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IF IT MATTERS, MEASURE IT: UNPACKING DIVERSIFICATION IN CANADA

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SUMMARY

Will greater diversification benefit our economy? While many think it will, few are explicit about what they mean by diversification or what an "ideal" level would be. Even fewer recognize that favoured policies to promote diversification could actually do more harm than good.

There are many ways to measure diversification in Canada, and each measure tells a different story. Canada's GDP and employment, for example, are more diverse than many other countries, including the U.S. Employment is also more diversified today than at any point in its recent history, even in resource-rich provinces. Perhaps surprisingly, Alberta and Saskatchewan lead the country in employment diversity. Even accounting for non-resource jobs that are indirectly linked to resources does not reveal resource-rich provinces to be less diverse than others. To be sure, by other measures they are less diverse and more volatile, so we gather and analyze a wealth of data to paint a full, nuanced, and sometimes surprising picture of diversification in Canada.

But does diversification even matter? Economists, for centuries, have found gains from specializing in areas where we have a comparative advantage. Subsidizing certain selected industries therefore risks causing economic damage by distorting activity and displacing workers and investment from more valuable uses. Policy-makers should therefore focus on neutral policies: create a favorable investment climate, facilitate adjustment and re-training, encourage savings (including by government), and so on. We discuss the pros and cons of various options.

At the end of the day, responsible governments must define their objectives clearly, and recognize the costs of policies meant to achieve those objectives. We cannot hope to have a sensible debate on economic policy without full and complete information. If it matters, measure it.

1 INTRODUCTION

It is a given that in a period of economic instability or slow growth there will be calls for diversification, to which politicians feel compelled to respond. This then provides the impetus for any number of government programs providing subsidies of one sort or another to "diversify the economy," often with a focus on expanding one or a few sectors, most commonly manufacturing.[1] And the greater the instability the louder are the calls for diversification. For example, with the downturn in Alberta's economy, diversification is once again regularly listed as a top priority by the provincial government.

At one level, this may be interpreted as simply a talking point, intended to capture the positive images around the very word "diversification." In support of this, one can note that no definition or specific goals are typically mentioned in these policy pronouncements. However, the fact that there are many billions of public dollars invested in pursuit of economic diversification makes it a serious policy issue. As such, there are some fundamental questions that require answers. To start with, clarity is required with respect to exactly what the goal or policy objective is, precisely what diversification is, how it is measured, how diverse we are, and what the most cost-effective ways of promoting diversification are. Of course, we must also recognize that diversification may not be a goal worth striving for. There may very well be a trade-off between "diversity" and "prosperity." It is these general questions that provide the focus in this paper.

In a recent poll, two-thirds of Albertans said the government should consider economic diversification a priority.[2] This is not dissimilar to the results of a poll taken in 1987 following an earlier downturn, with almost three-quarters of Albertans then indicating the importance of diversification versus specialization, even though specialization may lead to incomes and employment that are higher on average but less stable.[3] However, care must be taken in interpreting such polls. First, while it is not clear, it seems reasonable to suppose that what respondents really want is not diversification per se, but the outcomes that they suppose it would deliver. Perhaps the goal is greater prosperity, a less volatile economy, or more secure and stable employment. Diversification itself should not be the goal. Second, such polls typically do not mention any costs associated with diversification. When a direct cost was mentioned in the 1987 poll, a large majority indicated that they would be unwilling to pay any additional taxes to develop new diversifying activities. Further, the indirect costs may be large. Economists have — for centuries now — known the benefits of specialization. Focusing on a few productive activities based on areas of comparative and competitive advantage, and trading with others for all other goods and services, is the primary reason for our high productivity and standards of living. Indeed, such gains

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1 An example is Justin Trudeau's assertions that "What manufacturers and municipalities need is a partner in Ottawa to collaborate with them to make sure that we are diversifying our economy in all sorts of different ways, so that when challenges come in one sector there are other sectors to build on and to grow on, and that's the kind of strong leadership that Canada needs." See Liberal Party of Canada website, "Justin Trudeau's Speech to the Board of Trade of Metropolitan Montreal," March 3, 2015, http://www.liberal.ca/speech-by-the-leader-of-the-liberal-party-of-canada-justin-trudeau-to-the-board-of-trade-of-metropolitan-montreal-2015/; and Susana Mas, "Justin Trudeau points to interest rate cut as proof Tories lack fiscal prudence," CBC News, January 21, 2015, http://www.cbc.ca/news/politics/justin-trudeau-points-to-interest-rate-cut-as-proof-tories-lack-fiscal-prudence-1.2919992.

2 http://www.cbc.ca/news/canada/calgary/poll-pembina-alberta-climate-change-1.3249966.

3 R. L. Mansell and M.B. Percy, *Strength in Adversity: A Study of the Alberta Economy* (Western Centre for Economic Research and C.D. Howe Institute, 1990), 86-93.

are fundamental to the economic well-being of a federation such as Canada.[4] But one can accept this general point yet remain concerned about the level of concentrated economic activity across sectors, products, markets, and so on. At the risk of oversimplifying the issue, there are two broad ways in which we can think about diversification.

First, diversification is a way to minimize economic risk and volatility in an environment of cyclical variability. For example, individuals can distribute their investments over a range of company shares and covering a range of economic sectors. In general, the variability of this portfolio declines as the number of such placements increases and as there are increases in the number of situations of negative covariance (that is, where the share prices of individual companies tend to move in opposite directions).[5]

In general, the same principle applies in an economy. If employment (or income) is concentrated in just one industry or sector, it will vary directly with the cyclical variations of that industry or sector. However, if the employment (or income) is widely distributed across industries, the overall variability of this "portfolio" will be reduced, particularly the more cases there are where activity in the sectors tends to vary in opposite directions (that is, where the bad times in one sector tend to be offset by good times in another).[6]

A second view takes a longer-run perspective. If the economy is concentrated in industries that are in long-run decline there may be gains from shifting to industries with future growth prospects. Today, low oil prices are significantly depressing economic activity in Canada's oil and gas sector. We also see growing awareness of climate issues and, consequently, growing calls to transition away from fossil fuels. This, in turn, may be justification for a more diversified economy. Businesses are also able to make such forecasts themselves and shift accordingly, but even in this longer-run view, governments must consider if there is a market failure preventing firms from making such moves, and what policies (if any) might help.

Regardless of which perspective is used, we require a way to measure diversification. After all, how else can we know whether Canada's economy is diversified or not? Having a benchmark to which we can compare our current economic structure is necessary before any intelligent discussion of policy can begin. The analysis begins there. After proposing this measure, and using it with a wide variety of data, we can then see how volatile Canada's provincial economies are, how that volatility has changed over time, and how Canada's level of diversification compares internationally. The paper ends with a broader discussion that summarizes the findings and, importantly, discusses policy options available to governments and the critical trade-offs involved. Instead of the typical forced-growth policies, where chosen firms or sectors are given subsidies or preferential access to credit,

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4 The economic surplus or overall gain associated with a federation includes the gains from: a greater degree of specialization and economies of scale from the reduction/elimination of barriers to interregional trade and flows of factors; the pooling of risks at the national level to mitigate the regional instability associated with specialization; sharing of overhead expenditures (for example, related to defence or large-scale infrastructure); and, the potential market power at the national level in dealing with other matters, such as international trade.

5 As an approximation, with N individual units, each accounting for 1/N of the portfolio, the portfolio variance is equal to $(1/N) \times AvgVariance + (1 - 1/\mathrm{N}) \times AvgCovariance$. So, as N increases, the portfolio variance approaches the average covariance.

6 An example is where low natural gas prices hurt the natural-gas-producing industry but help the petrochemical industry, which uses components of natural gas as a key input.

there are many other instruments available to either limit economic volatility or mitigate the costs of such volatility on households and businesses.

The broad message of the paper is simple: If diversification matters, then measure it. To that end, it asks and answers a number of related questions. How concentrated is economic activity in Canada? Is its economy more or less concentrated than in the recent past? Do resource-rich provinces like Saskatchewan and Alberta have less diverse economies? Is employment for Canada's workers found only in a few sectors, with few prospects elsewhere? Are the markets to which our exporters sell concentrated in only a few countries? Is Canada's economy in general, and its provincial economies in particular, more or less volatile than the recent past? And, in all these ways, how do we compare with major economies around the world?

2 MEASURING DIVERSIFICATION IN CANADA AND ITS PROVINCES

There is much confusion around the concept of diversification. It is a concept that is multifaceted and subtle and, simultaneously, simple and complex. It can be measured in many different ways, including using employment, incomes, or production across sectors, across products, or across markets. Each dimension will have a different story to tell.

Though limited by space and data, this paper provides a wide variety of measures and a more complete picture of diversification in Canada and its provinces. The result is a nuanced look at the issue, with some measures showing a region as quite diverse by one measure and less so by others. In any case this is a critical issue not only to policy-makers but for all Canadians. We must endeavor to formulate policy with evidence, not anecdotes or buzzwords. The goal here is to provide such data and measurements.

2.1 A Simple and Easy Measure of Diversification

To fix ideas, consider a simple question: What are the odds that two randomly selected people work in the same sector? If everyone works in the same sector then this probability is one (100 per cent). If the labour force is evenly spread across 10sectors, say, then this probability is 0.1 (10 per cent). Specifically, the odds of two people both working in one sector — "Sector 1" — is one per cent, of both working in Sector 2 is also one per cent, and so on. So, the odds of selecting two people in the same sector, but any sector, is 10 per cent (10 times one per cent). In general, for N sectors, this probability is

$$H = \sum_{i=1}^{N} s_i^2,$$

where s_i is the share in sector i. This expression is called the Herfindahl Index. It is a standard measure of concentration and, as such, a useful indicator of the degree of diversification in terms of a range of variables.

Next, consider another situation: a portfolio of stocks. The price of one stock may be rising while the price of another may be falling. Overall, we'd expect a collection of stocks to have less risk than any individual stock it contains. It is straightforward to show this. Imagine

stocks all had the same level of volatility, each randomly rising and falling from one day to the next, but none systematically doing this more so than others. Further suppose the movements of these stocks are completely independent of each other, with the odds that one is up for the day completely unrelated to the performance of other stocks. Of course this is not meant to be a statement about how stock markets really work, but nonetheless provides a useful intuition.

How volatile would a collection of stocks be in this case? It is straightforward to show that the overall volatility of a portfolio is guaranteed to decline as we add more stocks. Specifically, if we hold just one of every stock and there is zero covariance among the stock prices, the variability of the portfolio is: [7]

$$Portfolio\ Volatility = Stock\ Volatility\ \div N,$$

where N is the number of stocks.[8]

In general, we can expand on this intuition by allowing our portfolio to hold different amounts of each stock. If the fraction of our total portfolio in stock i is denoted s_i then:

$$Portfolio\ Volatility = Stock\ Volatility\ \times \sqrt{\sum_{i=1}^{N} s_i^2},$$

The term on the end inside the square root is the same Herfindahl Index presented earlier.[9]

It is now clear how diversification and volatility are linked. If the shares s_i are very different, the portfolio volatility will be higher than if all the shares are the same. In fact, in this simple example, holding an equal amount of all stocks, which means $s_i = 1/N$, minimizes the variance.

In short, the Herfindahl Index (H) is a natural measure of diversification and will be used throughout this report. In plain English, it simply takes the shares of employment (or other variables such as GDP or incomes) across sectors, squares them, and then adds them up. One can also normalize the measure to more easily interpret the value of H.[10] If $H = 1$ then the basket of many possible items is concentrated in a single one; if $H = 0$, then the basket is evenly distributed across all items.

Let's put this measure to work.

2.2 Diversification in Canada's Employment

The distribution of Canada's employment across sectors has changed dramatically over time. In the past three decades, for example, employment has gradually — and steadily — moved away from the resource and manufacturing sectors and into services. This is common to all developed economies, and is a natural part of economic growth.

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7 As an approximation: if N units, each accounting for 1/N of the portfolio, the portfolio variance is equal to $(1/N) \times AvgVariance + (1 - 1/\mathrm{N}) \times AvgCovariance$.

8 In this case, "volatility" means the standard deviation.

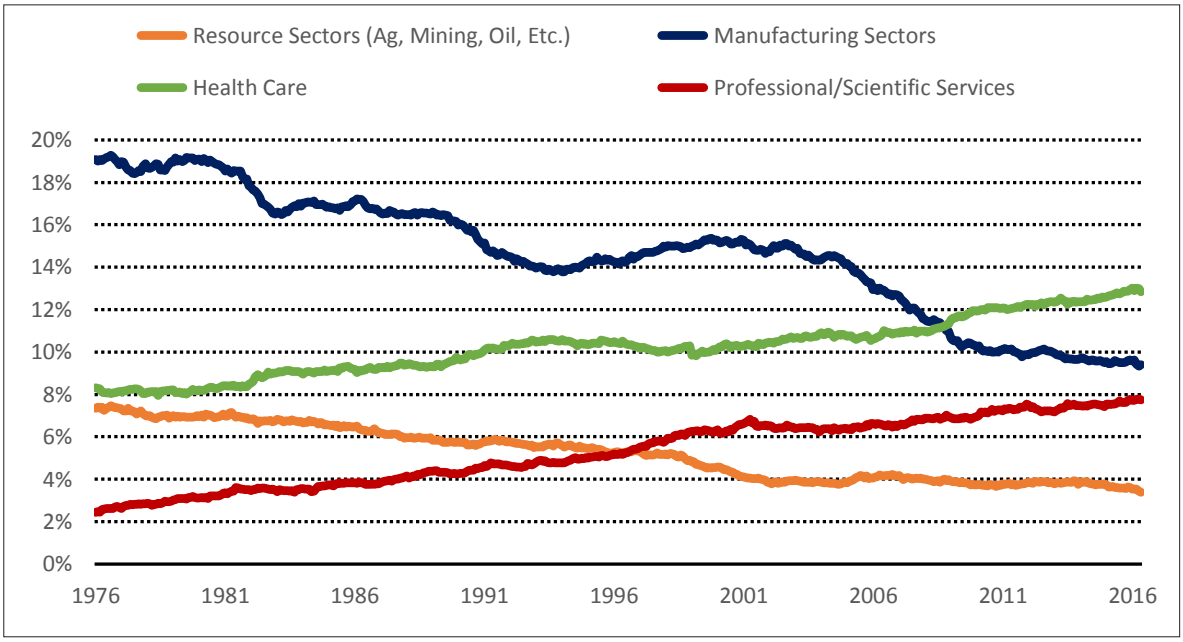
9 In general, the linear combination of uncorrelated random variables has a variance of $Var(\sum_i s_i x_i) = \sum_i s_i^2 var(x_i)$.

10 Specifically, in all that follows, we report $H^* = (H - 1/N)/(1 - 1/N)$, where N is the number of sectors.

To visualize these shifts, consider a few selected sector categories: The primary sectors (agriculture, mining, oil and gas, etc.), manufacturing sectors, and two large service sectors (health care and professional/scientific services). Figure 1 plots Canada's share of employment in these sectors.

It is well known that manufacturing employment has fallen, but it not due to an expanding resource sector. As mentioned earlier, a declining manufacturing sector, as a share of total employment and GDP, is actually a natural and global pattern of economic growth. It is so common it actually has a name: it's one of the "Kuznets Facts" of growth.[11] Although it is not worth dwelling on this point long, direct employment in the resource sector has not been expanding. Consider the forestry, fishing, mining, and oil and gas sectors as a fraction of Canada's total employment. From a high of around three per cent in the late 1970s the share has gradually and consistently declined to its current value of only two per cent of national employment. With only two per cent of Canada's total employment in forestry, mining and oil and gas, it's puzzling how one could ever think that all of Canada's economic eggs are in this basket. Only one in 50 workers have jobs in those sectors. If we include agriculture, as Figure 1 does, we find employment within the overall resource sector has declined from close to eight per cent to less than four per cent today. Note however that this does not include the indirect employment arising from the inputs (machinery and equipment, construction, finance, business services, etc.) purchased by the resource sector or from the processing, marketing, transportation, etc. of the products produced by this sector.

FIGURE 1 SHARES OF EMPLOYMENT FOR SELECTED SECTORS IN CANADA



Source: CANSIM 282-0088.

[11] From the late Nobel-prize-winning American economist Simon Kuznets.

If employment shares for the manufacturing and resource sectors have been falling, which sectors are increasing their share of total (direct) employment? Figure 1 plots two of the largest sectors in terms of employment-share changes: health care and professional services. Both have expanded dramatically since the 1970s. How about the remaining sectors? Table 1 reports employment shares for all major sectors in Canada. Sectors that grew the most include health care, professional and scientific services, business services, construction, and accommodation and food services. The sectors that shrank the most in terms of employment shares include agriculture, manufacturing, and public administration.

To summarize all of these changing shares and determine whether or not Canada's employment has become more or less diversified, use the Herfindahl Index. Figure 2 plots this index and reveals a clear pattern: Canada's employment is less concentrated today than at any point in its recent history. Stated differently, the diversification of Canada's employment — by this measure — is the highest in a generation. Of course, as some sectors expand (hiring more workers) and others shrink (losing workers), this measure changes. But, the overall trend of increasing employment diversification is clear.

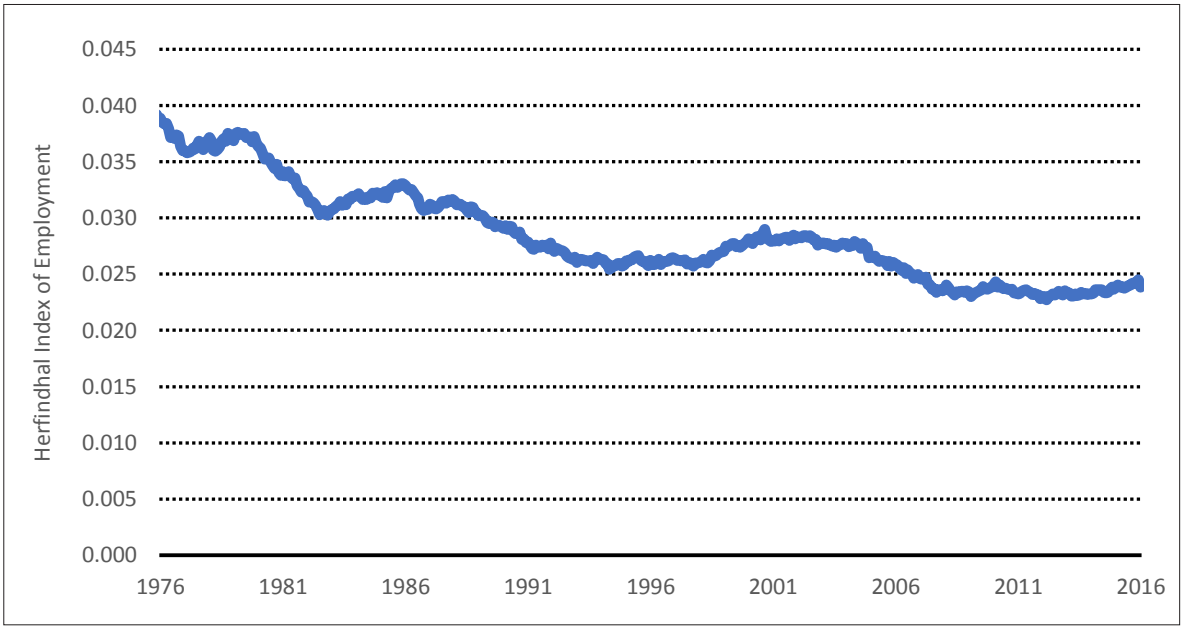
TABLE 1 EMPLOYMENT SHARES IN CANADA, BY SECTOR

	1976	2015	1976–2015 change
Agriculture	4.8%	1.7%	-3.1%
Forestry, fishing, mining, quarrying, oil and gas	2.5%	2.1%	-0.5%
Utilities	1.1%	0.8%	-0.4%
Construction	6.8%	7.8%	1.0%
Manufacturing	19.1%	9.6%	-9.5%
Wholesale and retail trade	16.5%	15.2%	-1.4%
Transportation and warehousing	5.9%	5.0%	-0.9%
Finance, insurance, real estate and leasing	5.2%	6.1%	0.9%
Professional, scientific and technical services	2.4%	7.6%	5.1%
Business, building and other support services	1.7%	4.2%	2.5%
Education	6.8%	7.1%	0.2%
Health care and social assistance	8.3%	12.6%	4.3%
Information, culture and recreation	3.5%	4.3%	0.8%
Accommodation and food services	4.1%	6.8%	2.7%
Other services	4.4%	4.3%	-0.2%
Public administration	6.7%	5.0%	-1.6%

Source: CANSIM 282-0088. Shares reflect the distribution across sectors in January of each year.

Employment is but one aspect of economic activity, and employment shares may not reflect production or income differences across sectors. Oil and gas, for example, is a fairly capital-intensive activity, so it will account for a smaller share of employment than production. In the next two sections we look at how diversified Canada's real GDP and nominal GDP are across sectors.

FIGURE 2 A MEASURE OF CANADA'S EMPLOYMENT CONCENTRATION



Note: A normalized Herfindahl Index across sectors, using data from CANSIM 282-0088.

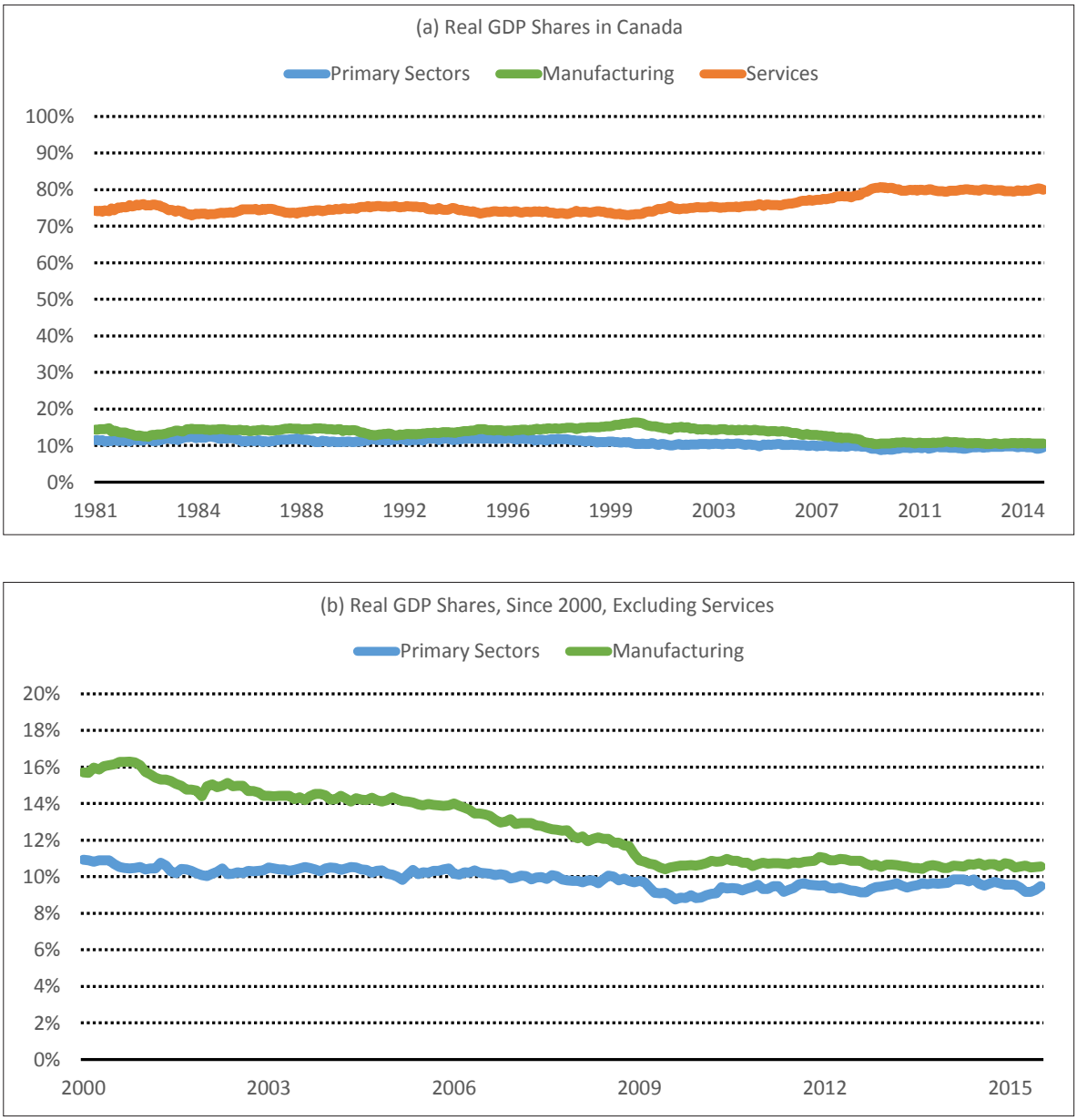
2.3 Diversification of Real Economic Activity (Real GDP)

Real GDP is a measure of value-added in Canada's economy that removes the effect of price changes. Simply put, consider real GDP as the quantity of physical production in Canada's economy valued at some constant (historical) set of prices. It is important to contrast these data with *nominal* GDP, which includes the effect of price changes and is a better measure of broad sources of income. For now, consider only real economic activity; in the next section we'll explore the nominal GDP data to get a measure of income diversity.

As with employment, it is useful to look at a few selected sectors. Figure 3 shows plots of the real GDP shares for three broad sectors: resources (agriculture, mining, oil and gas, etc.), manufacturing, and services. As with all developed economies, the service sector has become dominant, today accounting for about 80 per cent of real GDP in Canada. Since the 1980s this share has grown a bit while the shares for the resource and manufacturing sectors have declined slightly. To see this clearly, given the differences in scales, Panel (b) of Figure 3 displays the real GDP shares for the resource and manufacturing sectors. Since 2000, manufacturing has declined from about 16 per cent of the economy to just under 11 per cent today. Resources have also declined, from about 11 per cent to roughly nine per cent.

The (direct) real GDP shares for all sectors and changes between 1981 and in 2014 are shown in Table 2. Unlike for sectoral employment shares, we do not see a large increase in the real GDP share for health care. The main sectors that expanded their contribution to real GDP are professional and scientific services (which also showed increased employment shares) and finance, insurance, and real estate. We will see later that the primary driver of this increase is the real estate industry.

FIGURE 3 REAL GDP SHARES FOR SELECTED SECTORS IN CANADA



Source: CANSIM 379-0031.

We can use these shares and the Herfindahl Index to measure the level of economic diversification and changes over time. The resulting index is displayed in Figure 4. It has been rising, indicating that there is less diversification in Canada in terms of real GDP than was the case in the 1980s.[12]

[12] We confirm this holds in more disaggregated data, based on the three-digit NAICS industry classification codes.

TABLE 2 REAL GDP SHARES IN CANADA, BY SECTOR

	1981	2014	1981–2014 change
Agriculture, forestry, fishing, hunting	2.3%	1.6%	-0.7%
Mining, quarrying, oil and gas	9.0%	8.1%	-0.9%
Utilities	3.1%	2.4%	-0.7%
Construction	8.0%	7.1%	-0.9%
Manufacturing	14.2%	10.6%	-3.6%
Wholesale and retail trade	7.8%	11.1%	3.3%
Transportation and warehousing	4.0%	4.2%	0.2%
Finance, insurance, real estate, mgmt.	15.7%	20.2%	4.5%
Professional, scientific and technical services	2.7%	5.3%	2.6%
Administrative and support, waste management	1.9%	2.5%	0.7%
Education	7.3%	5.2%	-2.1%
Health care and social assistance	7.8%	6.8%	-1.0%
Information, culture and recreation	2.8%	3.9%	1.1%
Accommodation and food services	3.2%	2.1%	-1.1%
Other services	1.7%	2.0%	0.3%
Public administration	8.5%	6.8%	-1.7%

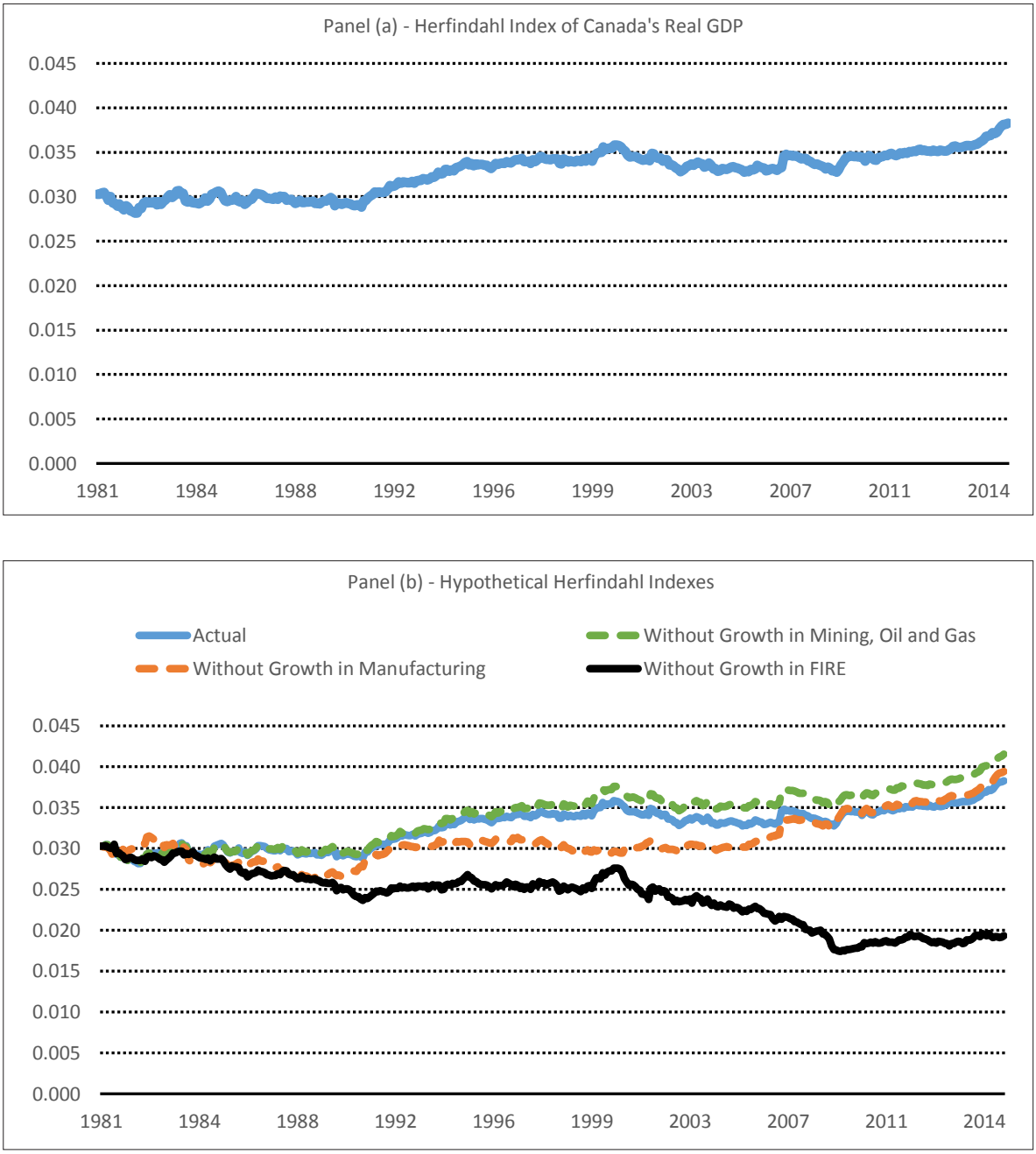
Source: CANSIM 379-0031 and 379-0019, both at 2007 constant prices. Adjust 379-0019 from 1997 prices to 2007 prices based on the ratio of real GDP in the overlap year 1997.

What's behind this change? To answer this question, we can look to a few calculations that reveal how individual sectors are contributing to this pattern. Panel (b) of Figure 4 plots various hypothetical Herfindahl indexes where the real GDP of selected sectors are held at their 1981 level. Specifically, this explores how Canada's economic diversification would be different if there were no real GDP changes at all in resources, or in manufacturing, or in finance and real estate (FIRE).[13] The results are clear: changes since 1981 in the manufacturing sector and in the mining and oil and gas sector had no material effect on the level or pattern of the overall Herfindahl Index. That is, the decline in the level of diversification in terms of Canadian real GDP since the early 1980s does not appear to be significantly caused by changes in the shares of either of these two large sectors.

If the resource sector does not account for the reduced level of diversification (or increased level of concentration), what does? It appears to be the finance and real estate (FIRE) sector. Had it remained at its 1981 relative size, Canada's real GDP diversification would have been greater today than in the past. So, which is it: finance or real estate? It is difficult to separate these two activities in the earlier years when Statistics Canada aggregated them into one. Instead, consider data since 1997, which reveal that finance is relatively stable, rising from 5.6 per cent of real GDP in 1997 to six per cent today.

[13] All real GDP values are left unchanged, except for the sector selected to remain fixed at its 1981 level. Then, new GDP shares are calculated and the Herfindahl Index formula applied.

FIGURE 4 CANADA'S REAL GDP DIVERSIFICATION



Source: CANSIM 379-0031 and 379-0019, both at 2007 constant prices. Adjust 379-0019 from 1997 prices to 2007 prices based on the ratio of real GDP in the overlap year 1997.

Real estate (and leasing), on the other hand, rose from 11.7 per cent in 1997 to 13.2 per cent today. Real estate is both much larger than the finance and insurance sectors and has grown by much more. What's behind this growth? Value-added in the real estate sector is mainly what's called *imputed rents* from owners or occupiers of homes. We live in homes and do not actually pay ourselves rent, but we consume the housing services provided by the home nonetheless. Statistics Canada attempts to estimate this value based on prevailing rental rates for similar homes. It turns out this accounts for the majority of the growth of the real estate sector's contribution as a whole.

This point also allows us to reconcile our measure of employment diversification with our measure of real GDP diversification. With employment, we saw greater diversification over time. As the real estate sector's contribution to GDP does not involve employees, real estate is the principal driver of falling GDP diversification in Canada.

2.4 Concentration of Income (Nominal GDP)

Let's move on to income. As discussed earlier, real GDP is a physical measure of economic activity while nominal GDP is a broad measure of the total income created in an economy over a particular amount of time (typically one year). It is not *exactly* income, as it adjusts for things like depreciation, but it is close enough to help with intuition. Unlike real GDP measures just presented, nominal GDP and income do not adjust for price changes through time. Of course, we are focused on shares, so we do not need to worry about economy-wide inflation. If manufacturing generates $50 billion in value-added in an economy with nominal GDP of $1,500 billion, then manufacturing accounts for three per cent of all sources of income. This is true regardless of the overall price level. But, keep in mind that *relative prices* can change over time.

TABLE 3 NOMINAL GDP SHARES, BY SECTOR

	1970	1990	2011	1970–2011 change
Agriculture, forestry, fishing, hunting	4.6%	2.9%	1.9%	-2.6%
Mining, quarrying, oil and gas	4.4%	4.3%	6.1%	1.7%
Utilities	2.2%	2.9%	2.3%	0.1%
Construction	7.1%	6.8%	5.7%	-1.4%
Manufacturing	21.2%	16.9%	16.9%	-4.3%
Wholesale and Retail Trade	12.6%	11.9%	11.8%	-0.8%
Transportation, storage, and communication	8.7%	7.2%	6.8%	-1.9%
Finance and insurance	5.3%	6.0%	7.9%	2.7%
Real estate, renting, business activities	11.5%	16.7%	18.1%	6.6%
Education	6.0%	5.5%	5.0%	-1.0%
Health care and social assistance	4.9%	6.5%	6.0%	1.1%
Accommodation and food services	2.5%	2.7%	2.4%	-0.1%
Other services	2.5%	2.8%	3.0%	0.5%
Public administration	6.7%	6.9%	6.1%	-0.6%
Herfindahl Index	*0.031*	*0.026*	*0.031*	

Source: OECD STAN database, extended to 2011 using WIOD.

Different data are required for this exercise to get as long a time series as possible. Statistics Canada does not readily make nominal GDP data for each sector available at the national level. Instead, we combine the OECD Structural Analysis database with more updated information from the World Input-Output Table. Unfortunately, this series ends in 2011 as this is the most recent year for which data are available. Table 3 shows the shares by sector for 1970, 1990, and 2011, and the changes over the entire period.

To highlight diversification directly, the last row of the table provides the Herfindahl Index. There is no overall change in the overall level of diversification, although there are notable changes in shares across sectors. Taking the manufacturing sector as a whole, its share of income has declined from 21 per cent in 1970 to 17 per cent in 2011. Notice that resource sector did not noticeably increase its share of income over this period. The share for the agriculture component declined while that for mining (which includes oil and gas) increased, though the increase of the latter did not fully offset the decline in the former.

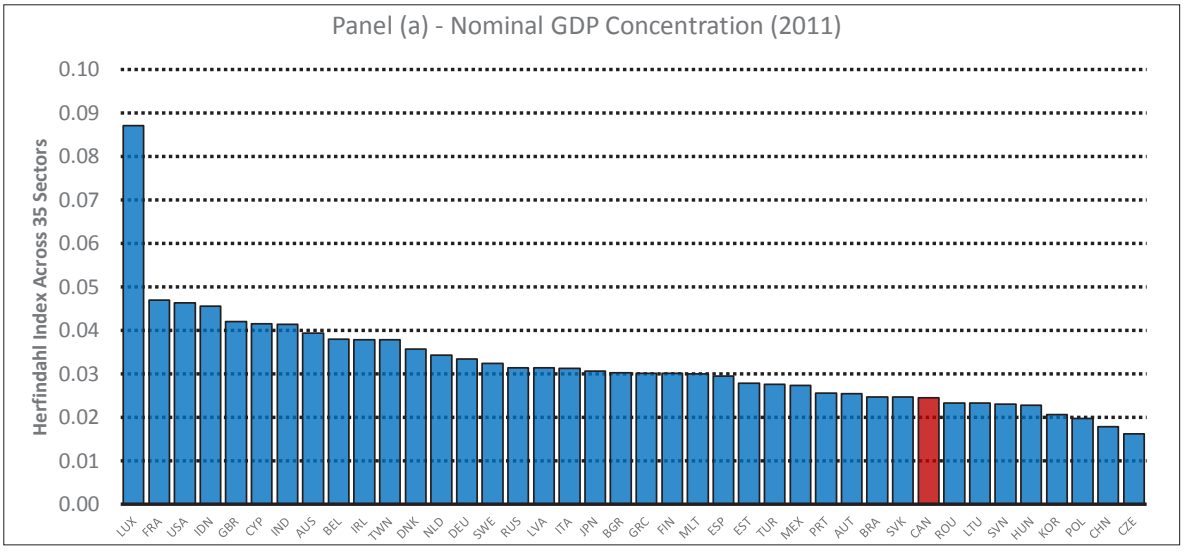
So which sectors increased? Not surprisingly, given the earlier discussion, we see the real estate sector expand its share by a remarkable 6.6 percentage points, followed by finance, by 2.7 per cent. Overall, the income share for the service sectors increased from 70 per cent of GDP in 1970 to 75 per cent today.

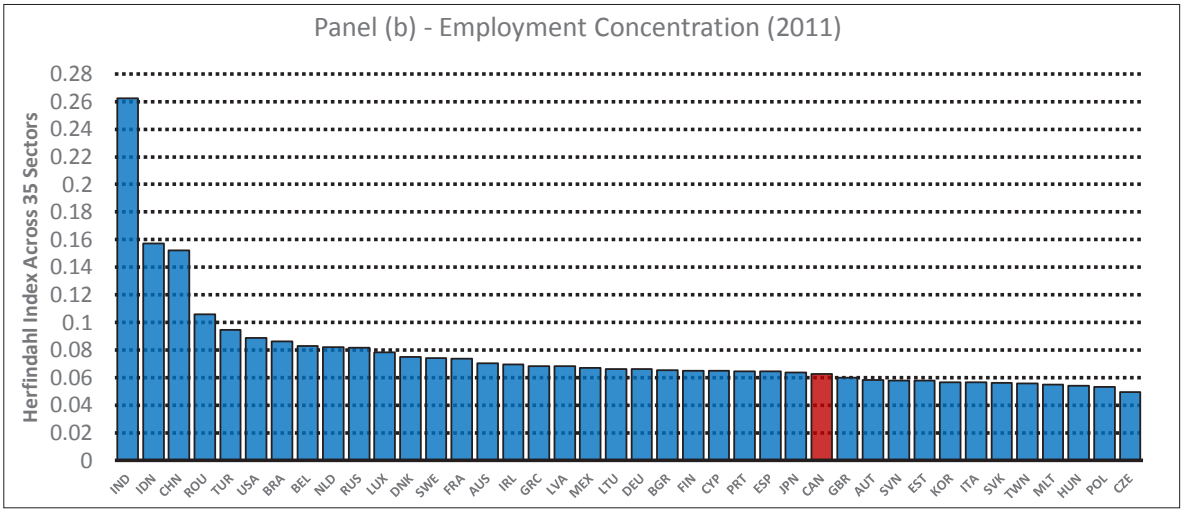
2.5 Comparing Canada's Diversification to the World

How does Canada's level of diversification compare to other major economies in the world? Using the most recently available data from the World Input-Output Database (a source that compares internationally), it is straightforward to construct Herfindahl indexes for each country. The result in shown in Figure 5.

There is a common perception that Canada's economy is relatively narrow and not highly diversified. However, this view is not borne out by the Herfindahl indexes measuring the level of concentration in terms of GDP and employment. In fact, it appears that in terms of both measures, the concentration levels are comparable (meaning the diversification levels are comparable) to those in most other large economies. Indeed, it is noteworthy that the level of diversification for Canada is significantly higher (or equivalently, the level of concentration is significantly lower) compared to some of the most highly developed economies, particularly that of the U.S. While this may seem surprising, it follows from Canada having a higher share in relatively small sectors, such as the resource sectors and construction, and smaller shares in relatively large sectors, such as finance or public administration and defence.

FIGURE 5 COMPARISON BY COUNTRY OF GDP AND EMPLOYMENT CONCENTRATION





Source: Year 2011 data from the World Input-Output Database.

Based on these measures, the view that the Canadian economy is narrow and overly dependent on just a few sectors does not appear valid. The results provide important perspective that weakens the case, as often heard in political circles, about the urgency of broadening the national economy.

2.6 Employment Diversification in Canada's Provinces

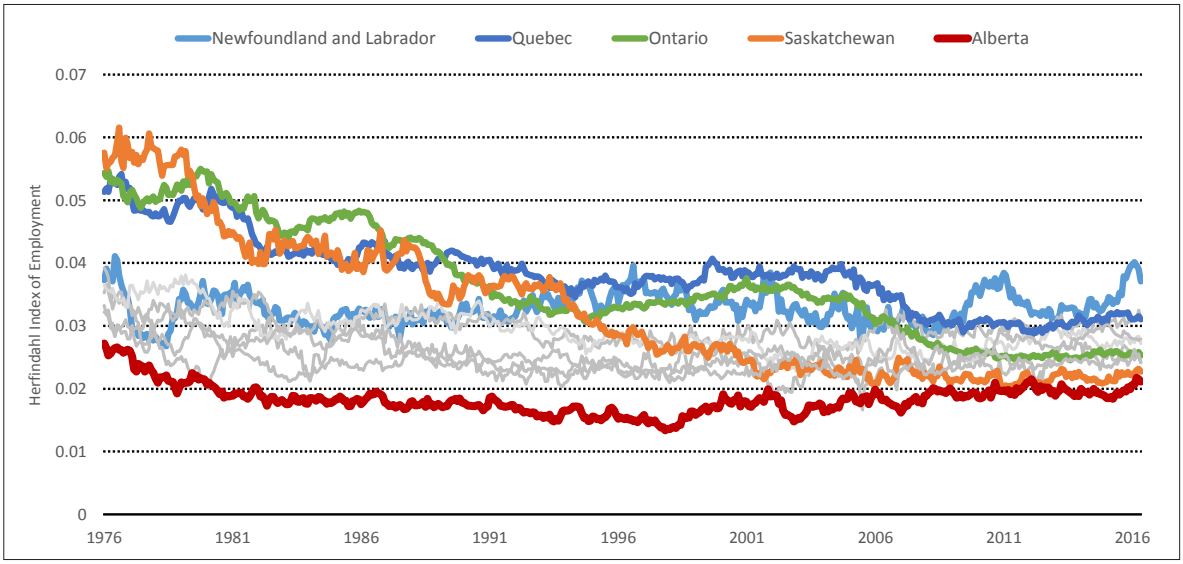
What about each of Canada's provinces? How diversified are their economies? Have they become more diversified over time, just as Canada as a whole has?

Let's begin with employment. These data are available at the provincial level for a much longer period of time than is the case for provincial GDP data. Figure 6 provides the employment Herfindahl Index since 1976 for each of Canada's provinces. Thick coloured lines highlight the key provinces.

Notice there's a common and persistent decline in the measure of employment concentration across sectors and provinces. For some provinces there is little detectable decline (Newfoundland and Labrador and Nova Scotia, for example) but in no province is there an increase in the concentration of employment (that is, a decrease in the level of diversification) across the 16 major sectors for which this calculation is done. This is completely in line with our national results.

In addition to the generally growing or stable diversification in employment we also see much more similarity between provinces today than in the past. In the mid-'70s, Saskatchewan, Ontario, and Quebec showed higher levels of employment concentration than was the case in the other provinces. The decline in concentration for Ontario and Quebec appears to be largely due to the rising importance of service-sector employment and a declining share in manufacturing. For Saskatchewan, the principal driver is falling share of agricultural employment, from one in four jobs in the '70s to roughly one in 15 today.

FIGURE 6 MEASURE OF EMPLOYMENT CONCENTRATION, BY PROVINCE



Source: CANSIM 282-0088. The graph displays the Herfindahl Index across 16 major sectors separately for each province. Only certain provinces are highlighted. The other provinces are in light grey.

Perhaps surprisingly, Alberta and Saskatchewan currently have the most diverse employment. The fact that both provincial economies are currently struggling should provide some caution for the view that greater diversification will necessarily translate into greater stability.

The results shown above focus on the distribution of direct employment across sectors. But many people work in one sector that supplies inputs to another. This "indirect employment" is important when discussing an economy's reliance on a few particular sectors. In Alberta, for example, professional services, manufacturing, finance, transport, construction, and so on, all provide inputs to the oil and gas sector. These linkages can be very important. For instance, in the case of typical types of oil and gas projects, input-output data indicate that about one-third of the activity shows up in the oil and gas sector while about two-thirds of the activity shows up in other sectors.

While it is important to take these linkages into account, it is not a simple matter to do so. A detailed and extensive analysis would be required and this is beyond the scope of this paper. However, it is possible to do an approximation using Statistics Canada's estimate of the number of indirect jobs per direct job employed in each sector. This is known as the "employment multiplier." For example, a sector with a multiplier of two would mean on average there are two jobs in total for each person directly employed in the sector — that is, one direct job plus one other indirectly. To be sure, one must interpret these multipliers with caution. They *do not* by any stretch imply that expanding employment in one sector by 10 will *cause* an increase in overall employment by 20. The aggregate supply of employment (the number of workers) is a binding resource constraint not typically accounted for in input-output analysis.

One must also use the multipliers with caution even when doing a simple accounting exercise. Every sector has indirect jobs for which it can claim some responsibility. On average, the total number of direct and indirect jobs adds up to nearly twice the total number of workers in Canada. So we cannot just apply each sector's multiplier to its

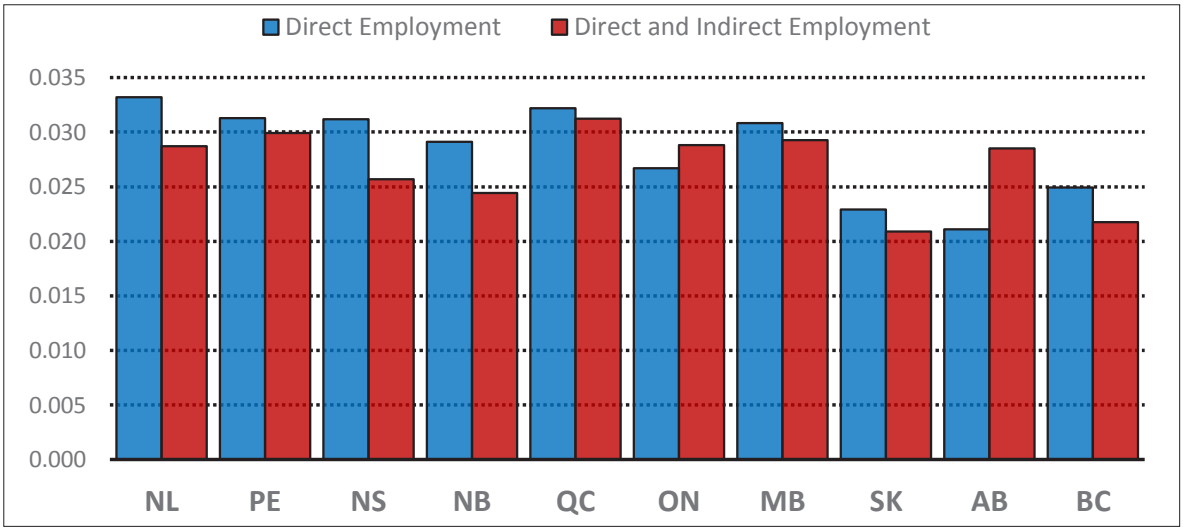
employment or we'd end up with more workers than exist. So, apply the following "normalization":

$$e'^{j}_{i} = e^{j}_{i} \times \left(\frac{m^{j}_{i}}{\sum_{k} e^{k}_{i} \times m^{k}_{i}} \right),$$

where e^{j}_{i} denotes the share of province i's direct employment in sector j, e'^{j}_{i} denotes the adjusted share of direct plus indirect employment, and m^{j}_{i} is Statistics Canada's jobs multiplier.[14] The adjustment term in brackets ensures that the total direct and indirect employment in each sector will sum to the province's actual total.

For many provinces, accounting for indirect employment does significantly change the measure of concentration (or diversification). For Alberta, however, it is clear that it makes a big difference. Since oil and gas in this province has a jobs multiplier of three, the importance of that sector for overall employment is amplified. Although even with this accounted for, only slightly more than 14 per cent of employment can be attributed to oil and gas — a share similar to Ontario's manufacturing sector. Despite this change, Alberta's measure of employment diversification is similar to that of Ontario and Quebec and ranks sixth overall. So, Alberta goes from the province with the most diverse employment to the middle of the pack.

FIGURE 7 MEASURE OF EMPLOYMENT CONCENTRATION, BY PROVINCE, INCLUDING DIRECT AND INDIRECT EMPLOYMENT FROM INPUT-OUTPUT LINKAGES (2010)



Source: CANSIM 282-0088 and the Statistics Canada Type-I Within-Province Jobs Multipliers for 2010. We adjust employment using the multipliers, and rescale such that the resulting direct and indirect employment matches the province's total. See text for details.

[14] Specifically, we use the "Type-I Within-Province" jobs multiplier. These are reported in the input-output tables for 35 sectors. This is more than the 19 we are working with from CANSIM 282-0008, so we take the simple average of the multipliers across all subsectors within each of the 19 broader sectors.

2.7 GDP Diversification in Canada's Provinces

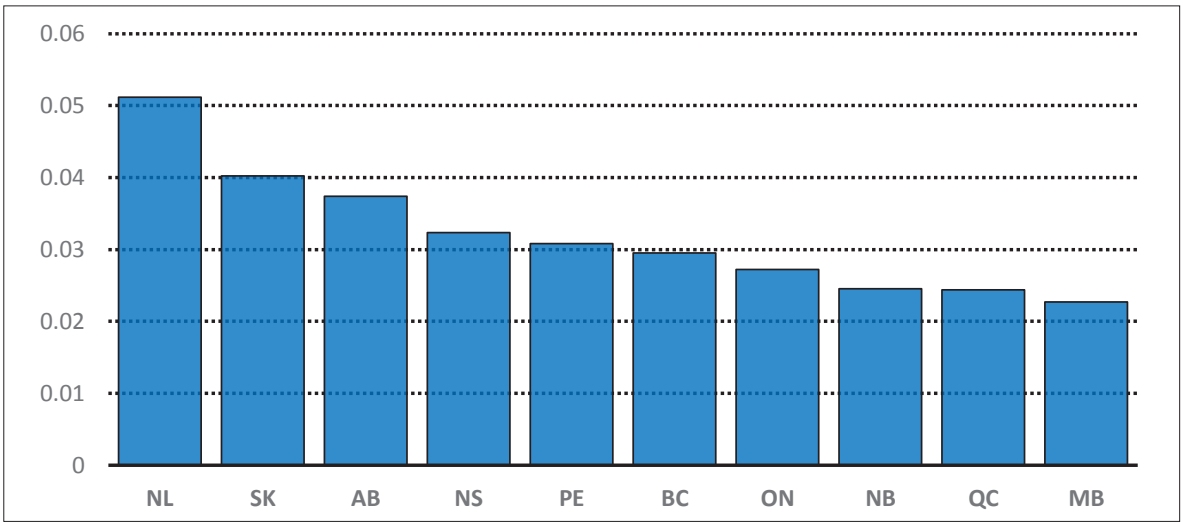
Next, let's turn to measuring diversification in terms of GDP within each of Canada's provinces. Figure 8 displays the Herfindahl Index of GDP across 18 sectors in 2014. There's a clear pattern: resource-rich provinces have more concentration (less diversification) than do other provinces. This is true whether we look at real or nominal GDP. The resource sectors are very capital-intensive so they account for far less employment than they do GDP, which explains why Alberta is more diversified in terms of employment than in terms of nominal GDP.

That being said, the resource sectors in Alberta and Saskatchewan account for a declining share of real economic activity. Consider Panel (a) of Figure 9, which displays the share of nominal GDP directly contributed by the mining and oil and gas sectors. In the late 1990s, they accounted for between 15 and 20 per cent of GDP in Alberta and Saskatchewan. In Newfoundland and Labrador — prior to fully developing its offshore fields — the share was only five per cent.

Over time, the shares rose dramatically — reaching almost 50 per cent in Newfoundland and Labrador by 2008, and about 30 per cent for Alberta and Saskatchewan at the same time. This rapid growth was largely due to higher commodity prices. In the late 1990s, commodities prices were very low relative to their pre-crisis levels. Then they crashed in 2008–09, recovering afterwards.

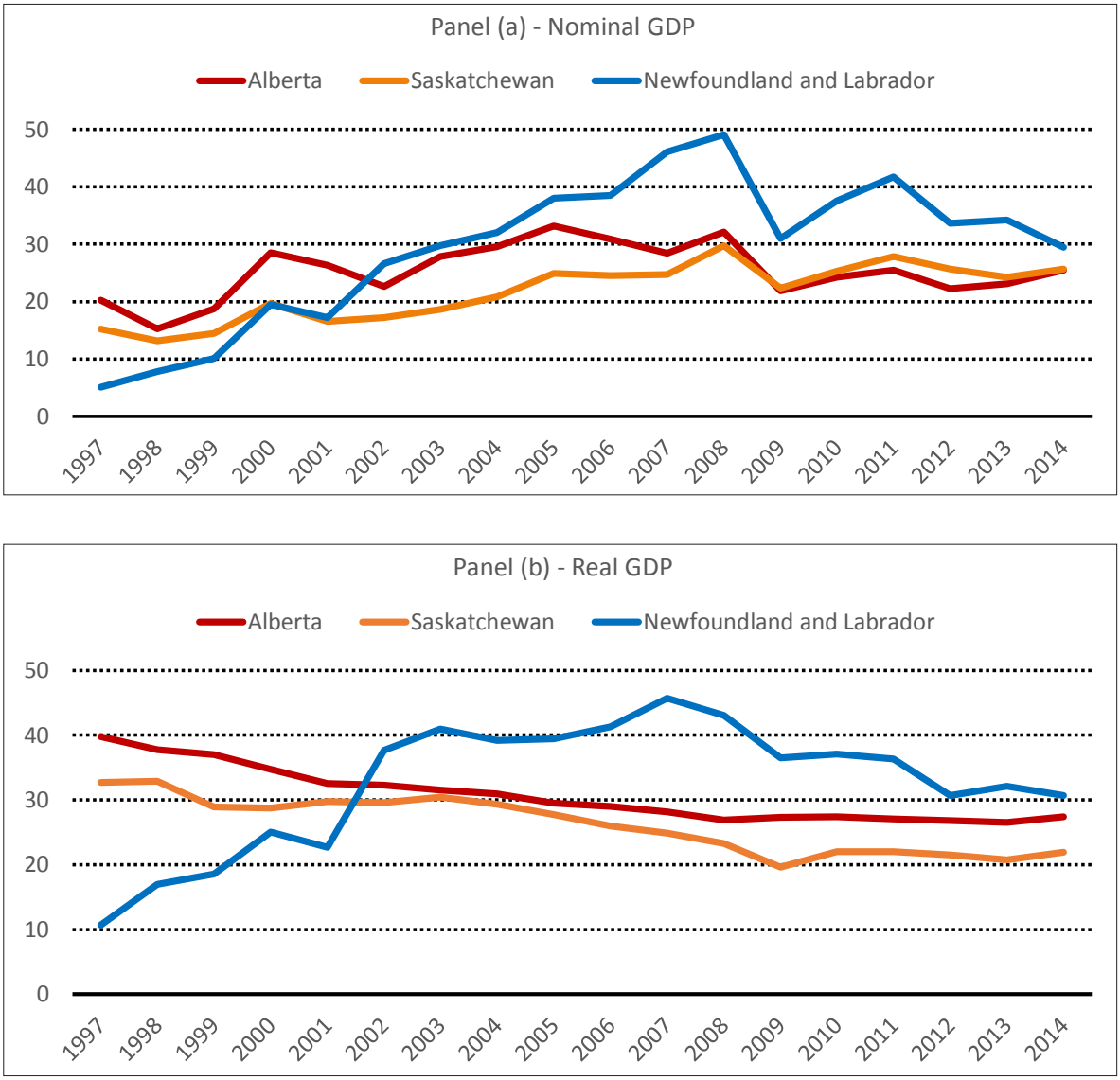
We can control for changing prices and look only at *real* GDP shares. Statistics Canada does this in CANSIM 379-0030, though we must use it with caution. The way in which industry prices are controlled for means that real GDP at the sector level will not sum to that of the overall economy. So, the level of the lines in Panel (b) should be taken with a small grain of salt. What the graph does show, however, is that the real GDP in mining and oil and gas sectors grew more *slowly* than the economy as a whole in Alberta and Saskatchewan since 1997.

FIGURE 8 HERFINDAHL INDEX OF NOMINAL GDP, BY PROVINCE, 2015



Source: CANSIM 282-0088 and GDP from CANSIM 379-0028.

FIGURE 9 MINING, OIL AND GAS SHARE OF GDP, SELECTED PROVINCES



Note: Author's calculations from CANSIM 379-0025, 379-0028, 379-0030.

Newfoundland and Labrador, on the other hand, saw a large increase as it developed its offshore fields; in fact, about two-thirds of the increase in the nominal GDP share of the mining and oil and gas sectors is due to their increased real GDP share. So production and quantity increases dominated the price effect for Newfoundland and Labrador. For Alberta and Saskatchewan, the increased nominal GDP shares are more than entirely due to higher oil prices.

This is much more consistent with our earlier measure of employment diversification. Resource sectors have actually been declining in importance in terms of their real economic activity, although as a source of income they have been increasing until only recently. In short, we've seen that employment and real economic activity are actually fairly diverse, but sources of income are less so.

2.8 Diversification of Markets

An important determinant of stability can be the diversity of the export markets for the outputs of a region or nation. Let's look beyond Canada's borders and measure the diversification of our export markets. While it may very well be that employment and real economic activity are fairly evenly spread across sectors, as we saw for Alberta, the markets to which a region sells may be either highly concentrated (with most exports going to only a few countries) or highly diversified. We can think of the Herfindahl Index as a measure of the probability that two randomly selected dollars worth of exports are destined for the same country. We can also think of it as an economy's exposure to economic shocks from abroad. To be sure, to the extent that some provinces' exports are dominated by homogenous and standardized products (such as oil), it may matter less where they are exported if a world price prevails. Although, even for oil, price differentials exist and specialized export infrastructure (i.e., pipelines) are subject to location-specific political risks, which means diversity in export markets may nonetheless have value.

Using recent export data for 2015 from Industry Canada,[15] the Herfindahl Index for each province is displayed in Figure 10. Two provinces stand out in terms of the concentration (or lack of diversity) of their export markets: New Brunswick and Alberta. And Ontario is not far behind. These provinces all disproportionately export to the United States, with over 90 per cent of New Brunswick's exports going there, 86 per cent of Alberta's, and just over 80 per cent of Ontario's. By contrast, B.C. sends just over 50 per cent of its exports to the United States, and much more (about a third) to the major Asian markets of China, Japan, South Korea, and India. The differences in export-market diversification are large. By this measure, there is nearly an 80 per cent chance that two randomly selected dollars worth of Alberta exports are destined for the same country. For B.C. and Saskatchewan, there is only a 30 per cent chance.

The situation for Alberta is also not improving. In 1992, for example, the same measure of export concentration was roughly 0.6. It grew steadily to 0.8 by 2014 before dropping slightly in 2015 due to low oil prices shrinking the value of Alberta's U.S. export volumes. Based on this measure, the increasing calls for better market access for Alberta's exports (that is, improved pipeline infrastructure to allow it to reach more destinations) seem a sensible way to increase this dimension of diversification.

As before, we can also compare Canada to the rest of the world. With data on bilateral trade shares between the largest 40 countries in the world, we can construct a comparable measure of export-market concentration. The results are displayed below in Panel (b). Note that 2011 is the most up-to-date year available from this particular dataset, although the broad pattern will not have changed much since.

Clearly, Canada as a whole has among the world's least diverse trade patterns. This should surprise no one, given the dominance of the United States market next door. Policy-makers also recognize this and are pursuing trade agreements with Europe (through the Comprehensive Economic and Trade Agreement), the Pacific Rim nations (through the Trans-Pacific Partnership), and will hopefully pursue more (especially with China).

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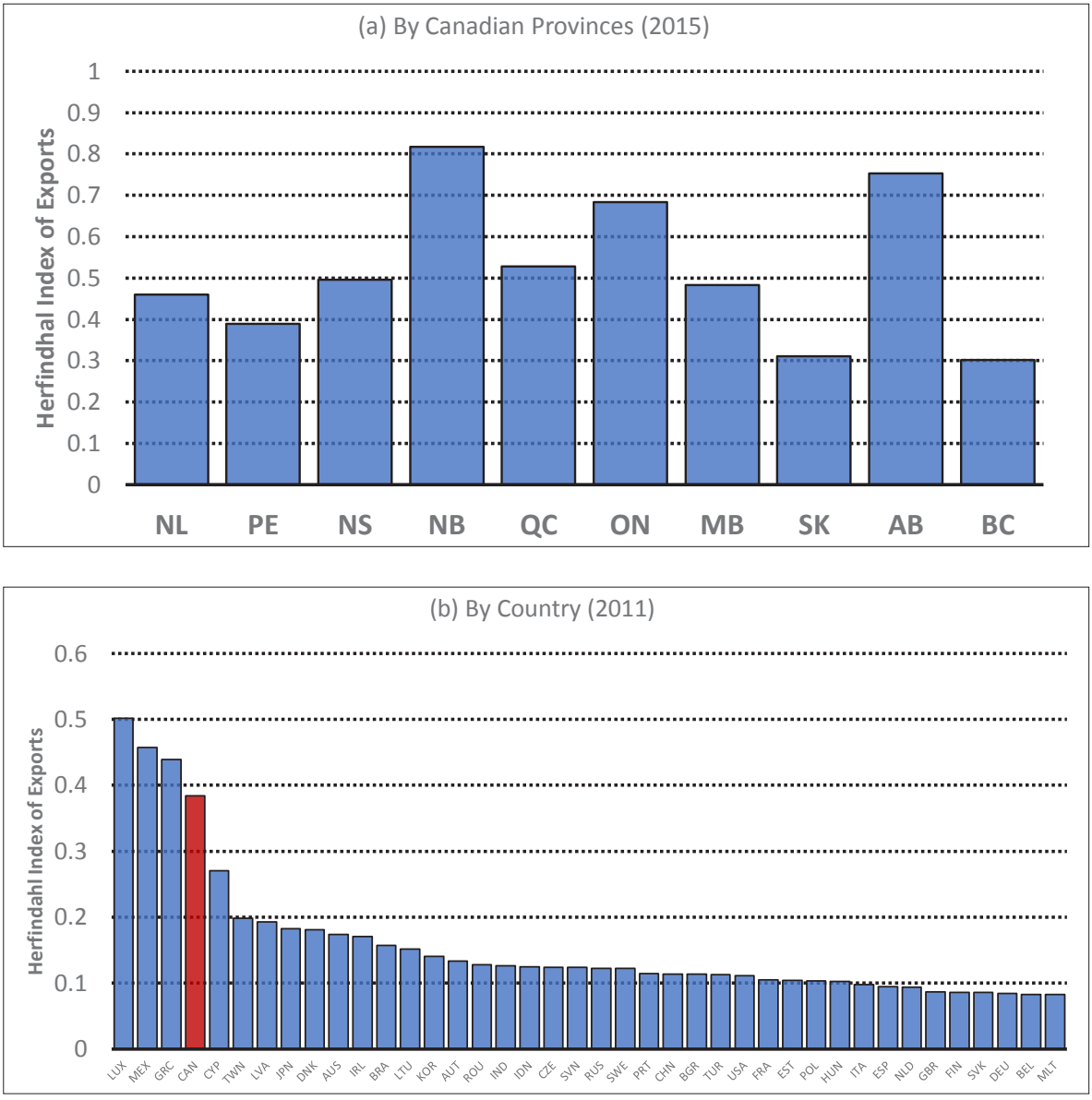
[15] Canada. Innovation, Science and Economic Development website, "Trade Data Online," at https://www.ic.gc.ca/eic/site/tdo-dcd.nsf/eng/home.

It is worth noting that the appropriate benchmark level of export-market diversification will vary by country, depending on each country's unique geographic characteristics, location in the world, and so on. Even with new trade agreements, Canada's export-market diversification is unlikely to approach the level of, say, Germany — nor should we want it to. Moreover, a country's comparative advantage will affect its trade patterns. Overall economic prosperity is served by concentrating in activities that we are relatively best at, not in evenly spreading our resources out over sectors and markets. In any case, a full analysis of the pros, cons, and potential policy responses to trade diversification is beyond the scope of this paper. For a full discussion and analysis, interested readers should see recent research by Beaulieu and Song.[16]

FIGURE 10 MEASURE OF EXPORT-MARKET CONCENTRATION



Note: Uses "Trade Data Online," from Industry Canada for 2015. Panel (b) uses the World Input-Output Database trade data for 2011.The Herfindahl Index is for export volumes across destinations.

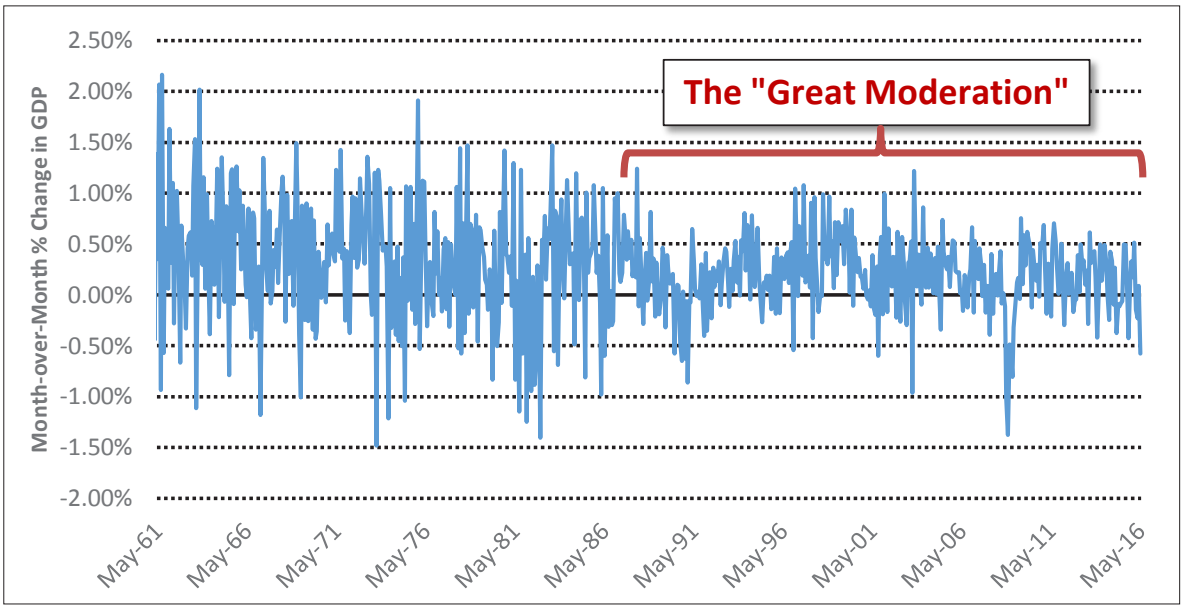
[16] Eugene Beaulieu and Victor Song, "What Dependency Issues? Re-Examining Assumptions about Canada's Reliance on the U.S. Export Market," University of Calgary School of Public Policy Research Paper 8, 3 (January 2015).

3 ECONOMIC VOLATILITY

This paper began by pointing out that diversification matters because it is seen as a determinant of the volatility of economic activity. Policy-makers hope that if our economy is not dominated by one sector or another, large fluctuations in employment and incomes can be avoided. Let's take a look at volatility directly. Overall, we'll see that volatility has fallen in Canada, both in terms of GDP and employment. We'll also see similar declines for Canada's provinces. This general trend is in line with international evidence that also finds economies are less volatile than in the past. Indeed, it has even been given a name: the "Great Moderation." Figure 11 plots the monthly growth rates of real GDP in Canada since the 1960s.

Visually, we can see the decline in GDP volatility. Does the Great Moderation describe provincial GDP growth patterns as well? That is, are provinces experiencing lower volatility of GDP growth rates? Also, which provinces have the most volatile GDPs? Figure 12 plots the standard deviation of real GDP growth rates, by province.

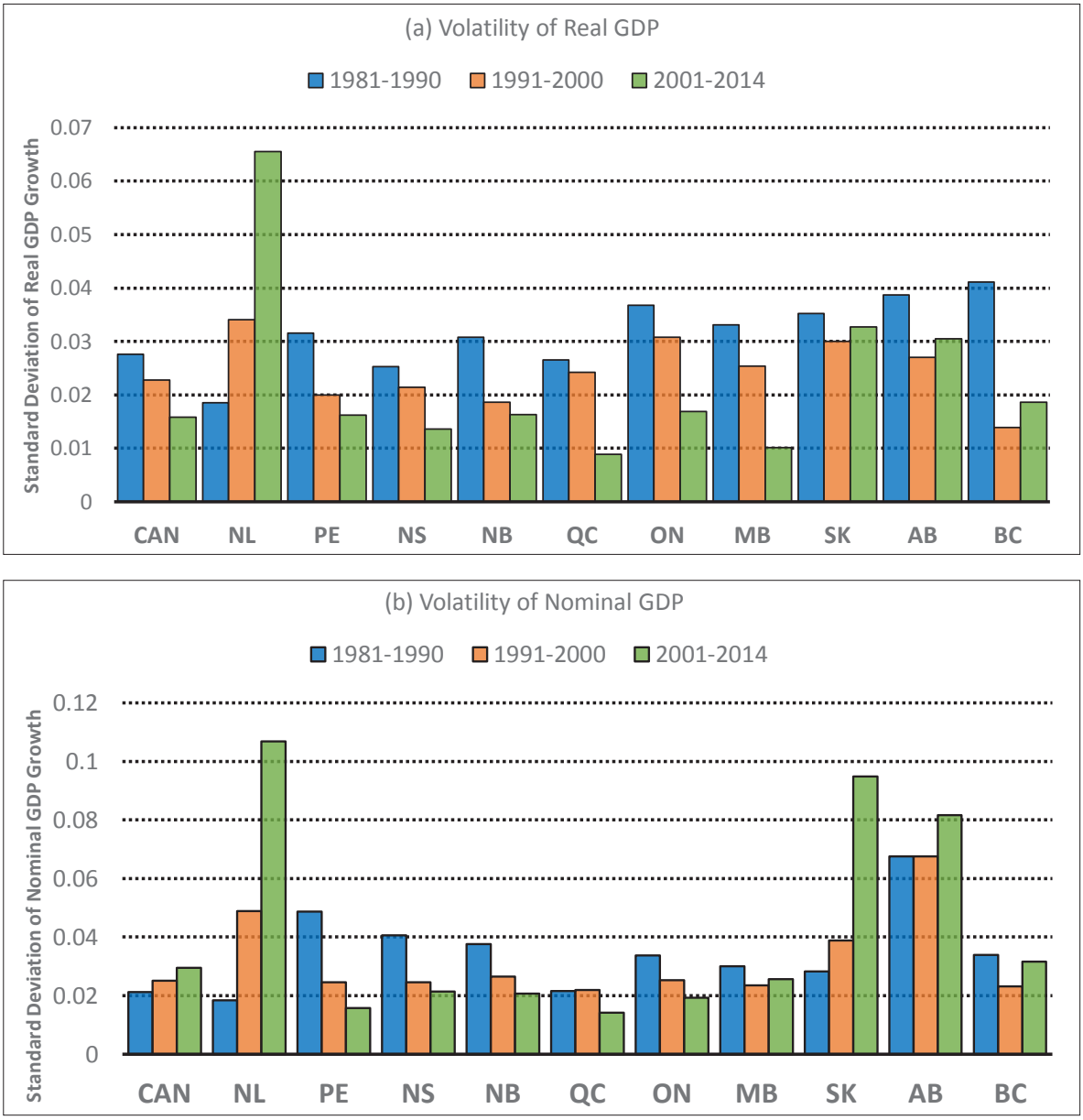
FIGURE 11 MONTHLY REAL GDP GROWTH RATES IN CANADA



Note: Monthly growth rates of Canada's real GDP from CANSIM 379-0006 and 379-0031.

For Canada, we can see the decline in recent years relative to the 1980s. Across provinces, we do see that resource-rich provinces have the most volatility in terms of real GDP, especially Newfoundland and Labrador. But, for the most part, all of Canada's provinces have seen lower volatility. This includes Alberta, although not Newfoundland and Labrador, which is the clear (and dramatic) exception.

FIGURE 12 VOLATILITY OF REAL AND NOMINAL GDP GROWTH, BY PROVINCE



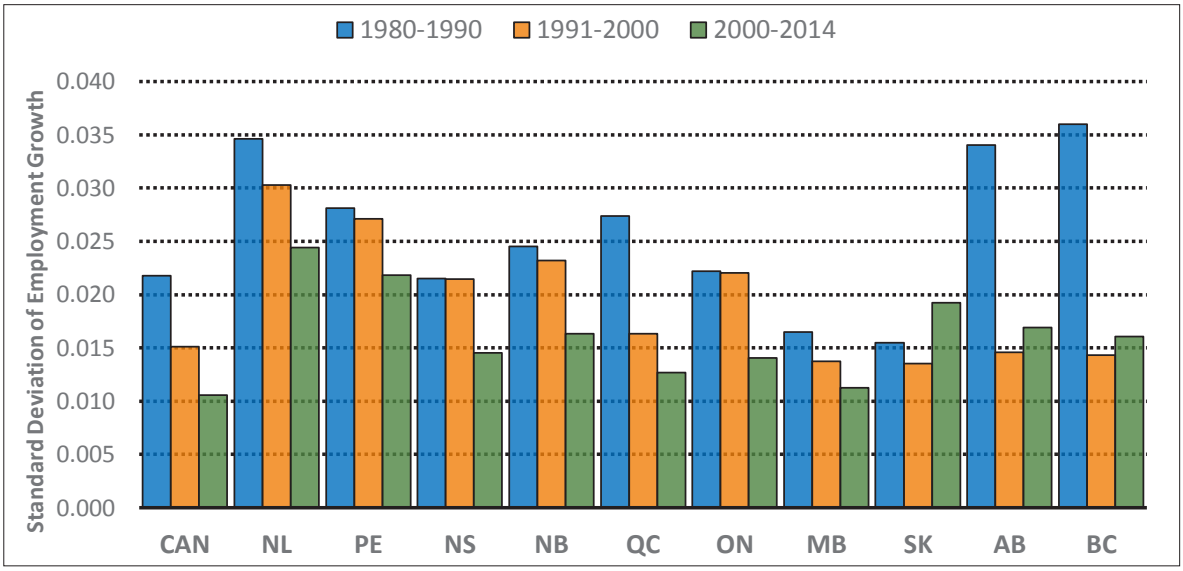
Source: Both figures use data from CANSIM 384-0038.

Comparing across provinces, the resource provinces of Alberta, Saskatchewan, and Newfoundland and Labrador do have higher levels of instability in their real GDP growth rates, but this is only slight. Indeed, some of the differences are due to Alberta's higher average growth. The coefficient of variation in real GDP growth rates between 2001 and 2014, for example, was 0.92 in Alberta and 1.04 in Ontario. That is, for both provinces, the standard deviation is about as large as average growth rates.

In the previous section, we saw the magnitude and sources of volatility in real economic activity — either real GDP growth rates or employment. Next, consider income or, more specifically, *nominal* GDP. The distinction between real economic volatility and income volatility is critically important. As we will see later, how to manage and buffer income volatility requires *very different* policy tools than what governments tend to consider when pursuing diversification agendas.

Panel (b) tells a very different story, though. It is clear that the resource-rich provinces of Alberta, Saskatchewan, and Newfoundland have considerably more volatile nominal GDP growth rates. For Alberta, it's triple that of the country as a whole. And unlike real GDP growth volatility, this is not simply an artifact of higher average growth rates in these provinces. The coefficient of variation in Alberta is 1.12 but for Ontario is only 0.56, and for the country as a whole is 0.69.

FIGURE 13 VOLATILITY OF EMPLOYMENT GROWTH



Source: CANSIM 282-0088.

Finally, it's useful to do the same examination for employment. Figure 13 plots the volatility of employment by province and over time. There has been a dramatic reduction in the volatility of employment in Alberta and B.C. since the 1980s. Overall, we see the Great Moderation manifesting itself both nationally and across provinces in terms of employment stability. Interestingly, a resource-rich province like Alberta has similar overall employment volatility to its neighbouring province of British Columbia.

3.1 Sources of Volatility in the Overall Economy

The previous section documents the magnitude of overall GDP and employment volatility in Canada and its provinces. But what sectors account for such fluctuations? To answer this question we must measure sectoral volatility and the covariance between each sector's movements and the movements of other sectors. That is, when one sector rises or falls, does it tend to do so jointly with other sectors? Once these patterns are documented, there are fairly standard variance-decomposition techniques that will attribute overall economic volatility to each individual sector.

To begin, consider a simple situation where each sector's volatility is uncorrelated with any other sector. Further suppose that each sector is the same size, so each accounts for $1/N$ of overall GDP. Denoting the variance of GDP in sector i as σ_i^2, the variance of aggregate GDP is given by

$$\sigma^2 = \sum_{i=1}^{N} \sigma_i^2/N^2,$$

and the contribution of sector i to the total is therefore $\left(\sigma_i^2/N^2\right)/\sigma^2$. Now, if the sectors differ in size so that sector i accounts for ω_i share of overall GDP, then overall variance would be

$$\sigma^2 = \sum_{i=1}^{N} \omega_i^2 \sigma_i^2.$$

Finally, the fully general case is where volatility of each sector is potentially correlated with that of each other sector. In that case, the algebra becomes more difficult, but overall GDP variance can be represented as

$$\sigma^2 = \sum_{i=1}^{N} \left[\omega_i \left(\sum_{j=1}^{N} \omega_j \sigma_{ij} \right) \right],$$

where σ_{ij} is the covariance between sector i and sector j.[17] So, in general, the contribution of sector i is given by $\omega_i\left(\sum_{j=1}^{N} \omega_j \sigma_{ij}\right)/\sigma^2$.

In any case, data on sectoral GDP (both real and nominal) are easily found by sector and year. With that, one can easily construct sectoral weights ω_i and variance-covariance terms σ_{ij}. Figure 14 plots the standard deviation of these annual real GDP growth rates between 1961–2013, which correspond to σ_{ij} in the above equation. It also displays the 2012 share of overall GDP by sector, which corresponds to ω_i. The covariance terms are not provided, but can be constructed from the same data. Also available is nominal GDP by sector.

With these data in hand, the contribution to overall GDP volatility can be constructed. Figure 15 plots $\omega_i\left(\sum_{j=1}^{N} \omega_i \sigma_{ij}\right)/\sigma^2$ for each of the main sectors of Canada's economy.

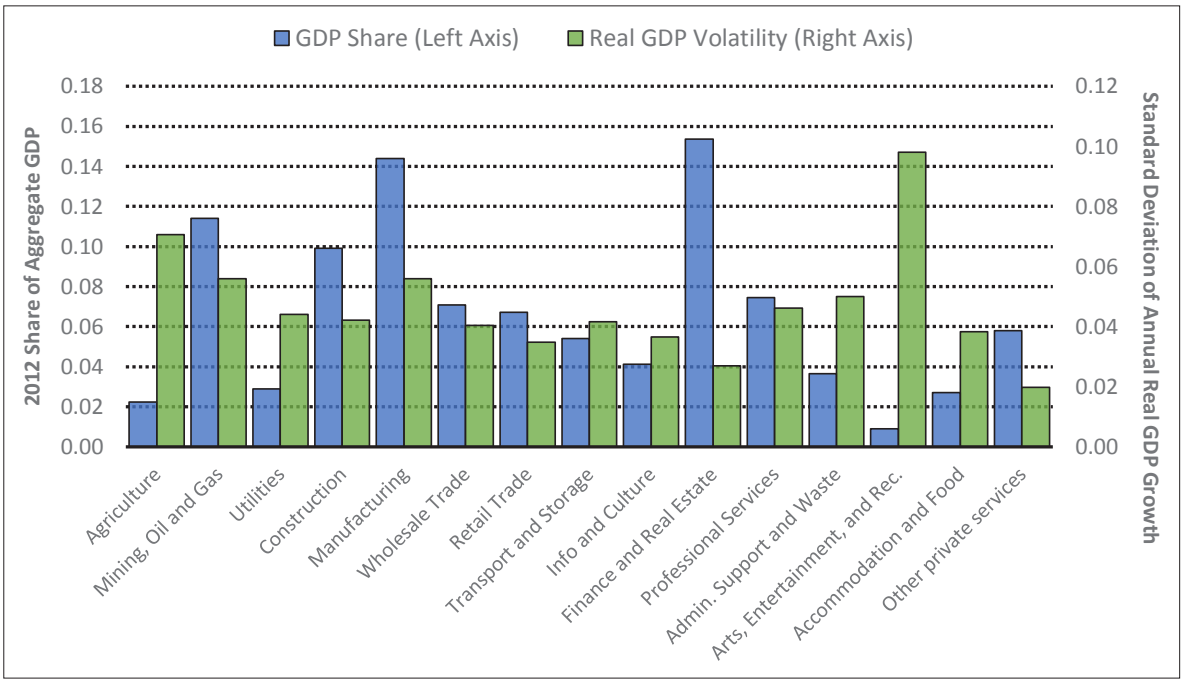
The manufacturing sector is the largest contributor to aggregate real GDP fluctuations, accounting for just over one-quarter of aggregate fluctuations. This shouldn't be surprising, as it is the largest sector in terms of gross output and the input-output linkages between this sector and most others are fairly large. So, shocks to that sector translate into large overall effects.

Looking at nominal GDP tells a very different story. For this, those sectors exposed to volatile internationally determined prices, such as mining and oil and gas, unsurprisingly account for a much larger share. Indeed, on this measure, that particular sector accounts for one-quarter of Canada's overall volatility. This is a key finding for policy-makers. Those concerned about smoothing aggregate economic volatility must distinguish real and

[17] This can be more compactly expressed using matrix notation as $\sigma^2 = \boldsymbol{\omega}'\boldsymbol{\Omega}\boldsymbol{\omega}$, where $\boldsymbol{\omega} = [\omega_1, \ldots, \omega_N]'$ is a vector collecting each sector's share of GDP and $\boldsymbol{\Omega}$ is the matrix collecting all variance and covariance terms (the i^{th} row and j^{th} column is σ_{ij}).

nominal volatility. Nominal GDP variation may be better ameliorated through insurance-type policies that save more in good times, provide short-term support to those whose incomes have fallen, and other measures that soften the blow of cyclical shocks, rather than with policies that attempt to structurally change the overall economy.

FIGURE 14 VOLATILITY OF GDP GROWTH AND SHARE OF TOTAL GDP, BY SECTOR

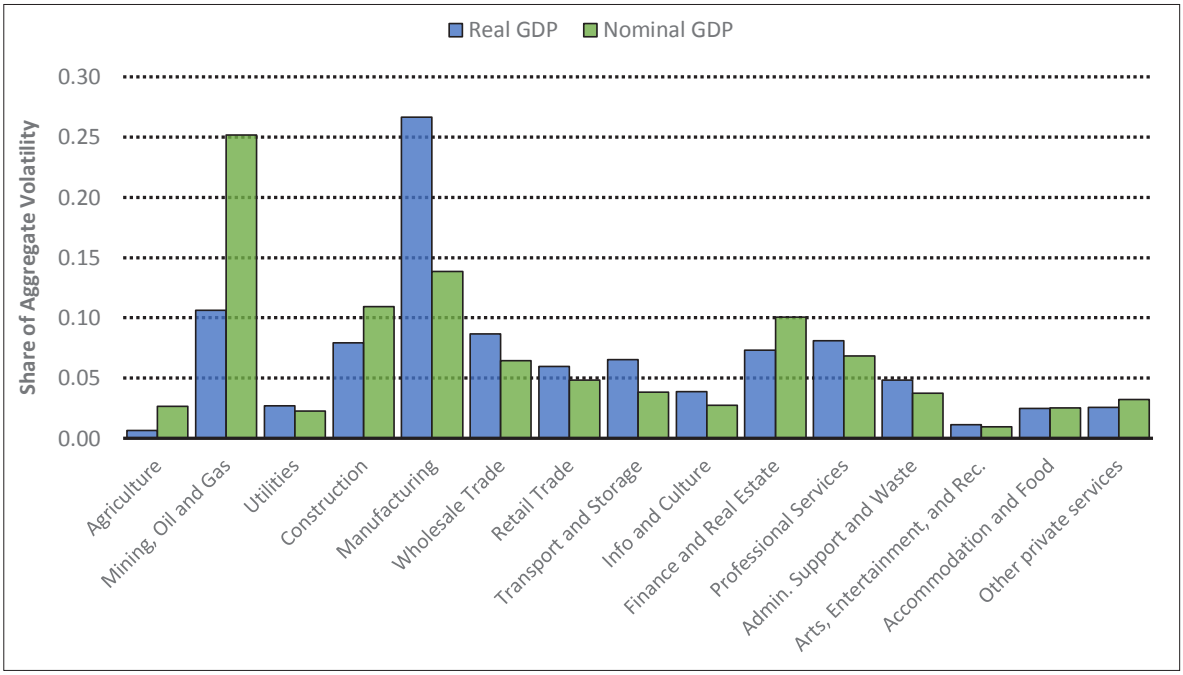


Note: Plots the standard deviation of annual real GDP growth rates between 1961 and 2012, and the share of 2012 overall GDP. The source for both data is CANSIM Table 383-0021.

Of course, as we've repeatedly seen throughout this report, the manufacturing sector has declined in importance and therefore the effect of shocks to that sector on overall GDP have also declined. In 1981, the contribution of manufacturing to overall volatility was much larger. Figure 16 compares the contribution to overall real GDP volatility by each sector using both the 1981 GDP weights and the 2012 weights. The drop in manufacturing partly explains why Canada's overall GDP volatility has shrunk. Indeed, recent research has documented this same result for the United States.[18] Diversifying the economy away from manufacturing and towards services may have contributed in no small part to the Great Moderation.

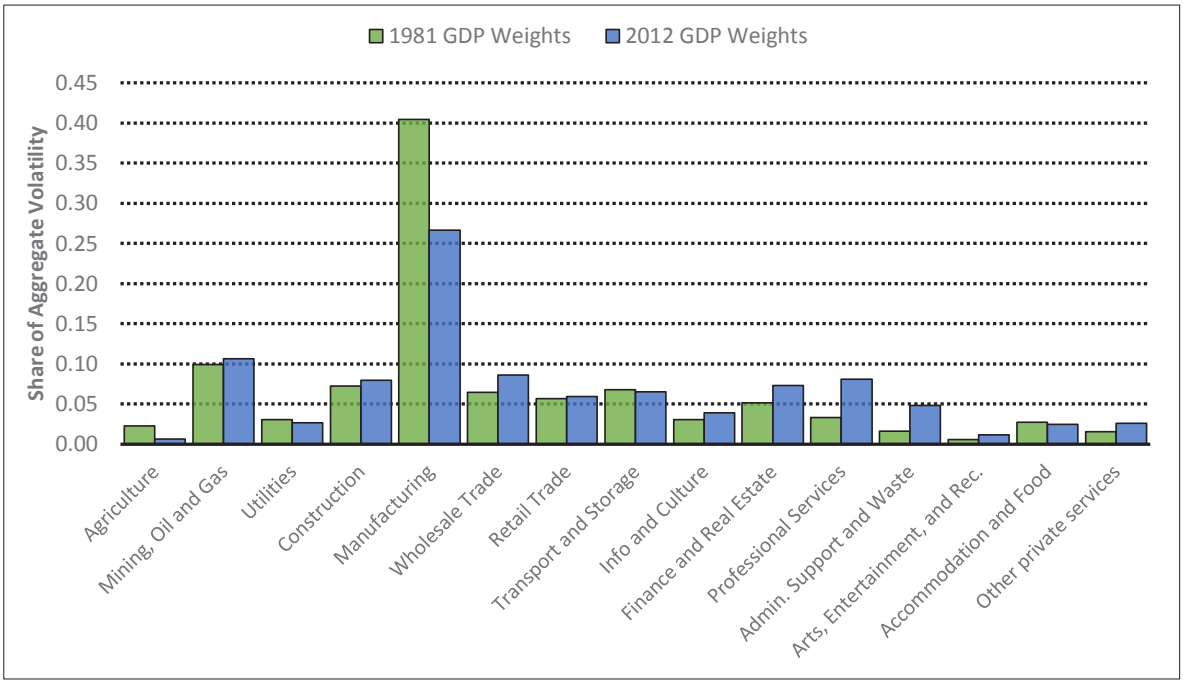
[18] Vasco Carvalho and Xavier Gabaix ,"The Great Diversification and Its Undoing," *American Economic Review* 103, 5 (2013): 1697-1727.

FIGURE 15 CONTRIBUTION OF EACH SECTOR TO CANADA'S OVERALL GDP VOLATILITY



Note: This graph plots the contribution to aggregate GDP volatility for each of the main sectors in Canada. It is based on data from CANSIM 383-0032; see text for details.

FIGURE 16 CONTRIBUTION OF EACH SECTOR TO CANADA'S OVERALL GDP VOLATILITY



Note: This graph plots the contribution to aggregate GDP volatility for each of the main sectors in Canada. It is based on data from CANSIM 383-0032; see text for details.

4 DISCUSSION AND POLICY OPTIONS

Calls for "diversification" are a very predictable response to economic volatility or slow growth. Equally predictable are the political responses promising to deliver diversification. Unfortunately, there are some troubling patterns in these responses. First, it is rarely clear what exactly is meant by and what would actually constitute diversification. Second, given the lack of definition and measurement as a starting point, there is no sense of how diversified (or undiversified) the existing economy actually is. If we think we desire more diversification, it is important to measure its current level to establish the starting point, trends, shortfalls and progress. But this step seems to be missing. Third, it is not clear why the policy goal should be diversification rather than something like "greater stability," which could be achieved by policies other than diversification of the economic structure. Fourth, if the policy goals are for more diversification, where are the estimates of costs and benefits to justify the policies?

To begin to address some of these fundamental issues, this analysis noted that there are a number of dimensions to economic diversification and, using an index of concentration, estimated levels and changes in the degree of diversification for these dimensions. The general conclusions from this analysis can be summarized as follows:

- Contrary to common perception, the level of diversification with respect to Canadian employment has been increasing over time and is currently greater than at any point in recent history. In comparison to most other countries Canada also ranks near the top in terms of diversification of employment, even higher than the U.S. Measuring diversification in terms of output (or real GDP), there has been a slight decline in diversity, but this decrease is primarily due to the rapidly increasing share of imputed rents for Canadian housing and, consequently, increased shares for the real estate component of the finance insurance and real estate sector. In terms of income (or nominal GDP), the level of diversification has been stable but would actually show an increase if the growing shares for imputed housing rents were factored out.
- The pattern for diversification of direct employment across the provinces is one of increasing diversity and convergence to the point where there are relatively small differences among the provinces. However, when we take into account both the direct and indirect employment associated with each of the sectors, the level of diversification in Alberta is significantly reduced, albeit still in line with that for Ontario and Quebec. If we focus on just income, then Newfoundland, Saskatchewan and Alberta stand out as having more concentration (or less diversity) than the other provinces.
- Another important dimension is diversification with respect to export markets. Here, Canada is among the countries with the least diversity in export markets. At a regional level, New Brunswick and Alberta share the distinction of having the least export-market diversity, with Ontario not far behind.
- If the focus is shifted from examining the level and changes in diversification to examining the level of economic volatility (a more meaningful policy concern), it is clear that the trend over time has been one of decreasing variability. This trend also holds for the individual provinces, but the levels of variability in terms of real GDP are still higher than average in Alberta, Saskatchewan and Newfoundland, while the

variability of employment is above average for Newfoundland and Prince Edward Island. In general the largest contributors to volatility across the regions are the manufacturing sector, followed by mining and oil and gas, construction, and finance and real estate.

- In evaluating the level of diversification for the provinces it is helpful to provide a summary for the various dimensions. For this purpose, Table 4 provides a ranking of the measure of diversification across the provinces and across the four dimensions discussed above in Section 2. As shown there, whether a provincial economy can be considered more or less diversified compared to that of other provinces depends heavily on which dimension is used. At the same time, it is clear that aggregating across dimensions reveals that the Western Canadian provinces tend to rank higher in terms of diversification than those in Central Canada, contrary to common perceptions.

TABLE 4 RANKING DIVERSIFICATION ACROSS PROVINCES

	Diversification Rank, by Province and Metric				
	Direct Employment	Direct and Indirect Employment	Nominal GDP	Export Markets	*Mean Reciprocal Rank*
SK	2	1	9	2	*1.9*
BC	3	2	5	1	*2.0*
MB	7	8	1	5	*2.7*
AB	1	5	8	9	*2.8*
NB	6	3	3	10	*4.3*
QC	9	10	2	7	*4.7*
PE	5	9	6	3	*4.9*
ON	4	7	4	8	*5.2*
NS	8	4	7	6	*5.8*
NL	10	6	10	4	*6.5*

Note: Ranks the provinces from most diverse (rank of one) to least diverse (rank of 10) across each of the four main metrics examined in Section 2. The mean reciprocal rank is a common method of aggregating rank lists — it is equivalently the harmonic mean of each province's rank across the four metrics.

4.1 The Potential Trade-Off Between Diversification and Productivity

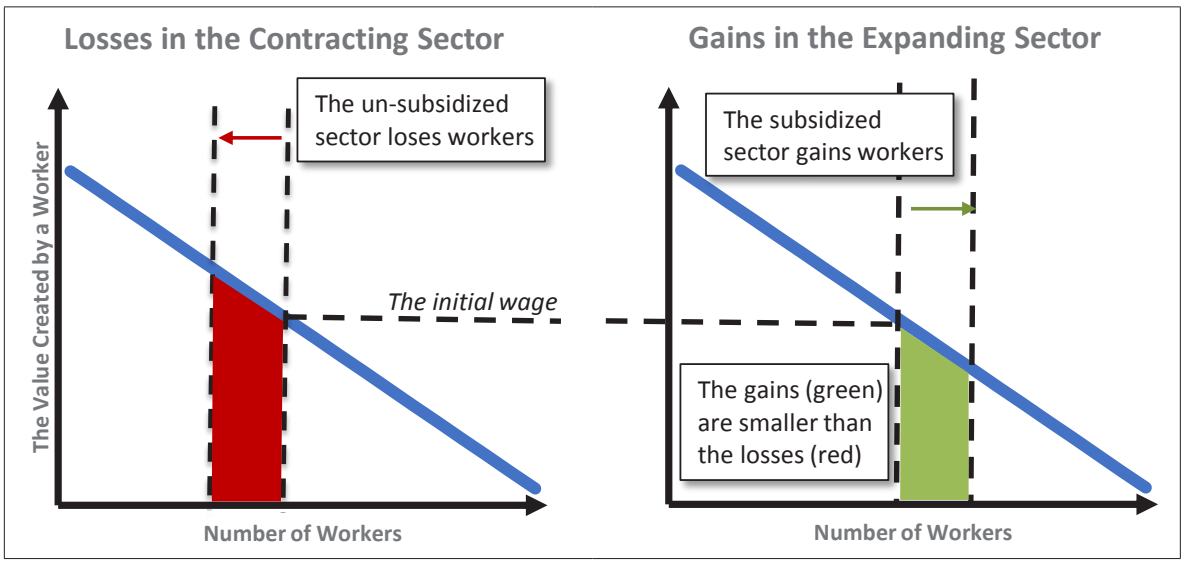
Let's begin our discussion of policy options on a cautionary note. There are potentially many ways to increase the level of diversification in the economy. The most common view is that it should involve changing the industrial structure, usually by providing some type of subsidy to enhance particular sectors. A government could, for example, provide preferential access to credit or other inputs, or perhaps even provide direct subsidies. To achieve the goal of increased diversification these supports would be directed at currently smaller sectors. As these smaller sectors grow as a result of the support, they draw workers and other inputs away from other areas of the economy. It is in this way that diversification could increase. But it comes at a cost.

In a well-functioning market, the allocation of workers, inputs, investment and so on, is determined by prices. Productive firms or sectors able to pay higher wages, for example, will naturally hire more workers and expand in size relative to other firms or sectors. The natural equilibrium allocation will tend to maximize productivity and incomes.

Government subsidies distort this allocation by allowing firms or sectors that would not otherwise attract workers to hire those workers nonetheless. Concretely, a firm may have tasks that generate only $20 per hour in revenue. It would make little sense to hire a worker for $25 per hour unless there are subsidies available to make up the difference. The workers this subsidized firm manages to attract, however, must come from somewhere — and those firms or sectors not receiving a subsidy (or supplying sufficiently many inputs to the subsidized sector) will lose workers. These displacement effects can be very costly.

Sometimes a simple illustration helps. Consider a world with two sectors. Workers are free to move between the two sectors, but with each additional worker employed the less value an additional worker will create. Imagine Walmart, where the first workers stock the shelves or operate the cash registers. These are valuable tasks for the store. As more workers are hired, however, they occupy progressively lower-value tasks, such as greeting customers at the front door. The firm will stop hiring when all tasks worth more than the prevailing wage rate are filled. Figure 17 below illustrates such a natural equilibrium, with the initial allocation of workers between the two sectors being determined by the prevailing initial wage rate. Now, imagine a government program diverts workers from the sector on the left to the sector on the right. The expanding sectors begin operating tasks that are worth less than the tasks available in the contracting sector. The gains in green are lower than the losses in red. The net result is a decrease in overall economic activity.

FIGURE 17 STYLIZED ILLUSTRATION OF LOSSES FROM MISALLOCATING WORKERS



Note: Illustrates how shifting workers from one sector to another results in overall losses. The value of the last worker hired in each sector is the same when market function well. A subsidy allows the sector on the right to expand employment into progressively lower-valued tasks. The resulting loss of employment in the sector on the left means relatively higher-valued tasks are lost.

Of course, this is just an illustration to build intuition, but the general result is sound: A subsidy that expands one sector comes at the costs of contractions elsewhere; absent a market failure, this reallocation will tend to lower overall productivity and harm the economy.

To be sure, markets do not always function well. Perhaps there are credit-market failures demanding a government response. Perhaps there are positive spillover benefits from certain sectors that justify a subsidy. But the onus is on policy-makers to state *precisely*

what the market failure is to justify a subsidy. Invoking "economic diversification" alone is not itself sufficient. If that is all that justifies a policy, then the increased diversification will come only at the cost of a smaller overall economy.

4.2 Other Policy Options and Concluding Thoughts

A key point coming out of the analysis in this paper is that, from a policy perspective, it is most important to keep the focus on a laudable goal of reducing the volatility in employment and incomes, rather than diversification. Diversification is but one potential way of obtaining this outcome but may well entail large costs and few benefits in terms of the stability goal. An example is the common preoccupation with enhancing the manufacturing sector relative to the resource sector to generate greater stability when, in fact, the former tends to exhibit greater cyclical and long-term volatility than the latter.

Further, by most measures the Canadian economy is already highly diversified and, with some exceptions, so are the provinces. And one should question the logic that every region (including metropolitan areas) should be highly (and equally) diversified rather than have economies that exploit the gains from comparative advantage and specialization. In a well-functioning federation, the focus would be more on offsetting the volatility associated with specialization by, for example, more highly developed "insurance-type" policies. Particularly in the case of cyclical volatility, these would allow regions to more easily accommodate the ups and downs while still achieving the higher incomes associated with an economy based on comparative advantage.

Much has been written on effective policy approaches for dealing with economic variability. [19] There is insufficient space here to review all of the details, but a few important themes are worth highlighting. In general, rather than focus on attempting to engineer or re-engineer an industrial structure to focus more on some politically selected and favoured sectors, all on the assumption that this will lead to greater stability while promoting prosperity, the focus should be more generally on:

- Creating a favourable investment climate, including policies aimed at building on existing comparative advantage or where there is clear evidence that such an advantage can realistically be created and sustained. Uncertainty is the enemy of investment and much can be gained by focusing on creating an environment of high quality social and physical infrastructure and stable and predictable economic policies.
- Limiting sector-shifting policies to cases where there are documented cases of market failure. Absent a market failure, subsidies to favoured sectors may very well increase economic diversity, but only at the cost of a smaller overall economy.
- Promoting policies that facilitate adjustment and encourage behaviours appropriate to an environment of inevitable economic variability. These include policies to encourage more saving in the good times, lower debt-to-income levels and policies to reduce a general tendency of government spending to be pro-cyclical.

[19] A summary can be found in Mansell and Percy, *Strength in Adversity*, Chapter 5.

- Ensuring pre-existing policies are not *themselves* causing a concentration in relatively few sectors. For example, it has been suggested that not tying royalties to a benchmark industry-wide average cost of extraction when calculating resource rents may lead to an incentive to over-invest in extraction.[20] More generally, targeted tax policies, such as accelerated depreciation, may encourage over-expansion of a particular sector that ultimately increases adjustment costs once a correction begins.

It is with these points in mind that government, commentators, and indeed all Canadians should evaluate future economic-diversification policies. But at the end of the day, critical public policy debates deserve full and complete information. Governments have a responsibility to define the objectives they have in mind. Diversification means different things in different situations, depending on how it's measured. Absent a clear goal, proposed policy solutions risk being counterproductive. So, on this file especially: If it matters, measure it.

[20] Recent changes to Alberta's royalty framework apply average cost benchmarks for conventional oil and gas extraction, although the oilsands formula does not. For a more detailed discussion of this issue, and recent royalty changes, see Blake Shaffer, "Lifting the Hood on Alberta's Royalty Review," University of Calgary School of Public Policy Briefing Paper 9, 7 (February 2016).

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Robert Mansell (PhD, University of Alberta), Professor of Economics, served as Head of the Department of Economics and Dean of the Faculty of Graduate Studies and Associate Provost from 1996-2005. In 2003 he was also appointed as Advisor to the President on Energy and Environment, and Managing Director of ISEEE. In January 2009 he was appointed as Academic Director of The School of Public Policy and he also served as Interim Director of The School from July 2015 to March 2016.

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Dr. Mansell is qualified as an expert witness before many energy and utility regulatory bodies. In addition to serving on a large number of University of Calgary committees, councils and task forces, he has provided extensive service on a variety of external committees and boards. Examples include service: on the Energy Strategy Advisory Committee for the Government of Alberta; as an advisor on the Mackenzie Gas Pipeline Project; on the Canadian Academy of Engineering Energy Pathways Taskforce; on the Council of Canadian Academies Study on Hydrates; and, on the Boards of Directors of the Alberta Chamber of Resources, the Alberta Energy Research Institute, Alberta Innovates-Energy and Environment Solutions, the Canadian Energy Research Institute, the Alberta Ingenuity Centre for In Situ Energy, the Van Horne Institute, and the Climate Change and Emissions Management Corporation.

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