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BREAKING THE BOOM AND BUST: EXPLORING THIRTY YEARS OF DIVERSIFICATION IN WESTERN CANADA

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The topic of diversification has been studied extensively by academics and policy makers. The theory of diversification, dating back to the 1930s and the Great Depression, suggests that increasing the variety of industries in a region spreads the risk and reduces the likelihood that all industries will suffer a downturn at the same time. This serves to mitigate the boom and bust pattern often experienced by a heavy reliance on a limited number of industries, which in three of the four western provinces, means natural resource-based industries.

This study examines diversification progress in the four western provinces over the last 30 years. The time span covers the greatest progress in trade liberalization policy in the nation's history, and the evidence is clear that increased trade is an important contributor to economic diversification.

Over the past three decades, Canada participated in the Tokyo (1973 to 1979), Uruguay (1986 to 1994) and Doha (beginning in 2001) Rounds of multilateral trade negotiations, and implemented the Free Trade Agreement with the United States in 1989 and the North American Free Trade Agreement in 1994. In addition to participating in international activities, provincial governments took important steps by reducing interprovincial trade barriers with the Agreement on Internal Trade in 1994 and the Alberta-BC Trade, Investment and Labour Mobility Agreement of 2006.

The study uses labour force data to examine whether the four western provinces have become more diversified and concludes that Alberta has made the most progress, while acknowledging that Manitoba's already-diversified economy leaves less potential for further progress in that province. The study also examines the actions taken by federal and provincial governments that contributed to increased diversification. Based on the results of the analysis it is possible to draw five key observations about diversification and how it can be encouraged.

The first observation is that economic diversification is a competitive pursuit. A quick survey of the international competition indicates Malaysia, Thailand, Chile, Australia, Kuwait, Korea, Uganda and Texas are just a few of the jurisdictions actively pursuing economic diversification strategies – each based on specific, internal strengths.

Promoting the 'provincial brand' internationally, creating a business-friendly climate, and differentiating a province from the competition are essential elements in attracting new investment that can contribute to diversification. But appropriate investment can only be realized if investors see a destination as offering a sustainable competitive advantage.

Competitive tax rates, access to skilled labour, excellent transportation and telecommunication services, reasonably priced power with certainty of supply, and access to globally competitive health and education services for incoming professionals are all essential ingredients.

The second observation is that chasing individual firms, in new industries, to relocate in a province by offering special incentives is not a silver bullet solution. The competition is intense and the practice can backfire when recent newcomers choose to leave for greener pastures.

The migratory nature of the call centre industry is a good example. Firms that once located in North America, enticed by special incentives such as tax holidays, subsequently moved to India to benefit from lower labour costs and are now moving from India to Egypt and Vietnam to lower costs further.

The third observation is that diversification is most likely to be achieved by building on existing strengths in a realistic way. For example, a development board in South Australia indicates its plan is to support the development of new enterprises to service the resources sector, which it recognizes is the prime economic driver in the region. The board is developing approaches to addressing skills shortages and facilitating emerging industries in tourism and food production. But they have taken that vital step of realizing that the resource sector is their economic lifeblood.

The fourth observation involves the entrepreneurial mindset and persistence required for diversification to occur. The western provinces, to varying degrees, have invested significantly in technical and trade schools, in universities, in research centres and in promoting entrepreneurship. This strategy recognizes that long term progress toward greater diversification starts at home.

But the journey is long and the objective can only be reached through persistence. Korea's efforts toward greater diversification, for example, span the last 50 years, and the country is not letting up. To ensure success, diversification requires a long term commitment.

The fifth and final observation relates to trade policy. Progress toward greater diversification cannot be made in a globalized economy if markets are kept closed, if market access is impeded by preferential government policies, or if protectionist measures prevail. A continued effort toward trade liberalization by federal and provincial governments is essential to increased diversification.

Executive Summary

This is the first in a series of studies by the Western Centre for Economic Research (WCER) exploring diversification in the economy of Western Canada during the past 30 years, a period which featured widespread trade liberalization and the introduction of specific free trade agreements in North America beginning in 1989

The study begins by exploring the concept of economic diversification and how diversification can be used to mitigate the boom and bust cycles that typify the economic history of Western Canada. Policy approaches to diversification by the federal and provincial governments are reviewed— including the expectations for diversification as a result of trade liberalization.

Three analytical techniques are then presented which use employment data to determine how much diversification has occurred in Manitoba, Saskatchewan, Alberta, British Columbia and the West as a region since 1977.

Location quotient analysis compares labour force composition for various time periods at the provincial and regional levels to the nation level—which is considered to be more diversified because of its greater size. *Shift-share analysis* compares the change in employment, by industry, at the provincial and regional level to the change in employment by industry at the national level. And *portfolio analysis*, which is adapted from a technique used in the financial industry, measures employment covariance between industries to assess diversification and employment stability.

The analysis indicates that, from 1977 to 1987, minimal levels of diversification occurred—even in Alberta and British Columbia where overall economic growth was rapid.

From the mid 1980s on, however, there were important shifts in public policy, in the relationships between the western economy and the national and international economies, and in the region's human resource capabilities. The evidence suggests that these factors induced a higher order of regional economic diversification.

For the West as a region, since the mid 1980s there has been a marked decline in employment concentration in agriculture, a rise in employment concentration in mining (including oil and gas), and major gains in employment concentration in several service industries. The latter is considered to be a strong indicator of increased diversification.

Employment growth for the region since the mid 1980s has been dominated by Alberta and British Columbia and significantly exceeded the national rate. And employment stability among industries as measured by covariance has increased, with an almost threefold leap in the period from 1996 to 2007.

As for individual provinces, Alberta is the leader in making progress toward diversification as measured by all three methods. Alberta is also the province that established diversification as a primary policy priority. However, it would be premature to state that there was a clear and direct relationship between government programs aimed at diversification and the increased diversification in the Alberta economy without further analysis.

The results for British Columbia were similar to the Alberta pattern but British Columbia achieved the greatest movement of all provinces in terms of employment concentration in service industries.

In Saskatchewan, the increase in inter-industry employment stability as measured by covariance is encouraging. But the most compelling finding for Saskatchewan is a virtual absence of employment growth compared to the national experience over the past thirty years.

Manitoba started the period of this study as the most diversified of the four provincial economies. The most noteworthy finding for Manitoba lies in the inter-industry employment relationships between 1996 and 2007 which show all industries displaying negative co-variance. This is a strong indication of the stability that economic diversification can offer.

This study represents a beginning, not an end. The three analytical methods used in this analysis should be supplemented by examinations of other factors that are part of the diversification process. Patterns in Gross Domestic Product, trade, earnings, industrial structure, and availability of capital should be examined to the extent that data is available. Alternative analytical methods need to be considered, and a more detailed examination of the effectiveness of previous diversification policies and programs in Western Canada and other jurisdictions should be conducted before a conclusive verdict on diversification is rendered.

Preface

...although natural resources will continue to be a major driving force behind western growth the West may no longer need to rely so exclusively on these resources to sustain solid economic growth. It will probably become decreasingly reliant on them over the next generation. Diversification, as normally understood, is unlikely, however, since the West will probably never become a major area for manufacturing of finished goods.

– Economic Council of Canada, 1984¹

The West must continue to diversify its economy and pursue value-added enterprises in traditional areas such as agriculture and resource extraction. Businesses, entrepreneurs, investors, and policy makers must learn from past attempts—both successful and unsuccessful—at economic diversification.

– The Canada West Foundation, 2001²

Regional economic development agencies support economic diversification and help create opportunities in communities across Canada. Budget 2009 provides new resources to create new regional agencies in Ontario and for the North, and to strengthen the activities of existing agencies in other regions.

– Federal Budget, January 27, 2009³

¹ Economic Council of Canada. (1984). *Western Transitions* (p.1).

² The Canada West Foundation. (2001). *Building the New West, A Framework for Economic Prosperity*.

³ Government of Canada. (2009). *Federal Budget, January 27, 2009*, p. 182.

Introduction

A range of serious, potentially catastrophic economic problems have occurred in the last few months. Many observers judge these to be the most acute problems in the post World War II period, even rivaling those of the 1930s' Great Depression. One element of these events is the extreme volatility in commodity prices. There is little argument that the Western Canadian economy is heavily affected both directly and indirectly by these ups and downs that in the past have been harbingers of 'boom-bust' conditions.

Will this be the case again? Some would argue that the West is more diversified than it was in the past. In British Columbia, for example, the government recently indicated that during the current round of economic turbulence, the province would do better than virtually any other jurisdiction in North America and sees diversification around both markets and industry.⁴ Is that evaluation applicable to other provinces in the West and to the region as a whole?

Diversification is a dynamic, evolving process in which an economy moves toward an optimal combination of growth and structural change supportive of stability. Where the fruits of growth are widely shared, rising household real incomes 'lifts all boats'. If those improved living standards occur without a high risk, 'boom-bust' environment—a highly volatile economy—economic uncertainties are modified with positive consequences for decision making.

A boom-bust economy affects all levels of the economy. For a regional economy, high volatility is not a trivial issue and it imposes costs. In the public sector, for example, high volatility causes two obvious disadvantages: instability in the flow of tax revenues coupled with unanticipated expenditure demands. The result is enhanced risk of error when making budget estimates, and budgeting errors often have political consequences. In the private sector, high volatility adds to the fragility and complexity of managing human resources, planning capital expenditures, and forecasting other input requirements. For the household, a 'boom-bust' environment can contribute to social breakdown.

General recognition of the costs of volatility and the desire to moderate them speaks to the sustained search for policies and actions that promote growth within a stable framework. The 'boom-bust'

⁴ British Columbia's Minister of Finance, Colin Hansen's speech to the Vancouver Board of Trade, October 3, 2008; see www.boardoftrade.com/vbot_speech.asp?pageID=174&speechID=1260&offset=10&speechfind=

syndrome frequently prompts policy-makers to apply incentives to change the industrial composition of regional economies. These often include a range of tax and expenditure programs to induce business development but also reduce economic volatility. But what is the nature of the trade-off between growth rates and reduced volatility? Put otherwise, we need to improve our understanding of the risks and rewards of administering solutions to regional economies suffering from boom-bust characteristics.

The Wild(er) West's Recent Economic History

The Western Canada of the past, the historic 'old west', best fits the model of a 'boom-bust' economy. Mansell and Percy (1990), using data ranging from 1950 to 1985, show that in terms of population, per capita income, GDP, and employment, economic variability in the western provinces generally far exceeds that in other parts of the country. It would appear that much has changed: the evolution of the Western Canadian economic environment over the past four decades is one of the significant national themes.

The evidence of transformation is in the realigned structure of the economy through the increased absolute and relative importance of the service sector, the regulatory changes in the transport infrastructure, and in the diffusion of the communications technology revolution that has reduced costs, expanded markets and overcome the socially alienating effects of distance and isolation. Not to mention the transformations wrought by the major public policy change in recent years—the FTA and its successor NAFTA—which altered many facets of the economy: the conditions of infrastructure use; the character of the infrastructure required; and even the private sector evaluation of economic opportunity and the assessment of market potential.

Reference must also be made to the region's most important asset—its human resources—whose character also changed substantially over this period. In 1976, 8.6% of the population 15 years of age and older had a university degree, while in 2007 this more than doubled to 18.5%, greatly increasing the flexibility and adaptability of the labour force. The human element is a crucial theme in transforming the West in this period and is the focus of analysis throughout our investigation.

Against this background of underlying change, this report examines what changes in risk-reward ratios, if any, may have accompanied the transformations. This is done by assembling evidence on Western Canadian economic diversification over the last four decades using three methodologies: location quotients; shift-share analysis; and an employment based portfolio approach. The results suggest that, for the region as a whole, growth has occurred within a more stable framework, an outcome indicative of increased diversification. However, the results

differ considerably for the individual provinces. The evidence of increased diversification is most strongly apparent in Alberta.

A Short History of Diversification in the West

Diversification rhetoric was part of the discourse on the Western economy during much of the twentieth century, intensifying during periods of economic stress—‘bust’—during the 1920s and 1930s, the late 1950s and early 1960s, and the 1980s, but less direct and more nuanced in tone during relatively good economic times.

Many in the West saw themselves as producers and shippers of commodities into national or foreign markets and, therefore, subject not only to large price fluctuations but also to the vagaries of international trade policy. The wheat boom and the simultaneous settlement of the prairies in the early part of the 20th century and the railway and other developments linked to the general ‘national policy’ had an enormous impact on the West, the lingering effects of which are still being debated amongst historians.⁵ But clearly, over the long haul, uncertainty about access to foreign markets went hand in hand with what was perceived as domestic tariff structures and interprovincial barriers that surely raised costs and inhibited opportunities for both producers and consumers.⁶

The commodity price collapse of the early 1980s and the ensuing high unemployment, property foreclosures, high bankruptcy rates and net out-migration from the West—the general economic misery—spurred a renewed interest in diversification and spawned serious studies and policy actions. A 1984 study, tellingly entitled *Western Transitions* by the Economic Council of Canada, states that

...although natural resources will continue to be a major driving force behind western growth the West may no longer need to rely so exclusively on these resources to sustain solid economic growth. It will probably become decreasingly reliant on them over the next generation. Diversification, as normally understood, is unlikely, however, since the West will probably never become a major area for the manufacturing of finished goods.⁷

⁵ For a recent overview of the historical interpretations of Canada’s economic development, see Keith Brownsey and Michael Howlett, *Canada’s Resource Economy in Transition: The Past, Present, and Future of Canadian Staples Industries* (Emond Montgomery Publication, Toronto, 2008); or see the classic text by Kenneth Norrie, Douglas O’ram, and J.C. Hebert Emery, *A History of the Canadian Economy* (3rd edition, Toronto, 2002).

⁶ A general explanation of diversification to which the reader may refer is found in a number of sources. (Conroy 1974; Siegel et al 1995; Kort 1981; Wagner 2000).

⁷ Economic Council of Canada. (1984). *Western Transitions* (p.1).

This study explicitly understands 'diversification' to mean the development and importance of manufacturing activity. But the natural resource economy could give rise to a different kind of diversification. The Economic Council emphasized the possibilities for change in the West based on the evolution of resource industries through upstream and downstream goods.

A much more thorough study of the many issues surrounding diversification is found in Mansell and Percy (1990), *Strength in Adversity: A Study of the Alberta Economy*. This analysis, undertaken in the wake of the disastrous economic experience of the 1980s, provides an analysis of the policies to deal with the 'adversity', and estimates the comparable measures of instability for the western provinces and other jurisdictions. The study also offers a serious evaluation of what is meant by diversification in the context of the West and how it might evolve:

....there is no clear definition of "diversification". It could mean expansion in the range of products produced by existing industries in the province: vertical integration and additional upgrading of primary products; diversification of the markets for the existing range of commodities produced in Alberta; or the introduction of new industries that exhibit either less variance than do the province's basic industries, or negative covariance with them, or both⁸.

This is the first Western Canadian study to spell out alternative diversification profiles distinguishing vertical from horizontal diversification and emphasizing the relevance to diversification of negative covariance among the components of the economy.⁹ In developing measures of volatility across provinces, Mansell and Percy found that Alberta, in particular, together with Saskatchewan and British Columbia, record the highest indexes.

Subsequently, Chambers and Percy in their study *Western Canada in the International Economy* (1992) outlined the open nature of the Western economy stressing the importance of development through a strategic emphasis on those products for which the West possesses a competitive advantage. These would be the building blocks for adding value and/or seeking out new markets, and, by inference, the instruments of diversification. Employment in such relevant sectors would be a priority and an important focal point for policy makers: the job market has an impact on every household—a direct impact on the individual.

⁸ Mansell, R.L. and Percy, M. (1990) *Strength in Adversity: A Study of the Alberta Economy*. (p.2)

⁹ For an explanation of this concept see 1.1 Location Quotient Results for the Canadian West, p. 8 of this report.

The Federal Response to Transition in Western Canada's Economic Development

At the federal level, the 1980s saw some dramatic initiatives whose consequences for the West were clearly positive. These initiatives were long advocated and strongly urged by one or more of the western provinces. The first of these was the 1988 Free Trade Agreement (FTA) with the United States, the predecessor of NAFTA. The FTA wiped out trade barriers—real or potential—that restricted access to the American market. The abolition of the Crow Rail Rate was a second major development. This swept away obstacles to structural changes in prairie agriculture and to needed capital improvement in transportation infrastructure. A third federal initiative was creation in 1987 of the Department of Western Diversification (WED). It is especially noteworthy that the word 'diversification' rather than 'development' was selected for the department's official name. Background to the creation of the department, detailed in *A Framework for Diversification in Western Canada* (1987), identified a federal obligation "in response to the consensus of Western Canadians,... to moderate the swings inherent in resource markets by stimulating the development of complementary economic activities".¹⁰ The implication was clear: diversification means a broadening of the West's economic base.

How the Provinces Fared

Historically, pursuit of diversification as a priority of provincial governments displayed considerable variation across the four provinces, particularly during the economic difficulties of the early 1970s and early and mid 1980s. The Western Economic Opportunities Conference held in Calgary in 1973 was unprecedented and marked a turning point in cross government relations as applied to economic diversification. It brought the four western provinces together with the Prime Minister to outline the provinces' views as to what federal policies were needed to encourage Western Canadian economic development and diversification. Although this was the first in a series of such meetings, it was also a continuation of federal support for developmental policies that existed since 1867.¹¹

After the Western Economic Opportunities Conference, the Premiers kept meeting periodically. In 1987, for example, a meeting of the four western premiers in Humboldt Saskatchewan strongly endorsed diversification and the action of the federal government in establishing WED.

¹⁰ Department of Western Diversification. (1987) *A Framework for Diversification in Western Canada*. (p. 3)

¹¹ For a brief overview of this conference, see Henry C. Klassen. (1999) *A Business History of Alberta* (University of Calgary Press), p. 273.

When revisiting the early Provincial efforts, it seems that a rural community in Saskatchewan really was the perfect place for the premiers to consider diversification. After all, Saskatchewan had been pursuing various policy measures aimed at encouraging economic development for years. For the most part, however, such programs were still very much agricultural. Basic food processing, especially fermentation and milling, were almost the extent of the province's diversification. This began to change in the 1970s.

One highlight of diversification activity circa 1977, for example, was the Saskatchewan Department of Industry and Commerce helping 60 small firms and how "this helped to increase the diversification of the economy and create a number of new jobs."¹² But much more was required. The 1983 Western Premier's Conference held in Swift Current during that tough economic period reinforced the Saskatchewan government's view that they could work with the other provinces "to restore confidence, to develop more efficient transportation systems and to diversify [the] economy."¹³ And the expansion of the forestry sector and of the mining industry (potash) in that province certainly contributed to a more broadly based economy.

The actions of Alberta stand out among the provinces. As early as the mid-1970s, then Premier Lougheed of Alberta told the Alberta Legislature that secular stability was an important economic objective and could be secured by less dependence on the sale of unprocessed resources.¹⁴ By 1985 the government had issued a White Paper, *Proposals for an Industrial and Science Strategy for Alberta 1985 to 1990*, which emphasized the upgrading and further processing of Alberta raw materials—effectively product and market diversification. And just prior to the crucial 1987 western Premier's Conference mentioned above, the province released *Alberta's Economic Diversification Policies and Programs*, summarizing the actions and budgetary commitments of government departments for these purposes. The paper states that:

*Diversification of Alberta's economic base has been, and remains, a major objective of the Government of Alberta. Diversification is viewed as a means for building additional stability into the province's economy, while at the same time contributing to the growth of employment. The aim of Alberta's diversification efforts is to encourage and strengthen activities that result in upgrading and further processing of the province's resources.*¹⁵

¹² Saskatchewan Department of Industry and Commerce. (1977). *Annual Report, 1976-7.7*, p. 5.

¹³ Saskatchewan Intergovernmental Affairs, *Annual Report 1982-83*, p. 10.

¹⁴ *Alberta Hansard*, October 23, 1974. (pp. 3133-3134)

¹⁵ Alberta Economic Development and Trade, 1987. *Alberta's Economic Diversification Policies and Programs*, p 1."

Alberta was also the most vocal provincial supporter of the major policy changes initiated by the federal government: the efforts to negotiate the FTA with the United States, and the abolition of the Crow Rate. With respect to support of the proposed FTA, for example, the chief government spokesperson, the Hon. James Horsman stated in 1986:

Quite simply, we produce well in excess of what we can ever consume given our comparatively small population. . . . Obviously we rely heavily on exports to foreign markets to sustain our standard of living, to generate employment and to stimulate our private sector. Exports are our lifeblood. We see a free trade agreement as vital to the maintenance of a healthy economy.¹⁶

Alberta's position was unique and forthright. None of the other three provincial governments exhibited such sustained concern and explicit actions. As we look back at this period, and as the rest of this paper will make clear, Alberta's actions helped lend shape to what is now the most dynamic and increasingly diversified provincial economy in the West.

Has Diversification Occurred Throughout the West?

Three different methods have been applied to evaluate the extent to which the western provinces have displayed evidence of diversification over the past four decades. Two of these, location quotients and shift-share calculations, are static in character. The first measures the composition of the designated measure of the economy at some point in time, while the second assesses the source of change between two points in time. The third, portfolio analysis, adapted from the finance literature, focuses on growth, the stability of that growth, and covariance between components of the growth portfolio. The estimates used in this study are calculated from time series data implying that portfolio analysis is dynamic rather than static.

In the application of all three methods, the industry "composition of employment" data are from the Statistics Canada *Labour Force Survey*. They cover sixteen sectors, five goods producing and eleven service producing. The goods producing sectors are agriculture/forestry, mining, utilities, construction and manufacturing; the service sectors are trade, transport, finance and real estate, information and culture, professional and technical, business management, education, health and social services, accommodation and food, other services and public administration. Results are reported for each of the four provinces and for the West as a whole. Those for the West are very much influenced by what took place in Alberta and British Columbia, where employment

¹⁶ Horsman, J. (November 1986). Speech to the Foreign Trade Association of Southern California.

growth was substantially more rapid and which together accounted for 70 percent of employment in 1976 and over 79 percent in 2007.

How do the Models Depict Diversification in the West?

Location Quotients

Location quotients measure the relation of the region's employment composition to that of the national which is used as the reference point. It is a technique that allows a regional economy or in the case here, a provincial economy, to be described in structural terms by way of its industry mix and its export activity. It can then be seen how the revenues generated by that export activity are multiplied in the region's economy. The location quotient for industry i is:

$$(1) \quad LQ_i = \frac{\frac{S_{ip}}{e_p}}{\frac{S_{in}}{e_n}}$$

where S_{ip} and S_{in} are the respective shares of i provincially and nationally, and e_p and e_n are employment totals provincially and nationally. The LQ for a given sector exceeds 1.0 the concentration of employment in the sector is greater than the national; if it approximates 1.0 it is about the same as the national; if it is less than 1.0 it is less than the national. Interpretation of LQs require caution. If they exceed 1.0 the implication is that—assuming similar production conditions—these are export sectors. More problematic is the fact that LQs are sensitive to the degree of aggregation in the data. For example, LQs for a 4-digit 'NAICS' or industry classification may lack consistency with the results of analysis at a more general level—the 2-digit level—used in this Report, since high degrees of aggregation obscure the impact of intra-sector diversification.

Location Quotient Results for the Canadian West

Results or 'snapshots' for the four provinces and the West for a number of years from 1976 to 2007 are in Table 1 (See Appendix) and are suggestive of economic transition. For the region several things stand out. First is the decline in the employment concentration of agriculture; second is the rise in the importance of mining sector (including oil and gas and potash); third is the change in concentration in several service sectors including professional and technical, education, and health and social services compared with the national.

Looking at the trends for each provincial situation we see that in Alberta the degree of concentration in agriculture declined sharply while it rose in mining. Together with British Columbia, there is a rise in employment concentration in construction and in professional, educational and health and social services. Manitoba is noteworthy for the stable concentration in agriculture and for rising concentrations in

educational, health and social services. Saskatchewan evidenced a decline in agriculture and a rise in mining and educational and health services. Employment concentrations in public administration are higher in British Columbia and Manitoba than the national average. For details see “Location Quotients for the West and the Provinces, 1976-2007” in Table 1 in the Appendix.

Table 2 completes the story by applying a Herfindahl value to summarize evolving industry concentration for the respective jurisdictions. A Herfindahl value is simply a measure of the size of **firms** in relationship to the **industry** and an indicator of the amount of competition among them. The Herfindahl may be stated as:

$$(2) \quad H = \sum_{i=1}^n S_i^2$$

where, in this case, s_i is the sector share of employment in i and n is the number of sectors. Generally, a larger Herfindahl value indicates a higher degree of concentration and a lower value a more equitably distributed sector composition.

The results suggest that the decline from the levels of 1976 was, not surprisingly, most evident in the 1980s when Western Canada was not only suffering from the national business cycle but also falling commodity prices.¹⁷ These declines show up most strongly in Saskatchewan, and then in Alberta and British Columbia. In the years since—Saskatchewan being the exception—the levels of employment concentration show little movement.

Shift-Share

This methodology goes back to the work of Edgar Hoover conveyed most precisely in his 1975 work.¹⁸ Shift-share analysis segments national from regional influences on the growth between two points in time and is, therefore, a static approach. It first determines how much the regional/provincial economy, and in our case using employment, would have grown if it grew at the rate of the national economy. The difference, which may be either positive or negative, is then attributed to regional/provincial conditions. According to Galambos and Schreiber (1978), it answers these two questions: how fast or slow is the growth compared to the national mix [and] is the local area getting an increasing or decreasing share of each industry.¹⁹ (p.26)

¹⁷ Chambers, E. J. and Percy, M.B. (1992). *Western Canada in the International Economy* University of Alberta Press: Edmonton. p. 37.

¹⁸ Hoover, E. M. (1975). *An Introduction to Regional Economics*, 2nd ed., N.Y.: Knopf.

¹⁹ Galambos, E. and Schreiber, A.F. (1978). *Making Sense Out of Dollars: Economic Analysis for Local Government*. Washington, National League of Cities. p. 26.

So these results may be separated into (1) those where the sectoral employment of the regional/provincial economy grew at rates different from national counterparts—a *differential* effect; and (2) where employment growth originates within the regional/provincial economy—a *proprietary* or *composition* effect. A positive proprietary/composition employment effect is a sign of internally generated growth and diversification. In Table 3 the shift-share differential and proprietary/own effects are shown provincially and for the West for a number of periods over the four decades.

Shift-Share Results for the Canadian West

What stands out when the provinces are considered is that Alberta and British Columbia have seen employment grow more rapidly than the national average, while Manitoba and Saskatchewan, with one exception, grew less rapidly and hence have negative entries. The results for the West are dominated by the experience of the two larger provinces, and they also suggest that growth may or may not be linked to diversification.

For the West large amounts of employment growth cannot be accounted for by simply looking at the national experience. Note the large positive differentials for Alberta and British Columbia and the dominance of negative values in the case of Manitoba and Saskatchewan. In the case of the former this means that sector employment expanded more rapidly than it did nationally, and in the latter case, less rapidly.

A second feature is the behaviour of proprietary employment in the West reflected in the change from negative values in the first period to positive in the later periods. This was also true of Alberta, while in British Columbia proprietary sources of growth were positive in all periods. For Manitoba and Saskatchewan these values fluctuate rather narrowly about a zero effect. Certainly, then, for the West, and for Alberta, the data generated by Shift-Share analysis suggest that experience in the latter period differed from that in 1976-1986 with regard to proprietary sources of growth and diversification.

The sectoral composition of own sources of growth in the three periods is reported in Table 4 (see Appendix) for the West and the two provinces that dominate the results—Alberta and British Columbia.

In the West as a whole proprietary based declines in the goods producing sector exceeded gains in the services sector during 1976-1986 resulting in a negative total. In 1987-1995 the service sector generated this growth in the economy. In 1995-2007 proprietary growth in the goods sector was no longer uniformly negative and the service sector continued its strong performance. The Alberta experience is consistent with developments in the region. British Columbia proprietary growth in the two earlier periods well reflects the shift to the service sector and its

growth push. In 1995-2007 there was slight positive growth in the goods sector and continuing positive growth in service employment.²⁰ Results for Manitoba and Saskatchewan generally show that own or proprietary increments in the goods sector were in some degree offset by own or proprietary increments in the service sector.

The Portfolio Choice Model

Put simply, the portfolio choice model applied to regional economies yields a measure of volatility in the economy. In the parlance of financial analysis, a portfolio model approach benefits the investor by spreading risk among various asset holdings where each asset's risk is measured by the variance in its return. Because the portfolio variance concept is the most widely accepted measure of the effects of diversity on volatility, effective asset diversification is assessed in the model by the volatility of the portfolio.

In applying the model provincially, the 'portfolio' becomes the industry composition of employment which plays the role of assets, human assets or human capital, and the region's employment mix is the portfolio. The 'return' (an accretion in the application of human capital) is the growth rate in employment; the 'risk' is the variance in the return.

The portfolio variance approach has certain technical advantages, and not simply from its welfare significance, but also because intra-annual data is available. Applying this model to provincial employment, however, runs up against the real world problem posed by Saskatchewan which had a declining population over portions of the period we are considering. Yet provincial GDP's were still growing (just as asset values do), so that instead of using the nonsensical (negative) mean employment growth rate we have an alternative in the mean GDP growth rate.

The portfolio model uses the variances, co-variances and weights of the portfolio component to arrive at the volatility of the portfolio. Risk is measured by portfolio variance: one component is the weighted sum of the variances of employment in each sector. When employment in a given industrial sector fluctuates a good deal, it displays high variance. Other things equal, the higher is employment variance in the respective employment sectors, the higher the overall volatility of the economy. The second component of total variance is the weighted covariance—the degree of interdependence between employment in the respective sectors. Should employment in the sectors move in the same direction—the case of positive covariance—the net result is to increase total variance and magnify volatility in the economy. Should employment changes move in opposite directions—the case of negative covariance—the net effect is to reduce total variance and moderate volatility. In sum, lower levels of variance and greater evidence of negative covariance indicate reduced

²⁰ For Manitoba and Saskatchewan results are not reported in TABLE 4 but may be obtained from the WCER (WCER@ualberta.ca) on request.

volatility in the regional employment portfolio. (See the corresponding note on portfolio formulas and Tables in Appendix A.1.)

It is important to recognize the ways in which a regional portfolio model differs from its financial counterpart. Sherwood-Call (1990) and others (Trendle, 1999; Brown and Pheasant, 1985; Board and Sutcliffe, 1991) outline these differences. Of prime importance is that regional differences in natural endowments yield different comparative advantages, and that is a powerful influence on the composition of an employment portfolio. For example, in the three provinces considered here the differing natural endowments of energy, forestry and agriculture, pose limits on the degree to which regions can—perhaps even should—shift measurably their industrial portfolios. Provinces have traditionally run with what they have at their core. The question becomes one of the extent to which those comparative advantages can be leveraged and diffused—through entrepreneurial initiative, skill transfer and the like—into productive activity in other industrial sectors.

A second important difference concerns flexibility. An investor who becomes more or less risk-averse can change the asset mix of her portfolio to reduce or increase risk at the execution of a buy or sell order. The change in portfolio mix is immediate. Whereas those in a region who seek an employment portfolio that generates reduced volatility have no market equivalent to investor's trades in financial assets. The market for attracting industries (through whatever means) is very imperfect and sought after adjustments evolve slowly and are much more complicated than the instantaneous adjustments possible in financial markets.

Further, returns to financial assets are independent of portfolio ownership. A share of IBM generates the same net income whether the owner resides in Brazil or Austria. However, growth performance of employment (the 'return') in a given sector is not independent of regional location. For example, between 1996 and 2003 employment in the 'trade' category grew at a rate of 1.3% in Saskatchewan compared with 2.9% in Alberta. Hence, there is a spatial or 'place' specific component to employment performance found in the return to any component of the portfolio.

Here we will search for evidence of decreased volatility, as determined by lower employment volatility relative to provincial GDP growth. If we find this to be the case, we look for the cause of the greater stability, namely negative co-variances among sector employment levels. Focus on the number and sector-weights of such negative covariance observations provides a fuller explanation of the causes of the reduced volatility. Put simply, if important sectors take up employees who are laid off in another major sector, then the industry composition of the province in question has moved toward greater stability.

In Table 5 (see Appendix) we list, for the three decades examined here, the results for the volatility of the provinces and the West as a whole relative to the respective average GDP growth rate. The most important

result is in the last column which permits an answer to the following question: what degree of employment stability is associated with the growth in GDP? For the West as a whole we see that there is a decline from 3.45 to 1.11 to 0.99, indicating increased stability for the more recent decades.

Estimates of sources of absolute employment risk—variance and covariance— are in the first three columns and risk relative to growth at the extreme right. Absolute risk, with the exception of Saskatchewan in the second, and Manitoba in the third era, were uniformly higher in the first period. For Alberta, British Columbia and the West this measure was lowest in the second era and increased in the third. However, if risk is related to growth—relative risk—the picture is rather different with the measure the lowest for all jurisdictions in the 1996-2007 period. Though absolute risk increased, returns to the portfolio—in this case measured by the higher trend growth in GDP—more than compensated. This, in some degree, is attributable to the rise in net negative co-variance. Particularly noteworthy are the risk reward ratios for the West and for Alberta. In the West as a whole the growth rate increased by almost one-third and the ratio declined by 11 percent, while in Alberta the growth rate increased by one-quarter and the ratio remained virtually unchanged. Manitoba shows a spike in the ratio during the 1987-1995 period due primarily to a substantial fall in negative covariance but a substantial improvement in the most recent period as falling variance combined with stronger negative co-variance. In Saskatchewan, in the most recent period, a lower growth was combined with reduced risk.

In the next table we focus on the number and weights of the observed sector-covariance levels for each of the three sub-periods. Adding the products of the sector weights for the observed negative covariance terms, we see that their sum is increasing for the more recent periods, providing an explanation of the source of the increase in overall stability. Table 6 (see Appendix) reports covariance presence by sector.

To reiterate, if two sectors move in lockstep, their covariance is positive. If the relationship between any two sectors is an inverse one, the covariance is negative. A negative covariance, multiplied by the respective sector weights, subtracts from the portfolio variance (volatility). This is even more so when the weights are heavier for sectors with negative covariance.

In the West, sector covariance increased sharply between the first and the later periods, effectively almost tripling in weighted sector presence in 1996-2007. In Alberta, negative weighted covariance doubled between the first and the third eras, changes sufficient to move total covariance from markedly positive in the first period to negative in the second and third periods. In British Columbia, it rose from a sector weight of 0.29 in 1976-1986 to 0.53 in 1996-2007 moving the total covariance from positive in the first era, to virtually neutral in the second, to negative in the third. The experience of these jurisdictions contrasts with that of Manitoba and

Saskatchewan where negative covariance is more prevalent across sectors in all three eras and encompassing all sectors in Manitoba in 1976-2007. In Saskatchewan, net total covariance was actually larger in the first than in the later periods.

Context cannot be ignored. There were notable changes in the provincial economies during the three periods chosen for analysis. In particular, the latter two eras saw both revamped transportation infrastructure and the progressive implementation of free trade under first, the FTA and then the NAFTA. As emphasized earlier in the Report, these were of great significance for Western Canada. Further Alberta and British Columbia avoided a repeat of the severe business cycle downturn experienced in the early 1980s. And as previously referenced, Manitoba already possessed a diversified economy whose employment variability was not measurably different from that for the country as a whole. For Manitoba the primary issue was growth—not diversification of industry—and growth potential through the diversification of geographic markets. Saskatchewan, however, had major problems associated with population loss and the restructuring of agriculture.

In the West, sector covariance increased sharply between the first and the later periods, effectively almost tripling in weighted sector presence in 1996-2007. In Alberta, negative weighted covariance doubled between the first and the third eras, changes sufficient to move total covariance from markedly positive in the first period to negative in the second and third periods. In British Columbia, it rose from a sector weight of 0.29 in 1976-1986 to 0.53 in 1996-2007, moving total covariance from positive in the first period, to virtually neutral in the second, to negative in the third. The experience of these jurisdictions contrasts with that of Manitoba and Saskatchewan where negative covariance is more prevalent across sectors than in other jurisdictions in all three eras, encompassing all sectors in Manitoba in 1996-2007. In Saskatchewan, net total covariance was actually larger in the first than in the later periods.

Conclusion

The late seventies and early eighties were a wild ride for the West. The evidence suggests minimal levels of diversification in these years—no matter how hard governments tried—even in Alberta and British Columbia where growth was rapid. The results for Manitoba and Saskatchewan indicate the absence of an intra-provincial growth dynamic and high risk/reward ratios—not strong evidence of diversification.

From the mid-eighties on, however, there were important shifts, outlined earlier in this report, in the policy and operational parameters of the western economy, and in the character of its human resources. Did

these induce a higher order of diversification in the West? The evidence is that they did.

Interest, understandably, is greater in what happened in each province. The results—most strongly expressed by shift-share and portfolio choice—indicate that Alberta is the leader with proprietary based job gains and stable and low risk/reward ratios. Alberta is also the province, more so than any other, that established diversification as a clear policy priority. The data from British Columbia also strongly suggest that diversification is occurring. In Manitoba and Saskatchewan proprietary sources of growth are problematic though there are lower risk/reward ratios.

During the last decade the economic experience of the West has been generally seen by many observers as a 'commodity boom' comparable to earlier boom periods, most notably the late 1970s through 1981. It is not difficult to draw this conclusion given the big swings in farm prices, in crude oil and natural gas, in potash and in mineral exploration. But the reality is that the West has changed dramatically in ways that include a much higher concentration of human capital, a more sophisticated and expanded service sector, and expanded urban centres with their own internal growth dynamics. These changes do not provide immunity to recessions, nor to periods in which a regional economy grows more rapidly than that of the nation. What can be said is, if the evolution of recent decades continues, then the region and its provincial components can no longer be characterized, nationally and world wide, as classic examples of 'boom-bust' economies. Surely that is good news.

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Appendix: Results and Notes on Methodology

Table 1(a): Location Quotients by Province and Sector

WEST	AG	MI	UT	CN	MA	TR	TP	FI	IFC	PTK	BMG	EDU	HEA	AFD	OTH	PA
1976	2.01	1.43	1.07	1.14	0.59	1.01	1.16	1.00	1.01	0.91	1.00	0.97	1.11	1.06	0.97	0.96
1981	1.73	1.70	0.93	1.37	0.59	1.03	1.17	0.95	1.11	0.98	0.92	0.95	1.19	0.92	0.97	0.96
1987	1.70	1.95	0.84	0.97	0.56	1.00	1.11	0.93	1.02	0.98	0.56	2.90	1.49	0.66	0.88	1.23
1990	1.70	1.86	0.76	1.03	0.58	1.01	1.10	0.91	1.00	1.14	0.52	2.65	1.49	0.65	0.79	1.32
1995	1.62	1.92	0.76	1.16	0.63	1.00	1.08	0.92	1.02	1.14	0.57	2.21	1.42	0.65	0.79	1.16
2000	1.58	2.15	0.85	1.16	0.63	1.00	1.16	0.96	0.98	1.40	0.52	1.88	1.58	0.71	0.76	1.01
2005	1.45	2.43	0.85	1.21	0.63	0.97	1.16	0.94	1.00	1.49	0.57	1.73	1.53	0.66	0.72	1.05
2007	1.42	2.39	0.87	1.27	0.69	0.97	1.11	0.91	0.96	1.45	0.56	1.68	1.52	0.61	0.68	1.05
AB	AG	MI	UT	CN	MA	TR	TP	FI	IFC	PTK	BMG	EDU	HEA	AFD	OTH	PA
1976	2.72	1.70	0.75	1.32	0.44	1.00	1.00	0.98	1.11	0.96	1.03	0.91	1.08	0.82	0.97	0.95
1981	1.71	2.35	0.85	1.71	0.50	1.00	1.08	0.92	1.30	1.15	0.82	0.85	1.55	0.62	0.94	0.89
1987	1.58	3.81	1.00	0.97	0.46	0.99	1.06	0.85	0.99	1.11	0.59	3.13	1.40	0.59	0.87	1.31
1990	1.73	3.72	0.85	1.03	0.47	0.99	1.04	0.87	0.95	1.14	0.59	2.92	1.39	0.58	0.77	1.38
1995	1.70	4.13	0.91	1.23	0.53	0.98	1.03	0.85	1.03	1.16	0.61	2.15	1.31	0.62	0.81	1.05
2000	1.43	4.46	0.89	1.45	0.57	1.01	1.16	0.85	0.89	1.53	0.53	1.75	1.44	0.68	0.74	0.85
2005	1.23	5.25	0.87	1.41	0.54	0.97	1.21	0.87	0.87	1.61	0.54	1.66	1.41	0.57	0.74	0.88
2007	1.09	4.94	1.22	1.46	0.60	0.93	1.10	0.80	0.84	1.60	0.56	1.59	1.37	0.54	0.76	0.95
BC	AG	MI	UT	CN	MA	TR	TP	FI	IFC	PTK	BMG	EDU	HEA	AFD	OTH	PA
1976	0.35	1.78	1.07	1.15	0.78	1.04	1.28	1.15	1.14	0.96	1.00	0.92	1.22	1.35	0.89	0.92
1981	0.43	1.82	1.00	1.43	0.78	1.11	1.37	1.14	1.35	1.00	0.98	1.01	1.14	1.26	1.05	1.04
1987	0.66	1.65	0.71	1.00	0.71	1.04	1.31	1.13	1.14	1.06	1.03	1.01	1.30	1.24	1.07	0.94
1990	0.97	0.91	0.62	1.02	0.73	1.08	1.24	1.09	1.20	1.21	0.66	2.83	1.48	0.80	0.97	1.18
1995	0.99	0.85	0.73	1.35	0.79	1.17	1.31	1.10	1.23	1.56	0.59	2.59	1.62	0.82	0.90	1.36
2000	1.10	0.70	0.64	1.59	0.91	1.30	1.35	1.27	1.37	1.69	0.76	2.83	1.77	0.89	1.00	1.45
2005	1.28	0.68	0.80	1.26	0.83	1.21	1.39	1.27	1.37	1.89	0.70	2.34	1.90	0.94	0.97	1.23
2007	1.23	0.61	0.73	1.51	0.83	1.19	1.37	1.24	1.40	2.05	0.79	2.05	1.81	0.93	0.83	1.26

MB	AG	MI	UT	CN	MA	TR	TP	FI	IFC	PTK	BMG	EDU	HEA	AFD	OTH	PA
1976	1.75	0.55	1.99	0.90	0.67	1.06	1.46	0.95	0.65	1.03	0.97	1.14	0.96	0.97	1.08	1.00
1981	2.36	0.62	1.05	0.82	0.71	1.02	1.40	0.88	0.76	0.88	1.06	1.16	1.01	0.92	0.97	1.06
1987	1.76	0.88	1.13	0.99	0.66	0.98	1.27	0.97	0.91	0.57	0.47	2.79	1.79	0.58	0.84	1.30
1990	1.86	0.78	0.87	0.73	0.68	0.97	1.29	0.90	0.94	0.86	0.47	2.87	1.72	0.64	0.82	1.41
1995	1.85	0.92	1.05	0.82	0.75	0.99	1.31	0.87	0.91	0.79	0.53	2.32	1.66	0.60	0.68	1.36
2000	1.83	0.68	1.41	0.96	0.83	0.95	1.20	0.95	0.81	0.97	0.45	1.91	1.88	0.63	0.65	1.30
2005	1.94	0.55	1.51	0.76	0.86	0.91	1.18	0.93	0.92	0.94	0.52	1.92	1.89	0.60	0.75	1.40
2007	1.96	0.56	1.10	0.84	0.97	0.94	1.18	0.93	0.87	0.92	0.42	1.87	1.90	0.58	0.65	1.46
SK	AG	MI	UT	CN	MA	TR	TP	FI	IFC	PTK	BMG	EDU	HEA	AFD	OTH	PA
1976	5.30	0.83	0.74	0.96	0.30	0.86	0.86	0.68	0.82	0.53	0.95	1.01	1.06	0.93	1.04	1.03
1981	5.17	1.08	1.01	1.11	0.29	1.05	0.86	0.76	0.54	0.73	1.03	1.05	0.78	0.91	0.98	1.05
1987	4.76	1.22	0.88	1.00	0.31	0.99	0.87	0.76	0.62	0.78	1.16	1.02	0.87	0.97	0.95	1.05
1990	4.24	1.55	0.82	0.95	0.28	0.97	0.85	0.75	0.78	0.57	0.40	3.00	1.59	0.60	0.85	1.22
1995	4.25	1.64	0.74		90=	0.97	0.83	0.77	0.89	0.58	0.39	2.77	1.67	0.57	0.77	1.39
2000	3.96	1.78	0.99	0.87	0.39	0.96	0.99	0.85	0.87	0.70	0.39	2.12	1.52	0.57	0.83	1.30
2005	3.97	2.56	0.81	0.89	0.39	1.03	1.09	0.97	0.83	0.77	0.35	2.04	1.69	0.64	0.75	1.18
2007	3.58	2.81	1.12	0.86	0.46	1.01	1.04	0.87	0.92	0.82	0.43	1.97	1.75	0.57	0.75	1.31

TABLE 1(b) Abbreviations of Sectors

AG	Agriculture	IFC	Information, Cultural, Recreation Services
MI	Mining	PTK	Professional Technical Services
UT	Utilities	BMG	Business Management Services
CN	Construction	EDU	Education
MA	Manufacturing	HEA	Health Services
TR	Trade	AFD	Accommodation and Food Services
TP	Transportation	OTH	Other
FI	Finance	PA	Public Administration

TABLE 2: Herfindahl Values for Selected Years 1976-2007

Year	West	AB	BC	MB	SK
1976	0.0848	0.0869	0.0911	0.0903	0.1164
1981	0.081	0.0804	0.0863	0.0879	0.1023
1987	0.082	0.079	0.086	0.087	0.0977
1990	0.0819	0.079	0.0866	0.0858	0.1019
1995	0.0807	0.0774	0.0851	0.0859	0.0982
2000	0.0808	0.0795	0.0836	0.0865	0.0914
2005	0.0801	0.0796	0.0839	0.0852	0.0875
2007	0.0804	0.0788	0.0848	0.0872	0.0837

Table 3: Provincial and Regional Differential and Proprietary/Composition Effects, Selected Periods 1976-2007

	Shift	Differential	Prop/Comp
West			
1976-1986	108.5	115.5	-7
1987-1995	313.5	261.6	51.9
1995-2007	603.9	539.4	64.5
AB			
1976-1986	131.5	141.3	-9.9
1987-1995	85	41.2	43.7
1995-2007	396	353.3	42.7
BC			
1976-1986	22.4	5.7	16.7
1987-1995	298.5	273	25.5
1995-2007	224.8	195.9	28.9
MB			
1976-1986	-35.3	-33.3	-2
1987-1995	-29.5	-35.7	6.2
1995-2007	5.7	7.6	-1.9
SK			
1976-1986	-10	1.8	-11.9
1987-1995	-38.3	-43.2	4.9
1995-2007	-18.2	-17.3	-0.9

The shift column in Table 3 indicates the change in employment which remains after taking account of the rate of national employment growth. It is segmented in the two right hand columns into differential (where the rate of sectoral growth differs from national experience) and own (intra-regional or intra-provincial) components. A shift value will be positive if employment has grown more rapidly than the national, and negative if less.

Table 4

WEST	1976-1986	1987-1995	1995-2007	AB	1976-1986	1987-1995	1995-2007	BC	1976-1986	1987-1995	1995-2007
AG	-55.5	-35.7	-77.8	AG	-23.6	-0.4	-27.2	AG	-3.8	-7.6	-18.3
MI	-7.7	-14.6	46.9	MI	-2.9	-5.5	33.4	MI	-3.7	-2.5	5.9
UT	-5.3	-0.1	1.7	UT	-1.2	-1.7	0.7	UT	-2	0	0.5
CN	-54.7	-16.5	67.3	CN	-19.8	-2.2	23.7	CN	-21.5	-6.4	32
MA	-45.9	-49	-89.1	MA	-10.7	-3.5	-25.1	MA	-23.7	-24	-44.4
TR	-2.8	-18.4	16.1	TR	-0.9	4.8	5.2	TR	-1.1	-7.4	7.2
TP	-25.4	-7.8	-18	TP	-6.8	2	-5.7	TP	-10.9	-3.2	-7.8
FI	25.6	5.2	22.4	FI	7.9	2	6.9	FI	11.4	2.3	10.6
IFC	42.5	4.7	6.5	IFC	14.7	14.8	2.2	IFC	18.6	2.1	3
PTK	22.1	4.5	7.3	PTK	7.3	22	2.5	PTK	9	2.1	3.7
BMG	-25.2	23.9	9.1	BMG	-8.1	3.2	3.2	BMG	-9.9	10.4	4.1
EDU	33	91.5	45.6	EDU	9.7	10.5	14.7	EDU	12.2	33.3	20.1
HEA	15.3	38.8	28.8	HEA	4.7	6.2	8.8	HEA	6.5	14.4	12.4
AFD	59.4	27.7	21.1	AFD	14.3	-3.9	6.7	AFD	29.2	12.5	10
OTH	25.6	10.8	-1.1	OTH	8	0	-0.4	OTH	9.2	4.4	-0.5
PA	-8	-13	-22.4	PA	-2.5	-4.7	-6.7	PA	-3	-4.7	-9.6
TOTAL	-7	51.9	64.5	TOTAL	-9.9	43.7	42.7	TOTAL	16.7	25.5	28.9
MB	1976-1986	1987-1995	1995-2007	MB	SK	1976-1986	1987-1995				
AG	-14.5	-5.3	-11.2	AG	AG	-20.5	-11.6				
MI	9.6	-0.9	2.8	MI	MI	-0.6	-1.5				
UT	2.5	0.0	0.3	UT	UT	-0.5	0.0				
CN	53.5	-2.4	6.0	CN	CN	-6.4	-2.1				
MA	-20.7	-8.3	-13.4	MA	MA	-3.2	-3.2				
TR	8.3	-2.6	2.0	TR	TR	-0.3	-2.3				
TP	3.1	-1.3	-2.7	TP	TP	-2.6	-0.8				
FI	-0.8	0.8	2.7	FI	FI	2.4	0.5				
IFC	-15.6	0.6	0.7	IFC	IFC	4.8	0.5				
PTK	-5.3	0.4	0.6	PTK	PTK	1.8	0.3				
BMG	14.0	2.9	1.0	BMG	BMG	-3.4	2.2				
EDU	7.9	12.6	6.0	EDU	EDU	4.8	12.4				
HEA	5.9	6.7	4.2	HEA	HEA	2.0	5.4				
AFD	-19.2	3.5	2.4	AFD	AFD	7.2	5.4				
OTH	-9.7	1.5	-0.1	OTH	OTH	3.8	1.4				
PA	-6.6	-2.0	-3.3	PA	PA	-1.2	-1.7				
TOTAL	12.4	6.2	-1.9	TOTAL	TOTAL	-11.9	4.9				

A.1 Notes for Portfolio Choice Section and Table 5 and 6

To simplify, in the case where employment consists of two sectors:

$$(3) VP = w_1^2 V_1 + w_2^2 V_2 + 2w_1 w_2 COV_{1,2}$$

VP is portfolio variance, V_1 and V_2 are the variances, the respective weights in total employment are w_1 and w_2 , $w_1 > 0$ and $w_2 > 0$ and $w_1 + w_2 = 1$, and $COV_{1,2}$ is the covariance. Thus portfolio variance depends on the size of V_1 relative to V_2 , the size of w_1 relative to w_2 , and the nature of the covariance. More generally:

$$(4) VP = \sum_i \sum_j w_i w_j V_{ij}$$

Where V_{ij} denotes the variance ($i=j$) or the covariance ($i \neq j$) for each employment sector or pair of employment sectors, and w_i and w_j are the industry weights based on the regional composition of employment. If we use the portfolio model and take readings of provincial employment variability as a proxy for diversification in different time periods, we will generate for the various sectors the volatility of employment (sector variance) as well as the relationship of each sector's employment level with those of the other sectors considered (covariance).

(Variance and covariance values are based on quarterly log differences in the respective employment sectors converted to annualized percent rates of change. The table also reports annual growth rates in provincial and regional GDP)

TABLE 5: Variance, Covariance and Growth, Selected Period 1976-2007

1976-1986	Var+2Cov	2 Covariance	Variance	Linea Growth Trend GDP	Variance + 2Cov/Growth
AB	22.9	1.5	21.4	4.5	5.2
BC	20.7	4.9	15.8	2.0	10.3
MB	9.0	-8.0	17.0	2.1	4.3
SK	10.4	-7.5	17.9	2.0	5.1
WEST	10.6	4.7	6.0	3.1	3.5
1987-1995	Var+2Cov	2 Covariance	Variance	Linea Growth Trend GDP	Variance + 2Cov/Growth
AB	5.9	-0.7	6.6	3.4	1.7
BC	8.8	0.0	8.7	2.5	3.5
MB	9.5	-0.4	9.9	1.0	9.5
SK	14.6	-2.8	17.5	2.4	6.0
WEST	3.0	0.1	2.9	2.7	1.1
1996-2007	Var+2Cov	2 Covariance	Variance	Linea Growth Trend GDP	Variance + 2Cov/Growth
AB	7.3	-3.7	10.9	4.3	1.7
BC	9.5	-1.6	11.1	3.3	2.9
MB	6.7	-3.8	10.4	2.5	2.7
SK	7.4	-2.8	10.3	2.0	3.7
WEST	3.4	-0.7	4.2	3.5	1.0

TABLE 6(a): Covariance by Sector for the West

	1976-1986		1987-1995		1996-2007	
	Co-variance	weight	Co-variance	Weight	Co-variance	Weight
AG	<i>negative</i>	0.08	<i>negative</i>	0.06	<i>negative</i>	0.04
MI	positive	0.05	positive	0.04	<i>negative</i>	0.04
UT	positive	0.01	<i>negative</i>	0.01	positive	0.01
CN	positive	0.07	positive	0.06	positive	0.07
MA	positive	0.1	positive	0.09	positive	0.09
TR	positive	0.16	<i>negative</i>	0.16	<i>negative</i>	0.16
TP	positive	0.06	<i>negative</i>	0.06	<i>negative</i>	0.06
FI	positive	0.06	<i>negative</i>	0.06	positive	0.06
IFC	positive	0.03	<i>negative</i>	0.05	<i>negative</i>	0.06
PTK	positive	0.02	<i>negative</i>	0.02	<i>negative</i>	0.03
BMG	positive	0.06	<i>negative</i>	0.07	<i>negative</i>	0.07
EDU	<i>negative</i>	0.08	positive	0.1	<i>negative</i>	0.1
HEA	positive	0.05	positive	0.04	positive	0.05
AFD	<i>negative</i>	0.05	positive	0.07	<i>negative</i>	0.07
OTH	positive	0.05	<i>negative</i>	0.05	<i>negative</i>	0.05
PA	<i>negative</i>	0.06	<i>negative</i>	0.06	<i>negative</i>	0.05
Net negative weight		0.27		0.6		0.73

TABLE 6(b): Covariance by Sector for Alberta

	1976-1986		1987-1995		1996-2007	
	Co-variance	Weight	Co-variance	Weight	Co-variance	Weight
AGR	<i>negative</i>	0.08	<i>negative</i>	0.07	<i>negative</i>	0.04
MI	positive	0.07	positive	0.06	<i>negative</i>	0.06
UT	positive	0.01	<i>negative</i>	0.01	positive	0.01
CON	positive	0.09	positive	0.06	<i>negative</i>	0.08
MAN	positive	0.08	<i>negative</i>	0.08	positive	0.08
TRD	positive	0.16	positive	0.16	<i>negative</i>	0.15
TRP	<i>negative</i>	0.06	<i>negative</i>	0.05	positive	0.06
FIRE	positive	0.06	positive	0.06	<i>negative</i>	0.05
TPK	positive	0.04	<i>negative</i>	0.05	<i>negative</i>	0.07
BMG	positive	0.02	<i>negative</i>	0.03	<i>negative</i>	0.03
EDU	<i>negative</i>	0.06	<i>negative</i>	0.07	<i>negative</i>	0.07
HEA	<i>negative</i>	0.08	<i>negative</i>	0.09	positive	0.09
IFC	positive	0.05	<i>negative</i>	0.04	<i>negative</i>	0.04
AFD	<i>negative</i>	0.04	positive	0.06	<i>negative</i>	0.07
OSV	positive	0.05	<i>negative</i>	0.05	<i>negative</i>	0.05
PA	<i>negative</i>	0.06	<i>negative</i>	0.06	<i>negative</i>	0.04
Net Weight	<i>negative</i>	0.38	<i>negative</i>	0.6	<i>negative</i>	0.76

TABLE 6(c): Covariance by Sector for British Columbia

	1976-1986		1987-1995		1996-2007	
	Co-variance	Weight	Co-variance	Weight	Co-variance	Weight
AG	<i>negative</i>	0.02	positive	0.02	<i>negative</i>	0.02
MI	positive	0.05	positive	0.04	<i>negative</i>	0.02
UT	positive	0.01	<i>negative</i>	0.01	<i>negative</i>	0.01
CN	positive	0.07	positive	0.07	positive	0.07
MA	positive	0.13	<i>negative</i>	0.12	positive	0.1
TR	positive	0.16	positive	0.17	<i>negative</i>	0.16
TP	positive	0.07	<i>negative</i>	0.06	<i>negative</i>	0.06
FI	positive	0.07	<i>negative</i>	0.07	<i>negative</i>	0.06
IFC	positive	0.04	positive	0.05	positive	0.07
PTK	<i>negative</i>	0.02	positive	0.02	<i>negative</i>	0.04
BMG	positive	0.06	positive	0.06	<i>negative</i>	0.07
EDU	<i>negative</i>	0.09	positive	0.09	<i>negative</i>	0.1
HEA	<i>negative</i>	0.04	<i>negative</i>	0.04	positive	0.05
AFD	<i>negative</i>	0.06	<i>negative</i>	0.07	positive	0.08
OTH	positive	0.05	<i>negative</i>	0.05	positive	0.05
PA	<i>negative</i>	0.06	<i>negative</i>	0.06	positive	0.05
<i>Net Weight</i>	<i>negative</i>	0.29	<i>negative</i>	0.48	<i>negative</i>	0.53

TABLE 6(d): Covariance by Sector for Manitoba

	1976-1986		1987-1995		1996-2007	
	Co-variance	Weight	Co-variance	Weight	Co-variance	Weight
AG	<i>negative</i>	0.09	positive	0.08	<i>negative</i>	0.06
MI	positive	0.02	<i>negative</i>	0.02	<i>negative</i>	0.01
UT	<i>negative</i>	0.01	<i>negative</i>	0.01	<i>negative</i>	0.01
CN	<i>negative</i>	0.05	<i>negative</i>	0.05	<i>negative</i>	0.05
MA	<i>negative</i>	0.12	positive	0.11	<i>negative</i>	0.12
TR	<i>negative</i>	0.17	<i>negative</i>	0.16	<i>negative</i>	0.15
TP	positive	0.08	positive	0.07	<i>negative</i>	0.06
FI	<i>negative</i>	0.05	positive	0.06	<i>negative</i>	0.05
IFC	<i>negative</i>	0.03	positive	0.03	<i>negative</i>	0.04
PTK	positive	0.02	<i>negative</i>	0.02	<i>negative</i>	0.03
BMG	<i>negative</i>	0.06	positive	0.07	<i>negative</i>	0.07
EDU	<i>negative</i>	0.1	positive	0.12	<i>negative</i>	0.13
HEA	<i>negative</i>	0.04	<i>negative</i>	0.04	<i>negative</i>	0.04
AFD	<i>negative</i>	0.05	<i>negative</i>	0.06	<i>negative</i>	0.06
OTH	<i>negative</i>	0.05	positive	0.05	<i>negative</i>	0.04
PA	<i>negative</i>	0.07	<i>negative</i>	0.07	<i>negative</i>	0.06
<i>Net Weight</i>	<i>negative</i>	0.88	<i>negative</i>	0.49	<i>negative</i>	1.00

TABLE 6(e): Covariance by Sector for Saskatchewan

	1976-1986		1987-1995		1996-2007	
	co-variance	weight	co-variance	weight	co-variance	weight
AG	<i>negative</i>	0.21	<i>negative</i>	0.22	<i>negative</i>	0.18
MI	<i>negative</i>	0.03	<i>negative</i>	0.03	<i>negative</i>	0.03
UT	positive	0.01	positive	0.01	<i>negative</i>	0.01
CN	<i>negative</i>	0.06	positive	0.07	positive	0.05
MA	positive	0.05	positive	0.05	positive	0.05
TR	<i>negative</i>	0.16	<i>negative</i>	0.16	<i>negative</i>	0.15
TP	<i>negative</i>	0.05	<i>negative</i>	0.05	<i>negative</i>	0.05
FI	positive	0.04	<i>negative</i>	0.04	positive	0.05
IFC	<i>negative</i>	0.02	positive	0.02	<i>negative</i>	0.03
PTK	positive	0.01	<i>negative</i>	0.01	<i>negative</i>	0.02
BMG	<i>negative</i>	0.07	<i>negative</i>	0.06	<i>negative</i>	0.07
EDU	<i>negative</i>	0.09	<i>negative</i>	0.09	<i>negative</i>	0.11
HEA	positive	0.03	positive	0.03	positive	0.04
AFD	<i>negative</i>	0.05	<i>negative</i>	0.05	<i>negative</i>	0.06
OTH	<i>negative</i>	0.04	positive	0.04	positive	0.05
PA	<i>negative</i>	0.07	positive	0.07	<i>negative</i>	0.07
<i>Net Weight</i>	<i>negative</i>	0.85	<i>negative</i>	0.71	<i>negative</i>	0.78