In the Footsteps of Mackintosh and Innis: Tracking Canada's Economic Centre of Gravity since the Great Depression

Sébastien Breau, Brian Toy, Mark Brown, Ryan MacDonald, Oliver T. Coomes

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SÉBASTIEN BREAU
Department of Geography, McGill University, Montreal, Quebec,
and Donald J. Savoie Institute, Moncton, New Brunswick

BRIAN TOY
Department of Geography, McGill University, Montreal, Quebec

MARK BROWN AND RYAN MACDONALD
Economic Analysis Division, Statistics Canada, Ottawa, Ontario

OLIVER T. COOMES
Department of Geography, McGill University, Montreal, Quebec

Les auteurs retracent les déplacements passés du centre de gravité de l'économie (CGE) du Canada, depuis le début du XXᵉ siècle. Une simple méthode du centre moyen pondéré est appliquée à un nouvel ensemble de données contenant des estimations à long terme du revenu des ménages à l'échelon provincial. L'analyse révèle que, de 1926 à 2013, le CGE du Canada s'est déplacé vers l'ouest d'une distance nette de 204 kilomètres. Parallèlement à cet important déplacement géographique, les auteurs définissent six moments historiques distincts où se sont produits des réalignements spatiaux majeurs, notamment un important déplacement d'ouest en est au cours des années de la Grande Crise et deux importants déplacements d'est en ouest à la faveur de deux épisodes d'essor dans le domaine des ressources naturelles attribuables au secteur énergétique, celui des années 1970 et celui de la période postérieure à 2000. La modélisation des séries chronologiques confirme que les hausses et les baisses des prix des ressources sont, de fait, fortement liées aux déplacements passés du CGE du Canada.

Mots clés : centre de gravité de l'économie du Canada, déplacement vers l'ouest, séries chronologiques provinciales à long terme

In this article, we track the historical movement in Canada's economic centre of gravity (ECG) since the early 20th century. A simple weighted mean centre approach is applied to a novel data set containing long-run estimates of household income at the provincial level. The analysis reveals that from 1926 to 2013, Canada's ECG shifted westward by a net distance of 204 kilometres. Concomitant with this broad geographical shift, we identify six distinct historical moments during which major spatial realignments occurred, including a significant west-to-east move during the Great Depression years and two important east-to-west shifts during the energy-driven resource booms of the 1970s and post-2000 period. Time series modeling confirms that the ups and downs of resource commodity prices are indeed strongly associated with historical movements of the ECG in Canada.

Keywords: Canada's economic centre of gravity; westward shift; long-run provincial time series

Introduction

It has often been said that if some countries have too much history, Canada has too much geography.[1] In 1923, Mackintosh was one of the first commentators to claim that scholars needed to pay more attention to the geographic and economic factors that shape the country's history. To understand the course of Canada's westward development, he argued, we need to examine the role played by the production and export of staples. A decade later, this idea would feature prominently in Innis's (1933) work. Innis argued that much of Canadian economic history could be understood as a series of staples exploitation waves, with different regions of the country developing and contributing more economically at distinct times. Each wave of staples exploitation was characterized by its own pattern of settlement, linkages to other economic activities, interactions with the centre, and set of institutional arrangements (Brodie 1989). Innis's staples theory would go on to have a profound impact on the Canadian political economy and debates about regional development in the country (see, e.g., Barnes, Hayter, and Hay 2001; Brodie 1989; Economic Council of Canada 1977; Hayter and Barnes 1990; Olewiler 2017; Savoie 1992; Watkins 1963).

Questions about the shifting political economic landscape of Canada have resurfaced of late since the post-2000 energy-driven resource boom. In *Looking West,* Berdahl and Gibbins (2014) argue that after decades of transformative changes wrought by globalization, technological innovation, resource development, immigration, and demographic aging, the economic and political map of Canada has been redrawn with an ever-increasing tipping toward the west. Bricker and Ibbitson (2013) refer to the "Big Shift" to describe concomitant changes in Canada's socio-economic and political landscape. Whether we like it or not, they argue, what was once a country that was mainly oriented to the Atlantic world is now increasingly becoming part of the Pacific world. Pitts (2008) has gone so far as to describe this westward shift as the "most important economic phenomenon in Canada's 140-year plus life" (12).

To document the westward shift, researchers have relied on a battery of economic indicators that generally show an increase in the relative strength of western provincial economies compared with the rest of Canada. Bricker and Ibbitson (2013), for instance, write, "In 1985, Manitoba, Saskatchewan, Alberta, and British Columbia collectively accounted for 32 percent of Canada's gross domestic product (GDP). In 2010, the figure was 36 percent" (92). Other studies point to western Canada's more dynamic labour markets (with lower unemployment rates and higher participation rates than the national average), faster population growth, slower aging demographic, higher levels of private capital investments, and rising proportion of corporate head offices (Beckstead and Brown 2006; Ray, Lamarche, and MacLachlan 2013; Siddiq and Babins 2013). In the end, the evidence converges on a commonly held view: the westward shift in the country's economic centre has been a steady drift, now decades old (Berdahl and Gibbins 2014).

Yet where exactly is Canada's economic centre of gravity (ECG), just how far west has it shifted over time, and has its movement been smooth or episodic? We seek to answer this question by means of a simple mean centre approach, a technique borrowed from population geographers, who have long used it to track changes in a country's spatial distribution in population. The novelty here is that the mean centre approach we adopt is applied to a new data set that provides long-term estimates of provincial-level household income figures from 1926 to 2013 (Baldwin and Macdonald 2012; Macdonald 2015).[2] Identifying the ECG and tracking changes in its direction and extent of movement over such a long period provides a new way of exploring and interpreting some of the underlying forces that have shaped Canada's recent economic history. To that end, and taking a cue from Mackintosh, we examine whether resource booms (or busts) are associated with westward (or eastward) shifts in Canada's ECG through time. This is done by assessing the correspondence of boom and bust eras and shifts in the ECG and formally testing the association between changing resource prices (see Macdonald 2017) and movements of Canada's ECG.

Overall, we find that the country's ECG shifted from east to west by about 204 kilometres over 1926–2013, with a slight tilt from south to north of about 35 kilometres. Although the predominant direction of change is indeed toward the west, the shift has been neither slow or steady, but rather episodic and revealingly so. We identify six distinct moments during which there have been major historical realignments reflecting changes in the industrial structure and trade activities of different regions. Among these, we identify three periods of west-to-east movements (the single largest one associated with the Great Depression years) and three predominant east-to-west shifts, including the resource booms of the 1970s and post-2000 era. In turn, these westward and eastward shifts are strongly associated with long-run rises and falls in resource prices. Canada's economic geography has and continues to be fundamentally tied to its resource base, with oscillations in resource prices profoundly affecting the historical movement of Canada's ECG.

Measuring Geographic Centres

There is a long history of using mean centre points in geographical research to summarize and track how the spatial distribution of population changes over time. In 1874, the US Census Bureau published one of the earliest attempts to determine the country's centre of population. Defined as the centre of gravity of the country's population, it was also described as its balance point, where an imaginary, flat, weightless, and rigid map of the United States would

balance perfectly if everyone counted in the census were of identical weight (Plane and Rogerson 2015; US Census Bureau 2011). Since then, with every decennial census, movement in this balance point, or the average location of the population (Hayford 1902), has been tracked to describe the history and geography of settlement in the United States and to summarize the changing features of population such as the spatial distribution of births, deaths, immigration, and emigration. Considerable media attention is given in the United States to the publication of this location (Aboufadel and Austin 2006), and it is often listed in popular almanacs and statistical abstracts of various kinds (Rogerson 2015).[3]

Recent debates over the impact of globalization and, in particular, the emergence of China as an economic superpower have led economists to use the concept of a geographical centre of gravity to describe the world's shifting distribution of economic activity. Using a three-dimensional projection (where the origin is given by the Earth's core) and national GDP figures allocated to 392 cities across the globe, Grether and Mathys (2010) locate the world's ECG (WECG) in the mid-1970s just beneath the northeastern coast of Iceland. By the mid-2000s, their calculations show that the WECG had shifted eastward to Spitzbergen, an island part of the Svalbard archipelago off the northern coast of Norway roughly 1,990 kilometres from Iceland. Using a similar approach with a more extensive data set (which also includes national GDP figures for a larger set of cities along with rural proxies), Quah (2011) finds that the WECG shifted approximately 4,800 kilometres eastward, from a location in the mid-Atlantic Ocean in 1980 to somewhere close to Izmir (Turkey) by 2008. Extrapolating forward to 2050, Quah also predicts that the WECG will continue to shift east to eventually lie somewhere between India and China. A similar analysis has yet to be undertaken for Canada.

Methodology

Data Sources

The primary economic data used for our analysis come from Statistics Canada's newly developed long-run estimates of economic variables for provinces (see CANSIM Table 384–5000). This data set, originally compiled to examine patterns of income convergence across Canadian provinces (see Brown and Macdonald 2015), links three different vintages of data from the Canadian System of National Accounts to provide a unique time series of historical estimates for household income and consumer prices from 1926 to 2013. Because key definitions and concepts vary across vintages, the challenge in producing such a time series lies in how the data sources are linked. Here, the historical estimates are linked on the basis of their growth rates: figures from the latest national accounts are projected back through time using the growth rates of the historical estimates going back to 1926. The advantage of using growth rates (and

not regression-based estimates) to back-cast through time is that the magnitude of historical events can be preserved (for more details, see Macdonald 2015).

To examine movements in the ECG, we use household income. *Household income* is defined as the sum of compensation to employees, net mixed income, and net property income before taxes and transfers. Measured as such, household income reflects production rather than disposable income. Although it would be preferable to use GDP so as to include gross operating surplus (profits) in the production measure, only household income measures are available over the long period from 1926 to 2013. To incorporate the longest time span available, we therefore adopt household income measures.

Household income does follow trends similar to GDP because regions with more capital tend to pay higher wages, and regions that grow more rapidly tend to see more rapid household income growth. The addition of gross operating surplus (profits) tends to accentuate these movements and to add a larger amplitude to cyclical changes. To the extent, therefore, that the use of household income rather than GDP biases results, they will tend to underestimate the distance travelled by the ECG and to reduce the amplitude of cyclical changes; they can thus be viewed as, at a minimum, a lower bound for the movement.[4]

We use the nominal rather than real value of household income because nominal incomes induce workers to move across regions, and nominal income is used to demonstrate the relative share of production from one province versus another. Moreover, metrics related to investment or financial reporting, such as rate of return or return on equity, are based on nominal flows that reflect price movements that influence returns. Nevertheless, as a robustness check, we also computed the real values on the basis of a major-city consumer price index (CPI), and the results were found to be consistent.[5]

Calculating the Economic Centre of Gravity

Canada's ECG is calculated using the weighted mean centre of the X and Y coordinates associated with the centroids of each province. More formally, the ECG is defined as

$$\bar{X}_t = \frac{\sum_{i=1}^{n} HI_{it}X_i}{\sum_{i=1}^{n} HI_{it}} , \ \bar{Y}_t = \frac{\sum_{i=1}^{n} HI_{it}Y_i}{\sum_{i=1}^{n} HI_{it}} ,$$

where X_i and Y_i represent the longitudinal and latitudinal coordinates of each province's centroid ($n = 10$ provinces) and HI_{it} represents the household income level of each province (i.e., its relative economic weight) at time t (1926–2013). The location of the mean centre will, of course, depend on how it is projected on a two-dimensional surface. Here, we use the cartographic boundary files produced by Statistics Canada, which are

Table 1: Provincial and Metropolitan Area Centroids (Unweighted)

| Province | Provincial Centroids | | Largest Metropolitan Area | Population (× 1,000)[a] | Metropolitan Area Centroids | |
	Longitude	Latitude			Longitude	Latitude
Newfoundland	−60.4611	52.8625	St. John's	208.8	−52.8983	47.7045
Prince Edward Island	−63.2577	46.4009	Charlottetown	64.5[b]	−63.1915	46.2782
Nova Scotia	−63.3261	45.1502	Halifax	410.3	−63.5752	44.6488
New Brunswick	−66.3804	46.6272	Moncton	144.6	−64.7782	46.0878
Quebec	−71.7725	53.3828	Montreal	3,980.8	−73.5673	45.5017
Ontario	−86.0730	50.4510	Toronto	5,967.2	−79.3832	43.6532
Manitoba	−97.4289	54.9260	Winnipeg	770.5	−97.1375	49.8998
Saskatchewan	−105.8894	54.4180	Saskatoon	290.7	−106.6700	52.1332
Alberta	−114.5071	55.1636	Calgary	1,353.9	−114.0708	51.0486
British Columbia	−124.7366	54.7679	Vancouver	2,444.3	−123.1207	49.2827

[a]The population of metropolitan areas is based on 2013 estimates (CANSIM Table 051–0056).
[b]The population estimate for the Charlottetown census agglomeration is based on the 2011 National Household Survey.
Source: Statistics Canada cartographic boundary files.

portrayed in Lambert conformal conic projection and are based on the North American Datum of 1983. Because these boundary files depict the standard geographic areas with the shoreline of the major land mass of Canada and its coastal islands, they provide good directional and shape relationships for generating representative points in the mid-latitudes that have a mainly east-to-west extent. In other words, areal distortions, in terms of scale and distance, are minimized throughout the region of interest and will only increase as we move away from the standard parallels (see Statistics Canada 2012, 2015, for more details).

For analytical purposes, the *XY* coordinates of each province's centroid are delineated in two different ways. The first approach is based on the common geographic centroid of a province, that is, the *XY* point location representing its geographic centre. The centre is the point at which a physical cutout of the shape of each province on a flat two-dimensional map would be perfectly balanced on the head of a pin. Given that the country stretches from east to west across the continent with a discontinuous ecumene, as an alternative to the geographic centre of each province, our second set of centroid coordinates is based on the *XY* centroid location of each province's largest metropolitan area (according to 2013 population estimates; see Table 1). The rationale is that these metropolitan areas represent the largest economic centres of activities in each province.

Although the ECG can be readily calculated for both of these sets of coordinates, we recognize an important limitation in that they assume the centroid of each province or city is fixed in time. Instead, we know that significant shifts in economic activity occur within each province. To capture intra-provincial shifts, more geographically

detailed data on household income would be required. These data are not currently available over a sufficient period of time.[6]

Results

Directional Shifts in Canada's ECG

Figure 1 presents the first map of Canada's ECG based on the geographic centroids of provinces. To facilitate the tracking and interpretation of movements in the country's ECG, key dates are identified along with major historical shifts in the inset map (see also the timeline presented in Table 2).

The westward shift in Canada's ECG since just before the Great Depression is clearly visible on this map. In 1926, Canada's ECG was located at a latitude of N 52° 13′ and a longitude of W 89° 05′ in the northwest corner of the province of Ontario. Specifically, the centre was situated on a small remote island in Totogan Lake, roughly 416 kilometres due north of Thunder Bay (the nearest community, some 44 kilometres east, is Neskantaga First Nation—formerly known as Lansdowne House—on the shores of Attawapiskat Lake). By 2013, Canada's ECG was located at a latitude of N 52° 43′ and a longitude of W 92° 01′, a point close to Windigo Lake, approximately 211 kilometres east of the Manitoba border. In terms of distances, the ECG has thus shifted a net 204 kilometres from east to west and slightly north by about 35 kilometres. The amplitude of this shift over time is even more pronounced when considering the maximum range values (see bottom panel of Table 2) based on the most easterly and southerly coordinates of the ECG (which are, respectively, in 1931 at a longitude of W 87° 41′ and in 1941 at a latitude of N 51° 92′).
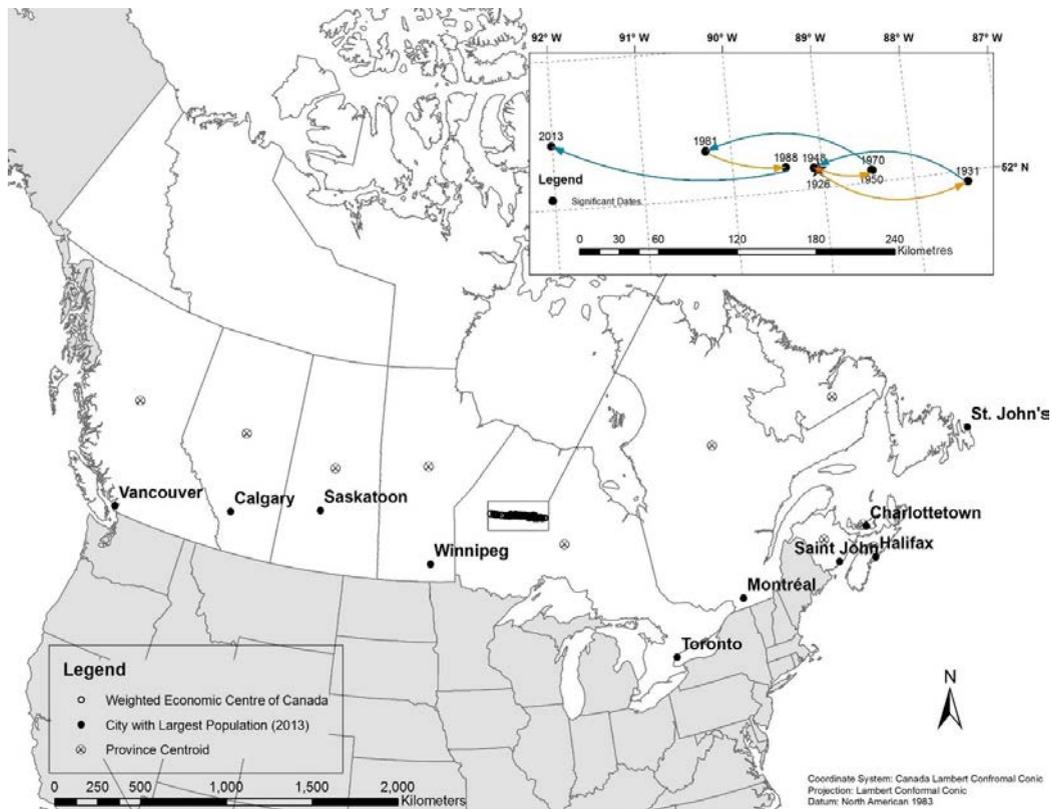
Figure 1: Canada's Economic Centre of Gravity (Based on Provincial Centroids), 1926–2013

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Table 2: Timeline of Major Historical Shifts in the Canadian Economy's Centre of Gravity

Years	Distance (km)	Direction	Defining Political Economic Events
East–west shifts			
1926–1931	114	East	Great Depression, US imposes Smooth-Hawley Tariff Act (1930)
1931–1939	53	West	Great Depression aftermath continues
1939–1948	64	West	World Ware II and post-war economic transition and boom
1948–1950	44	East	Newfoundland joins Confederation (1 April 1949)
1950–1970	1	West–east	Little "net" movement in centre of gravity.
1970–1981	128	West	Oil shocks (1973, 1979) → oil and gas boom out west
1981–1988	63	East	National Energy Program years, softening of world energy prices, recession (early 1980s).
1988–2013	179	West	Bulk of shift (112 km) occurs post-2000 as the resource boom leads to increased energy production out west. Short blip (16 km) from West to East after the Great Recession years (2008–2010)
Net 1926–2013	204	West	
South–north shift			
Net 1926–2013	35	North	Gradual shift north though southern deviation from 1987 to 1989 after the implementation of the Canada–US Free Trade Agreement (this southern drift continued shortly into the early 1990s)
Maximum range values in shifts			
1931–2013	318	West	1931 is the most easterly point in the economic centre of gravity
1941–2013	55	North	1941 is the most southerly point in the economic centre of gravity

Source: Authors' calculations.

In many respects, the east–west movement and the south–north movement reflect the same phenomenon. Southern Ontario is the largest regional economy in Canada, and it extends below the 49th parallel. As a result, almost any shift east or west would necessitate a north–south adjustment purely on the basis of Canada's geography. For the purposes of this article, we focus on the east–west movement in the ECG because it tends to be a better indicator of the tension between differential growth patterns, more so than the north–south movement.

The net westward shift of 204 kilometres is not trivial in terms of magnitude. To put things into perspective, if we take the straight-line distance ("as the crow flies") between St. John's, Newfoundland, and Vancouver, British Columbia, as our barometer (a total of 5,005 km), the westward movement represents a 4.1 percent shift in the ECG.[7]

Perhaps more interesting than the general trend westward are moments of directional shifts that mark important eras in Canadian economic history. We observe six major changes in direction that occurred over the nearly 90-year period studied.

The first major shift observed takes place from 1926 to 1931 as the ECG moves from west to east by roughly 114 kilometres. Much of this shift occurred between 1928

and 1931 as the Canadian economy was swept into the worldwide downswing of the Great Depression. Although no region was spared (by 1933, one-fifth of the Canadian labour force was without work; see Safarian 2009), the impact of the decline was uneven across the country. At the time, the Canadian economy was still heavily oriented toward agricultural production (see Figure 2). Wheat and wheat flour were the country's leading exports, accounting for as much as 50 percent of the world's total wheat exports in the late 1920s (Easterbrook and Aitken 1975). As prices for these commodities collapsed on world markets, together with a mix of flawed production technologies and poor weather conditions, the Prairie Provinces, which relied heavily on agricultural exports, suffered the most severe drop in incomes (Safarian 2009, 84).

The decline associated with the Great Depression continued until 1933 when the level of annual real GDP reached its low point, down 28 percent from its pre-depression level in 1929 (Cross and Bergevin 2012). Although it is difficult to speak of a recovery, this period does signal the beginning of a turnaround corresponding to the second directional shift in the ECG. Exports began to rise again as prices for key commodities stabilized and previously imposed restrictions on international trade were eased between Canada and its main trading partners
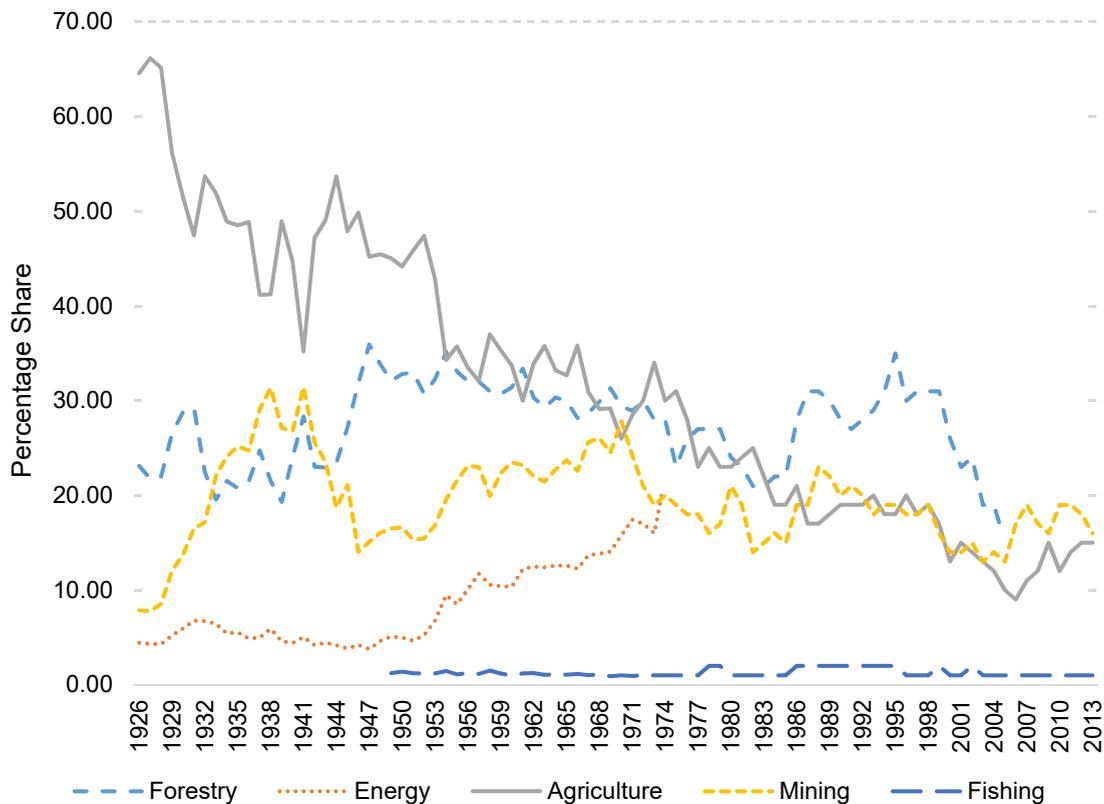

Figure 2: Share of Production of Resource Products, 1926–2013

Note: Production of major resource commodities important for trade. Source: Data series from Macdonald (2017).

(with the United Kingdom after the 1932 Ottawa Agreements and with the United States in a series of treaties signed in the mid-1930s providing some concessions to the severe duties under the *Tariff Act of 1930,* commonly known as the *Smoot-Hawley Tariff*). Growth in the forestry sector (pulp and paper in particular) resumed, and the 1934 passing of the *Gold Reserve Act* in the United States (which saw the nominal price of gold re-evaluated from $20.67 to $35.00 per ounce) led to a gold rush in Canada that propelled the non-ferrous mining sector forward. All told, the country's ECG shifted from east to west by about 53 kilometres during this slow and—as Safarian (2009) has referred to it as—incomplete recovery. The westward shift would progress by another 64 kilometres from 1939 to 1948, as World War II saw the Canadian economy "retooled" to meet the industrial demands of the war effort. Traditional agricultural production expanded, as did metals and manufacturing industries primarily concentrated in Central Canada.

The third directional shift took place from 1948 to 1950 as the province of Newfoundland joined Confederation (officially at midnight on 31 March 1949). Fisheries, and especially cod, were the primary staple of the provincial economy at the time, and the pulp and paper and mining industries were beginning to thrive. When Newfoundland joined Canada, the country's ECG moved roughly 44 kilometres eastward.

It is interesting that the period stretching from 1950 to 1970, which can be described as one of robust and sustained economic growth (Nicholson 2003; Norrie, Owram, and Emery 2007), is also characterized by very little movement in the nation's ECG (barely 1 km in net total movement). For much of the 1950s, natural resources developments and exports continued their expansion. Mining-related activities grew rapidly in Quebec (asbestos, gold, copper, and lead), Ontario (iron ore, nickel, cobalt), Manitoba (nickel), and Saskatchewan (uranium and new discoveries of potash deposits). Aluminum production was also expanded in Quebec's Saguenay region and in Kitimat, British Columbia, to serve the fast-growing world aviation industry (Baldwin and Macdonald 2012). The discovery of crude oil at Leduc, Alberta, in 1947 also marked the beginning of a new era that would eventually see oil and gas activities supplant agriculture as the province's primary industry.

The short-distance oscillations of the ECG continued throughout the 1960s as the rapid expansion of the country's manufacturing sector forged ahead (this was the heyday of post-war Fordism), especially to the benefit of the Canadian heartland,[8] where the growing concentration of US branch plants played a prominent role (Courchene and Telmer 1998; Wallace 2002). An especially pivotal year was 1965, as the Canada–United States Auto Pact came into effect. An example of managed trade (i.e., targeted toward the specific removal of tariffs on new vehicles

and original equipment parts between the two countries), the Auto Pact would significantly alter the country's trade patterns, which still remained dominated by natural resources even though their relative importance had gradually fallen over time (see Figure 2).[9] The growth of the aerospace, telecommunications, and pharmaceutical industries, which are predominantly located around the Montreal, Toronto, and Ottawa metropolitan areas, also explains the lack of movement in the country's ECG at the time.

The fourth major realignment of Canada's ECG—this time to the west—came in the 1970s and can be explained by two major events. On the one hand, western Canada was increasingly feeling the pull of Japan's rapidly growing economy (which had become the world's second largest economy) and its thirst for natural resources. Mining activities and pulp and paper mills in British Columbia, in particular, benefited from the surge in demand from the Asian market (Bradbury 1978). The other major development at the time was on the energy front. Although Alberta was already enjoying steady income growth from its oil and gas industries (after the construction of a series of pipelines in the 1950s and the 1961 National Oil Policy, which ensured a market for its energy resources), the oil shocks of the 1970s fuelled further growth in the sector. Domestic oil production, buoyed by the 1973 OPEC embargo (which saw the price of Brent crude rise from $2.48 per barrel in 1972 to US$11.58 per barrel in 1974), hit peak output of 114 million cubic meters in 1973 (or roughly 1.96 million barrels per day, a level not seen again until the mid-1990s; CANSIM Tables 126-0001 and 126-0002) before levelling off to an average of 90.4 million cubic meters over the remainder of the decade. This surge in production is clearly visible in Figure 2, and it coincides with the first energy boom in Canada, which translated into a 128-kilometre westward shift in the ECG from 1970 to 1981.

The following decade saw a fifth major directional change take place. After rapid escalations in 1973 and 1979, world oil prices stabilized or declined modestly during the early 1980s before collapsing in 1986. Combined with the National Energy Program, which encouraged greater Canadian ownership of the oil industry and capped the domestic price for oil below international prices, fewer investments in large-scale projects in Alberta slowed development in the sector. At the same time, Canada's manufacturing base was restructuring. In Ontario, billions in new capital investments poured into the auto sector as it adjusted to greater competition from Japanese automakers (Holmes 1996). Other technology-intensive activities (e.g., aerospace, biotechnology, and telecommunications) also expanded with more and more research and development also coming from the service sector (e.g., software design and development, producer services, engineering, and scientific services; Britton 1996). This amalgam of economic

developments translated into a 63-kilometre shift of the ECG back toward the east.

Since the late 1980s, however, the country's ECG has been steadily moving westward. From 1988 to 2013, the ECG moved from east to west by 179 kilometres. Within this broad sixth shift, we can identify two distinct periods. First, while moving some 67 kilometres west, the ECG during the 1990s also slightly shifted from north to south by some 3 kilometres. Although small in distance, this shift represents one of the few times the ECG has drifted from its gradual and steady south-to-north progression since the post-war years. In many ways, it signaled the continuation of a southward realignment in the ECG which began in the late 1980s with the implementation of the Canada–United States Free Trade Agreement (1988) and its successor the North American Free Trade Agreement (1994). During this period, the dollar was also devaluing rapidly, which gave further incentive for central Canada manufacturers to expand their operations. By 1999, this trend had resorbed itself, and the east-to-west shift also came to a halt as output from new energy projects was coming online in the east (the Hibernia offshore oil field in Newfoundland and gas production from Sable Island in Nova Scotia).

The second distinct movement corresponds to the 112-kilometre westward shift that occurred between 2000 and 2013. After the 1970s, this shift represents the second largest movement in the ECG since 1926 and, again, it can be attributed to a second energy resource boom in Western Canada (see Figure 2). Throughout the 1990s, the growth of the iron, steel, auto, and aircraft sectors had largely overshadowed that of the energy sector such that the share of exports attributable to natural resources had fallen to its lowest point on record (36 percent in 1999; Baldwin and Macdonald 2012). With the rapid growth of non-conventional oil resources in Alberta during the 2000s, now Canada's primary source of oil, and an expansion of natural gas activities in nearby Saskatchewan and British Columbia, the decline had reversed itself and the share of resources in exports rose again to 53 percent by 2010. Given the expansiveness of the post-2000 resource boom,[10] it is no wonder economists expressed concern over the possible impacts of the so-called "natural resource curse" on the Canadian economy (e.g., Boyce and Emery 2011; Cross 2008).

Our discussion so far has focused on the movement of Canada's ECG as it is defined by the geographic centroids of provinces. Figure 3 maps an alternate ECG using the *XY* centroid location of each province's largest metropolitan
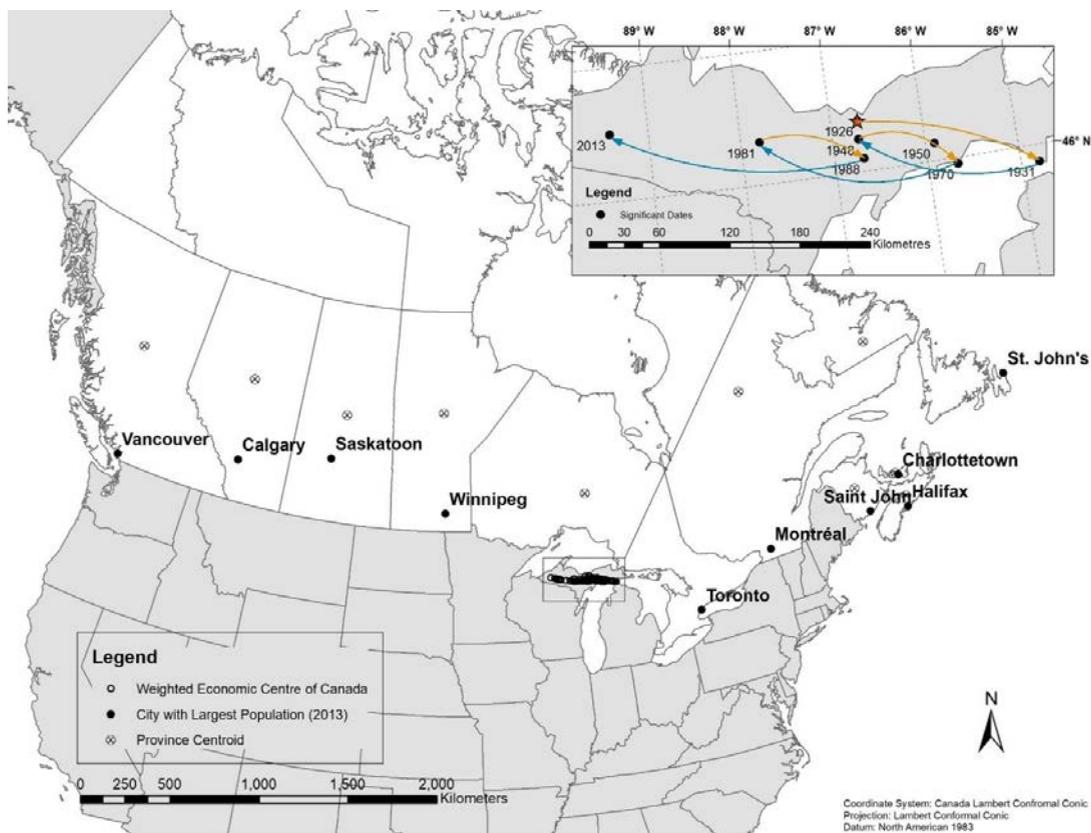

Figure 3: Canada's Economic Centre of Gravity (Based on Metropolitan Centroids), 1926–2013

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area instead. The striking feature here is that the ECG lies historically not in Canada but south of the border, in the United States, in the northwestern peninsula of Michigan, close to the city of Marquette on the shores of Lake Superior. In 1926, the ECG—based on metropolitan centroids—would be located at a latitude of N 46° 38′ and longitude of W 86° 70′. That is roughly 660 kilometres south-east from the ECG calculated using the geographic centroids of provinces. By 2013, the ECG is found at a latitude of N 46° 50′ and a longitude of W 89° 42′, a point just 33 kilometers due north of the Wisconsin border. Compared with the province-based ECG, the east–west distance in the movement of the city-centroids ECG is similar, although the south-to-north shift is slightly less pronounced (which reflects the relatively more compact spatial distribution of metropolitan centres). More important, the six major moments in the directional changes of the ECG are also evident on this map.

If the idea of having an ECG that lies outside of Canada at first seems somewhat unnatural, it does reflect the fact that our country is not a convex set. With Toronto as the largest metropolitan economy, the anchor of the Golden Horseshoe in southern Ontario (situated at a latitude of N 43° 65′), the ECG is pulled southward considerably. The latter finding using a different set of centroid coordinates based on a more disaggregated geography does raise the classic problem of what areal unit of analysis should be adopted for tracking movements in the ECG (see Openshaw 1983). For the time being, we are limited by the data

currently available but in a future article based on Census Division–level estimates of household income, we will be able to re-estimate and compare movements in the ECG using a finer geography.

Resource Prices and Canada's Economic Centre of Gravity

As noted earlier, one of the most striking characteristics of the six major shifts in Canada's ECG is the role of natural resources. Although the types of resource may have changed (e.g., from fish and wood to wheat to oil), the pattern is quite clear: rising resource prices are associated with westward shifts in the ECG.

Here we test this association more formally by regressing changes in the long-run Bank of Canada Commodity Price Index (BCPI) with east–west (longitude) shifts in the ECG. The BCPI is an index that expresses changes in global, US$ prices for commodities important to Canada (Kolet and Macdonald 2010).[11] Extending from 1870 to 2015, the long-run version of the BCPI is particularly useful here because it was constructed to consistently trace resource price shifts over a long period of time that encompasses the study period. It consists of a basket of 23 commodities whose weights change through time to reflect the overall composition of production (see Macdonald 2017 for more details).

Figure 4 presents the eastward–westward shifts in the ECG compared with growth in commodity prices from the BCPI over the study period. We use a 9-year moving
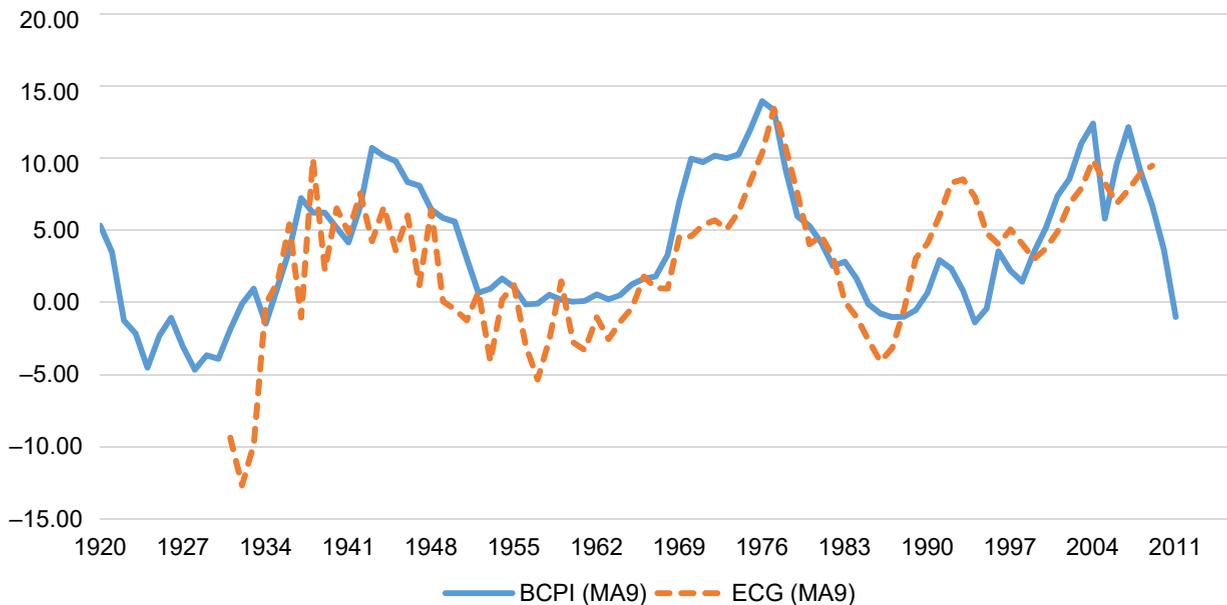

Figure 4: Commodity Price Growth versus East–West Movements in Canada's Economic Centre of Gravity

Notes: Percentage change in BCPI (9-year moving average) and west (+) vs. east (−) movements in ECG, measured in kilometers (9-year moving average). BCPI = Bank of Canada Commodity Price Index; ECG = economic centre of gravity.

Source: Authors' calculations.

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average to present a trend because both series are quite volatile, making it difficult to extract an underlying signal from the noise. Both series follow the same path through time with rising resource prices associated with westward shifts in the ECG (positive changes) and falling resource prices resulting in eastward shifts (negative changes). To formally test this relationship, we begin by regressing the BCPI on the ECG such that

$$ECG9_t = \alpha + \beta BCPI9_{t+l} + D + \varepsilon_t,$$

where *ECG9* is the nine-year moving average of the ECG in year *t*, the vector BCPI9 is the nine-year moving average of the BCPI in year *t* with *l* leads (+) and lags (−), and *D* is a binary variable for the early depression years (1929–1934), where there is a clear break in the series. There is a positive and significant association between the one-year lag of the BCPI9 and the westward shift in the ECG, but no association with the other leads and lags. That is, there is a one-year delay in the reaction of the ECG to changes in the BCPI, but no more than that. Similarly, there is no association with leads in the BCPI. Using a more parsimonious specification with just a one-year lag in the BCPI leads to qualitatively similar results and an adjusted R^2 of 0.61 (see Table 3). Hence, about 60 percent of the variation in the east–west movement in the ECG is accounted for by the BCPI and an indicator variable for the depression.

Table 3: Economic Centre of Gravity as a Function of Commodity Prices

Coefficient label	Coefficient estimate	*p*-value
α	0.26	0.63
β	0.70	0.00
D	−7.38	0.00
Probability (*F* statistic)		0
R^2	0.61	
N	79	
Durbin-Watson	0.89	

Table 4: Granger Causality after World War II

Hypothesis	*F*	*p*
Commodity price change does not Granger cause ECG change	3.8	0.0
ECG does not Granger cause BCPI price growth	0.0	1.0

Notes: Sample: 1950–2013. Lags = 5, *N* = 60. Lags = 5 provides the information needed to generate the degrees of freedom. Note also that the test was conducted for lags = 1 to lags = 5 and that the results are consistent in all cases. BCPI = Bank of Canada Commodity Price Index; ECG = economic centre of gravity.

We also tested the direction of the association between the ECG and BCPI using Granger Causation for the period after World War II. Our findings suggest that a change in the BCPI is associated with a change in the ECG, but not otherwise (see Table 4). Overall, the intuition that resource prices are strongly associated with shifts in Canada's economic centre through time is supported. Canada's economic history, as expressed through its ECG, is accounted for—to a remarkable degree—by one resource-based price index.

Concluding Remarks

We set out to track movements in Canada's ECG. Our results show that there has been a net westward shift in the country's ECG of 204 kilometres from 1926 to 2013 along with a net south-to-north shift of 35 kilometres. Moreover, within this period we have identified six different moments during which major historical realignments have occurred (not only from east to west, but also west to east). In a nod to Mackintosh and Innis, we also find these realignments to be strongly associated with the long-run cyclical ups and downs of commodity prices.

Although it is an abstract construct, the ECG (or centre point) does provide a convenient and novel way of graphically summarizing distributional tendencies across the country's economic landscape. In particular, tracking changes in the ECG's direction and extent of movement over such a long period of time helps us illustrate key historical moments in Canadian economic development. To be sure, there is also room for improvement from a methodological point of view. With the development of a more geographically disaggregated data set based on census divisions as regional units of analysis, we will be able to explore more carefully how intra-provincial shifts in economic activities have influenced the trajectory of the ECG, albeit over a shorter period of time.

Looking forward, it will also be interesting to see how the ECG evolves in the face of new political economic challenges and opportunities. Economic conditions in Alberta have changed markedly after a pronounced decline in the price of oil that began in 2014 as West Texas Intermediate fell from US$105.79 per barrel in June of that year to US$30.32 per barrel in February 2016. Today, business investments in the province remain lower than in the post-2000 energy boom era even if global commodity prices are now slowly recovering. Questions also arise as to how the continued growth of Asian economies and evolving multilateral trade agreements will affect the country's trading relations and partnerships. In addition, how will population aging and what some observers are calling the Great Demographic Imbalance (Saillant 2016) shape the fortunes of different regions across the country? If anything, our historical overview of movements in the ECG suggests that all of these forces will likely play a major role in shaping the future of Canada's economic geography.

Notes

1 This notion was popularized in a speech by Prime Minister William Lyon Mackenzie King to the House of Commons in 1936.
2 The lack of a consistent and continuous time series on household income figures below the national level is argu-ably one of the reasons such an empirical exercise was not carried out earlier.
3 Although it has not received as much media attention in Canada, the *Globe and Mail* (see Jackman 2011) and *Maclean's* (see Campbell 2015) have run stories about the geographi-cal centre of the country.
4 We thank one of the reviewers for pointing this out.
5 Note that although historical estimates for the CPIs are not available for provinces, they are for Halifax, Saint John, Montreal, Toronto, Winnipeg, Regina, Calgary, and Van-couver from 1926 to 2013. The CPI for St. John's is only available from 1952 onward; thus, the average of Halifax and Saint John is used as a proxy for 1949–1951. Likewise, the CPI for Charlottetown is only available from 1974 on-ward (here, Saint John is the reference for 1926–1973). City-specific CPIs were thus applied to our provincial income estimates to produce a real income series (expressed in 2002 dollars). Results are available from the authors on request.
6 We are currently working on the development of a data set that will allow us to explore such dynamics.
7 And, if we use existing international studies of movements in population centres of gravity as a benchmark for compari-son, this 4.1 percent shift lies in between Sweden's 1.8 per-cent southerly shift in population centre of gravity from 1930 to 2010 (Ernstson 2015) and the United States' westward pro-gression in population centre of gravity of 11.8 percent over the same period of study (Plane and Rogerson 2015).
8 This harkens back to the heartland–hinterland debate, which was a focal point of the 1970s–1980s literature on the spatial dimensions of Canadian regionalism (e.g., McCann 1998; Ray 1985). The heartland–hinterland (or core–periphery) approach is a meaningful framework for region-al analysis, especially at a finer scale where intra-provincial shifts in economic activity can be examined. As stated in the "Calculating the Economic Centre of Gravity" section, although we are currently working on developing a data set that will allow us to investigate such dynamics more closely, the focus of this article is on the broader east–west movements in the ECG, a spatial progression that is part of what Holdsworth and Kerr (2000) have called the country's "Great Transformation" during the 20th century.

9 Up through the early 1960s, agriculture, forestry, non-fer-rous metals, and non-metallic minerals still accounted for 80 percent of all Canadian exports (Baldwin and Macdon-ald 2012).
10 It is interesting to note, however, that the Great Recession of 2008–2009 did momentarily halt the ECG's westerly pro-gression (with a 15 km west-to-east realignment from 2008 to 2009 alone).
11 Because the BCPI is measured in US$, the force of rising commodity prices can differ between periods with floating exchange rates and periods with fixed exchange rates. As a robustness check, a measure of C$ BCPI was substituted for the US$ BCPI, and the results were essentially unchanged.

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