Annals of Regional Science*, 35 (2001), pp. 133-152.

Badia-Miró, M., 'The evolution of the location of economic activity in Chile in the long run: a paradox of extreme concentration in absence of agglomeration economies', *Estudios de Economia*, 42 (2015), pp. 143-167.

Badia-Miró, M., Guilera, J., and Lains, P., 'Regional incomes in Portugal: industrialisation, integration and inequality, 1890-1980', *Revista de Historia Económica,* 30 (2012), pp. 225-244.

Barro, R. and Sala-i-Martin, X., *Economic Growth* (New York, 1995).

Berger, T., and Frey, C.B., 'Did the Computer Revolution shift the fortunes of U.S. cities? Technology shocks and the geography of new jobs,' *Regional Science and Urban Economics*, 57(2016), pp. 38-45.

Breinlich, H., Ottaviano, G., and Temple, J., 'Regional Growth and Regional Decline,' in S. N. Durlauf and P. Aghion, eds, *Handbook of Economic Growth*, 2 (Amsterdam, 2014), pp. 683-779.

Brown, M, and MacDonald R., *Provincial Convergence and Divergence in Canada, 1926 to 2011*, Economic Analysis Research Paper Series, 2015096e (2015).

Caselli, F., and Coleman II, W.J. 'The US structural transformation and regional convergence: A reinterpretation', *Journal of political Economy*, 109 (2001), pp. 584-616.

Caselli, F., and Michaels, G., 'Do Oil Windfalls Improve Living Standards? Evidence from Brazil', *American Economic Journal: Applied Economics*, 5 (2013), pp. 208-238.

Caselli, Francesco, and Silvana Tenreyro. *Is Poland the Next Spain?*', National Bureau of Economic Research working paper, 11045 (2005).

Cashin, P.A., 'Real GDP in the Seven Colonies of Australasia: 1861-1991', *Review of Income and Wealth*, 41(1995), pp. 19-39.

Chambers, E. J., and Gordon, D. F., 'Primary Products and Economic Growth: An Empirical Measurement', *Journal of Political Economy*, 74 (1966), pp. 315-32.

Chernoff, A. '1871 Productivity Differentials and the Decline of the Maritime Manufacturing Sector', *Acadiensis*, 43 (2013), pp. 65-88.

Combes, P., Lafourcade, M., Thisse, J.F. and Toutain, J.C., 'The rise and fall of spatial inequalities in France: A long-run perspective', *Explorations in Economic History*, 48 (2011), pp. 243-271.

Coe, P., and Emery, J.C.H., 2004. 'The disintegrating Canadian labour market? The extent of the market then and now', *Canadian Journal of Economics/Revue canadienne d'économique* , 37(2004), pp. 879-897.

Coulombe, S., and Lee, F.C.. 'Convergence across Canadian provinces, 1961 to 1991,' *Canadian Journal of Economics/Revue canadienne d'économique* , 28 (1995), pp. 886-898.

Courchene, T., 'A market perspective on regional disparities', *Canadian Public Policy / Analyse de Politiques*, 7 (1981), pp. 506-518.

Crafts, N., and Mulatu, A., 'What explains the location of industry in Britain, 1871–1931?', *Journal of Economic Geography*, 5 (2005), pp. 499-518.

Davis, D. and Weinstein D., 'Bones, bombs, and break points: The geography of economic activity', *American Economic Review*, 92 (2002), pp. 1269–1289.

DeJuan, J., and Tomljanovich, M., 'Income convergence across Canadian provinces in the 20th century: Almost but not quite there', *Annals of Regional Science*, 39 (2005), pp. 567-592.

Domenech, J., 'Mineral Resource Abundance and Regional Growth in Spain, 1860-2000', *Journal of International Development*, 20 (2008), pp. 1122-1135.

Dowrick, S., and Nguyen, D.T., 'OECD comparative economic growth 1950-85: catch-up and convergence', *American Economic Review*, 79 (1989) pp. 1010-30.

Emery, J.C.H., and Kneebone, R.D., 'Socialists, Populists, Resources, and the Divergent Development of Alberta and Saskatchewan', *Canadian Public Policy*, 34 (2008), pp. 419-440.

Emery, J.C.H., and Levitt, C., 'Cost of living, real wages and real incomes in thirteen Canadian cities, 1900-1950', *Canadian Journal of Economics/Revue canadienne d'économique*, 32 (2002), pp. 115-137.

Enflo, K., and Rosés, J.R., 'Coping with regional inequality in Sweden: structural change, migrations, and policy, 1860–2000', *Economic History Review*, 68 (2015), pp. 191-217.

Felice, E, 'Regional value added in Italy, 1891–2001, and the foundation of a long-term picture', *Economic History Review,* 64 (2011), pp. 929-950.

Gabaix, X., 'Zipf's Law for Cities: An Explanation', *Quarterly Journal of Economics*, 114(1999), pp. 739–67.

Geary, F., and Stark, T., 'What happened to regional inequality in Britain in the twentieth century?', *Economic History Review*, 69(2016), pp. 215-228.

Gluschenko, K., 'Measuring regional inequality: to weight or not to weight?', *Spatial Economic Analysis*, 12 (2017), pp. 1-24.

Glaeser, E.L., and Saiz, A., 'The Rise of the Skilled City', *Brookings-Wharton Papers on Urban Affairs*, 5 (2004), pp. 47-94.

Glaeser, E.L, Ponzetto, G. and Tobio, K.2014. 'Cities, Skills and Regional Change', *Regional Studies*, 48 (2014), pp. 7-43.

Green, A.G., *Regional aspects of Canada's economic growth* (Toronto 1971).

Hamilton, G. C., Keay, I., and Lewis, F.D., 'Contributions to Canadian economic history: The last 30 years," *Canadian Journal of Economics/Revue canadienne d'économique* , 50 (2017), pp. 1633-1657.

Helliwell, J.F., 'Convergence and migration among provinces', *Canadian Journal of Economics/Revue canadienne d'économique* , 29 (1996), pp. S324-S330.

Helliwell, J.F., 1996. 'Do National Borders Matter for Quebec's Trade?', *Canadian Journal of Economics/Revue canadienne d'économique* , 29 (1996), pp. 507-22.

Helliwell, J.F., and Verdier, G., 'Measuring internal trade distances: a new method applied to estimate provincial border effects in Canada', *Canadian Journal of Economics/Revue canadienne d'économique* 31 (2001), pp. 1024-1041.

Historical Statistics of Canada, http://www.statcan.gc.ca/pub/11-516-x/11-516-x1983001-eng.htm (accessed on 19 Jan. 2018).

Innis, H.A. *The Fur Trade in Canada: An Introduction to Canadian Economic History* (Toronto, 1930).

Innis, H.A. *The cod fisheries: the history of an international economy* (Toronto, 1954).

Inwood, K.E., 'Maritime Industrialization from 1870 to 1910: A Review of the Evidence and its Interpretation', *Acadiensis* (1991), pp. 132-155.

Jacobsen, G.D. and Parker, D.P., 'The Economic Aftermath of Resource Booms: Evidence from Boomtowns in the American West', *Economic Journal*, 126 (2016), pp. 1092-1128.

Keay, I., 'The engine or the caboose? Resource industries and twentieth-century Canadian economic performance', *Journal of Economic History,* 67 (2007), pp. 1-32.

Kim, S. and Margo, R.A., 'Historical perspectives on U.S. economic geography', in J. V. Henderson and J. F. Thisse, eds., *Handbook of Regional and Urban Economics*, 4 (Amsterdam, 2004), pp. 2981-3019.

Krugman, P. and Venables, A.J., 'Globalization and the Inequality of Nations', *Quarterly Journal of Economics*, 110 (1995), pp. 857-880.

Lew, B. 'The diffusion of tractors on the Canadian prairies: The threshold model and the problem of uncertainty', *Explorations in Economic History,* 37(2000), pp. 189-216.

Martínez-Galarraga, J., Rosés, J.R. and Tirado, D., 'The Long-Term Patterns of Regional Income Inequality in Spain, 1860-2000', *Regional Studies*, 49 (2015), pp. 502-517

McInnis, M. A consistent classification of Canadian work force statistics, 1911-1961. Unpublished mimeo, Queen's University, (1969).

McInnis, M. 'The trend of regional income differentials in Canada', *Canadian Journal of Economics/Revue canadienne d'économique*, 1 (1968), pp. 440-470.

McInnis, M. 'Output and productivity in Canadian agriculture, 1870-71 to 1926-27', in S.L. Engerman and R.E. Gallman, eds., *Long-Term Factors in American Economic Growth* (Chicago, 1986), pp. 737-778.

Minns, C., and MacKinnon, M., 'The costs of doing hard time: a penitentiary-based regional price index for Canada, 1883–1923', *Canadian Journal of Economics / Revue canadienne d'économique* 40 (2007), pp. 528-560.

Neri, F., 'The economic performance of the states and territories of Australia: 1861–1992', *Economic Record* 74 (1998), pp. 105-120.

Norrie, K. Owram, D., and Emery, J. C. H., *A History of the Canadian Economy*, 4th ed. (Thomson Nelson 2008).

Olewiler, N. 'Canada's dependence on natural capital wealth: Was Innis wrong?', *Canadian Journal of Economics/Revue canadienne d'économique*, 50 (2017), pp. 927-964.

Olmstead, A.L., and Rhode, P.W., *Creating Abundance* (Cambridge, 2008).

Papyrakis, E.s, and Gerlagh, R., 'Resource Abundance and Economic Growth in the United States', *European Economic Review*, 51 (2007), pp. 1011-1039.

Polèse, M. and Shearmur, R., 'Growth and location of economic activity: the spatial dynamics of industries in Canada, 1971-2001', *Growth and Change*, 37 (2006), pp. 362-395.

Rosés, J.R., 'Why isn't the whole of Spain industrialized? New economic geography and early industrialization, 1797–1910', *Journal of Economic History*, 63 (2003), pp. 995-1022.

Rosés, J.R., Martínez-Galarraga, J., and Tirado, D., 'The upswing of regional income inequality in Spain (1860–1930)', *Explorations in Economic History,* 47 (2010), pp. 244-25.

Sachs, J., and Warner, A., 'The Curse of Natural Resources', *European Economic Review*, 45 (2001), pp. 827-838.

Simon, H. 'On a Class of Skew Distribution Functions', Biometrika, 1955, 42, pp. 425–40.

Syrquin, M., 'Patterns of structural change', in H. Chenery and T.N. Srinivasan, eds., *Handbook of development economics*, 1 (Amsterdam, 1988), pp. 203-273.

Torvik, R., 'Natural resources, rent seeking and welfare,' *Journal of development economics*, 67 (2002), pp. 455-470.

Van der Ploeg, F., 'Natural Resources: Curse or Blessing?', *Journal of Economic Literature*, 49 (2011), pp. 366-420.

Wakerly, E.C., Scott, B.G. and Nason, J.M., 'Common Trends and common cycles in Canada: who knew so much has been going on?,' *Canadian Journal of Economics/Revue canadienne d'économique*, 39(2006), pp.320-347.

Watkins, M.H., 'A Staple Theory of Economic Growth', *Canadian Journal of Economics and Political Science,* 19 (1963), pp. 141-158.

Williamson, J.G., 'Regional inequality and the process of national development: a description of the patterns', *Economic development and cultural change* 13 (1965), pp. 1-84.

Table 1. The share (per cent) of Canadian Provinces in national GDP, 1890-2006

	1890	1910	1929	1956	1971	1981	1997	2006
Alberta		4.01	6.82	8.90	8.97	15.27	14.38	18.19
British Columbia	2.19	6.03	9.19	10.95	11.34	12.98	13.52	13.52
Manitoba	2.91	5.78	5.78	4.99	4.24	3.82	3.46	3.20
New Brunswick	7.38	4.36	2.41	2.49	2.02	1.77	2.03	1.91
Newfoundland					1.41	1.35	1.22	1.90
Nova Scotia	8.94	6.15	3.40	3.58	2.73	2.31	2.59	2.41
Ontario	50.95	43.60	39.26	37.28	39.94	34.81	37.16	35.26
Prince Edward I.	2.07	0.90	0.42	0.36	0.27	0.29	0.34	0.31
Quebec	24.96	25.01	26.29	25.84	25.25	23.10	21.73	19.88
Saskatchewan	0.61	4.17	6.42	5.61	3.83	4.29	3.58	3.41

Sources: see appendix 1.

Table 2. Real Output per worker, 1890-2006 (Canada 2006 = 100)

	1890	1910	1929	1956	1971	1981	1997	2006
Alberta		11.84	20.70	64.33	90.21	114.42	117.40	155.95
British Columbia	9.25	13.99	23.66	63.53	90.32	87.21	86.88	103.57
Manitoba	11.16	15.52	18.15	42.55	70.28	72.27	78.76	90.04
New Brunswick	13.92	17.38	14.74	38.61	66.08	61.01	78.23	89.42
Newfoundland					73.22	64.39	77.08	145.22
Nova Scotia	11.55	16.96	14.96	37.88	71.61	95.54	81.07	89.63
Ontario	14.20	21.04	23.98	48.61	78.87	71.90	83.98	89.60
Prince Edward I.	11.92	13.41	11.13	27.73	49.20	53.82	68.37	75.12
Quebec	11.22	18.31	21.13	45.30	75.99	73.36	81.84	87.11
Saskatchewan	5.85	9.56	16.64	48.58	77.47	88.25	92.11	113.91
Canada	**12.67**	**17.56**	**21.13**	**48.71**	**78.93**	**79.21**	**87.15**	**100.00**

Sources: see Appendix 1.

Table 3. β-Convergence among Canadian Provinces, 1890-2006

	Coefficient	Implied Rate	N	Adj. R2	F-test
1890-1910	-0.0120	0.0137	8	0.15	2.24
1910-1929	-0.0398	0.0744	9	0.26	3.86
1929-1956	-0.0041	0.0044	9	-0.09	0.31
1956-1971	-0.0216	0.0260	9	0.74	23.75
1971-1981	0.0020	-0.0020	10	-0.12	0.00
1981-1997	-0.0284	0.0378	10	0.64	17.06
1997-2006	0.0175	-0.0163	10	-0.10	0.14
1890-2006	**-0.0059**	**0.0100**	**65**	**0.06**	**5.35**

Sources: see Appendix 1.

Table 4. Rankings in real Output per Worker of Canadian Provinces, 1890-2006

	1890	1910	1929	1956	1971	1981	1997	2006
Alberta		8	4	1	2	1	1	1
British Columbia	7	6	2	2	1	4	3	4
Manitoba	6	5	5	6	8	6	7	5
New Brunswick	2	3	8	7	9	9	8	8
Newfoundland					6	8	9	2
Nova Scotia	4	4	7	8	7	2	6	6
Ontario	1	1	1	3	3	7	4	7
Prince Edward I.	3	7	9	9	10	10	10	10
Quebec	5	2	3	5	5	5	5	9
Saskatchewan	8	9	6	4	4	3	2	3

Sources: see Appendix 1.

Table 5. The sector distribution of Canadian GDP, 1890-2006

	Agriculture	Construction	Manufacturing	Resource	Services
1890	27.19	4.97	23.97	9.79	34.09
1910	24.51	5.65	25.72	8.11	36.02
1929	12.15	6.27	21.95	5.41	54.22
1956	7.32	11.09	31.37	6.81	43.42
1971	3.40	7.68	22.49	4.59	61.84
1981	3.52	8.18	19.61	6.70	61.99
1997	1.78	5.30	17.12	5.33	70.46
2006	1.19	6.49	13.44	9.52	69.35

Sources: see Appendix 1.

Table 6. Decomposing Relative Gross Value Added per Worker Growth, 1890-2006

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
			Within industry						
	Overall	**All sectors**	**Agric.**	**Const.**	**Manuf.**	**Res.**	**Serv.**	**Labour Realloc.**	**Between-industry**
BC	0.43	1.20	0.03	0.04	0.07	0.77	0.28	-0.47	-0.30
MB	0.19	0.21	0.06	0.03	-0.03	0.02	0.13	-0.02	0.00
NB	0.02	0.15	0.17	-0.02	0.02	0.04	-0.06	-0.06	-0.07
NS	0.16	0.49	0.12	0.02	-0.01	0.34	0.02	-0.11	-0.21
PE	0.00	0.04	0.11	0.01	0.00	0.02	-0.09	0.00	-0.05
QC	0.16	0.19	0.09	0.03	0.02	0.03	0.02	-0.01	-0.02
SK	1.06	0.96	0.16	0.07	0.06	0.31	0.37	0.18	-0.08
Canada	**0.33**	**0.49**	**0.09**	**0.04**	**0.03**	**0.27**	**0.07**	**-0.08**	**-0.09**

Notes: See text (equation 3) for calculation details. Column 1 is the sum of columns 2, 8, and 9. Column 2 is the sum of columns 3 to 7.
Sources: See Appendix 1.

Table 7. Decomposing Relative Gross Value Added Per Worker Growth, 1890-1956

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
			Within industry						
	Overall	**All sectors**	**Agric.**	**Const.**	**Manuf.**	**Res.**	**Serv.**	**Labour Realloc.**	**Between-industry**
BC	0.99	2.31	0.06	0.28	0.20	1.37	0.41	-0.49	-0.84
MB	0.14	0.22	0.05	0.09	-0.12	0.01	0.20	-0.04	-0.04
NB	-0.28	-0.03	0.04	-0.06	-0.12	0.13	-0.02	0.11	-0.36
NS	-0.05	0.77	-0.01	-0.01	-0.09	0.76	0.12	-0.08	-0.74
PE	-0.41	-0.17	-0.08	0.00	-0.13	0.10	-0.06	-0.06	-0.17
QC	0.22	0.24	0.04	0.04	-0.04	0.14	0.07	0.04	-0.07
SK	0.89	1.30	0.63	0.15	0.03	0.13	0.37	-0.35	-0.06
Canada	**0.25**	**0.59**	**0.12**	**0.06**	**-0.02**	**0.33**	**0.10**	**-0.11**	**-0.24**

Notes: See Table 6.
Sources: See Appendix 1.

Table 8. Yields and Land Use in Agriculture, 1911-1956: Ontario vs Prairies

	Farmland (000s of acres		% improved		Improved acres / worker		Capital / improved acre		Tractors / improved acre	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Ontario	*Prairies*	*Ontario*	*Prairies*	*Ontario*	*Prairies*	*Ontario*	*Prairies*	*Ontario*	*Prairies*
1911	22.2	57.6	62	40	.04	.08	89	77	0.5	1.7
1931	22.8	88.9	58	67	.04	.14	105	42	1.4	1.4
1956	19.9	126.7	63	60	.06	.23	217	66	10.8	3.6

Sources: Historical Statistics of Canada, Series L7; L27; L31; L55; L59; L324; L326.

Table 9. Decomposing Relative Gross Value Added Per Worker Growth, 1956-2006

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
			Within industry						
	Overall	**All sectors**	**Agric.**	**Const.**	**Manuf.**	**Res.**	**Serv.**	**Labour Realloc.**	**Between-industry**
AB	0.75	0.17	-0.01	-0.12	0.05	0.21	0.04	0.45	0.13
BC	-0.27	-0.14	0.01	-0.22	-0.01	0.11	-0.03	-0.22	0.10
MB	0.23	0.09	0.03	-0.02	0.08	0.07	-0.07	0.08	0.06
NB	0.36	0.19	0.11	0.02	0.17	0.03	-0.13	0.04	0.13
NS	0.40	0.12	0.12	0.05	0.08	0.09	-0.21	0.12	0.15
PE	0.48	0.15	0.18	0.01	0.13	-0.06	-0.10	0.23	0.09
QC	0.07	0.02	0.05	0.04	0.09	-0.04	-0.10	0.03	0.02
SK	0.49	-0.12	-0.14	-0.10	0.05	0.10	-0.02	0.50	0.10
Canada	**0.32**	**0.25**	**0.02**	**-0.01**	**0.08**	**0.19**	**-0.04**	**0.00**	**0.07**

Notes: See Table 6.
Sources: See Appendix 1.

Table 10. Wages and in mining and manufacturing, 1911-2000 (Ontario = 100)

	(1)	(2)	(3)	(4)	(5)	(6)
	Mining and Resource Extraction			**Manufacturing**		
	Alberta	**Saskatchewan**	**British Columbia**	**Alberta**	**Saskatchewan**	**British Columbia**
1911	91	74	108	135	130	116
1921	108	82	92	111	121	92
1931	79	57	80	110	112	93
1941	78	67	81	88	84	92
1951	104	94	95	89	85	94
1961	120	108	93	92	85	95
1961	114	109	100	95	92	103
1971	112	94	107	97	93	107
1981	122	104	116	110	100	118
1991	107	85	100	96	102	97
2000	106	94	103	90	86	92

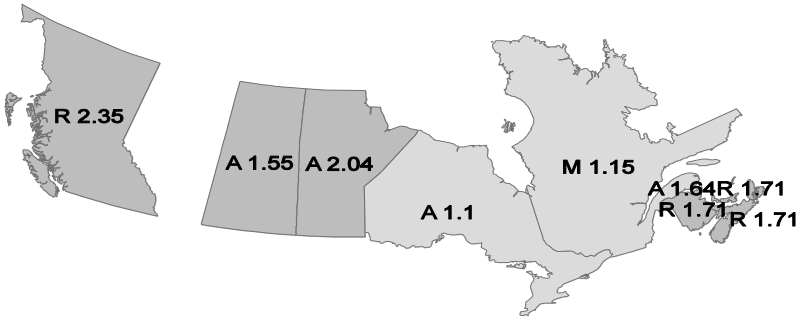
Notes: Annual averages are reported.
Sources: 1911 to 1961 from McInnis (1968); 1961 to 2001 from CANSIM 281-0021 and CANSIM 281-0053.

Figure 1. Unweighted Gini coefficient, Canadian provincial real GDP per capita, 1890-2006.

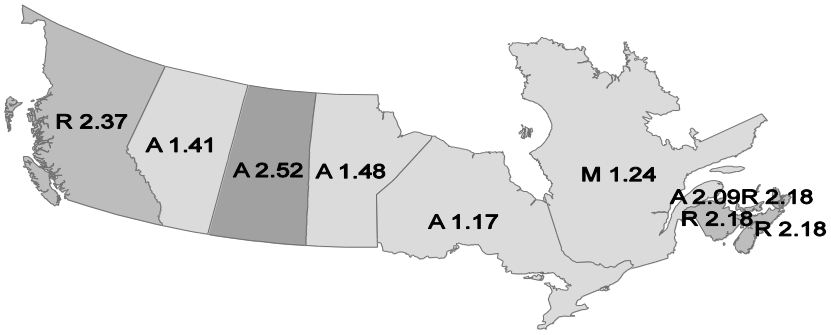
Notes: See text for calculation details.
Sources: See appendix 1.

Figure 2. Provincial Location Quotients, 1890-2006

1890



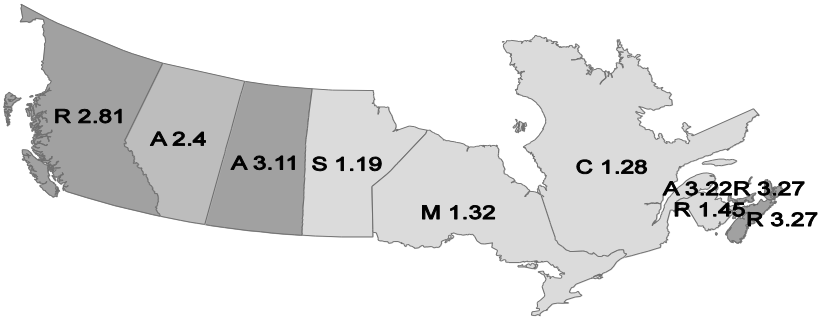
1910



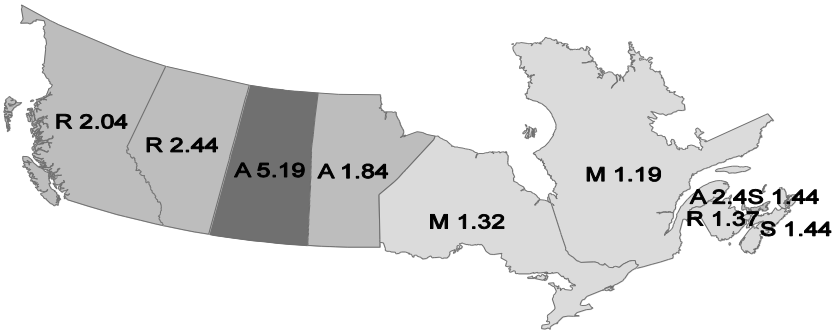
Notes: A – Agriculture C – Construction M – Manufacturing R – Resources S – Services. The number behind the initial is the location coefficient.
Sources: See appendix 1

Figure 2, cont. Provincial Location Quotients, 1890-2006

1929



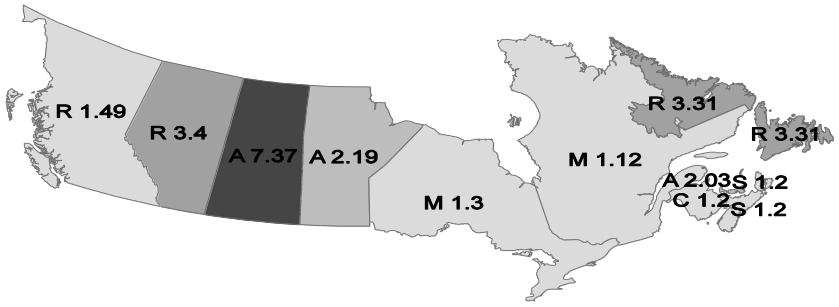
1956



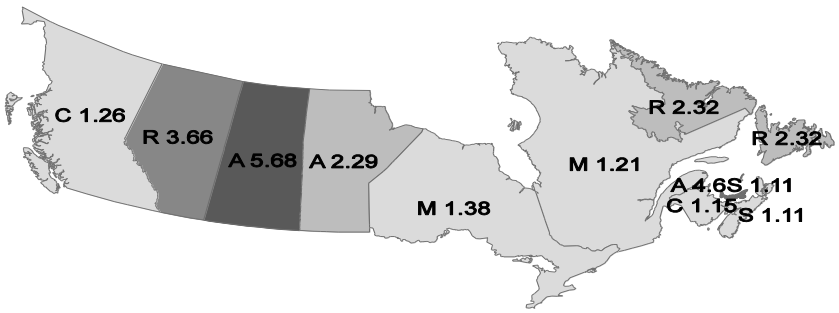
Notes: A – Agriculture C – Construction M – Manufacturing R – Resources S – Services. The number behind the initial is the location coefficient.
Sources: See appendix 1

Figure 2, cont.. Provincial Location Quotients, 1890-2006

1971



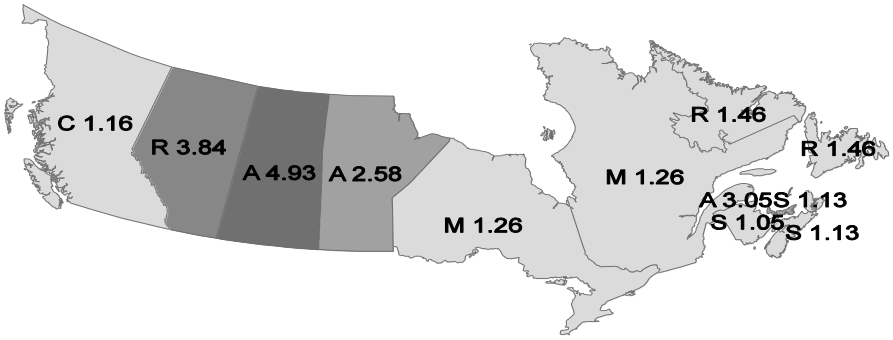
1981



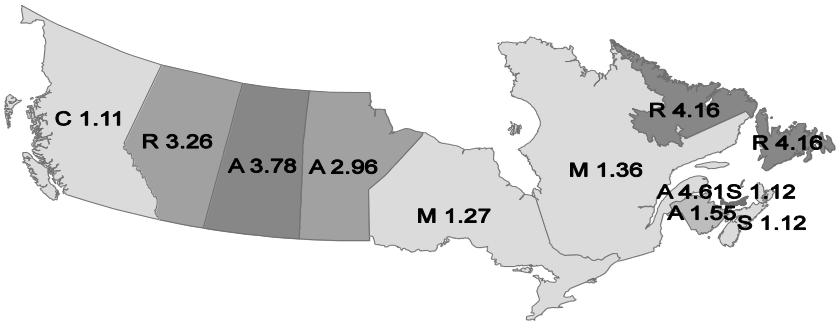
Notes: A – Agriculture C – Construction M – Manufacturing R – Resources S – Services. The number behind the initial is the location coefficient.
Sources: See appendix 1

Figure 2. Provincial Location Quotients, 1890-2006

1997

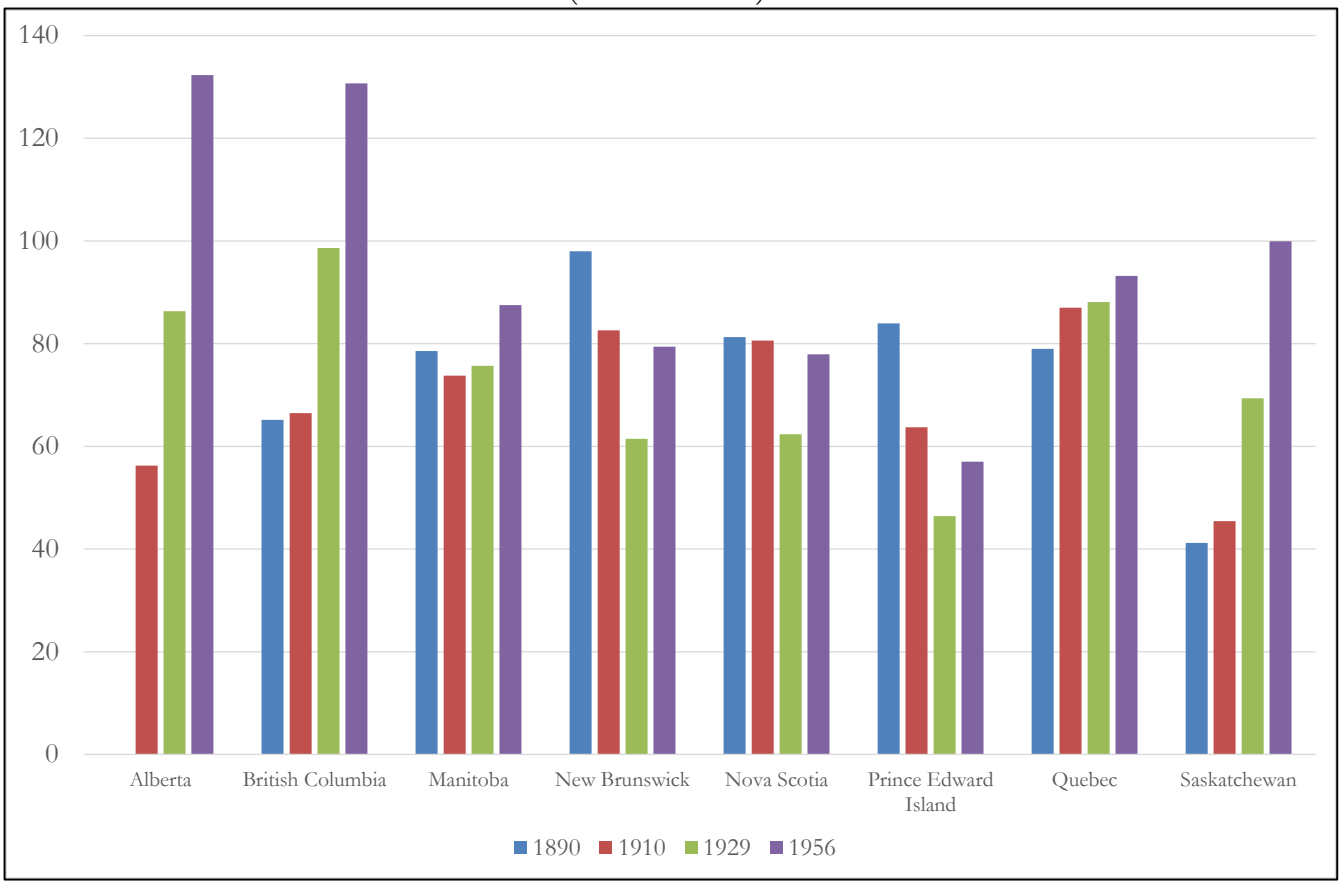


2006



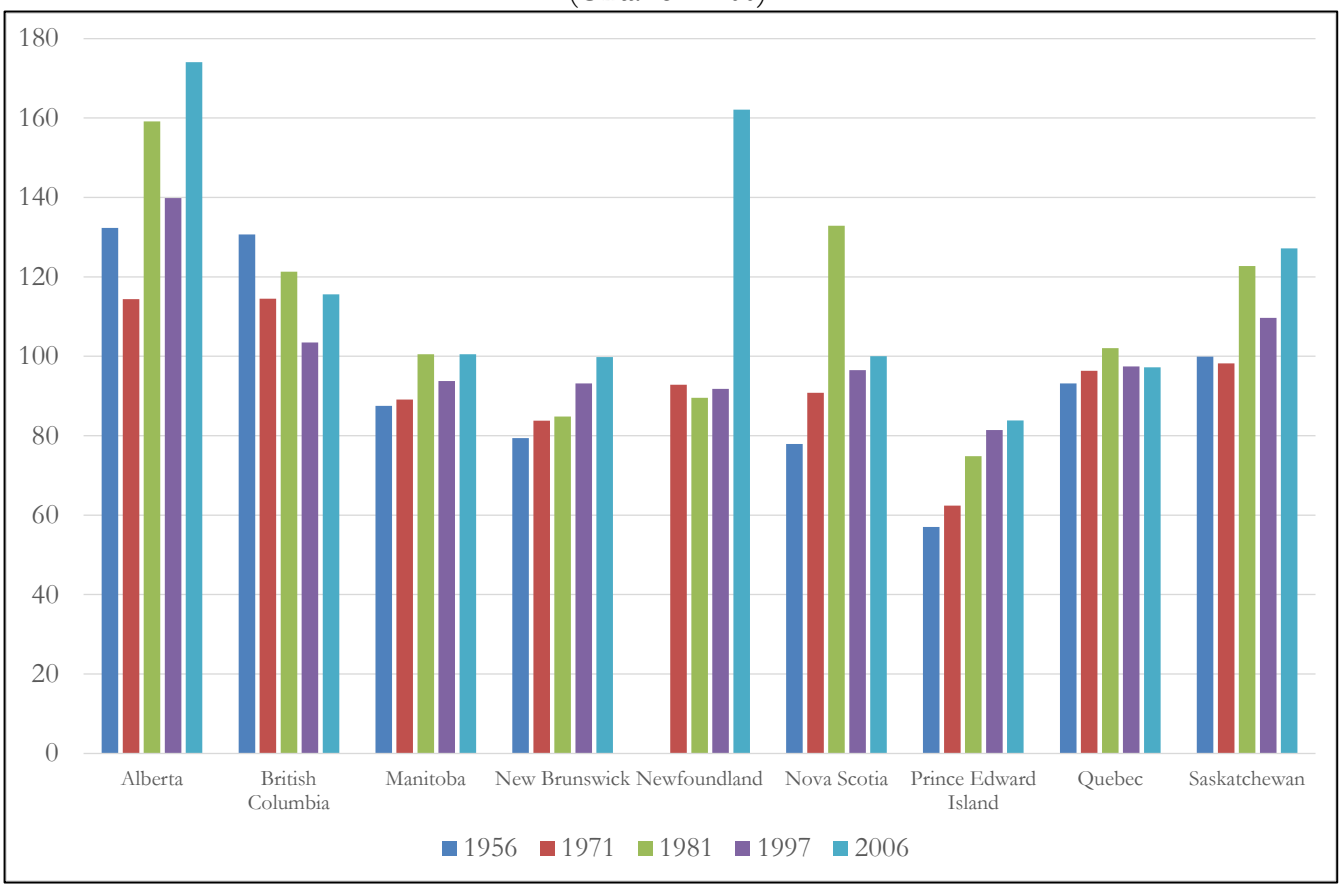
Notes: A – Agriculture C – Construction M – Manufacturing R – Resources S – Services. The number behind the initial is the location coefficient.
Sources: See appendix

Figure 3. GDP per capita by Canadian Province, 1890-1956
(Ontario = 100)



Sources: See Appendix 1

Figure 4. Canadian provinces GDP per capita, 1956-2006
(Ontario = 100).



Sources: See appendix 1.

APPENDIX 1:
CONSTRUCTING A DATASET OF PROVINCIAL SECTORAL INCOMES AND INCOME PER WORKER, 1890-2010

a) 1890

Income: Green (1971, Table B-1) provides gross value added in current dollars by sector for each Canadian province. Alberta and the Northwest Territories are included with Saskatchewan. We collapse Green's original sectors as follows:

Agriculture = Agriculture.

Manufacturing = Manufacturing.

Resource Sector = Fishing and Trapping; Forestry; and Mining.

Construction = Construction.

Services = Transportation; Personal and professional services; Domestic trade and Government.

Employment (for the estimation of Y/L)**:** Green (1971, Table C-1) lists gainfully occupied by sector for each province in 1891. This data was drawn from the Census of Canada for that year. The same sectoral rearrangement is applied as was done for income.

Population (for the estimation of Y/N)**:** Green (1971, Table A-1). We combine male and female population estimates for 1891, which are drawn from the Census of Canada.

b) 1910

Income: Green (1971, Table B-2) provides gross value added in current dollars by sector for each Canadian province. Alberta is a separate entry, Northwest Territories drop out. We collapse Green's original sectors as in 1890.

Employment: Green (1971, Table C-2) lists gainfully occupied by sector for each province in 1911. This was drawn from the Census of Canada for that year. The same sectoral rearrangement is applied as was done for income.

Population: Green (1971, Table A-1). We combine male and female population estimates for 1911, which are drawn from the Census of Canada.

c) 1929

Income: Green (1971, Table B-3) provides gross value added in current dollars by sector for each Canadian province. Green adds two new sectors in this year. We collapse Green's original sectors as follows:

Agriculture = Agriculture.

Manufacturing = Manufacturing.

Resource Sector = Fishing and Trapping; Forestry; and Mining.

Construction = Construction.

Services = Transportation; Utilities; Personal and professional services; Finance: Domestic trade and Government.

Employment: Green (1971, Table C-3) lists gainfully occupied by sector for each province in 1931. This was drawn from the Census of Canada for that year. The employment sectors do not match up perfectly with production sectors in Green's summary tables, so we collapse as in income.

Population: Green (1971, Table A-1). We combine male and female population estimates for 1931, which are drawn from the Census of Canada.

d) 1956

Income: Green (1971, Table B-4) provides gross value added in current dollars by sector for each Canadian province. We collapse Green's original sectors in the same fashion as 1929.

Employment: Green (1971, Table C-4) lists labour force by sector for each province in 1956. This is calculated from the Canada Yearbook for that year. The employment sectors are as in 1929.

Population: Provincial populations for 1956 from Census of Canada, accessed at Statistics Canada at http://www.statcan.gc.ca/tables-tableaux/sum-som/l01/cst01/demo62c-eng.htm

e) 1971

Income: CANSIM Table 379-0009 provides provincial GDP 1971-1984 for selected industries. This is GDP at factor cost, which we think meshes nicely with Gross Value Added from previous years. One issue is that only selected industries are included, with a bunch of service activities (especially, financial activities) not listed. However, services could be computed as a "residual" from the provincial aggregate series at market prices. To convert market prices into factor cost, we multiply the former by 0.87 (this scalar is based on Statistics Canada documentation related to the transition from estimating GDP at factor cost to basic prices and/or market prices). We collapse CANSIM Tables as follows:

Agriculture = Agriculture and related services

Manufacturing = Manufacturing industries

Resource = Fishing and trapping; Logging and forestry; and Mining quarrying and oil wells

Construction = Construction industries

Services = 0.87 * provincial GDP at market prices – (Agriculture + Manufacturing + Resource + Construction).

Employment: CANSIM 281-0015 lists employment by sector and province, 1961-1983. There are some comparability issues with the use of this source for 1971. Employees does not match up perfectly with labour force per industry for obvious reason, or with gainfully employed. We will replace this with Census data on labour agriculture. We have drawn separately from Historical Statistics of Canada, Series M67-M77 listing totals in agricultural occupations per Census year and by province, 1901-1971. Here is how sectors for this paper were constituted:

From Historical Statistics of Canada M67-77

Agriculture = Agriculture

From CANSIM 281-0015

Manufacturing = Manufacturing

Resource = Fishing and Trapping; Forestry: and mining including milling.

Construction = Construction.

Services = Transportation, communication and utilities; Trade, Community, business and personal services; Public administration and defence; Finance and insurance and real estate.

There is no data for the resource sector in Prince Edward Island (for any years in the CANSIM table). We have taken mean monthly unadjusted employment.

Population: Provincial populations for 1971 from Census of Canada, accessed at Statistics Canada at http: and and www.statcan.gc.ca and tables-tableaux and sum-som and l01 and cst01 and demo62c-eng.htm

f) 1981

Income: From CANSIM Table 379-0009. All the same issues are faced as in constructing estimates for 1971.

Employment: CANSIM 282-0088 provides labour force estimates by sector and province, 1976-2013. The employment data is monthly and available adjusted or unadjusted for seasonality. We have taken mean monthly unadjusted employment. Here is how sectors for this paper were constituted:

Agriculture = Agriculture

Manufacturing = Manufacturing

Resource = Forestry; fishing; mining; quarrying: oil and gas.

Construction = Construction

Services = Utilities and Services producing sector

Population: Provincial populations for 1981 from Census of Canada, accessed at Statistics Canada at http: and and www.statcan.gc.ca and tables-tableaux and sum-som and l01 and cst01 and demo62c-eng.htm

g) 1997

Income: From CANSIM Table 379-0025. This series provide provincial GDP by sector at basic prices. This will generate somewhat larger numbers (on average) than a factor price measure. Following Statistics Canada's national estimates of the differences between GDP at factor cost and at basic prices, we multiply through all values by 0.94 to put them at estimated factor cost terms prior to analysis. A further issue is that sector values are occasionally omitted between 1984 and 1996. This is particularly the case for the resource sector of several provinces. For this reason, we have selected 1997 as the date for the next set of cross-sectional observations. Here is how sectors for this paper were constituted:

Agriculture = Crop and animal production; and Support activities for agriculture and forestry.

Manufacturing = Manufacturing.

Resource = Fishing, hunting and trapping; Forestry and logging; and Mining, oil and gas extraction.

Construction = Construction.

Services = Utilities; Wholesale trade; Retail trade; Transportation and warehousing; Information and cultural industries; Finance and insurance and real estate; Profession and scientific and technical services; Administration and support and waste management and remediation services; Educational services; Health care and social assistance; Arts and entertainment and recreation; Accommodation and food services; Public administration; and other services.

Employment: CANSIM 282-0088 provides labour force estimates by sector and province, 1976-2013. All issues and choices the same as for 1981.

Population: Provincial populations for 1996 from Census of Canada, accessed at Statistics Canada at http: and and www.statcan.gc.ca and tables-tableaux and sum-som and l01 and cst01 and demo62c-eng.htm

h) 2006

Income: From CANSIM Table 379-0025. Details regarding construction are identical as for 1997.

Employment: CANSIM 282-0088 provides labour force estimates by sector and province, 1976-2013. All issues and choices the same as for 1981 and 1997.

Population: Provincial populations for 2006 from Census of Canada, accessed at Statistics Canada at http: and and www.statcan.gc.ca and tables-tableaux and sum-som and l01 and cst01 and demo62c-eng.htm

i) Provincial deflators, 1890-2006

1890: Minns and MacKinnon (2007), with Ontario 1900 set as the base year

1910: Minns and MacKinnon (2007), with Ontario 1900 set as the base year and Emery and Levitt (2002) with Toronto 1913 (Ontario) set as the base year.

1929: Emery and Levitt (2002) with Toronto 1913 (Ontario) set as the base year and CANSIM 384-5000 (provincial CPI) with 2002=100 for each province

1956-2006: CANSIM 384-5000 (provincial CPI) with 2002=100 for each province.

APPENDIX 2:
THE DECOMPOSITION OF GDP PER WORKER CONVERGENCE

In this appendix, we discuss our methodology for the decomposition of GDP per worker convergence in Canada. We modified the original methodology of Francesco Caselli and Wilbur Coleman and Kerstin Enflo and Joan R. Rosés.[50] We use the largest spatial unit, Ontario, as the benchmark in our comparisons. In two differnces from the previous studies, we use real values of output per worker (not nominal as they did) and calculate convergence per year (they calculated the total changes over the entire period without yearly weighting). Labour productivity is described in the following equation:

(1A) $$LP_t^i = \sum_{j=1}^{J} S_{jt}^i \, LP_{jt}^i$$

where LP is labour productivity (real value-added per worker), S is the share of employment, *i* indexes provinces, *j* industries (in this case, agriculture, construction, manufacturing, resources and services) and *t* time. So, overall labour productivity is equal to a weighted sum of each sector's labour productivity with weights given by the share in total employment of each sector. Given that we use Ontario as the reference in our convergence analysis, $i = O$, convergence to Ontario is equal to:

(2A) $$\Delta\left(\frac{LP_t^i - LP_t^O}{LP_t^O}\right) = \frac{LP_t^i - LP_t^O}{LP_t^O} - \frac{LP_{t-1}^i - LP_{t-1}^O}{LP_{t-1}^O}$$

This straightforward measure of convergence can be further decomposed into three different sources of convergence: within-industry convergence, labour reallocation and between-industry convergence. To obtain this decomposition, we begin by adding and subtracting to equation (2A) the following term:

[50] Caselli and Tenreyro, 'Poland'.

(3A) $$\sum_{j=1}^{J} S_{jt}^{i}\, LP_{jt}^{O}$$

With this operation, we obtain the equation 4A:

(4A) $$LP_t^i \;=\; \sum_{j=1}^{J} S_{jt}^{i}\left(LP_{jt}^{i} - \; LP_{jt}^{O}\right) + \sum_{j=1}^{J} S_{jt}^{i}\, LP_{jt}^{O}$$

Further manipulation of the above expression yields equation 5A:

(5A) $$\frac{LP_t^i \;-\; LP_t^O}{LP_t^O} \;=\; \sum_{j=1}^{J} S_{jt}^{i}\left(\frac{LP_{jt}^{i} - \; LP_{jt}^{O}}{LP_t^O}\right) + \sum_{j=1}^{J}(S_{jt}^{i} - S_{jt}^{O})\frac{LP_{jt}^{O}}{LP_t^O}$$

If we take first differences, group terms conveniently and divide each term by the number of years (1/n), we get the expression necessary for our convergence decomposition:

(6A) $$\begin{aligned}\frac{1}{n}\Delta\frac{LP_t^i \;-\; LP_t^O}{LP_t^O} \;=\; & \frac{1}{n}\sum_{j=1}^{J} \bar{S}_{jt}^{i}\,\Delta\left(\frac{LP_{jt}^{i} - \; LP_{jt}^{O}}{LP_t^O}\right) + \\ & + \frac{1}{n}\left\{\sum_{j=1}^{J}\left(\frac{\overline{LP_{jt}^{i}}}{LP_t^{SK}}\right)\Delta S_{jt}^{i} - \sum_{j=1}^{J}\left(\frac{\overline{LP_{jt}^{O}}}{LP_t^O}\right)\Delta S_{jt}^{O}\right\} + \\ & + \frac{1}{n}\left\{\sum_{j=1}^{J}\left(\bar{S}_{jt}^{i} - \; \bar{S}_{jt}^{O}\right)\Delta\left(\frac{LP_{jt}^{O}}{LP_t^O}\right)\right\}\end{aligned}$$

Note that the first differences and the means are computed as:

$$\Delta x_{jt} \;=\; x_{jt} - \; x_{jt-1}$$

$$\bar{x}_{jt}^{i} \;=\; \frac{x_{jt}^{i} + \; x_{jt-1}^{i}}{2}$$

We refer to "Total convergence" the quantity on the left-hand side of equation 6A; "within-industry convergence" is the quantity in the first line of the right-hand side; "Labour reallocation" is the quantity in the second line; and "Between-industry convergence" is the quantity in the third line.

APPENDIX 3:
ANCILLARY TABLES

Table A1. Regional Location Quotients, 1890-2006

		Sector				
Year	Province	Agriculture	Construction	Manufacturing	Resource	Services
1890	BC	0.45	1.00	0.98	2.35	1.07
	MB	2.04	0.13	0.52	0.37	0.81
	NB	0.75	1.97	0.83	1.71	0.97
	NS	0.67	0.82	0.87	1.91	1.13
	ON	1.10	1.09	1.02	0.77	0.95
	PE	1.64	0.43	0.59	1.01	0.85
	QC	0.84	0.75	1.15	0.91	1.08
	SK	1.55	1.04	0.39	0.63	1.09
1910	AB	1.41	1.13	0.28	1.04	1.21
	BC	0.28	1.58	0.76	2.37	1.26
	MB	1.48	0.74	0.58	0.16	1.20
	NB	0.78	1.33	0.76	2.18	1.00
	NS	0.61	0.85	0.78	3.06	0.98
	ON	1.01	1.08	1.17	0.76	0.91
	PE	2.09	0.22	0.29	1.00	0.88
	QC	0.82	0.92	1.24	0.71	1.03
	SK	2.52	0.13	0.10	0.11	0.95
1929	AB	2.40	0.74	0.38	1.62	0.91
	BC	0.50	1.02	0.72	2.81	1.05
	MB	1.16	1.04	0.58	0.34	1.19
	NB	0.94	0.46	0.65	1.45	1.17
	NS	0.73	0.74	0.59	3.27	1.03
	ON	0.77	0.93	1.32	0.68	0.96
	PE	3.22	0.25	0.36	0.72	0.88
	QC	0.61	1.28	1.17	0.68	1.02
	SK	3.11	0.85	0.20	0.27	0.94
1956	AB	2.29	1.53	0.38	2.44	0.87
	BC	0.34	1.36	0.83	2.04	0.98
	MB	1.84	1.00	0.60	0.43	1.24
	NB	0.74	1.01	0.56	1.37	1.30
	NS	0.39	0.80	0.52	1.37	1.44
	ON	0.57	0.86	1.32	0.48	0.96
	PE	2.40	0.83	0.18	0.54	1.47
	QC	0.47	0.88	1.19	0.90	1.00
	SK	5.19	1.09	0.22	0.76	0.87

Sources: See appendix 1.

Table A1. Regional Location Quotients, 1890-2006 (cont.)

		Sector				
Year	Province	Agriculture	Construction	Manufacturing	Resource	Services
1971	AB	2.02	1.35	0.42	3.40	0.93
	BC	0.38	1.26	0.78	1.49	1.04
	MB	2.19	0.98	0.60	0.89	1.09
	NB	0.55	1.20	0.69	1.04	1.11
	NF	0.15	2.52	0.44	3.31	0.89
	NS	0.41	1.15	0.55	0.72	1.20
	ON	0.61	0.83	1.30	0.46	0.97
	PE	2.03	1.39	0.37	0.70	1.15
	QC	0.51	0.90	1.12	0.54	1.03
	SK	7.37	0.99	0.26	2.06	0.84
1981	AB	1.46	1.59	0.40	3.66	0.80
	BC	0.39	1.26	0.74	0.91	1.09
	MB	2.29	0.75	0.78	0.42	1.09
	NB	0.68	1.15	0.84	0.83	1.07
	NF	0.10	1.18	0.60	2.32	1.01
	NS	0.53	1.05	0.83	0.61	1.11
	ON	0.64	0.73	1.38	0.30	1.01
	PE	4.60	1.01	0.36	0.33	1.07
	QC	0.57	0.87	1.21	0.32	1.05
	SK	5.68	1.12	0.27	1.60	0.88
1997	AB	1.50	1.31	0.62	3.84	0.84
	BC	0.75	1.16	0.64	1.08	1.08
	MB	2.58	0.89	0.78	0.46	1.06
	NB	0.94	1.01	0.85	0.85	1.05
	NF	0.33	1.16	0.41	1.46	1.11
	NS	0.61	1.01	0.61	0.63	1.13
	ON	0.55	0.88	1.26	0.21	1.02
	PE	3.05	0.99	0.48	0.57	1.11
	QC	0.76	0.89	1.26	0.24	1.01
	SK	4.93	1.09	0.41	2.90	0.89
2006	AB	0.98	1.38	0.54	3.26	0.74
	BC	0.83	1.11	0.72	0.85	1.07
	MB	2.96	0.73	0.96	0.51	1.07
	NB	1.55	1.01	0.93	0.54	1.07
	NF	0.26	0.57	0.29	4.16	0.76
	NS	0.78	0.93	0.66	0.67	1.12
	ON	0.62	0.88	1.27	0.14	1.08
	PE	4.61	0.91	0.72	0.23	1.11
	QC	1.01	0.88	1.36	0.16	1.06
	SK	3.78	0.96	0.48	2.58	0.84

Sources: See appendix 1.

Table A2. Decomposing Relative Gross Value Added Per Worker Growth, 1890-1956

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
			Within industry						
	Overall	**All sectors**	**Agric.**	**Const.**	**Manuf.**	**Res.**	**Serv.**	**Labour Realloc.**	**Between-industry**
a) 1890-1910									
BC	0.07	3.79	-0.17	0.13	-0.07	3.48	0.41	-0.47	-3.25
MB	-0.24	-0.27	-0.36	0.11	-0.25	-0.02	0.26	-0.28	0.30
NB	-0.77	-0.29	-0.34	-0.30	-0.19	0.54	0.00	0.02	-0.49
NS	-0.03	2.80	-0.17	0.02	-0.13	2.98	0.11	-0.20	-2.64
PE	-1.01	-0.76	-0.71	-0.03	-0.24	0.30	-0.08	-0.33	0.08
QC	0.40	0.61	0.02	0.06	0.05	0.32	0.16	-0.10	-0.11
SK	0.45	0.68	-0.04	-0.02	-0.07	0.25	0.56	-0.44	0.21
Canada	**-0.31**	**0.66**	**-0.17**	**-0.01**	**-0.09**	**0.90**	**0.03**	**-0.32**	**-0.65**
b) 1910-1929									
AB	1.58	2.23	1.27	0.12	0.21	0.30	0.33	-0.21	-0.44
BC	1.69	2.29	0.29	0.08	0.32	0.88	0.72	-0.28	-0.31
MB	0.10	0.18	0.00	0.16	-0.06	0.04	0.04	-0.12	0.04
NB	-1.11	-0.79	0.30	-0.18	-0.11	-0.38	-0.43	0.17	-0.49
NS	-0.96	0.14	0.24	-0.08	-0.15	0.55	-0.42	-0.12	-0.98
PE	-0.91	0.02	0.49	-0.04	0.09	0.04	-0.56	-0.08	-0.85
QC	0.06	-0.02	0.15	0.15	-0.19	0.02	-0.15	0.10	-0.02
SK	1.26	1.94	1.18	0.22	0.14	0.11	0.30	-0.14	-0.54
Canada	**0.41**	**0.76**	**0.42**	**0.11**	**0.00**	**0.20**	**0.04**	**-0.07**	**-0.28**
c) 1929-1956									
AB	1.70	1.64	0.34	0.30	0.06	0.60	0.35	0.15	-0.09
BC	1.19	1.55	0.03	0.47	0.25	0.65	0.15	-0.34	-0.02
MB	0.44	0.66	0.22	0.07	0.00	0.07	0.30	-0.05	-0.17
NB	0.66	0.50	0.07	0.12	-0.05	0.01	0.35	0.15	0.01
NS	0.58	0.43	-0.08	0.01	-0.01	-0.09	0.60	0.05	0.10
PE	0.39	0.32	-0.06	0.05	-0.16	-0.02	0.53	0.07	0.00
QC	0.19	0.20	-0.02	-0.04	0.00	0.09	0.17	-0.05	0.04
SK	1.13	1.38	0.77	0.20	0.01	0.19	0.21	-0.12	-0.13
Canada	**0.69**	**0.74**	**0.13**	**0.11**	**0.04**	**0.21**	**0.25**	**-0.04**	**-0.02**

Sources: See Appendix 1.

Table A3. Decomposing Relative Gross Value Added Per Worker Growth, 1956-2006

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
			Within industry						
	Overall	**All sectors**	**Agric.**	**Const.**	**Manuf.**	**Res.**	**Serv.**	**Labour Realloc.**	**Between-industry**
a) 1956-1971									
AB	-1.20	-1.90	-0.30	-0.63	-0.10	-0.15	-0.71	0.20	0.50
BC	-1.08	-1.08	-0.05	-0.47	-0.16	-0.33	-0.07	-0.26	0.25
MB	0.11	-0.43	-0.05	0.00	0.09	0.03	-0.50	0.14	0.40
NB	0.29	-0.38	0.01	-0.02	0.30	0.05	-0.72	0.38	0.29
NS	0.86	-0.27	0.09	0.18	0.16	0.06	-0.77	0.76	0.37
PE	0.36	-0.75	-0.21	0.20	0.39	-0.07	-1.07	0.57	0.53
QC	0.21	0.01	0.07	0.05	0.08	-0.07	-0.12	0.18	0.03
SK	-0.11	-0.96	-0.25	-0.28	0.06	-0.01	-0.47	0.23	0.62
Canada	**0.00**	**-0.29**	**0.01**	**-0.09**	**0.06**	**0.03**	**-0.29**	**0.05**	**0.24**
b) 1971-1981									
AB	4.48	3.36	0.35	0.49	0.09	0.92	1.52	1.28	-0.16
BC	0.68	0.72	0.08	-0.17	0.16	-0.05	0.71	0.19	-0.23
MB	1.14	1.09	0.08	-0.08	0.33	0.04	0.73	0.05	0.00
NB	0.11	0.24	0.08	0.13	0.19	0.08	-0.24	0.05	-0.19
NF	-0.33	-0.26	0.00	-0.59	-0.10	-0.56	0.99	0.27	-0.34
NS	4.21	4.36	0.06	0.44	0.87	0.27	2.72	0.04	-0.19
PE	1.25	1.04	0.73	-0.29	-0.12	0.07	0.66	0.23	-0.02
QC	0.57	0.62	0.05	0.24	0.31	0.03	-0.01	-0.02	-0.04
SK	2.45	1.69	0.41	-0.01	0.08	-0.06	1.27	0.52	0.25
Canada	**1.64**	**1.54**	**0.13**	**0.18**	**0.26**	**0.32**	**0.66**	**0.19**	**-0.09**
c) 1981-1997									
AB	-1.21	-0.81	-0.15	-0.31	0.29	-0.40	-0.25	-0.30	-0.09
BC	-1.11	-1.06	-0.01	-0.16	-0.23	0.10	-0.76	-0.05	-0.01
MB	-0.42	-0.38	-0.04	-0.01	-0.11	-0.06	-0.16	0.08	-0.11
NB	0.52	0.48	0.01	-0.08	0.14	-0.05	0.47	0.02	0.01
NF	0.14	0.04	0.02	0.07	-0.06	-0.35	0.36	0.01	0.09
NS	-2.27	-2.35	0.01	-0.25	-0.35	-0.20	-1.56	0.08	0.00
PE	0.41	0.47	-0.08	0.00	0.02	0.01	0.53	0.09	-0.15
QC	-0.29	-0.33	0.00	-0.05	-0.09	-0.04	-0.16	0.02	0.02
SK	-0.82	-0.63	-0.35	-0.03	-0.02	0.15	-0.37	0.08	-0.28
Canada	**-0.65**	**-0.55**	**-0.05**	**-0.12**	**-0.04**	**-0.05**	**-0.29**	**-0.07**	**-0.03**
a) 1997-2006									
AB	3.81	2.14	0.08	0.43	-0.14	1.30	0.47	1.02	0.64
BC	1.35	1.29	-0.01	0.03	0.32	0.49	0.46	-0.20	0.26
MB	0.75	0.67	0.14	-0.03	0.18	0.44	-0.06	-0.04	0.12
NB	0.74	0.49	0.07	0.16	0.14	0.05	0.07	-0.07	0.32
NF	7.81	7.03	-0.02	-0.15	0.19	5.71	1.30	0.06	0.72
NS	0.39	0.05	0.06	0.01	0.09	0.24	-0.35	0.00	0.34
PE	0.27	-0.15	0.16	0.00	0.23	-0.35	-0.20	0.08	0.34
QC	-0.03	-0.07	0.01	-0.05	0.21	-0.05	-0.20	0.01	0.03
SK	1.94	0.81	-0.04	-0.03	0.16	0.68	0.03	0.78	0.36
Canada	**1.44**	**1.13**	**0.03**	**0.07**	**0.18**	**0.70**	**0.15**	**0.05**	**0.26**

APPENDIX 4:
SENSITIVITY TEST

The sensitivity test (Table A.4) replaces real values with nominal figures, as has typically been done in previous analyses (e.g. Enflo and Rosés, 2015). Our initial insights on the limited importance of structural change are confirmed, but convergence within services (instead of convergence within the resource sector) becomes the main determinant of relative convergence. This result is due to the Balassa-Samuelson effect: higher (nominal) wages in the tradable goods sector of a region also lead to higher (nominal) wages in the non-tradable (service) sector of its economy. Therefore, when we adjust for living costs in the main calculations, this effect is mitigated.

Table A.4. Decomposing Relative Gross Value Added Per Worker Growth, 1890-1956 (nominal values)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
			Within industry						
	Overall	**All sectors**	**Agric.**	**Const.**	**Manuf.**	**Res.**	**Serv.**	**Labour Realloc.**	**Between-industry**
BC	0.80	1.55	0.06	0.05	0.14	0.76	0.54	-0.46	-0.30
MB	0.73	0.86	0.23	0.03	0.08	0.05	0.47	-0.13	0.00
NB	0.69	0.99	0.22	0.04	0.13	0.14	0.46	-0.23	-0.07
NS	0.67	1.13	0.15	0.03	0.09	0.38	0.47	-0.25	-0.21
PE	0.59	0.82	0.24	0.02	0.07	0.09	0.39	-0.19	-0.05
QC	0.72	0.91	0.16	0.05	0.16	0.07	0.47	-0.16	-0.02
SK	1.19	1.23	0.21	0.08	0.08	0.33	0.54	0.04	-0.08
Canada	**0.85**	**1.14**	**0.16**	**0.06**	**0.14**	**0.30**	**0.50**	**-0.20**	**-0.09**

Notes: See Table 6.
Sources: See Appendix 1.