

Changing Industrial Structure

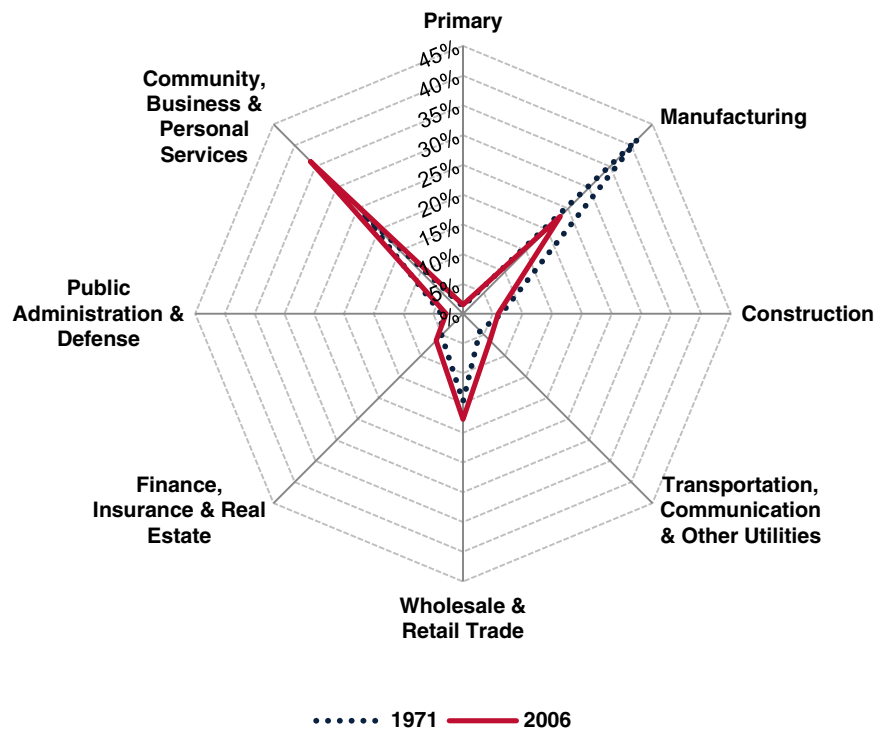
Waterloo Region

Over the past 25 to 30 years, the Waterloo region's economy has undergone a substantial transformation. Figure 1 shows the broad shifts in the industrial composition of the regional economy. Most notably, employment in manufacturing decreased from 41.5% of the workforce in 1971 to 23.1% in 2006. By contrast, employment in service-based industries increased from 23.2% to 36.1% between 1971 and 2006. However, as Table 1 shows, even though the overall proportion of employment in manufacturing has declined in relative terms, between 1971 and 2006, in absolute terms, the region added almost 17,000 jobs in the manufacturing industries.

Other sectors, such as trade, construction and the FIRE industries have only witnessed small changes through this time. Employment in wholesale and retail trade increased slightly from 14.8% of the region's workforce to 17.8% by 2006. Likewise, construction has routinely accounted for between 5% and 6% of employment throughout this period.

Employment in public administration declined from 3.7% to 2.8%, while primary industries accounted for only a small proportion of the regional economy (1.5% in 2006).

Figure 1: Change in industrial structure, 1971-2006



Source: Statistics Canada, Census of Population, 1971 and 2006

Table 1: Employment by industry, 1971-2006

	1971	1981	1991	2001	2006	1971-2006	CAGR
Primary	1,225	2,600	3,325	3,265	3,774	2,549	3.3%
Manufacturing	41,360	56,080	51,830	59,429	58,338	16,978	1.0%
Construction	6,445	7,970	13,160	12,484	14,943	8,498	2.4%
Transp., Comm. & Other Utilities	4,070	6,525	9,610	14,202	16,140	12,070	4.0%
Wholesale & Retail Trade	14,690	25,205	35,600	40,036	44,848	30,158	3.2%
Finance, Insurance & Real Estate	5,040	8,740	12,875	15,102	16,149	11,109	3.4%
Public Administration & Defense	3,635	5,430	8,530	6,663	7,088	3,453	1.9%
Community, Business & Personal Services	23,120	39,790	63,125	76,823	91,250	68,130	4.0%
Total	99,585	152,340	198,055	228,004	252,530	152,945	2.7%

CAGR = Compound Annual Growth Rate

Source: Statistics Canada, Census of Population, 1971-2006

Data Sources

Due to changes in industrial and occupational classification schemes, there are analytical challenges in ensuring that the data are comparable over time. Thus, the data in this report are often presented in aggregate form and for varying time periods. Long term structural change (1971 to 2006) is evaluated using Census data using eight industrial and occupational groups to ensure consistency. *Labour Force Survey* (LFS) data are only available from 1987 onwards. These data can only be used reliably at high levels of aggregation due to the nature of the LFS sampling frame. Cluster analysis relies on detailed 4-digit codes from the North American Industrial Classification System (NAICS). Such employment data are only available from the 2001 and 2006 *Census of Population*, due to changes in the classification scheme. Detailed occupational data from the Census are comparable from 1991 onwards.

Manufacturing Dynamics

Waterloo Region

The role of manufacturing is critical to understanding the changes to the industrial structure of Waterloo region over time. Figure 2 compares employment in the manufacturing industries to the overall employed labour force in Waterloo over the period between 1987 and 2010. Employment is indexed to 100 in the base year (1987) to allow for easier comparison of their relative growth performance over time.

Figure 2 shows that the share of employment accounted for by manufacturing has fluctuated over time. After a sharp downturn in the early 1990s, manufacturing employment increased through the 1990s. Beginning in 2001, manufacturing employment began a steady decline even as the regional workforce continued to grow. However, the slight growth of

manufacturing employment seen in recent years may signal somewhat of a revival in the sector.

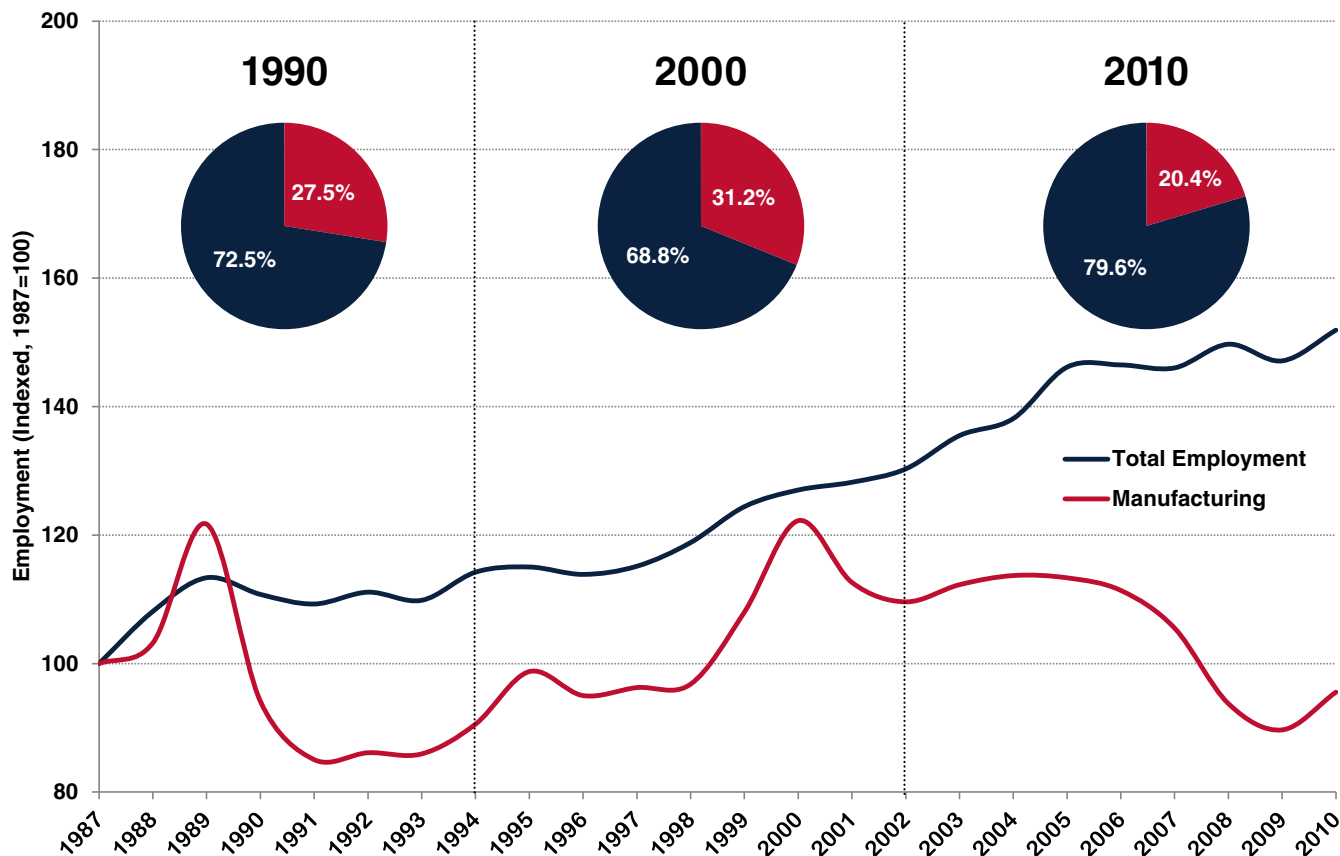
While manufacturing has traditionally been an important source of employment, a more detailed examination of the regional economy is warranted. Table 2 shows employment in eighteen industrial groups in 2001 and 2006. While there is a high level of employment in the automotive and plastics and rubber groups, growth performance and levels of specialization vary across industrial groups. These industrial groups, when demonstrating sufficient size, scope and specialization form the basis of clusters in the regional economy (see next page).

Table 2: Employment by industrial group, 2001 and 2006

Industrial Group	2001	2006
Agriculture	9,425	10,065
Mining	800	1,105
Oil and Gas	1,610	1,490
Wood & Wood Products	1,285	1,450
Maritime	295	285
Textiles & Apparel	4,480	2,470
Food	8,250	9,945
Steel	7,780	7,395
Automotive	22,130	21,475
Plastics & Rubber	11,125	10,660
Biomedical	2,565	2,840
ICT Manufacturing	7,165	8,135
ICT Services	11,615	15,405
Finance	15,710	19,570
Business Services	20,395	27,620
Creative & Cultural	5,250	7,685
Higher Education	7,840	12,265
Logistics	10,560	13,035

Source: Statistics Canada, Census of Population, 2001 and 2006

Figure 2: Manufacturing Employment, 1987-2010 (1987=100)



Source: Statistics Canada, Labour Force Survey, 1987-2010 [custom tabulations]

Cluster Dynamics

Waterloo Region

Figure 3 depicts a 'bubble chart' comparing the performance of eighteen industrial groups (or clusters) in Waterloo Region. The horizontal axis shows the employment growth rate between 2001 and 2006. The vertical axis shows the employment location quotient comparing the proportion of Waterloo Region's employment in an industrial sector to the Canadian average. The diameter of each 'bubble' is proportional to employment in the specified industrial group in 2006. Industrial groups that appear in the upper-right quadrant have positive growth rates and have a higher-than-expected proportion of employment (specialization) in this group of industries.

A more sophisticated analysis of industrial structure involves cluster analysis. Clusters represent groups of inter-related firms and industries that gain competitive advantage by concentrating geographically in certain locations. In this report, industrial groups that meet a set of quantitative criteria are identified as clusters. Clusters are identified based on their relative size (employment), their relative specialization (location quotient), as well as the breadth or scope of activities undertaken in the region.¹

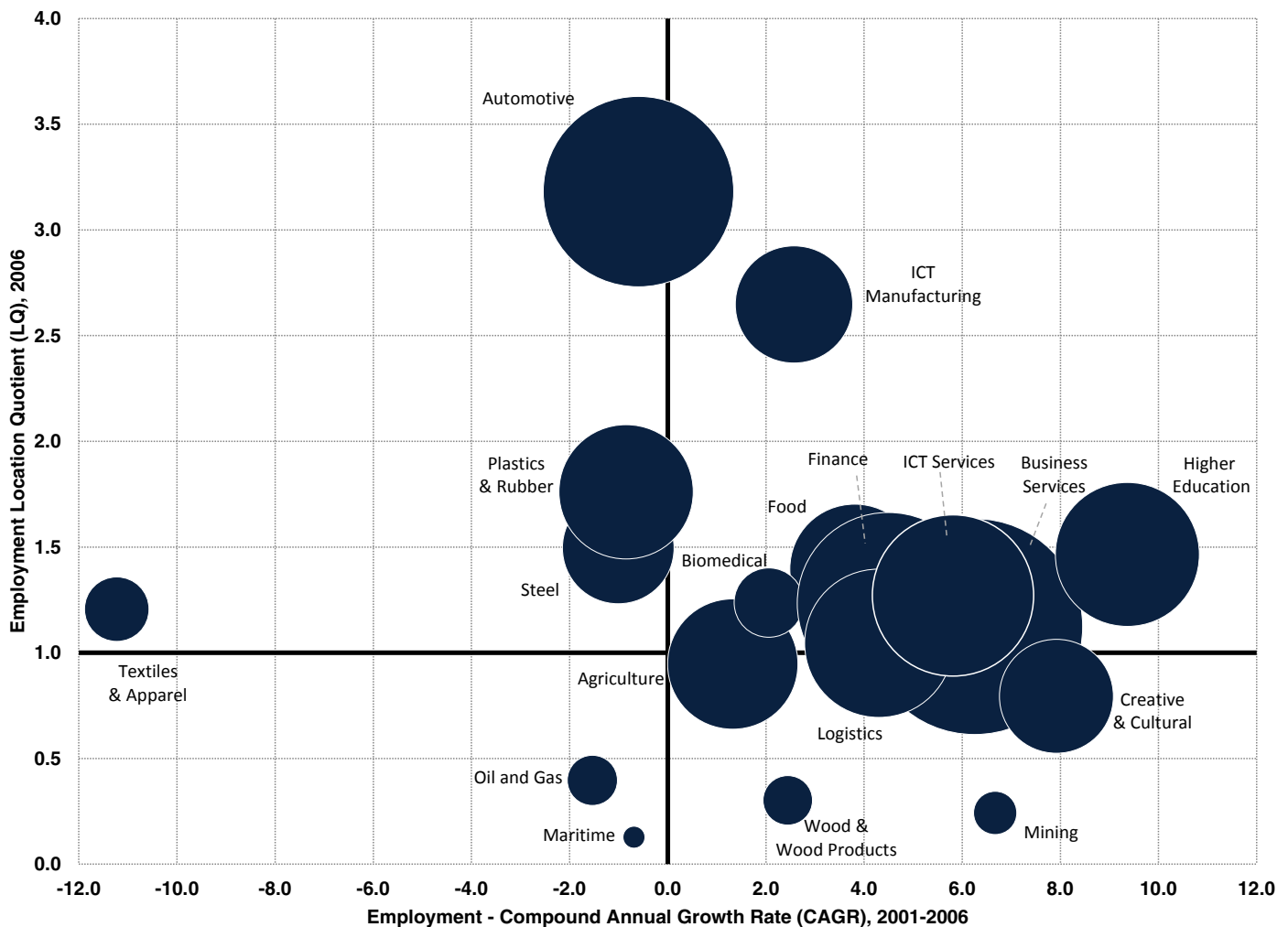
According to these criteria, in 2006, there were seven clusters in the Waterloo Region region: textiles and

apparel, steel, automotive, plastics and rubber, biomedical, ICT manufacturing, and logistics.

However, a number of other industrial groups (food, ICT services, finance, business services, and higher education) also demonstrated high levels of growth between 2001 and 2006, highlighting the growth and dynamism of the region as a whole.

1. For a more detailed description of the methodology, see: Spencer, G. M., Vinodrai, T., Gertler, M. S., & Wolfe, D. A. (2010). Do Clusters Make a Difference? Defining and Assessing their Economic Performance. *Regional Studies*, 44(6), 697-715.

Figure 3: Cluster growth and specialization, 2001-2006



Source: Statistics Canada, Census of Population, 2001 and 2006

Changing Occupational Structure

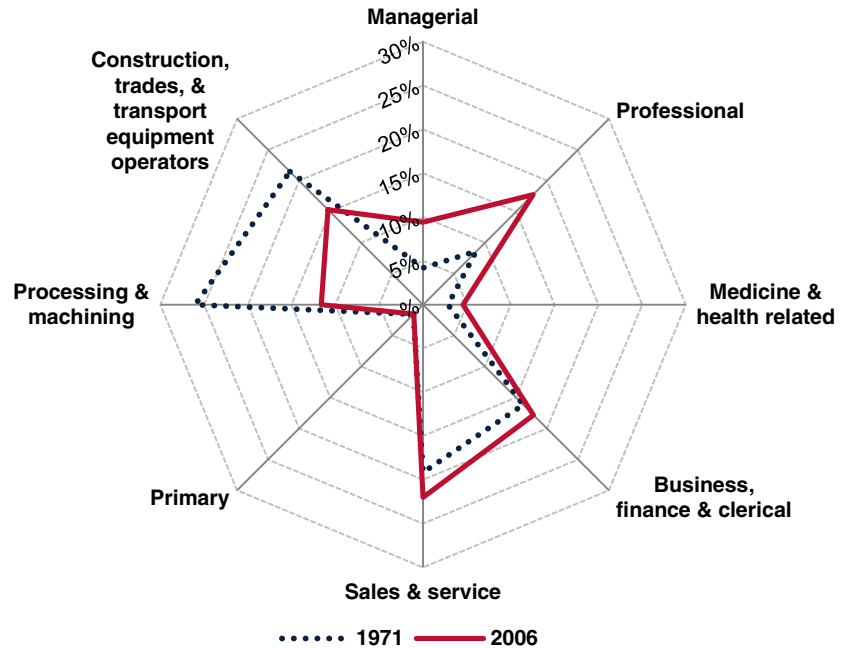
Waterloo Region

In addition to a broad shift in the industrial composition of the regional economy, Waterloo's workforce has undergone a substantial transition in the forms of work over the past 25 to 30 years. Figure 4 shows the broad shifts in the occupational composition of the regional economy.

Most notably, the proportion of employment accounted for by processing and machining occupations has decreased from 26% of the workforce in 1971 to 11.6% in 2006. Similarly, employment in construction, trades and other related occupations decreased from 21.5% to 15.3% in the same time period. By contrast, employment in professional occupations increased from 8.6% to 17.7% between 1971 and 2006. Modest increases have also been seen in the proportion of employment accounted for by sales and service occupations (22%), business, finance and clerical occupations (17.8%), and medicine and health related occupations (4.5%).

Table 4 provides more detail of these changes. It is clear that occupations relating to routine and production oriented labour have underperformed relative to overall regional employment growth, especially in comparison to the very strong growth seen in managerial and professional occupations. These marked shifts in Waterloo's regional workforce provide a clear example of the broader economic shifts away from manufacturing towards more service-oriented, knowledge-based work.

Figure 4: Change in occupational structure, 1971-2006



Source: Statistics Canada, Census of Population, 1971 and 2006

Table 4: Employment by occupation, 1971-2006

	1971	1981	1991	2001	2006	1971-2006	CAGR
Managerial	4,450	12,335	24,230	24,460	23,950	19,500	4.9%
Professional	9,105	16,090	25,255	37,910	45,155	36,050	4.7%
Medicine & health related	3,025	4,970	7,640	8,530	11,575	8,550	3.9%
Business, finance & clerical	17,155	27,435	34,995	39,750	45,380	28,225	2.8%
Sales & service	20,305	30,980	40,870	49,150	56,000	35,695	2.9%
Primary	1,645	2,785	3,330	3,520	3,830	2,185	2.4%
Processing & machining	27,565	38,305	32,815	28,765	29,620	2,055	0.2%
Constr., trades, & transport equip. operators	22,770	19,450	28,930	37,805	39,010	16,240	1.6%
Total	106,020	152,350	198,065	229,890	254,520	148,500	2.5%

CAGR = Compound Annual Growth Rate

Source: Statistics Canada, Census of Population, 1971-2006

Emerging Knowledge Economy

Waterloo Region

One of the most striking features of the contemporary economy is the shift towards creative and knowledge-intensive forms of work. Figure 5 shows how the occupational composition of the Waterloo region has changed between 1987 and 2010. One of the most notable patterns is the almost mirror-image relationship between the decline of employment in production-oriented occupations and the growth of knowledge-based occupations. The former accounted for a high proportion of employment in Waterloo in the late 1980s, peaking at 35.3% in 1989. However, alongside the relative decline of manufacturing, by 2010, this type of work accounted for only 21.5% of employment.

By contrast, knowledge-based work grew substantially. As Table 5 shows, employment in creative and knowledge based occupations increased at 2.7% per year between 1991 and 2006, outpacing the region's overall

employment growth rate of 1.7% per year. Also noteworthy is the steady share of employment accounted for by routine, service work. These occupations maintained a share of roughly 40% throughout the period between 1987 and 2010. Not surprisingly, agricultural work accounted for only a fraction of employment.

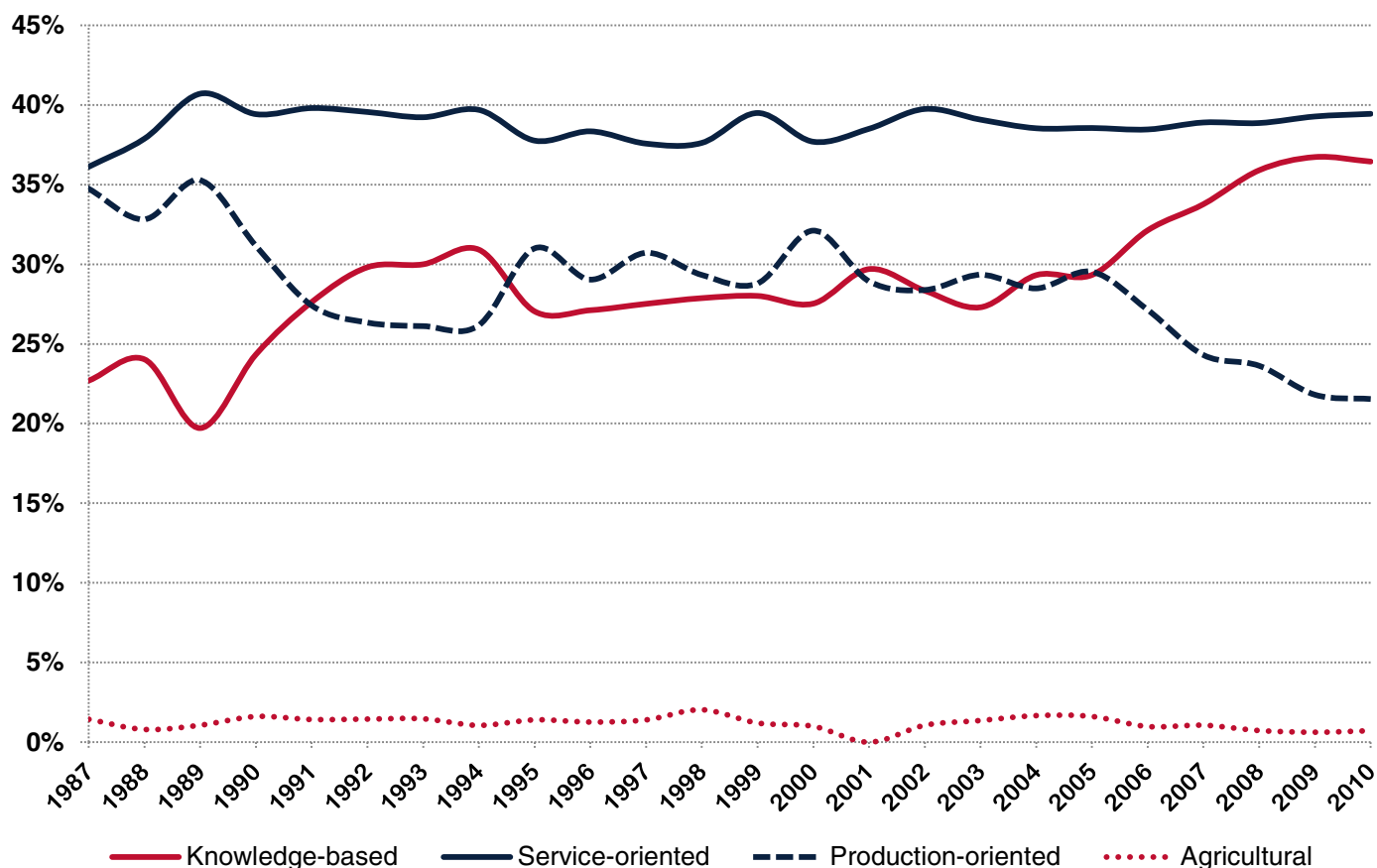
Table 5: Employment by occupation class, 1991-2006

	Agricultural occupations	Knowledge-based	Service-oriented	Production-oriented	Total Workforce
1991	2,360	54,490	81,495	59,715	200,715
1996	2,290	57,960	83,425	59,240	209,000
2001	2,165	73,745	86,055	67,915	232,860
2006	2,040	81,675	100,370	70,415	257,690
1991-2006	-320	27,185	18,875	10,700	56,975
CAGR	-1.0%	2.7%	1.4%	1.1%	1.7%

CAGR = Compound Annual Growth Rate

Source: Statistics Canada, Census of Population, 1991-2006 (custom tabulations)

Figure 5: Changing occupational composition of the labour force, 1987-2010



Source: Statistics Canada, Labour Force Survey, 1987-2010 [custom tabulations]