Diversity in Edmonton's Economy

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All city names in this document refer to Census Metropolitan Areas (CMAs). In Edmonton, the CMA contains the same municipalities as the Edmonton Capital Region, with the exception of Lamont and Lamont County.

Introduction

This analysis discusses two indices of economic diversity. The first, a frequently used GDP distribution index similar to that used by the Conference Board of Canada, measures how evenly a city's GDP is spread across different industries. By this measure, as of 2014 Edmonton has the most diversified economy among major Canadian cities. Edmonton's largest industry sector, primary and utilities, comprises only 17% of GDP (compared to 32% of GDP in Calgary).

The composition of Edmonton's GDP has not drastically changed since 1994. The primary and utilities sector makes up a slightly smaller share of GDP (19% in 1994 compared to 17% in 2014) while construction makes up a larger share (7% compared to 12%). Like most major Canadian cities, Edmonton's economic diversity, as measured by the GDP distribution index, has been relatively constant since 1987. The exception is Calgary, which has become significantly more diverse over the same time period.

However, if the goal of diversification is to reduce volatility and risk in a city's economic growth, then the GDP distribution index paints an incomplete picture of diversity because it does not account for volatility or interdependence between industries.

An alternate, less widely used diversification index accounts for interdependence by relating a region's economic structure to an investment portfolio and calculating the total growth volatility of that portfolio over a given time period. Using this total GDP growth volatility approach reveals that Edmonton's economy is among the most volatile in Canada, and the growth rates of our different industries are related in a way that suggests strong industry interdependence compared to other major cities. Combining the GDP distribution and GDP growth volatility measures portrays Edmonton's economy as one that is superficially diverse, but has deeper structural dependencies that have prevented it from achieving stable growth.

These two measures are inherently backward-looking, and by themselves do not suggest paths towards true economic diversity. One approach could be to start with two of Edmonton's most volatile industries, construction (12% of GDP in 2014) and manufacturing (9% of GDP in 2014), both of which are closely tied to oil sands activity. Diversifying the customer and product base of these two industries and decoupling them from the energy sector could be an effective way to improve Edmonton's economic stability.

Defining Economic Diversity

An economy is typically considered to be diverse if its economic output is spread evenly over a variety of industry sectors. Conventional wisdom suggests that a diversified economy will see more stable and sustainable growth, because risk is spread more evenly over a greater number of industries. While this

relationship makes intuitive sense, empirical results from studies on the link between diversity and growth have been inconsistent despite over 50 years of research.

This definition of diversification has been criticised for two major reasons. First, the selection of an equal distribution of activity across industries as the 'ideal' reference point is essentially arbitrary. Second, it only considers how output is distributed across industries; it does not take into account the degree to which different industries are interrelated. For example, a hypothetical economy with 10 industries, each with 10% share of output, would be considered highly diverse even if 9 industries existed solely to sell inputs to the remaining one. Despite being technically 'diverse', this economy is still dependent on one industry and exposed to high levels of risk. The GDP growth volatility index captures the level of this interdependency.

It is important to recognize that diversity is only one aspect of a region's economic structure. Natural resources and comparative advantage are important contributors to economic growth, and diversification for diversification's sake could be counter-productive. Rather, the pursuit of economic growth and stability can be considered a balance between the stability of diversification and the growth potential of exploiting comparative advantages.

Finally, diversity of output is not the only type of diversity that can affect regional economic performance. Diversity of export markets can also theoretically improve economic stability even in regions with highly concentrated output, because risk is spread over multiple export 'customers'. And within the broad industry categories typically used to categorize output, diversification through selling different or similar products to customers in a wide range of industries could theoretically have a similar effect.

Measuring Local Economic Diversity

This analysis uses GDP as a measure of economic activity, and computes two separate indices of economic diversity – one GDP distribution index and one GDP growth volatility index. Over the years a wide variety of diversity measures and indices have been developed, from extremely simple (the percentage of manufacturing activity accounted for by nondurable goods) to more complex measures using input-output models. The specific indices used here were chosen for ease of computation and data availability at the city level.

The first index used is the Herfindal Index, which captures the extent to which GDP is evenly distributed over different industry sectors. It computes the sum of squares of industry shares of GDP[1], with lower values of the index indicating a more equal distribution of GDP and therefore higher levels of economic diversity. The Herfindal Index comes from a widely used family of related diversity indices and is very similar, though not exactly equivalent, to the diversity index published by the Conference Board of Canada.

The second index captures a region's total GDP growth volatility by treating it's distribution of economic activity among industries as analogous to an investment portfolio, and measuring diversification by the level of total volatility in that portfolio. A region's total GDP volatility incorporates each industry's share of GDP, the historical variance in their growth rates, and the historical covariance (the degree to which different industries tend to change together) between all industry growth rates. Assuming that diverse

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[1] $Herfindal_{region} = \sum \left(\frac{GDP_{region,industry}}{GDP_{region}} \right)^2$

economies should exhibit lower levels of both industry volatility and interdependence, higher values of the GDP growth volatility index indicate lower levels of economic diversity. This framework paints a more complete picture of diversification than the Herfindal Index, as it considers not only how economic activity is distributed, but also the degree of interdependence between a region's different industries.

Caveats and Limitations

The two most common values used to measure industry shares of output are employment and GDP. In this case real GDP estimates from the Conference Board of Canada were used to compute the Herfindal and GDP growth volatility indices. These estimates are unofficial (Statistics Canada does not publish GDP estimates for metropolitan areas) and are a source of error in the analysis. The basic process used by the Conference Board is to estimate a city's GDP in a given industry by multiplying that city's share of province-wide industry employment by province-wide industry GDP. This process will very likely over-estimate city GDP in industries where capital is used in a separate geographic area from labour, for example the oil and gas industry.

The specific values of the GDP growth volatility index for each city are sensitive to the chosen time period. Here the overall diversity rankings are calculated using GDP growth from 1987 to 2014, the longest time period available. The index was calculated for various other time periods (see Figure 6. for 1987 to 1996, 1997 to 2004, and 2007 to 2014), but the overall rankings did not change significantly.

Conclusion

Both the indices used here have unfortunate limitations in substantiating a link between diversity and economic performance. For a variety of methodological and conceptual reasons, decades of economic research on the Herfindal and similar GDP distribution indices has not found a conclusive relationship between index ratings and economic growth or stability. The GDP growth volatility index cannot be used to estimate a link with growth or stability, because it does not measure diversity independent of them.

Despite their limitations, when analyzed together these two measures of diversity paint a clear picture of Edmonton's economy. It is superficially diverse, with GDP distributed more evenly across its various industry sectors than any other major Canadian city. Despite this it is also relatively volatile, and exhibits high levels of interdependence between its different industries. This is counter to the theory of diversification, which suggests that diverse economies should see less volatile and interdependent growth. There must be a deeper structural dependency at work in Edmonton's economy, but these indices do not offer an explanation on their own.

Though not directly supported by this analysis, the obvious explanation for Edmonton's volatility is the link between its economy and Alberta's energy industry. There are two facts in the GDP growth volatility data that indirectly suggest this: first, four cities commonly thought of as having natural resource economies – Calgary, Edmonton, Saskatoon, and Regina – have markedly higher GDP growth volatility index values than other Canadian cities. Second, within Edmonton's economy our most volatile industries have historically been manufacturing and construction, both of which are generally thought to be closely linked with the energy sector.

On their own these two indices do not clearly point towards a policy for improving Edmonton's economic diversity. In fact, whether decreasing GDP growth volatility through diversification at the expense of periods of very high GDP growth is a desirable policy goal is an important question to consider. However, if reducing volatility is a priority, then the data suggests that a logical starting point would be to decouple Edmonton's most volatile industries, manufacturing and construction, from Alberta's energy sector by diversifying their export markets and customer base.

Figure 1. In Terms of GDP by Industry, Edmonton is the Most Diversified Economy in Canada

Index of Real GDP by Industry Concentration, 2014 (Lower Index = More Diversified)

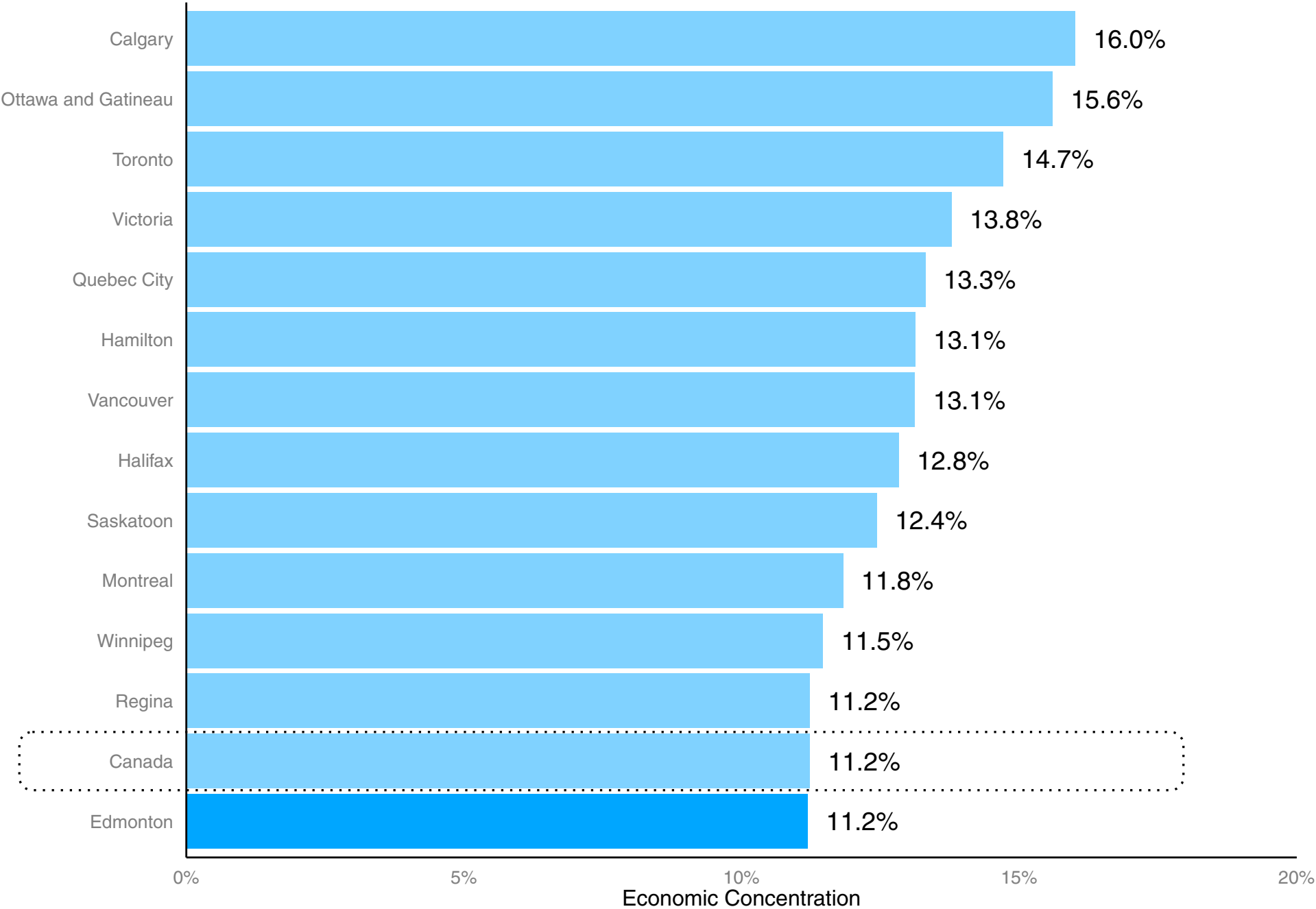| City	Economic Concentration
Calgary	16.0%
Ottawa and Gatineau	15.6%
Toronto	14.7%
Victoria	13.8%
Quebec City	13.3%
Hamilton	13.1%
Vancouver	13.1%
Halifax	12.8%
Saskatoon	12.4%
Montreal	11.8%
Winnipeg	11.5%
Regina	11.2%
Canada	11.2%
Edmonton	11.2%

Economic Concentration

Figure 2. Calgary's GDP Has Significantly Diversified Since the 1980s, While Edmonton's Has Remained Relatively Diverse

Index of Real GDP by Industry Concentration, Major Canadian Cities, 1987 - 2014 (Lower Index = More Diversified)
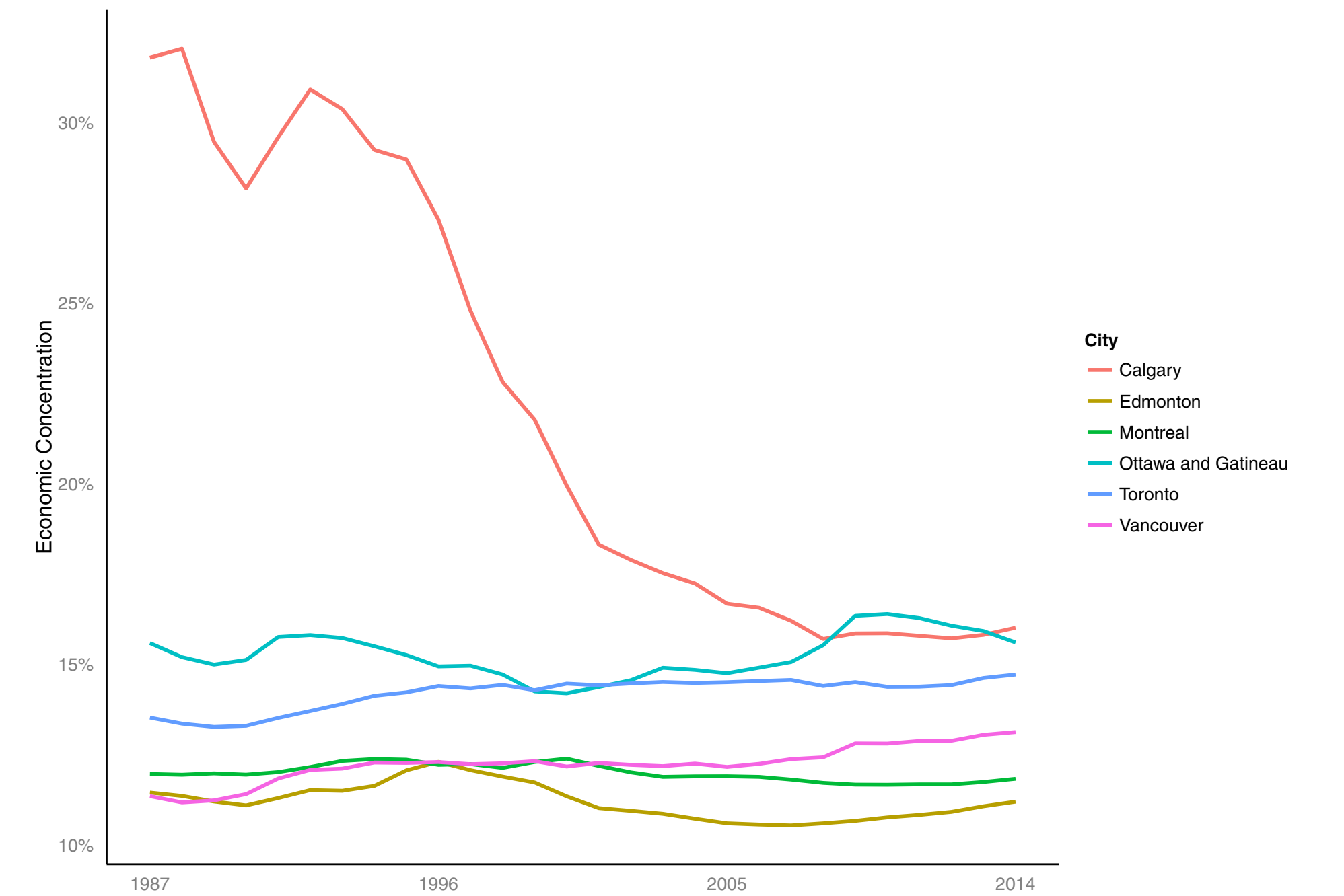
Figure 3. The Industry Composition of Edmonton's GDP Has Not Drastically Changed in 20 Years

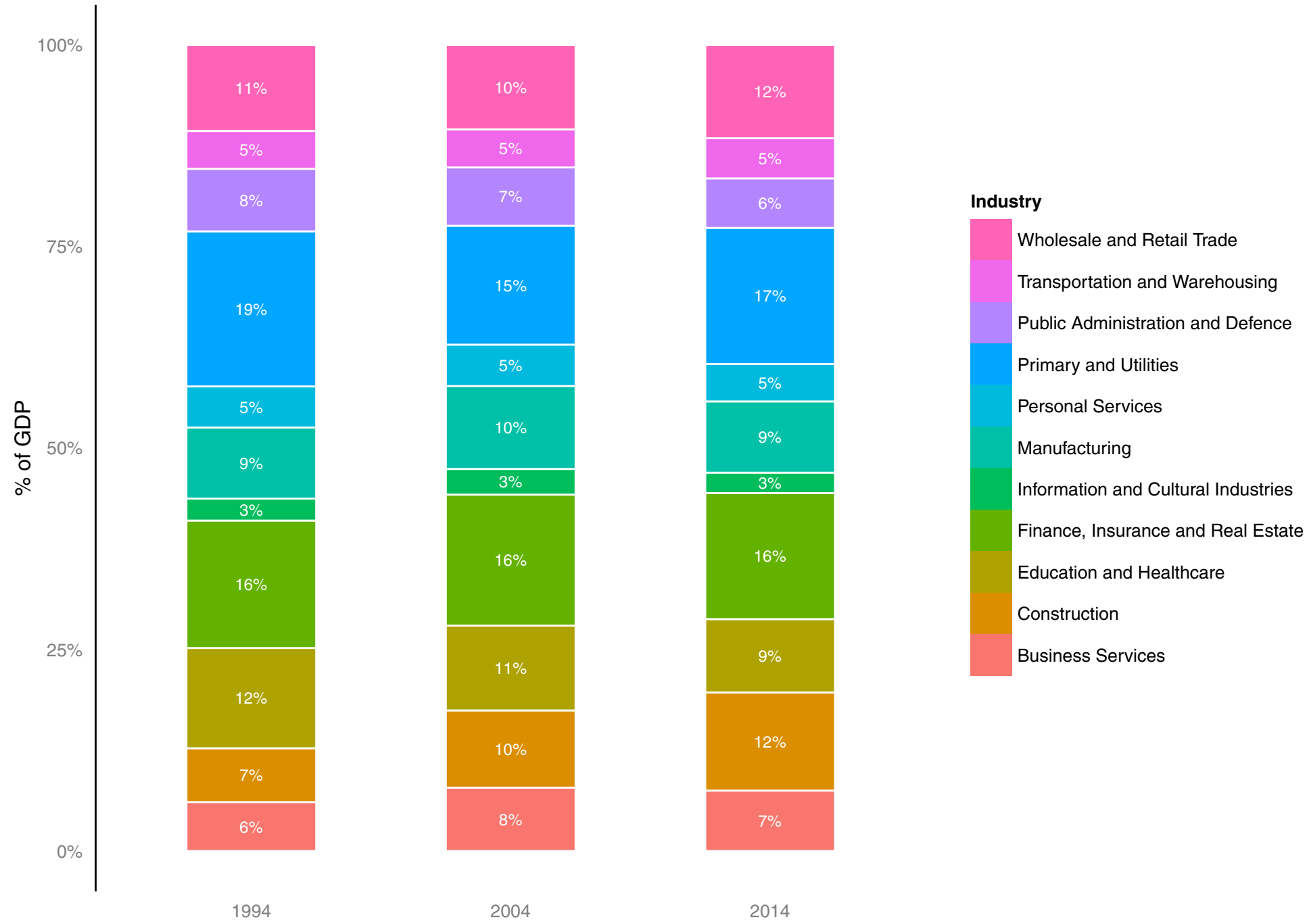Estimated Real GDP by Industry, Edmonton CMA, 1994 - 2014

Figure 4. Compared to Calgary, Edmonton's Economy is Much Less Concentrated in Primary Industries

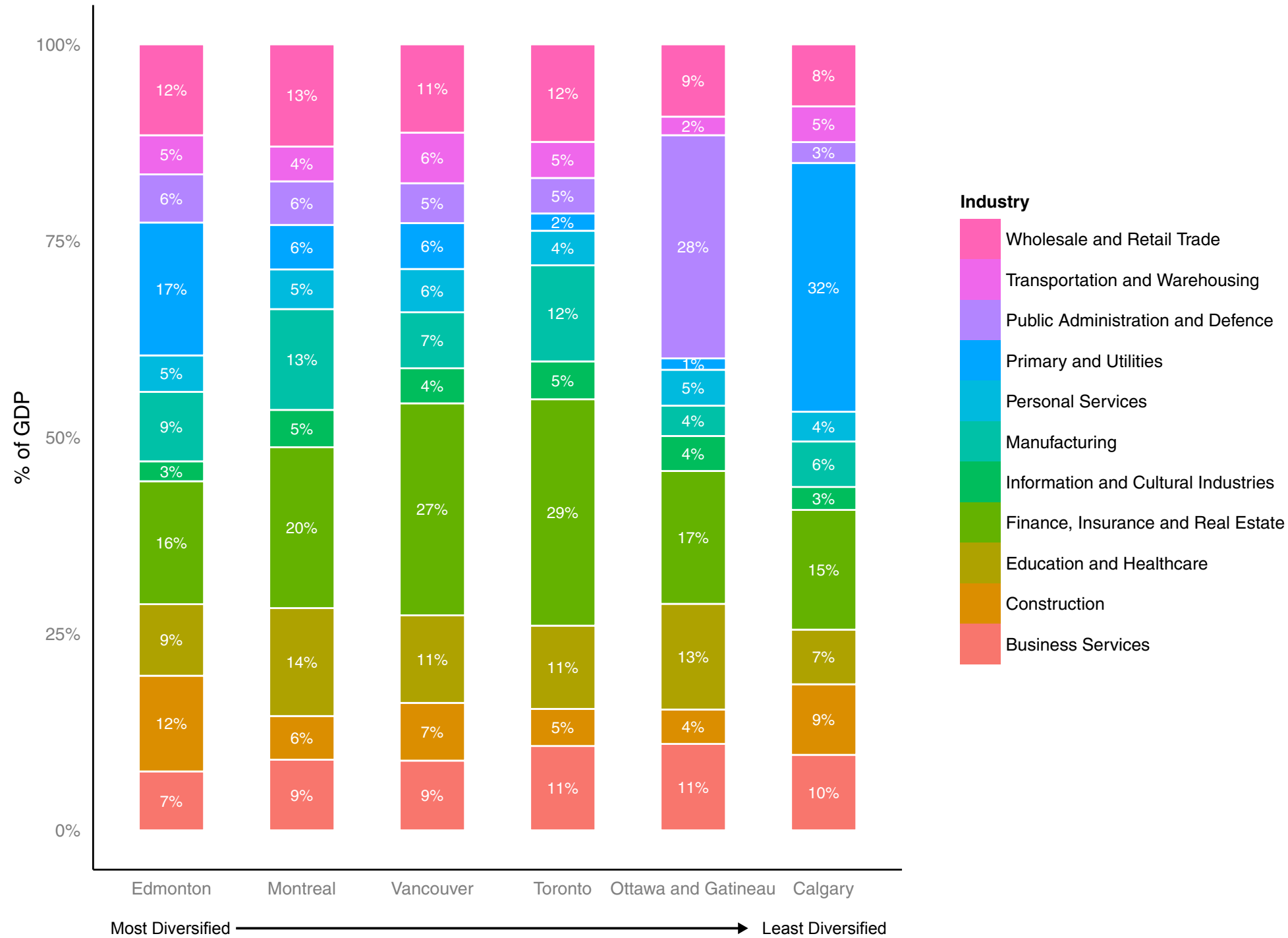Estimated Real GDP by Industry, Major Canadian Cities, 2014

% of GDP (y-axis, 0% to 100%)

	Edmonton	Montreal	Vancouver	Toronto	Ottawa and Gatineau	Calgary
Wholesale and Retail Trade	12%	13%	11%	12%	9%	8%
Transportation and Warehousing	5%	4%	6%	5%	2%	5%
Public Administration and Defence	6%	6%	5%	5%	28%	3%
Primary and Utilities	17%	6%	6%	2%		32%
Personal Services	5%	5%	6%	4%	1%	
Manufacturing	9%	13%	7%	12%	5%	4%
Information and Cultural Industries	3%	5%	4%	5%	4%	6%
Finance, Insurance and Real Estate	16%	20%	27%	29%	4%	3%
Education and Healthcare	9%	14%	11%	11%	17%	15%
Construction	12%	6%	7%	5%	13%	7%
Business Services	7%	9%	9%	11%	4%	9%
					11%	10%

Industry
- Wholesale and Retail Trade
- Transportation and Warehousing
- Public Administration and Defence
- Primary and Utilities
- Personal Services
- Manufacturing
- Information and Cultural Industries
- Finance, Insurance and Real Estate
- Education and Healthcare
- Construction
- Business Services

Most Diversified ⟶ Least Diversified

Figure 5. In Terms of GDP Growth Volatility, Edmonton is Among the Least Diversified Economies in Canada

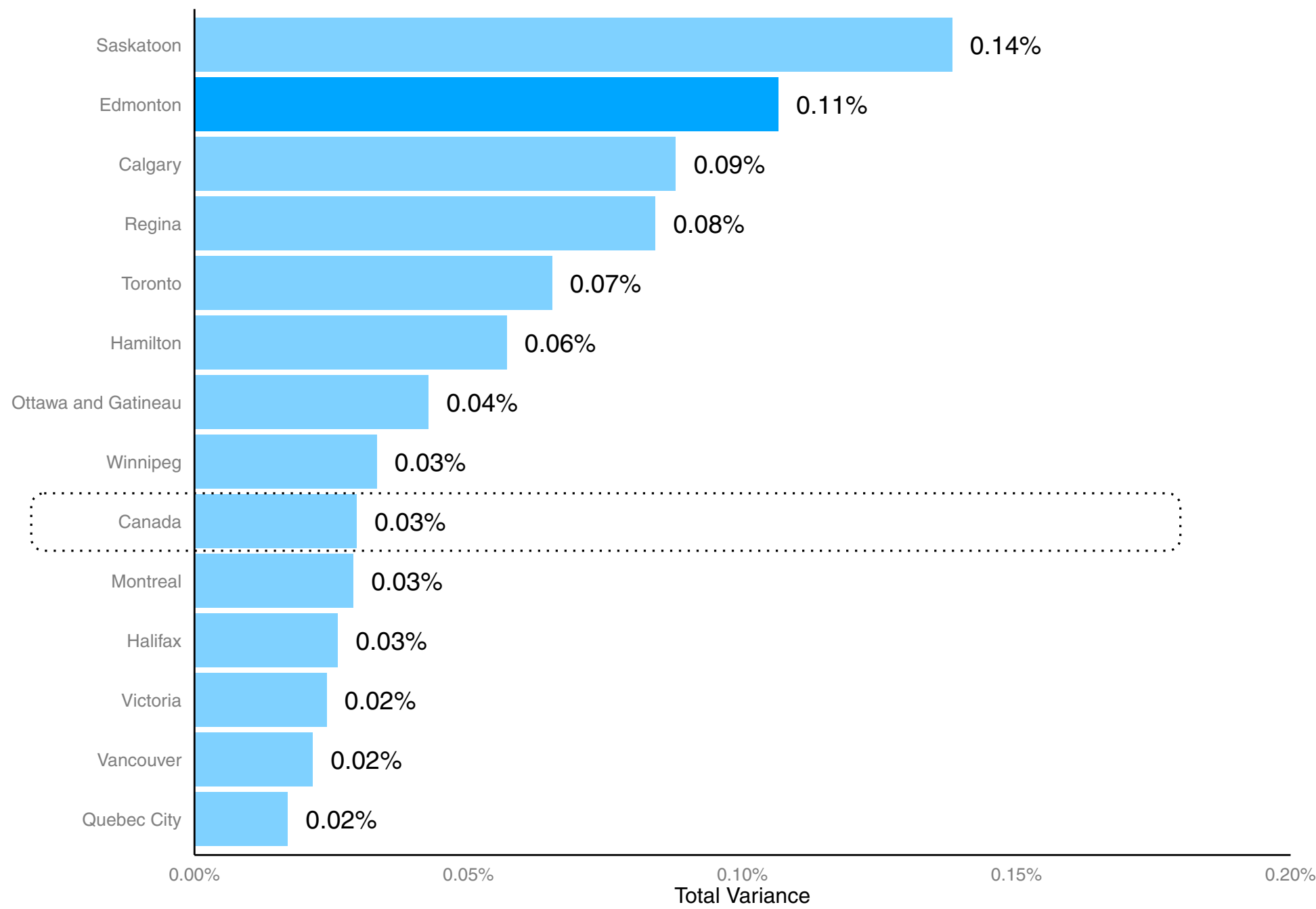Index of GDP Growth Volatility, 1987 - 2014 (Higher Index = Less Diversified)

City	Total Variance
Saskatoon	0.14%
Edmonton	0.11%
Calgary	0.09%
Regina	0.08%
Toronto	0.07%
Hamilton	0.06%
Ottawa and Gatineau	0.04%
Winnipeg	0.03%
Canada	0.03%
Montreal	0.03%
Halifax	0.03%
Victoria	0.02%
Vancouver	0.02%
Quebec City	0.02%

Total Variance

Figure 6. In Terms of GDP Growth Volatility, Edmonton's Economy Has Become Less Diverse Over Time

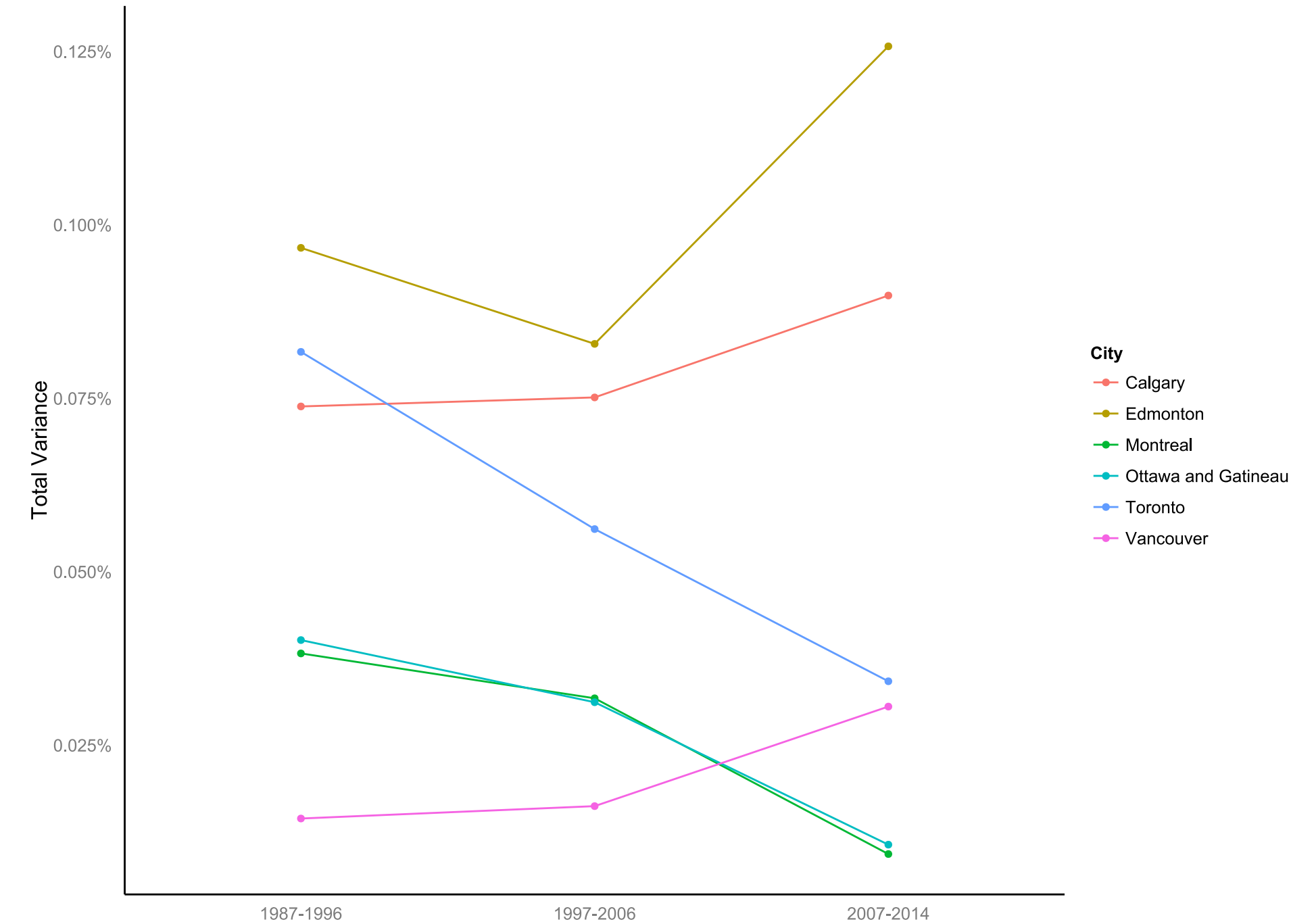Index of GDP Growth Volatility, Major Canadian Cities, 1987 - 2014 (Higher Index = Less Diversified)

Figure 7. Edmonton's GDP Growth in Many Industries is Relatively Volatile

GDP Growth by Industry, Edmonton vs. Range of Growth Rates for Major Canadian Cities, 1987 - 2014

Industry Definitions

Primary and Utilities

- Growing crops, raising animals, harvesting timber, harvesting fish and other animals from their natural habitats and providing related support activities

- Extracting naturally occurring minerals (incl. coal and ores, crude petroleum, natural gas)

- Operating electric, gas and water utilities

Construction

- Constructing, repairing and renovating buildings and engineering works, and in subdividing and developing land

Manufacturing

- The chemical, mechanical or physical transformation of materials or substances into new products. These products may be finished, in the sense that they are ready to be used or consumed, or semi-finished, in the sense of becoming a raw material for an establishment to use in further manufacturing.

Wholesale and Retail Trade

- Wholesaling or retailing merchandise, generally without transformation, and rendering services incidental to the sale of merchandise

Transportation and Warehousing

- Transporting passengers and goods, warehousing and storing goods, and providing services to these establishments. The modes of transportation are road (trucking, transit and ground passenger), rail, water, air and pipeline

Information and Cultural Industries

- Producing and distributing (except by wholesale and retail methods) information and cultural products. The main components of this sector are the publishing industries, the motion picture and sound recording industries, the broadcasting industries, the telecommunications industries, and the data processing and hosting services industries.

Finance, Insurance and Real Estate

- Conducting financial transactions (that is, transactions involving the creation, liquidation, or change in ownership of financial assets) or facilitating financial transactions, including financial intermediation and the pooling of risk by underwriting annuities and insurance.

- Renting, leasing or otherwise allowing the use of tangible or intangible assets. Managing real estate for others; selling, renting and/or buying of real estate for others; and appraising real estate.

Business Services

- Legal services; accounting, tax preparation, bookkeeping and payroll services; architectural, engineering and related services; specialized design services; computer systems design and related services; management, scientific and technical consulting services; scientific research and development services; and advertising, public relations, and related services.

- Managing companies and enterprises and/or holding the securities or financial assets of companies and enterprises, for the purpose of owning a controlling interest in them and/or influencing their management decisions

- Activities that support the day-to-day operations of other organizations; and waste management activities

Education and Healthcare

- Providing instruction and training in a wide variety of subjects. This instruction and training is provided by specialized establishments, such as schools, colleges, universities and training centres. These establishments may be privately owned and operated, either for profit or not, or they may be publicly owned and operated

- Providing health care by diagnosis and treatment, providing residential care for medical and social reasons, and providing social assistance, such as counselling, welfare, child protection, community housing and food services, vocational rehabilitation and child care

Personal Services

- Operating facilities or providing services to meet the cultural, entertainment and recreational interests of their patrons

- Providing short-term lodging and complementary services to travellers

- Preparing meals, snacks and beverages, to customer orders, for immediate consumption on and off the premises

- Repairing, or performing general or routine maintenance, on motor vehicles, machinery, equipment and other products; providing personal care services, funeral services, laundry services and other services to individuals, such as pet care services and photo finishing services; organizing and promoting religious activities; supporting various causes through grant-making, advocating (promoting) various social and political causes, and promoting and defending the interests of their members

Public Administration

- Activities of a governmental nature, that is, the enactment and judicial interpretation of laws and their pursuant regulations, and the administration of programs based on them. Legislative activities, taxation, national defence, public order and safety, immigration services, foreign affairs and international assistance, and the administration of government programs are activities that are purely governmental in nature