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The Labour Market Situation of Highly Skilled Immigrants in Canada's Hi-Tech Clusters

Peter V. Hall (University of Waterloo)

Working Paper 2006 D-18

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The research and analysis are based on data from Statistics Canada. The opinions expressed do not represent the views of Statistics Canada. Direct access to the Longitudinal Survey of Immigrants to Canada, and indirect access to the 1991-2001 confidential Census microdata (the 20% sample) were provided through the Southwestern Ontario Research Data Center. Thanks to the center analyst, Dr. Pat Newcombe-Welch, and Statistics Canada employees in Ottawa, especially Susan Carruthers and Paul Hartung, for their support and assistance. All the usual disclaimers apply.

Abstract

This paper examines the labour market situation of highly skilled immigrants in Canada's hi-tech clusters. Using census customized tabulations it traces the coincident clustering of hi-tech economic activity and immigration settlement in Canada's largest cities. It is thus not surprising that we find the largest concentrations of immigrants employed in the hi-tech sector within a small group of large cities. Over the 1990s, earnings of immigrants declined relative to those of the native-born working in the hi-tech sector. This trend was most pronounced in the largest cities. Using confidential Census micro-data to control for demographic and human capital characteristics, we find that hi-tech immigrants in Toronto do relatively worse than hi-tech immigrants employed elsewhere. The paper then focuses on the employment experiences of newly arrived immigrants to Canada, using a sample survey of immigrants interviewed six months after arrival. Immigrants with more education are less likely to be employed shortly after arrival than those with less education. This finding is consistent with the notion that immigrants face challenges in having their qualifications recognized by employers. We also find that certain forms of previous work experience, especially pre-immigration Canadian work experience and hi-tech experience (obtained anywhere), is rewarded with increased likelihood of employment. At the same time, hi-tech employers are more likely than others to recognize and reward foreign education and pre-immigration hi-tech work experience.

Résumé

L'auteur examine la situation sur le marché du travail des immigrants hautement spécialisés dans les grappes de haute technologie du Canada. À l'aide de tableaux personnalisés de données de recensements, l'auteur retrace le regroupement d'activités économiques de haute technologie avec l'établissement d'immigrants dans certaines grandes villes canadiennes. Il n'est pas surprenant de voir les plus grandes concentrations d'immigrants du secteur de la haute technologie dans un petit nombre de grandes villes. Durant les années 1990, les gains des immigrants ont diminué par rapport à ceux des travailleurs de haute technologie nés au Canada. Cette tendance est plus prononcée dans les grandes villes. À l'aide de micro-données confidentielles de recensements pour tenir compte des caractéristiques liées à la démographie et au capital humain, l'auteur observe que les immigrants de haute technologie à Toronto ont des résultats relativement moins bons que les immigrants de haute technologie ailleurs. L'auteur se penche ensuite sur l'expérience de travail des immigrants nouvellement arrivés au Canada en se servant d'un échantillon d'immigrants interrogés six mois après leur arrivée. Les immigrants dont le niveau de scolarité est plus élevé sont moins susceptibles d'avoir un emploi peu après leur arrivée que ceux dont le niveau de scolarité est moins élevé. Cette constatation confirme l'idée que les immigrants ont de la difficulté à faire reconnaître leurs qualifications par les employeurs. L'auteur a aussi observé que certaines formes d'expérience de travail antérieure, surtout l'expérience de travail au Canada avant d'immigrer et l'expérience en haute technologie (acquise ailleurs) donnent plus de chance

à un immigrant de se trouver un emploi. Parallèlement, les employeurs du secteur de la haute technologie sont plus susceptibles que les autres de reconnaître et de récompenser la formation acquise à l'étranger et l'expérience de travail en haute technologie acquise avant d'immigrer.

INTRODUCTION AND OVERVIEW

This paper contains the results of an analysis of the labour market situation of highly skilled immigrants in Canada's hi-tech clusters, in light of the geography of immigrant settlement and overall patterns of regional economic development. Hi-tech economic activity, which is so important for overall national economic growth, tends to cluster geographically to take advantage of face-to-face contacts and other highly localized sources of global competitive advantage. This geographically selective process raises important questions for public policy related to the distribution of opportunity and activity in the Canadian space-economy. At the same time, several authors have noted that many sectors in the emerging knowledge economy are associated with increasingly bifurcated labour markets where increasing returns to skill and entrepreneurship co-exist with increasing labour market churning and contingency. What happens in the hi-tech sector may be the harbinger of future trends in the labour market and wider economy, and what happens to immigrants seeking a future in the hi-tech sector may be a harbinger of future trends for other labour market entrants.

With the knowledge that new immigrant flows to Canada have increasingly become concentrated in the largest cities, our research is thus concerned with the interaction between two geographically selective phenomena of critical importance to the future welfare of Canadian society. The analysis presented uses customized tabulations and confidential micro-data from the 1991, 1996 and 2001 population censuses, and the first wave of the Longitudinal Survey of Immigrants to Canada.[1]

The paper begins with a brief review of some relevant literature. We then present an analysis of the geography of hi-tech immigrant employment. Here we highlight the coincident clustering of hi-tech economic activity and immigrant settlement in Canada's largest cities. It is thus not surprising that we find the largest concentrations of immigrants employed in the hi-tech sector within a small group of cities. The implication of this macro-level analysis is that hi-tech immigrant flows reflect, and likely reinforce, other agglomerative trends in the Canadian space-economy. We also show that there are geographical variations in the earnings of immigrants relative to those of the native-born in the hi-tech sector.

In the second empirical section of the paper we focus on the employment experiences of newly arrived immigrants to Canada, using a sample survey of immigrants interviewed six months after arrival. We examine the likelihood of immigrants being employed, highlighting in particular the role of geography and previous work experience in the hi-tech sector. Our findings confirm assertions that immigrants, in general, face challenges in having their skills recognized by employers. However hi-tech employers are more likely than others to recognize and reward foreign education and pre-immigration hi-tech work experience.

[1] The research and analysis are based on data from Statistics Canada. The opinions expressed do not represent the views of Statistics Canada. Direct access to the Longitudinal Survey of Immigrants to Canada, and indirect access to the 1991-2001 confidential Census microdata (the 20% sample) were provided through the Southwestern Ontario Research Data Center. We want to thank the center analyst, Dr. Pat Newcombe-Welch, and Statistics Canada employees in Ottawa, especially Susan Carruthers and Paul Hartung, for their support and assistance. All the usual disclaimers apply.

RELEVANT THEORETICAL PERSPECTIVES

It is well known that new immigrant flows to Canada have increasingly become concentrated in the largest cities (MacDonald, 2004; Sweetman, 2004). In an increasingly specialized knowledge economy, flows of highly skilled immigrants are regionally and sectorally selective (Guellec & Cervantes, 2001; also Hiebert, 2000a and 2000b). Immigrants may play an important role in innovation and in smoothing labour market adjustment in specific regions and sectors (Gertler, 2001; Harris, 2004; Boothby & Rainville, 2004). At the same time, many researchers, policy makers and advocates are raising concerns about the continued upward mobility of immigrants in the Canadian labour market, and in particular about the matching of highly skilled immigrants to appropriate employment opportunities (Frenette & Morissette, 2003; Gera, Laryea & Songsakul, 2004; Kazemipur & Halli, 2001). What then is the relationship between these drivers of innovation, international skilled labour mobility, and labour market outcomes in the Canadian context?

The sectoral and regional dimensions of this question are of particular importance to economic policy-making because the processes of innovation and learning, that underpin much contemporary hi-tech economic development, also tend to be geographically clustered (Wolfe, 2003). In part, the clustering effect is prevalent because innovation and learning depend on human beings in two inter-related ways. Innovation requires both a sufficient density of people with appropriate knowledge or human capital, and that these people interact in relationships that foster the transfer and transformation of existing knowledge into new processes and products (see Romer, 1992 and HRSDC, 2003). An emerging body of research has begun to recognize that highly skilled immigrants can play this dual role very effectively (Saxenian, 1999 and 2002). That is, they can be both a source of new ideas and knowledge, as well as a source of new relationships and connections.

This research draws upon debates in the fields of immigration and regional economic development. One irony of economic globalization is the increased relative importance of localized processes of learning and innovation as a source of economic growth (Vernon, 1979; Storper, 1997). Improvements in transportation and telecommunications technologies have allowed codified knowledge, standardized data and production systems, raw materials and other production inputs, and consumer products to be more ubiquitously available. These developments have rendered competition on the basis of cost a vulnerable development strategy. Instead, the ability of firms to grow increasingly depends upon their ability to engage in ongoing innovation (or learning), understood here as the creation of new ideas and the recombination or new application of existing ideas (Morgan, 1997; Maskell and Malmberg, 1999). This requirement is especially true in leading and exporting hi-tech industries.

Furthermore, the ability to innovate is founded on networks of firms, entrepreneurs and workers that share a common set of practices, experiences and tacit knowledge, and that are sustained through a series of institutionalized norms, social, economic and political relationships, and associations and organizations (Saxenian, 1994; Storper, 1997; Amin, 1999). Concepts such as “social capital” (Putnam, 1993; Lorenzen, 2005),

"the learning region" (Morgan, 1997), "clusters" (Porter, 1998), "regional innovation systems" (Wolfe, 2003) and "the creative class" (Florida, 2002) have been advanced to encapsulate aspects of this social architecture of innovation and to guide policy-making. Across this diverse literature, there is widespread agreement on the importance of innovation in today's economy, and on its geographically clustered nature.

A particular challenge faced by innovative hi-tech clusters in relatively small economies is that of connecting to external resources, finance, knowledge and markets (Gera, Gu & Lee, 1999; Parker, 2001; Wolfe, 2003). For example, Bathelt and Hecht (1990) showed that most hi-tech firms in Canada's Technology Triangle (Kitchener-Waterloo-Guelph) rely on markets outside the region. It is this challenge of connecting to the outside world that is of particular importance in scholarly and policy debates about immigration.

What happens when immigrants settle in a local labour market? A simple supply and demand framework would suggest that an increase in supply of labour would, other things being equal, result in lower wages, negatively affecting both immigrants and natives. However, in his seminal analysis, Card (1990) showed that the sudden influx of large numbers of relatively unskilled Cuban immigrants to Miami as a result of the Mariel boatlift did not have significant impacts on the city's less-skilled residents. This finding has found wide support across several empirical studies in a variety of contexts (see Borjas, 1994), and it has become accepted that immigration has relatively little impact on the labour market outcomes for locals. In a Canadian study, Laryea (1998) found that foreign-born labour had an overall complementary effect on the wages of Canadian-born workers, although in some sectors (excluding hi-tech), foreign-born workers may have replaced locals.

The precise nature of the mechanism(s) by which absorption occurs remains unclear. One explanation is that an influx of workers with particular skill characteristics will shift the industrial and exporting mix of an economy towards these skill characteristics; another is that influx of immigrants leads to local outmigration. In a recent paper, Lewis (2004) offers an intriguing explanation which rests on the notion that production technologies may vary from place to place according to local factor endowments and path-dependent trajectories of industrial development. Support for the assertion about regional variations in technology enjoys wide support in the economic geography literature, and has previously been noted in a study of the Canadian manufacturing sector (see Rigby and Haydamack, 1998; also Rigby and Essletzbichler, 2006). Lewis shows that locals did not leave and that industrial mix did not change in Miami following the boatlift; in other words, Miami did not become more specialized as an exporter of low-skill content products and services. Instead, using micro-data from an annual survey of manufacturers he traces a form of intra-sector production technology adjustment. In comparison to other cities, industries within Miami became more labour-intensive, and computer use at work was also lower.

Saxenian's work focusing on high-skilled immigrants in Silicon Valley's technology sectors suggests another explanation for the observed easy absorption of immigrants, namely that immigrants contribute to regional economic growth by fostering international connections trade, knowledge and technological interactions (see Saxenian, 1999 and 2002). Saxenian (1999) showed that although Chinese and Indian-born immigrants in Silicon Valley do face considerable barriers to upward occupational mobility, they did not earn less than their native-born counterparts. These findings on earnings and relative occupational immobility are supported by Tang (1993) and Fernandez (1998). The

response of some immigrants to such barriers has been to engage in hi-tech entrepreneurial activities.

Saxenian's (2002) subsequent work has traced the local and transnational networks formed by these immigrant entrepreneurs. These networks have been instrumental both in sustaining innovation within the Silicon Valley 'cluster', and in creating linkages to various external sites of production, innovation and marketing. We already know that immigrant men to Canada are more likely than natives to be self-employed (Li, 2001; Frennette, 2002); to what extent is this occurring in particular hi-tech clusters?

Of course, it can not simply be deduced that the experiences of high-skilled workers in Silicon Valley will be repeated elsewhere. Nevertheless, arguments similar to Saxenian's have been made in Canada; for example, Head and Ries (1998) showed that immigration raises bilateral trade (see also Gertler, 2001). In summary, this line of research suggests a far more complex picture that recognizes the range of possible labour market situations for highly skilled immigrants, and the potentially crucial role they may play in sustaining innovation in particular hi-tech clusters.

Unfortunately these positive findings are accompanied by some more negative observations. Despite Canada's long record of successfully accepting and accommodating immigrants from a variety of backgrounds, scholars and policy-makers have recently become aware of some serious barriers to the upward mobility of immigrants (see Frenette and Morissette, 2003; Reitz, 2001; Sweetman, 2004). Bauder (2003) argues that non-recognition of foreign credentials and experience of immigrants by professional associations and employers leads to their active exclusion from the upper segments of the labour market. The devaluation and under-utilization of immigrant's experience and skills are also noted in recent reports of the Institute for Competitiveness and Prosperity (ICP, 2003) and Human Resources and Skills Development Canada (HRSDC, 2003).

Using data from the Survey of Labour and Income Dynamics for 1993, Hum and Simpson (1999) showed that immigrants who are members of visible minority groups receive lower wage offers than do comparable natives (other than native-born black men, who also receive lower wage offers). This observation is related to the wider concern about declining fortunes of immigrants, or more precisely, to the declining likelihood that immigrant wages will converge with those of comparable native-born workers (for recent reviews, see Hum and Simpson (2004) and Picot (2004)).

In public policy discourse, particular concerns have been raised about the lack of recognition of lack of recognition of education and certification (see Albiom, Finnie and Meng (2005)), the discounting of foreign experience and barriers to assimilation of immigrants that are older, visible minorities and non-English first language speakers (see Aydemir and Skuterud, 2005; Schaafsma and Sweetman, 2001; Anisef, Sweet and Frempong, 2003).

The concerns about the recognition of foreign skills and experience are closely related to the changing nature of the economy, and in this sense trends in the hi-tech sector may be a harbinger of future economy-wide trends. Several authors have noted the increasingly contingent or flexible nature of the employment in the hi-tech economic sectors (see Benner, 2002), and similar trends have been noted in the Canadian labour market (Cranford, Vosko and Zukewich, 2003). Concerns have been raised about the

relatively poor record of incorporating marginalized local residents in the hi-tech sector, giving rise to calls for the development of 'just clusters' (see Torjman and Leviten-Reid, 2003).

Reitz (2005) argues that in order to understand the declining earnings of immigrants relative to others, one needs to take account of the particular importance placed on certification of skills and experience in the knowledge economy, as well as the flexible dynamics of emerging (hi-tech) industries. In other words, while all new entrants to the knowledge economy face the same challenges, recent cohorts of immigrants in particular face barriers to the recognition of previous experience and skills that act against the convergence of employment and income. We find support for this assertion in our empirical analysis.

Lastly, in a recent paper, Warman and Worswick (2004) show that the difference between immigrant and native-born earnings vary across the eight largest cities in Canada. Their results suggest that immigrants to the largest CMAs "experience a lower level of immigrant economic integration" (p62) than do immigrants to Canada overall. And, because immigrants overwhelming favour these large city destinations that have higher than average earnings levels, analysis of the integration of immigrants that ignores geographic differences may underestimate the gap between immigrants and native-born earnings. Unfortunately these suggestive results do not control for differences in education and other individual characteristics. We present preliminary findings examining this question in the paper.

The literature we have reviewed here has addressed the intersection of hi-tech economic activity, geographic clustering, immigration, and labour market outcomes. We have raised the prospect that highly skilled immigrants may be situated in a hi-tech cluster in a variety of different ways. Immigrants may fill critical skills shortages, provide linkages to external resources and markets, or engage in entrepreneurial activity. However, the employment of immigrants may lead to lower wages or allow employers to implement strategies of increased labour market flexibility. While none of these labour market situations are mutually exclusive in a given place, they do imply very different social welfare outcomes and suggest the need for differentiated immigration, training and related policy responses. This research will begin by asking whether immigrants are situated differently in the labour market in the various Canadian hi-tech clusters, and then begin to seek causal explanations for the observed patterns.

THE GEOGRAPHY OF HI-TECH IMMIGRANT EMPLOYMENT IN CANADA

In this section we investigate the geography of immigrant employment in the hi-tech sector. We know that hi-tech economic activity tends to cluster in a highly localized fashion in urban centers, and that immigrants to Canada also concentrate in a small number of major urban centers. What is the relationship between these two widely accepted stylized facts about Canada's economic geography? Where are immigrants employed in the hi-tech sector clustered? Does this geographic distribution follow the overall geographic distribution of hi-tech activity and/or the geographic distribution of overall immigrant settlement?

The geography of immigrant hi-tech employment is to a large extent a reflection of overall trends in the Canadian urban space-economy. Immigrants employed in the hi-tech sector are settling and finding employment in the same highly selective fashion, that is, in the largest urban centers as are all other immigrants. Hi-tech immigrants also appear to have experienced the same relative earnings declines as other immigrants. The geography of hi-tech immigrant employment thus appears to be closely related to overall urban economic growth trends.

In coming to this conclusion, we have analysed customized census tabulations on the employment of immigrants in the hi-tech sector in the 43 largest CMAs/CAs, for the period 1991-2001.[2] Our definition of the hi-tech sector consists of sixteen 3-digit sub-sectors in the Standard Industrial Classification, including aircraft, communication, electronic, business and scientific equipment, bio-medical, telecommunications, electrical wholesales, employment agencies, computer, engineering, scientific and business services, and film (for full details, see Table A1). We examine growth rates, a series of employment specialization indices, and earnings differences. Appendix A contains notes on this data source, including full definitions of the specialization indices (LQ1, LQ3 etc) used. In this section, we also present preliminary wage equations analysis of the earnings of immigrants using confidential census micro-data.[3]

The employment specialization indices we use are all based on location quotients (for a standard source, see Bendavid-Val, 1991). The location quotient is a simple and widely used method for determining whether a region (i.e. CMA/CA) or social group (i.e. immigrants) is more or less specialized in employment in a particular economic sector, relative to some larger category (i.e. relative to all regions, or all workers). A location quotient or employment specialization index score greater than 1 indicates over-representation or relative specialization. We use the following indices:

[2] We began with a Census Custom Tabulation of the 50 largest cities in Canada, but excluded the seven CAs with 100 or fewer hi-tech immigrants in any census period since 1991. The excluded CAs are: Cape Breton, Chicoutimi–Jonquière, Drummondville, Medicine Hat, North Bay, Saint-Jean-sur-Richelieu, and Trois-Rivières.

[3] Due to delays in remotely accessing Population Census micro-data through the Southwestern Ontario Research Data Center and Statistics Canada, this analysis is incomplete at the time of writing.

- Basic specialization index (LQ1): Greater than 1 means that the hi-tech sector employment is over-represented in this place relative to the proportion of hi-tech sector employment in the economy overall.
- Adjusted hi-tech specialization index (LQ1A): the basic hi-tech specialization index (LQ1) is multiplied by the percentage of national employment in that sector (i.e. by a number between 0 and 100).
- Immigrant in city specialized in hi-tech index (LQ3): Greater than 1 means that immigrants are over-represented in the hi-tech sector in that place relative to all immigrant employment in that place.
- Immigrant Specialization in City Index (LQ4): Greater than 1 means that immigrant employment is over-represented in the city relative to immigrant employment of all the country.
- Immigrant in hi-tech specialized in city index (LQ5): Greater than 1 means that there is an over representation of immigrant employed in the hi-tech sector relative to the concentration of immigrants population in the hi-tech sector of all places.

We have organized our findings in a series of stylized factual statements, followed by a multivariate analysis of the determinants of immigrant hi-tech employment growth. In the final sub-section, we examine the earnings differential between immigrants and native-born in the hi-tech sector.

IMMIGRANTS, HI-TECH ACTIVITY AND LARGE CITIES

First*, immigrants to Canada are over-represented in the largest cities*. This has been established in analyses of successive population censuses (Hiebert, 2000; see also Guellec & Cervantes, 2001) and is confirmed in our data.

Table 1 shows the dominance of the largest cities as immigrant destinations.[4] The six largest cities in terms of population and employment also contain the most employed immigrants. In 2001, these cities accounted for 43.5% of the Canadian population, 44.9% of all employment, and 74.1% of immigrant employment. The three largest cities, Toronto, Montreal and Vancouver, alone were home to over three-fifths of all employed immigrants.

Over the 1990s, the relationship between immigration and Canada' largest cities became stronger. We examined the correlation between city size (total employment) and the concentration of employed immigrants (LQ4; see Table 2). We found that the correlation increased from 0.624 in 1991, to 0.666 in 1996, to 0.709 in 2001. The tendency for immigrants to settle in the largest Canadian cities is strong and intensifying.

[4] McDonald (2004) provides evidence of even further geographic selectivity within the major centers of immigrants settling into ethnic enclaves, but we do not examine these intra-metropolitan dynamics here.

Table 1: Hi-tech and Immigrant Employment in Canadian Cities, 2001

City	Total Population	Total Employment	Total Immigrant Employment	Total hi-tech employment	Total immigrant hi-tech employment
Canada	30,007,094	16,961,080	3,441,145	1,664,790	466,340
Abbotsford	147,370	80,515	20,205	4,240	1,015
Barrie	148,480	85,460	10,675	7,350	1,045
Belleville	87,395	47,105	4,265	3,850	455
Brantford	86,417	47,285	6,875	3,665	510
Calgary	951,395	609,885	140,860	89,765	22,265
Chatham-Kent	107,709	60,285	5,605	2,060	175
Chilliwack	69,776	35,635	5,225	1,350	245
Edmonton	937,845	573,505	113,090	54,295	11,300
Fredericton	81,346	49,890	3,105	4,620	375
Greater Sudbury	155,601	83,445	5,065	5,260	330
Guelph	117,344	71,385	15,050	6,020	1,130
Halifax	359,183	210,895	16,195	24,370	2,030
Hamilton	662,401	368,280	89,005	31,045	7,715
Kamloops	86,491	49,520	5,175	2,420	245
Kawartha Lakes	69,179	36,060	2,635	1,710	190
Kelowna	147,739	79,995	10,325	5,705	710
Kingston	146,838	82,320	10,390	5,085	925
Kitchener	414,284	248,310	58,375	24,220	6,100
Lethbridge	67,374	40,025	4,425	1,760	245
London	432,451	246,495	47,820	19,810	3,605
Moncton	117,727	70,015	2,310	6,935	215
Montréal	3,426,350	1,902,300	375,085	285,425	60,465
Nanaimo	85,664	45,010	7,015	2,700	515
Oshawa	296,298	170,450	29,225	17,410	3,165
Ottawa - Hull	1,063,664	631,535	121,700	114,620	32,405
Peterborough	102,423	54,515	4,700	3,545	365
Prince George	85,035	51,135	5,550	2,755	235
Québec	682,757	386,595	12,435	32,890	1,480
Red Deer	67,707	43,020	4,085	2,490	160
Regina	192,800	113,870	8,945	9,820	745
Saint John	122,678	66,565	2,805	7,735	110
Sarnia	88,331	48,060	5,850	3,245	410
Saskatoon	225,927	132,360	10,955	9,050	815
Sault Ste. Marie	78,908	40,545	3,880	1,995	145
Sherbrooke	153,811	85,010	4,170	6,175	455
St. Catharines - Niagara	377,009	205,830	34,985	13,235	2,325
St. John's	172,918	96,480	3,345	8,890	355
Thunder Bay	121,986	67,100	6,705	3,390	295
Toronto	4,682,897	2,741,935	1,340,190	427,145	214,730
Vancouver	1,986,965	1,148,260	458,150	143,910	57,735
Victoria	311,902	179,255	33,120	15,715	3,410
Windsor	307,877	169,230	37,440	10,600	3,240
Winnipeg	671,274	393,035	72,885	34,260	6,315

Source: Statistics Canada, Custom Tabulation.

Second*, the largest cities in Canada are centers of hi-tech activity*. The correlation between city size and all hi-tech employment in 2001 was 0.681.[5] Depending on which indicator is used, as many as fourteen cities can be described as 'hi-tech cities' having significant concentrations of hi-tech employment.

In nine cities, the basic hi-tech specialization index (LQ1) was greater than 1 in 2001 (see Table 2). This means that in Toronto, Montreal, Ottawa, Vancouver, Calgary, Halifax, Saint John, Moncton, and Oshawa, employed residents were to be found in the hi-tech sector at a rate higher than the national average. However when we take the overall size of hi-tech employment into account, smaller cities such as Oshawa, Moncton and Saint John drop out as hi-tech centers. There were over 20,000 employed in the hi-tech sector in eleven cities in 2001: Toronto, Montreal, Ottawa, Vancouver, Calgary, Edmonton, Winnipeg, Halifax, Quebec, Hamilton, and Kitchener. The adjusted location quotient (LQ1A) attempts to capture both size and specialization dimensions (see Table 2 and Appendix A). By this measure, some twelve cities emerge as significant centers of hi-tech employment, namely Toronto, Montreal, Ottawa, Vancouver, Calgary, Edmonton, Winnipeg, Halifax, Quebec, Hamilton, Kitchener, and Oshawa.

Hi-tech employment growth between 1991 and 2001 in nine of these twelve cities was above the national hi-tech employment growth rate of 61.1% (see Table 3). Winnipeg, the city with the lowest hi-tech employment growth rate of the twelve, experienced hi-tech employment growth of 29 percent over the decade.

All of the hi-tech cities are associated with concentrations in specific hi-tech sub-sectors (see Table 4). However, concentrations of employment in all 12 hi-tech sub-sectors exist in Montreal and Toronto, in 8 sub-sectors in Vancouver, but in no more than 3 each in the other nine cities. With the exception of the *Office, store and business machines* and *Telecommunication* industries, these hi-tech sub-sectors experienced strong growth over the 1990s. In 2001, the hi-tech sector accounted for almost one-tenth of all employment (see Table 4).

Third, *immigrants are over-represented in the hi-tech sector*. Over one-quarter (28%) of those employed in the hi-tech sector in 2001 were immigrants, although immigrants only account for one-fifth (20.3%) of all employed in Canada.

Immigrants appear to be playing an increasingly important role in the hi-tech economy; the proportion of all hi-tech employment taken by immigrants was up from 24% in 1991. Immigrant hi-tech employment had a growth rate of 85% over the 1990s (compared to a 9.4% growth in employment overall and 15% growth in immigrants employed, and 61% growth in hi-tech overall; see Table 3).

The proportion of hi-tech employment taken by immigrants increased most dramatically in the *Communications and electronic equipment*, and *Office, store and business machine* sub-sectors, but declined in the *Aircraft* sub-sector (see Table 5).

[5] We also examined the relationship between city size and hi-tech employment concentration using the tech-pole index, and in so doing replicated the results reported by Gertler et al (2002). The correlation between city size and the tech-pole LQ1 index is 0.669. Using the adjusted location quotient (LQ1A), which adjusts for total hi-tech employment in the city, we get the same high r-square reported by Gertler et al (2002).

Table 2: Employment specialization indices, 2001

City	Basic hi-tech specialization index (LQ1)	Adjusted hi-tech specialization index (LQ1A)	Immigrant specialized in city index (LQ4)	Immigrant in city specialized in hi-tech index (LQ3)	Immigrant in hi-tech specialized in city index (LQ5)
Abbotsford	0.54	0.14	1.24	0.95	0.37
Barrie	0.88	0.39	0.62	1.14	0.72
Belleville	0.83	0.19	0.45	1.31	0.79
Brantford	0.79	0.17	0.72	0.96	0.55
Calgary	1.5	8.09	1.14	1.07	1.17
Chatham-Kent	0.35	0.04	0.46	0.91	0.23
Chilliwack	0.39	0.03	0.72	1.24	0.35
Edmonton	0.97	3.15	0.97	1.06	0.74
Fredericton	0.94	0.26	0.31	1.30	0.89
Greater Sudbury	0.64	0.2	0.30	1.03	0.48
Guelph	0.86	0.31	1.04	0.89	0.55
Halifax	1.18	1.72	0.38	1.09	0.92
Hamilton	0.86	1.6	1.19	1.03	0.64
Kamloops	0.5	0.07	0.52	0.97	0.51
Kawartha Lakes	0.48	0.05	0.36	1.52	0.53
Kelowna	0.73	0.25	0.64	0.96	0.35
Kingston	0.63	0.19	0.62	1.44	0.66
Kitchener	0.99	1.45	1.16	1.07	0.77
Lethbridge	0.45	0.05	0.54	1.26	0.41
London	0.82	0.97	0.96	0.94	0.56
Moncton	1.01	0.42	0.16	0.94	0.69
Montréal	1.53	26.21	0.97	1.07	1.19
Nanaimo	0.61	0.1	0.77	1.22	0.54
Oshawa	1.04	1.09	0.85	1.06	0.80
Ottawa - Hull	1.85	12.73	0.95	1.47	1.96
Peterborough	0.66	0.14	0.42	1.19	0.57
Prince George	0.55	0.09	0.53	0.79	0.33
Québec	0.87	1.71	0.16	1.40	0.88
Red Deer	0.59	0.09	0.47	0.68	0.29
Regina	0.88	0.52	0.39	0.97	0.61
Saint John	1.18	0.55	0.21	1.27	0.72
Sarnia	0.69	0.13	0.60	1.04	0.52
Saskatoon	0.7	0.38	0.41	1.09	0.55
Sault Ste. Marie	0.5	0.06	0.47	0.76	0.28
Sherbrooke	0.74	0.27	0.24	1.50	0.81
St. Catharines-Niagara	0.66	0.52	0.84	1.03	0.49
St. John's	0.94	0.5	0.17	1.15	0.78
Thunder Bay	0.52	0.11	0.49	0.87	0.32
Toronto	1.59	40.72	2.41	1.03	1.18
Vancouver	1.28	11.04	1.97	1.01	0.93
Victoria	0.89	0.84	0.91	1.17	0.76
Windsor	0.64	0.41	1.09	1.38	0.64
Winnipeg	0.89	1.83	0.91	0.99	0.64

Source: Authors analysis of Statistics Canada, Custom Tabulation.

Table 3: Employment Growth, 1991-2001 (percent)

City	Growth in all employment	Growth in all immigrant employment	Growth in hi-tech employment	Growth in immigrant hi-tech employment
Canada	9.4	15.3	61.1	85.8
Abbotsford	32.6	45.9	93.6	138.8
Barrie	49.3	33.0	86.5	60.8
Belleville	-3.3	-9.1	23.8	46.8
Brantford	5.6	-3.4	87.5	79.0
Calgary	28.5	26.7	93.5	120.3
Chatham-Kent	-2.6	-23.9	46.1	40.0
Chilliwack	22.7	9.7	70.9	63.3
Edmonton	12.2	4.8	47.0	51.5
Fredericton	11.8	-1.6	78.0	29.3
Greater Sudbury	-8.0	-31.8	60.9	34.7
Guelph	19.8	12.1	57.0	28.4
Halifax	7.5	7.1	63.8	60.5
Hamilton	6.6	-1.9	50.6	48.8
Kamloops	15.6	-8.7	40.7	40.0
Kawartha Lakes	8.7	-10.7	30.0	18.8
Kelowna	33.2	19.6	103.0	132.8
Kingston	2.9	-14.6	28.2	36.0
Kitchener	15.6	10.5	68.1	75.8
Lethbridge	14.2	-17.8	-6.4	-9.3
London	4.7	-2.3	37.6	23.9
Moncton	16.2	1.1	137.5	72.0
Montréal	5.7	9.7	65.5	88.3
Nanaimo	15.4	17.8	48.4	53.7
Oshawa	21.2	3.0	74.1	45.9
Ottawa - Hull	10.7	25.3	85.0	138.9
Peterborough	2.6	-8.3	6.9	-15.1
Prince George	6.6	-20.3	27.8	2.2
Québec	5.0	30.0	68.3	171.6
Red Deer	23.4	15.9	79.8	23.1
Regina	0.7	-15.3	9.8	23.1
Saint John	8.6	-16.5	80.9	-12.0
Sarnia	-6.4	-30.2	14.7	-34.4
Saskatoon	7.7	-5.8	28.9	48.2
Sault Ste. Marie	-10.3	-32.8	30.8	20.8
Sherbrooke	10.2	26.9	53.6	127.5
St. Catharines - Niagara	2.0	-12.5	27.0	-0.4
St. John's	0.6	-11.0	58.0	44.9
Thunder Bay	-6.6	-29.7	17.9	-11.9
Toronto	15.0	23.9	61.7	87.6
Vancouver	19.1	37.7	72.4	109.6
Victoria	9.4	0.8	55.5	70.1
Windsor	15.3	14.4	65.2	154.1
Winnipeg	1.9	-5.3	29.2	28.5

Source: Authors analysis of Statistics Canada, Custom Tabulation.

Table 4: Hi-tech sub-sector clusters and employment

Sub-sector description	Cities with significant employment concentrations	Employment growth, 1991-2001	Percent of all Canadian Employment, 2001
Aircraft and aircraft parts industry	Montreal, Winnipeg, Toronto	27.1%	0.4%
Office, store and business machine industries	Toronto, Kitchener, Ottawa, Vancouver, Hamilton, Oshawa	-24.1%	0.1%
Scientific and professional equipment industries	Toronto, Quebec, Montreal	43.6%	0.2%
Management consulting services & Other business services	Toronto, Montreal, Vancouver	54.6%	2.1%
Employment agencies and personnel suppliers	Toronto, Montreal	91.0%	0.6%
Communication and other electronic equipment industries	Ottawa, Montreal, Toronto	97.7%	0.6%
Architectural, engineering and other scientific and technical services	Calgary, Toronto, Montreal, Vancouver	44.4%	1.5%
Electrical and Electronic machinery, equipment and Supplies, Wholesale & Other Machinery, Wholesale	Toronto, Montreal, Vancouver	57.3%	1.1%
Pharmaceutical and Medicine Industry & Medical and other health Laboratories.	Montreal, Toronto, Vancouver, Edmonton	15.7%	0.4%
Computer and related services	Toronto, Ottawa, Montreal, Vancouver	210.5%	2.0%
Motion picture, audio and video production and distribution	Toronto, Vancouver, Montreal, Halifax	108.4%	0.3%
Telecommunication Carriers Industry & other telecommunication industries	Montreal, Toronto, Vancouver	-7.2%	0.8%
All hi-tech	Toronto, Montreal, Ottawa, Vancouver, Calgary, Edmonton, Winnipeg, Halifax, Quebec, Hamilton, Kitchener, Oshawa	61.1%	9.8%

Source: Authors analysis of Statistics Canada, Custom Tabulation.

Table 5: Immigrants as a percentage of total employment

	1991	2001	Change in percentage immigrant
All sectors	19.2%	20.3%	+1.1
All high-tech	24.3%	28.0%	+3.7
Aircraft and aircraft parts industry	34.3%	26.8%	-7.5
Communication and other electronic equipment industries	30.2%	38.0%	+7.8
Office, store and business machine industries	33.2%	50.2%	+17.0
Scientific and professional equipment industries	32.8%	32.5%	-0.3
Telecommunication Carriers Industry & other telecommunication industries	13.8%	19.2%	+5.4
Electrical and Electronic machinery, Equipment and Supplies, Wholesale & Other Machinery, Wholesale	22.0%	24.8%	+2.8
Employment agencies and personnel suppliers	22.2%	30.1%	+7.9
Computer and related services	26.3%	32.6%	+6.3
Architectural, engineering and other scientific and technical services	29.2%	28.8%	-0.4
Management consulting services & Other business services	22.4%	24.2%	+1.8
Motion picture, audio and video production and distribution	19.2%	20.5%	+1.3
Pharmaceutical and Medicine Industry & Medical and other Health Laboratories	27.5%	29.8%	+2.3

Source: Authors analysis of Statistics Canada, Custom Tabulation.

As one might expect given these three stylized facts*, immigrants in hi-tech employment are over-represented in the largest hi-tech cities*. While two-thirds (67%) of hi-tech employment is found in the six largest cities, 85.5% of immigrants employed in the hi-tech sector reside there. The correlation between hi-tech specialization (LQ1) and immigrant specialization (LQ4) is statistically significant at 0.501 (see Table 2).

Due to immigrant settlement being so highly concentrated in a few large cities, only 4 cities employed immigrants in the hi-tech sector at a rate higher than their employment in the hi-tech sector overall LQ5 (Toronto, Montreal, Ottawa, and Calgary). However, in only 14 of the 43, and only 2 of the 12 hi-tech cities (Oshawa and Winnipeg), are immigrants under-represented in the hi-tech sector compared to the other sectors within the city (see LQ3, Table 2).

In summary, the employment of immigrants in the hi-tech sector in Canada is highly concentrated in the main urban centers. In the following analyses we examine this geographic distribution in a multivariate format, first in a cluster analysis and then through linear regression.

MULTIVARIATE DETERMINANTS OF IMMIGRANT HI-TECH EMPLOYMENT

A cluster analysis allows us to determine whether there are groups of cities which share common characteristics with respect to the employment of immigrants in the hi-tech sector. The following variables were used to group the 43 largest cities:

- LQ1, accounting for the extent to which the hi-tech sector is locally concentrated;
- LQ4, accounting for the extent to which immigrants are concentrated in the city;
- LQ5, accounting for the extent to which immigrants in the hi-tech sector are concentrated in the city; and
- LQ3, accounting for the extent to which immigrants in the city are concentrated in the hi-tech sector.

We present the results in Table 6 for the grouping of cities using 2001 data for the “all hi-tech” aggregated sector. [6] We also clustered cities using various combinations of 1991 and 2001 data, for the “all hi-tech” and “tech-pole” aggregated sectors (see Table A1). The results of each analysis were essentially the same. Each cluster analysis identified the big 5 cities, and a second tier of cities divided into those with hi-tech specialization, other mid-sized cities, and smaller cities without much hi-tech activity or immigrant presence. The striking point about this analysis is that we can depict a great deal about the overall urban geography of Canada’s major and mid-sized cities, simply by examining the characteristics of hi-tech immigrant employment.

[6] We completed this analysis in SPSS, using the Ward’s cluster method, with z-score standardization. We produced a dendrogram, visually inspected it and identified the groups. We followed this with a discriminant analysis to verify how well the cities had been grouped.

Table 6:
Cluster analysis of cities based on characteristics of employment of hi-tech immigrants

Cluster	CMA/CAs	LQ1: Hi-tech specialization	LQ4: immigrant specialization	LQ5: hi-tech immigrant specialization	LQ3: immigrants within city specialized in hi-tech	Geographic characteristics of cities
Big 5 cities (5)	Calgary, Montréal, Ottawa, Toronto, Vancouver	High	High	High	Above average	Major metropolitan areas of 1 million plus population.
Hi-tech cities (10)	Abbotsford, Barrie, Edmonton, Guelph, Hamilton, Kitchener, London, Oshawa, Victoria, Winnipeg	Above average	Above average	Average	Below average	Metropolitan-edge, major 401 corridor and major provincial capitals, typically of 100,000 plus population.
Mid-sized cities (14)	Belleville, Chilliwack, Fredericton, Halifax, Kawartha Lakes, Kingston, Lethbridge, Nanaimo, Peterborough, Québec, Saint John, Sherbrooke, St. John's, Windsor	Low	Low	Average	High	Diverse group of mid-sized cities.
Smaller cities (14)	Brantford, Chatham-Kent, Greater Sudbury, Kamloops, Kelowna, Moncton, Prince George, Red Deer, Regina, Sarnia, Saskatoon, Sault Ste. Marie, St. Catharines – Niagara, Thunder Bay	Low	Low	Low	Low	Typically smaller and more isolated mid-sized cities.

Source: Authors analysis of Statistics Canada, Custom Tabulation.

What happened in these groups of cities over the 1990s? Table 7 contains five indicators of the growth characteristics of the city clusters from 1991-2001. There is clear evidence that the biggest cities extended their advantage with higher than average overall employment growth, hi-tech employment growth, overall immigrant growth, and hi-tech immigrant growth. The hi-tech cities generally held their relative position, while the mid-sized and smaller cities all experienced stagnant or negative trends.

Table 7: Employment and Immigrant growth characteristics of city clusters, 1991-2001

Cluster	All employment growth	All immigrant growth	All hi-tech growth	All hi-tech immigrant growth	2001 hi-tech earnings difference
Big 5 cities (5)	Well above average	Almost 25%	Well above average	Well above average	Immigrants earn less
Hi-tech cities (10)	Well above average	About 10%	Above average	Above average	Immigrants earn same
Mid-sized cities (14)	Below average	Flat	Below average	Below average	Immigrants earn more
Smaller cities (14)	Well below average	Decline	Below average	Below average	Immigrants earn more

Source: Authors analysis of Statistics Canada, Custom Tabulation.

There are some anomalies that warrant further investigation; for example, in smaller and mid-sized cities immigrants in the hi-tech sector maintained their above or at average earnings. Further analysis of census micro-data may reveal whether employers in these cities pay a premium to attract skilled immigrants, or whether this may simply be an artifact of decline. In other words, if these mid-sized and smaller cities are not attracting new cohorts of immigrants, and new cohorts are experiencing declining economic integration, then we would expect the relative earnings of immigrants in these cities to remain constant or rise.

In the final analysis presented in this sub-section, we examine the determinants of hi-tech immigrant employment growth from 1991 to 2001 using multivariate linear regression. Regression results are presented in Table 8. We control for regional variation using dummy variables for major Canadian regions (Ontario is omitted), and for industrial structure using eight factor scores extracted using principle components analysis.[7] The core findings are consistent whether we include or exclude the control variables (compare Columns A through D in Table 8).

As one would expect, immigrant hi-tech employment growth is positively associated with overall city growth, overall hi-tech growth, and overall immigrant growth. Apart from overall growth, what else explains which Canadian cities are attracting hi-tech immigrants?

The only other significant factor is intriguing; the 1991 *Immigrant in city specialized in hi-tech index* (LQ3) is negatively correlated with subsequent immigrant hi-tech employment growth. This finding is robust to alternative specifications of the regression analysis. It implies that places in which immigrants were relatively under-represented in hi-tech sector employment relative to their employment within the city as a whole in 1991, experienced a greater increase in immigrant employment in the hi-tech sector over the subsequent decade, holding overall growth and other factors equal. This suggests something of a convergence process across Canadian cities in the 1990s, with the concentration of immigrants within the hi-tech sector within cities moving towards the national average. However, this 'convergence' is relative to the overall unevenness in hi-tech immigrant employment growth rates; hence the process identified here adds further weight to the finding that the largest cities are extending their dominance as destinations for hi-tech immigrants, as well as for immigrants in general.

In this section we have used a series of specialization indices to establish that immigrants in hi-tech employment are concentrated in the largest cities, along with other immigrants and along with Canada's hi-tech economic activity. There are also strong indications that this concentration intensified over the 1990s. The cluster analysis confirmed that the distribution of immigrant hi-tech employment essentially describes the

[7] The eight factor scores indicating industrial structure were extracted using principal component analysis with varimax rotation from 1991 census employment counts in 55 industry groups (defined by one or more 2-digit SIC group). We omitted seven unclearly defined or ubiquitous industry groups, namely Other services, Miscellaneous Wholesale (Farm, Petroleum, Other), Membership Organizations, Personal and household service, Other retail stores, General retail merchandising and Other Utilities. In order to control for size variations, we used the sectoral proportion of total employment. Twelve components with eigen values over 1 were extracted, of which eight were deemed sufficiently well defined for inclusion in further analysis, namely (1) Light Manufacturing, (2) Business Services, (3) Forestry, lumber and wood, (4) Heavy Manufacturing, (5) Tourism, (6) Housing, (7) Agriculture, and (8) Food and beverage.

Canadian urban space-economy, while the regression analysis showed the strong relationship between hi-tech immigrant employment growth, and overall city growth.

Table 8:
Determinants of immigrant hi-tech employment growth in 43 Canadian cities, 1991-2001

	A	B	C	D
	Unstandardized coefficient (std. error)			
(Constant)	0.571 (0.937)	0.723 (0.789)	1.005 (0.712)	0.970 (0.514)
Dummy for Maritime Province	0.265 (0.539)	-	-0.104 (0.337)	-
Dummy for Quebec	0.798 (0.620)	-	0.198 (0.405)	-
Dummy for Prairie Province	-0.159 (0.314)	-	-0.269 (0.253)	-
Dummy for Western Province	0.135 (0.464)	-	0.014 (0.234)	-
Factor scores:				
Light manufacturing	-0.210 (0.188)	-0.091 (0.127)	-	-
Business services	-0.278 (0.209)	-0.300 (0.183)	-	-
Forestry-wood products	-0.110 (0.124)	-0.056 (0.080)	-	-
Heavy manufacturing	-0.014 (0.110)	-0.086 (0.096)	-	-
Tourism	0.027 (0.123)	0.027 (0.095)	-	-
Housing	0.065 (0.138)	0.035 (0.095)	-	-
Agriculture	0.068 (0.117)	0.037 (0.108)	-	-
Food and Beverage	0.010 (0.122)	0.050 (0.097)	-	-
1991 Immigrant Specialization in City Index (LQ4)	-0.110 (0.356)	-0.190 (0.292)	-0.378 (0.282)	-0.318 (0.200)
1991 Basic hi-tech specialization index (LQ1)	1.032 (0.693)	0.887 (0.673)	0.275 (0.356)	0.098 (0.284)
1991 Immigrant in city specialized in hi-tech index (LQ3)	-1.943 (0.649) **	-1.779 (0.514) **	-1.406 (0.468) **	-1.271 (0.380) **
1991-2001 City employment growth %	-0.028 (0.013) *	-0.039 (0.012) **	-0.030 (0.012) *	-0.037 (0.010) **
1991-2001 All hi-tech employment growth %	0.012 (0.005) *	0.014 (0.004) **	0.012 (0.004) **	0.013 (0.003) **
1991-2001 Total immigrant employment growth %	0.036 (0.010) **	0.043 (0.007) **	0.038 (0.009) **	0.042 (0.006) **
Adjusted r-square	0.716	0.723	0.732	0.783

* Indicates significance at 5%

** Indicates significance at 1%

Source: Authors analysis of Customized Census Tabulations for 43 CMAs.

There are however many questions which a broad overview analysis of census tabulations cannot address, specifically (1) the conditions of employment, especially earnings, controlling for multivariate differences, and (2) the processes of new immigrant absorption in the hi-tech sector. We turn to the latter question in the next section, whereas the former question regarding the conditions of employment of immigrants in the hi-tech sector will be addressed next.

EARNINGS DIFFERENCES BETWEEN IMMIGRANTS AND NATIVE-BORN IN THE HI-TECH SECTOR

Immigrants in hi-tech employment used to enjoy an earnings advantage over the native-born working in the same sector, but this difference evaporated over the decade of the 1990s. The first row of Table 9 shows that whereas in 1990 (as reported in the 1991 Census) immigrants in hi-tech employment enjoyed higher earnings than the native-born in hi-tech employment, the difference had evaporated by 2000. This change in the unadjusted differences in earnings between immigrants and the native-born in hi-tech employment replicates what has been observed in comparisons between immigrants and the native-born in the economy overall (see literature review above).

Geography is also clearly present in this change; during 1990, in 30 of the 43 cities, average earnings of immigrants in hi-tech employment were significantly above those of the native-born in hi-tech employment, and in only 5 cities were earnings of immigrants significantly below those of the native-born. By 2000, earnings of hi-tech immigrants were significantly below those of the native-born in 15 cities. The switch was most dramatic in the largest cities. During 1990, Toronto's immigrants employed in the hi-tech sector earned over $3,000 less per year than the native-born; by 2000, the gap was $10,000 per year. In all the next five largest cities, whereas immigrants' earning exceeded those of the native-born in 1990, the situation had reversed by 2000.

It is important to understand that the data presented in Table 9 simply compares the earnings of immigrants and native-born hi-tech workers. One possible explanation for the observed difference between immigrants and the native-born is that the individual characteristics of these groups differ, and are changing. To account for this possibility, we used confidential census micro-data and a wage equation regression framework to control for demographic and human capital characteristics of individuals. In the analysis that follows (see Tables 10-18 and related text), we show that the patterns observed in the 'unadjusted' earnings data are still visible even when we control for demographic and human capital differences.

Another possible source of the observed difference is that in some cities, immigrants may be represented in some hi-tech sub-sectors in different proportions than the native-born. We would then observe earnings differences between immigrants and the native-born if there are earnings differences between these sub-sectors. We do not examine this possibility in the analysis presented here; further work will cast further light on this issue.

Table 9: Difference in annual earnings of hi-tech immigrants vs natives

Geography / City	Difference in 1990		Difference in 2000	
Canada	$3,462	*	-$230	
Abbotsford	$4,161	*	-$779	*
Barrie	-$443		$5,041	*
Belleville	$9,510	*	$16,793	*
Brantford	$2,055		$2,412	*
Calgary	$3,062	*	-$3,981	*
Chatham-Kent	-$748		-$1,888	*
Chilliwack	$760		-$2,103	*
Edmonton	$207	*	-$727	*
Fredericton	$1,010		$6,546	*
Greater Sudbury	$3,556	*	$7,117	*
Guelph	$3,240	*	$4,466	*
Halifax	$10,614	*	-$224	*
Hamilton	$6,887	*	$1,639	*
Kamloops	$2,408		$9,972	*
Kawartha Lakes	$6,845	*	$1,702	*
Kelowna	-$1,392		-$3,641	*
Kingston	$2,461	*	$10,449	*
Kitchener	$2,625	*	-$3,086	*
Lethbridge	$910		-$2,411	*
London	$5,915	*	$784	*
Moncton	$16,978	*	$1,570	*
Montréal	$3,391	*	-$2,040	*
Nanaimo	$4,792	*	$6,048	*
Oshawa	$10,885	*	$2,942	*
Ottawa - Hull	$4,337	*	-$1,828	*
Peterborough	$5,698	*	$8,057	*
Prince George	$10,569	*	$4,295	*
Québec	-$4,037	*	$4,181	*
Red Deer	$3,989	*	-$3,648	*
Regina	$2,095	*	$1,639	*
Saint John	-$2,051	*	$10,892	*
Sarnia	$9,336	*	$16,282	*
Saskatoon	$11,627	*	$8,019	*
Sault Ste. Marie	$25,502	*	$28,297	*
Sherbrooke	-$1,107	*	$385	*
St. Catharines - Niagara	$10,769	*	$4,523	*
St. John's	$15,507	*	$12,785	*
Thunder Bay	$9,716	*	$15,630	*
Toronto	-$3,116	*	-$10,938	*
Vancouver	$1,794	*	-$5,788	*
Victoria	$4,435	*	$3,440	*
Windsor	$6,257	*	$1,900	*
Winnipeg	-$890	*	-$3,272	*

* Difference significant at the 95% level
Source: Statistics Canada, Custom Tabulation.

To examine whether demographic and human capital characteristics of individuals explain the observed differences and changes in earnings of immigrants relative to native-born hi-tech workers, we use a standard wage equation framework, where:

$$ln\$ = \alpha + \beta_1 Demog + \beta_2 Location + \beta_3 Hitech + \beta_4 Immigrant + \Phi Hitech*Immigrant + \varepsilon,$$ where

- *ln$* is the log of annual earnings (sum of wages, salaries and non-farm self-employment income), log of annual wages and salaries, log of annual non-farm self-employment income, or log of weekly wages and salaries, in the year prior to the census (i.e. 1990/1995/2000);

- *Demog* is a vector of variables controlling for experience (years in the Canadian labour market in quadratic form)[8], sex, years of education, marital status, visible minority status, aboriginal status, internal migrant status, non-permanent resident status, and part-time employment status;

- *Location* is a series of dummy variables that account for the individual effect of geographical (city[9]) differences in labour markets;

- *Hitech* is a dummy variable indicating employment in a hi-tech sub-sector or occupation[10];

- *Immigrant* is a dummy variable indicating immigrant status; and

- *Hitech*Immigrant* is a dummy variable indicating an individual who is an immigrant working in the hi-tech sector, and hence Φ is the main coefficient of interest.

We include only those individuals who had been in the labour force since January 1st in the year before the Census (i.e. for the 1991 data, those who have been in the labour force since January 1st, 1990). We also exclude all those who were attending school on a full-time basis. Finally we also excluded very high (above $500,000 / year or $10,000 / week) and very low (below $500 / year or $10 / week) earnings, income or wages and salaries.

Descriptive statistics for all variables used in the analysis are provided in Appendix B. Note that the universe for the descriptive statistics includes all Canadians in the labour force (employed, self-employed or unemployed) and not in full-time schooling, in the year prior to the Census. Those with very high or low earnings, income or wages and salaries are not excluded in the descriptive statistics.

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[8] We calculate "years in the Canadian labour market" using the standard Mincerian experience calculation (age minus 6 minus years of education), except for immigrants for whom it is the lesser of years since immigration and Mincerian experience. We use years in the Canadian labour market as an indicator of experience rather than age because previous findings have indicated that immigrants to Canada are increasingly unlikely to be rewarded for pre-immigration experience. However, note that our findings in the second section using the LSIC raise questions about whether this finding holds true for immigrants in the hi-tech sector. We could not include both age and "years in the Canadian labour market" in the same regression because of collinearity. Using age (quadratic form) alone changes the size, but not the sign of the coefficients.

[9] The inclusion of regional dummy variables (for the Maritimes, Quebec, Prairies, British Columbia and the North) does not change the results.

[10] For the regression analysis, we define hi-tech status as including those working in one of the hi-tech sub-sector as defined in Table 4, or as working in a hi-tech occupation as defined in Appendix E.

The key findings of this analysis for 1990 for all Canada are (see Table 11):

- Determinants of total earnings, self-employment income and wages and salaries are as expected; experience, marriage, education, internal migration and hi-tech sector employment are all correlated with higher earnings, while female, visible minority, aboriginal, part-time and immigrant status are correlated with lower earnings.

- Determinants of income for those in self-employment appear to be somewhat different than the determinants of those earning wages and salaries. The self-employed do not appear to receive any income benefit from internal migration; likewise self-employed immigrants receive a larger income penalty when compared to those who are employed by someone else. Self-employment in the hi-tech sector is also correlated with lower wages.

- Surprisingly, we find that immigrant workers overall did not, in 1990, receive lower weekly wages than non-immigrants. This surprising finding could be explained by our use of city-level controls or years in the Canadian labour force as an indicator of experience, and/or the admittedly noisy nature of the weekly wages variable as derived from the Census.

- Hi-tech immigrants earn between 1 and 3% less than comparable native workers.

How have these general determinants of earnings, income and wages changed over the decade of the 1990s? In Tables 12 and 13 we duplicate the regressions for 1995 and 2000 earnings, income and wages respectively. These regressions reveal some interesting trends over the decade such as the narrowing difference between men and women, and the widening difference between visible minorities and other Canadians. We focus here on the evolution of just three coefficients:

- Consistent with findings in other studies, we find that the overall immigrant earnings / income / wage penalty increased over the decade, with most of the deterioration occurring between 1990 and 1995. The immigrant penalty increased from between 0-4% to between 2-5%.

- By almost all measures, the earnings and wage premium for those working (but not self-employed) in a hi-tech sector or occupation increased over the decade by almost all measures. The hi-tech premium increased from between 11-14% to about 15%. An important question for analysis of the 2006 Census will be whether the 2000 premium survived the dot-com / telecommunications bust of the early years of the current decade.

- There is evidence that the hi-tech immigrant earnings penalty actually narrowed over the decade. For annual wages and salaries, the penalty narrowed from 3% to 1%, while for weekly wages and salaries a 1% penalty in 1990 and 1995 became a 1% premium in 2000.

In summary, across all of Canada and holding other things equal, immigrants do earn significantly less than non-immigrants, and this trend has intensified over the last decade. More positively, in the hi-tech sector the gap is smaller and may be declining.

Table 10:
Determinants of earnings and wages of immigrants in hi-tech sector, Canada, 1990

	Ln Earnings			Ln Annual self-employment income			Ln Annual Wages and Salaries			Ln Weekly Wages and Salaries		
	B	Std. Error		B	Std. Error		B	Std. Error		B	Std. Error	
(Constant)	8.282	0.003	**	8.374	0.021	**	8.251	0.003	**	5.014	0.003	**
Years In Canadian Labour Force	0.047	0.000	**	0.028	0.001	**	0.048	0.000	**	0.034	0.000	**
Years In Canadian Labour Force Squared	-0.001	0.000	**	0.000	0.000	**	-0.001	0.000	**	-0.001	0.000	**
Dummy For Female	-0.376	0.001	**	-0.508	0.007	**	-0.375	0.001	**	-0.366	0.001	**
Dummy For Married	0.184	0.001	**	0.150	0.008	**	0.187	0.001	**	0.139	0.001	**
Years Of Education	0.084	0.000	**	0.078	0.001	**	0.086	0.000	**	0.065	0.000	**
Dummy For Visible Minority	-0.116	0.002	**	-0.043	0.013	**	-0.121	0.002	**	-0.098	0.002	**
Dummy For Aboriginal	-0.337	0.002	**	-0.218	0.020	**	-0.348	0.002	**	-0.134	0.002	**
Dummy For Internal Migrant	0.022	0.001	**	-0.006	0.008		0.022	0.001	**	0.036	0.001	**
Dummy For Non Permanent Resident	-0.427	0.006	**	-0.101	0.054		-0.435	0.006	**	-0.297	0.005	**
Dummy For Mostly Parttime Last Year	-0.912	0.001	**	-0.814	0.009	**	-0.928	0.002	**	-0.644	0.001	**
Hi-Tech By Sector or Occupation	0.136	0.002	**	-0.053	0.013	**	0.139	0.002	**	0.113	0.002	**
Hi Tech Immigrant By Sector or Occupation	-0.034	0.004	**	-0.006	0.024		-0.032	0.004	**	-0.014	0.004	**
Dummy For Immigrant	-0.019	0.002	**	-0.041	0.009	**	-0.013	0.002	**	0.001	0.001	
N	2,581,850			111,857			2,343,444			1,504,601		
Adjusted R-square	0.337			0.203			0.357			0.293		

Dummy variables for CMA / CA of residence were included in all regressions but are not reported here.

* Indicates significance at 5%

** Indicates significance at 1%

Source: Authors analysis of Census micro-data.

Table 11:
Determinants of earnings and wages of immigrants in hi-tech sector, Canada, 1995

	Ln Earnings			Ln Annual self-employment income			Ln Annual Wages and Salaries			Ln Weekly Wages and Salaries		
	B	Std. Error		B	Std. Error		B	Std. Error		B	Std. Error	
(Constant)	8.220	0.003	**	8.294	0.020	**	8.173	0.003	**	4.918	0.003	**
Years In Canadian Labour Force	0.054	0.000	**	0.033	0.001	**	0.057	0.000	**	0.041	0.000	**
Years In Canadian Labour Force Squared	-0.001	0.000	**	-0.001	0.000	**	-0.001	0.000	**	-0.001	0.000	**
Dummy For Female	-0.289	0.001	**	-0.424	0.006	**	-0.294	0.001	**	-0.306	0.001	**
Dummy For Married	0.187	0.001	**	0.137	0.007	**	0.195	0.001	**	0.143	0.001	**
Years Of Education	0.085	0.000	**	0.074	0.001	**	0.089	0.000	**	0.070	0.000	**
Dummy For Visible Minority	-0.135	0.002	**	-0.044	0.012	**	-0.145	0.002	**	-0.118	0.002	**
Dummy For Aboriginal	-0.373	0.003	**	-0.183	0.020	**	-0.396	0.003	**	-0.127	0.002	**
Dummy For Internal Migrant	-0.008	0.001	**	-0.038	0.008	**	-0.008	0.001	**	0.012	0.001	**
Dummy For Non Permanent Resident	-0.420	0.008	**	-0.201	0.055	**	-0.431	0.008	**	-0.272	0.007	**
Dummy For Mostly Parttime Last Year	-0.953	0.001	**	-0.830	0.007	**	-0.960	0.001	**	-0.691	0.001	**
Hi-Tech By Sector or Occupation	0.125	0.002	**	0.007	0.010		0.127	0.002	**	0.119	0.002	**
Hi Tech Immigrant By Sector or Occupation	-0.031	0.004	**	-0.030	0.020		-0.031	0.004	**	-0.010	0.004	**
Dummy For Immigrant	-0.039	0.002	**	-0.054	0.008	**	-0.025	0.002	**	-0.013	0.002	**
N	2,613,294			148,814			2,317,837			2,319,745		
Adjusted R-square	0.334			0.194			0.362			0.304		

Dummy variables for CMA / CA of residence were included in all regressions but are not reported here.

* Indicates significance at 5%

** Indicates significance at 1%

Source: Authors analysis of Census micro-data.

Table 12:
Determinants of earnings and wages of immigrants in hi-tech sector, Canada, 2000

	Ln Earnings			Ln Annual self-employment income			Ln Annual Wages and Salaries			Ln Weekly Wages and Salaries		
	B	Std. Error		B	Std. Error		B	Std. Error		B	Std. Error	
(Constant)	8.372	0.003	**	8.556	0.019	**	8.322	0.003	**	4.960	0.003	**
Years In Canadian Labour Force	0.053	0.000	**	0.031	0.001	**	0.055	0.000	**	0.039	0.000	**
Years In Canadian Labour Force Squared	-0.001	0.000	**	-0.001	0.000	**	-0.001	0.000	**	-0.001	0.000	**
Dummy For Female	-0.283	0.001	**	-0.415	0.006	**	-0.287	0.001	**	-0.288	0.001	**
Dummy For Married	0.178	0.001	**	0.122	0.006	**	0.184	0.001	**	0.143	0.001	**
Years Of Education	0.085	0.000	**	0.068	0.001	**	0.089	0.000	**	0.074	0.000	**
Dummy For Visible Minority	-0.154	0.002	**	-0.098	0.011	**	-0.160	0.002	**	-0.130	0.002	**
Dummy For Aboriginal	-0.330	0.002	**	-0.079	0.018	**	-0.354	0.002	**	-0.123	0.002	**
Dummy For Internal Migrant	0.022	0.001	**	-0.001	0.008		0.020	0.001	**	0.033	0.001	**
Dummy For Non Permanent Resident	-0.329	0.007	**	-0.011	0.050		-0.350	0.007	**	-0.161	0.006	**
Dummy For Mostly Parttime Last Year	-0.978	0.001	**	-0.834	0.007	**	-0.986	0.001	**	-0.704	0.001	**
Hi-Tech By Sector or Occupation	0.149	0.002	**	0.054	0.009	**	0.152	0.002	**	0.147	0.002	**
Hi Tech Immigrant By Sector or Occupation	-0.016	0.003	**	-0.069	0.018	**	-0.016	0.004	**	0.014	0.003	**
Dummy For Immigrant	-0.042	0.002	**	-0.051	0.008	**	-0.030	0.002	**	-0.018	0.002	**
N	2,793,615			161,764			2,481,900			2,478,441		
Adjusted R-square	0.339			0.192			0.366			0.297		

Dummy variables for CMA / CA of residence were included in all regressions but are not reported here.

* Indicates significance at 5%

** Indicates significance at 1%

Source: Authors analysis of Census micro-data.

The overall trends revealed to this point mask some important differences in the labour market performance of hi-tech immigrants in different cities. We next compared hi-tech immigrant performance across the major cities, for total annual earnings (Table 13-15) and for weekly wages and salaries (Table 16-18).

Key findings for 1990 are:

- The immigrant earnings and wage penalty does vary from city to city. In 1990, immigrants in Toronto earned 3.2% less than non-immigrants, while those in Montreal earned 5.9% less (see Table 13). The weekly wage and salary penalty was similarly distributed, but is smaller (see Table 16).

- Likewise, the hi-tech sector annual earnings and weekly wage premium varies from city to city, presumably reflecting differences in the presence of employment alternatives outside the hi-tech sector as well as the specific local sub-sectoral composition of the hi-tech sector.

- Most interesting is that while the hi-tech immigrants receive a premium in some cities, they receive a penalty in others. This is most visible in terms of weekly wages; whereas hi-tech immigrants in Calgary, Montreal and Vancouver received between 3.6 and 4.6% higher weekly wages, in Toronto they received 1.9% less (see Table 16).

Over the course of the decade of the 1990s, the following trends are identified:

- The immigrant earnings and wage penalty increased in all cities, but was most noticeable in the largest city. In Toronto, the annual earnings penalty of immigrants increased from 3.2% in 1990 to 7% in 2000 (compare Tables 13 and 15). For weekly wages and salaries it increased from 0% to 4.6%. A substantial deterioration for immigrants is also noted in Vancouver.

- The hi-tech sector premium increased in all cities, but most dramatically in Ottawa, where hi-tech sector workers earned almost 22% more in 2000 (see Table 15).

- With respect to the hi-tech immigrant premium/penalty, the difference between Toronto and the other major cities persisted over the decade. In 2000, Toronto was still the only major city in which hi-tech immigrants received an annual earnings and weekly wage penalty (see Tables 15 and 18). In contrast, the premium for hi-tech immigrants in Ottawa increased substantially in the early 1990s. The desirability of Ottawa to hi-tech immigrants is confirmed in the analysis presented in the next section of the report.

In summary, this section has shown that there are geographic differences in the relative earnings of immigrants and native-born Canadians in hi-tech employment, even when we control for demographic and human capital differences. In particular, the Toronto labour market, despite whatever other advantages it may offer, does penalize immigrants relative to the native-born in the hi-tech sector.

Table 13:
Determinants of annual earnings of immigrants in hi-tech sector, selected cities, 1990

	Calgary			Montreal			Ottawa			Toronto			Vancouver		
	B	Std. Error		B	Std. Error		B	Std. Error		B	Std. Error		B	Std. Error	
(Constant)	8.291	0.019	**	8.480	0.008	**	8.359	0.015		8.828	0.007		8.656	0.013	
Years In Canadian Labour Force	0.055	0.001	**	0.047	0.000	**	0.052	0.001	**	0.048	0.000	**	0.051	0.001	**
Years In Canadian Labour Force Squared	-0.001	0.000	**	-0.001	0.000	**	-0.001	0.000	**	-0.001	0.000	**	-0.001	0.000	**
Dummy For Female	-0.346	0.006	**	-0.331	0.003	**	-0.286	0.005	**	-0.295	0.003	**	-0.323	0.004	**
Dummy For Married	0.186	0.007	**	0.169	0.003	**	0.160	0.005	**	0.164	0.003	**	0.191	0.004	**
Years Of Education	0.095	0.001	**	0.080	0.001	**	0.095	0.001	**	0.070	0.000	**	0.071	0.001	**
Dummy For Visible Minority	-0.106	0.011	**	-0.149	0.006	**	-0.148	0.011	**	-0.135	0.004	**	-0.113	0.006	**
Dummy For Aboriginal	-0.265	0.017	**	-0.084	0.012	**	-0.079	0.013	**	-0.160	0.012	**	-0.245	0.013	**
Dummy For Internal Migrant	-0.050	0.008	**	0.046	0.003	**	0.010	0.006		0.050	0.003	**	-0.007	0.005	
Dummy For Non Permanent Resident	-0.454	0.039	**	-0.499	0.015	**	-0.494	0.033	**	-0.432	0.009	**	-0.472	0.019	**
Dummy For Mostly Parttime Last Year	-0.957	0.009	**	-0.838	0.004	**	-1.057	0.008	**	-1.008	0.004	**	-0.928	0.006	**
Hi-Tech By Sector or Occupation	0.126	0.009	**	0.137	0.005	**	0.119	0.007	**	0.106	0.005	**	0.116	0.007	**
Hi Tech Immigrant By Sector or Occupation	0.022	0.020		0.050	0.011	**	0.007	0.016		-0.008	0.007		0.029	0.013	*
Dummy For Immigrant	-0.053	0.009	**	-0.059	0.005	**	-0.041	0.008	**	-0.032	0.003	**	-0.049	0.005	**
N	77,703			285,261			92,214			374,781			156,474		
Adjusted R-square	0.338			0.311			0.375			0.308			0.322		

Dependent variable is ln (annual wages and salaries and self-employment income).

* Indicates significance at 5%

** Indicates significance at 1%

Source: Authors analysis of Census micro-data.

Table 14:
Determinants of annual earnings of immigrants in hi-tech sector, selected cities, 1995

	Calgary			Montreal			Ottawa			Toronto			Vancouver		
	B	Std. Error		B	Std. Error		B	Std. Error		B	Std. Error		B	Std. Error	
(Constant)	8.237	0.020	**	8.399	0.009	**	8.293	0.017	**	8.651	0.008	**	8.565	0.014	**
Years In Canadian Labour Force	0.060	0.001	**	0.051	0.000	**	0.055	0.001	**	0.059	0.000	**	0.059	0.001	**
Years In Canadian Labour Force Squared	-0.001	0.000	**	-0.001	0.000	**	-0.001	0.000	**	-0.001	0.000	**	-0.001	0.000	**
Dummy For Female	-0.288	0.006	**	-0.243	0.003	**	-0.207	0.005	**	-0.206	0.003	**	-0.205	0.004	**
Dummy For Married	0.189	0.007	**	0.176	0.003	**	0.151	0.006	**	0.159	0.003	**	0.186	0.004	**
Years Of Education	0.096	0.001	**	0.082	0.001	**	0.097	0.001	**	0.075	0.001	**	0.076	0.001	**
Dummy For Visible Minority	-0.133	0.011	**	-0.154	0.007	**	-0.135	0.011	**	-0.142	0.004	**	-0.125	0.006	**
Dummy For Aboriginal	-0.317	0.024	**	-0.154	0.030	**	-0.112	0.025	**	-0.268	0.022	**	-0.337	0.016	**
Dummy For Internal Migrant	-0.068	0.008	**	0.021	0.004	**	-0.022	0.006	**	0.028	0.004	**	-0.023	0.005	**
Dummy For Non Permanent Resident	-0.190	0.045	**	-0.609	0.019	**	-0.577	0.042	**	-0.425	0.014	**	-0.463	0.022	**
Dummy For Mostly Parttime Last Year	-1.003	0.008	**	-0.870	0.004	**	-1.065	0.007	**	-1.040	0.004	**	-0.964	0.005	**
Hi-Tech By Sector or Occupation	0.133	0.009	**	0.159	0.005	**	0.137	0.007	**	0.095	0.005	**	0.111	0.007	**
Hi Tech Immigrant By Sector or Occupation	0.046	0.019	*	0.038	0.011	**	0.085	0.016	**	-0.009	0.007		0.006	0.012	
Dummy For Immigrant	-0.084	0.009	**	-0.087	0.005	**	-0.063	0.009	**	-0.066	0.004	**	-0.080	0.006	**
N	82,658			282,749			93,711			382,165			168,758		
Adjusted R-square	0.348			0.297			0.376			0.320			0.331		

Dependent variable is ln (annual wages and salaries and self-employment income).

* Indicates significance at 5%

** Indicates significance at 1%

Source: Authors analysis of Census micro-data.

Table 15:
Determinants of annual earnings of immigrants in hi-tech sector, selected cities, 2000

	Calgary			Montreal			Ottawa			Toronto			Vancouver		
	B	Std. Error		B	Std. Error		B	Std. Error		B	Std. Error		B	Std. Error	
(Constant)	8.408	0.018	**	8.544	0.009	**	8.326	0.017	**	8.820	0.008	**	8.701	0.013	**
Years In Canadian Labour Force	0.059	0.001	**	0.046	0.000	**	0.057	0.001	**	0.059	0.000	**	0.060	0.001	**
Years In Canadian Labour Force Squared	-0.001	0.000	**	-0.001	0.000	**	-0.001	0.000	**	-0.001	0.000	**	-0.001	0.000	**
Dummy For Female	-0.289	0.005	**	-0.242	0.003	**	-0.183	0.005	**	-0.227	0.003	**	-0.187	0.004	**
Dummy For Married	0.184	0.006	**	0.164	0.003	**	0.168	0.006	**	0.149	0.003	**	0.160	0.004	**
Years Of Education	0.098	0.001	**	0.087	0.001	**	0.102	0.001	**	0.074	0.000	**	0.075	0.001	**
Dummy For Visible Minority	-0.139	0.010	**	-0.188	0.006	**	-0.146	0.010	**	-0.161	0.003	**	-0.143	0.006	**
Dummy For Aboriginal	-0.281	0.018	**	-0.226	0.027	**	-0.130	0.022	**	-0.223	0.019	**	-0.313	0.015	**
Dummy For Internal Migrant	-0.021	0.007	**	0.030	0.004	**	-0.011	0.007		0.066	0.004	**	0.013	0.005	*
Dummy For Non Permanent Resident	-0.198	0.032	**	-0.425	0.018	**	-0.412	0.035	**	-0.357	0.014	**	-0.330	0.021	**
Dummy For Mostly Parttime Last Year	-1.040	0.008	**	-0.916	0.004	**	-1.071	0.008	**	-1.047	0.004	**	-0.975	0.005	**
Hi-Tech By Sector or Occupation	0.170	0.008	**	0.177	0.004	**	0.218	0.007	**	0.161	0.004	**	0.141	0.007	**
Hi Tech Immigrant By Sector or Occupation	0.005	0.016		0.032	0.010	**	0.063	0.014	**	-0.024	0.006	**	0.031	0.011	**
Dummy For Immigrant	-0.061	0.009	**	-0.076	0.005	**	-0.065	0.009	**	-0.070	0.003	**	-0.086	0.006	**
N	98,881			298,493			98,463			431,140			178,641		
Adjusted R-square	0.362			0.300			0.360			0.323			0.337		

Dependent variable is ln (annual wages and salaries and self-employment income).

* Indicates significance at 5%

** Indicates significance at 1%

Source: Authors analysis of Census micro-data.

Table 16:
Determinants of weekly wages of immigrants in hi-tech sector, selected cities, 1990

	Calgary			Montreal			Ottawa			Toronto			Vancouver		
	B	Std. Error		B	Std. Error		B	Std. Error		B	Std. Error		B	Std. Error	
(Constant)	4.805	0.017	**	5.032	0.007	**	4.820	0.013	**	5.291	0.007	**	5.250	0.012	**
Years In Canadian Labour Force	0.041	0.001	**	0.032	0.000	**	0.040	0.001	**	0.033	0.000	**	0.036	0.000	**
Years In Canadian Labour Force Squared	-0.001	0.000	**	0.000	0.000	**	-0.001	0.000	**	-0.001	0.000	**	-0.001	0.000	**
Dummy For Female	-0.322	0.005	**	-0.311	0.003	**	-0.260	0.004	**	-0.284	0.002	**	-0.312	0.004	**
Dummy For Married	0.157	0.006	**	0.125	0.003	**	0.128	0.005	**	0.135	0.003	**	0.147	0.004	**
Years Of Education	0.083	0.001	**	0.068	0.000	**	0.085	0.001	**	0.061	0.000	**	0.054	0.001	**
Dummy For Visible Minority	-0.080	0.010	**	-0.129	0.006	**	-0.131	0.009	**	-0.126	0.003	**	-0.084	0.006	**
Dummy For Aboriginal	-0.186	0.015	**	-0.052	0.010	**	-0.031	0.012	**	-0.103	0.011	**	-0.144	0.011	**
Dummy For Internal Migrant	-0.010	0.007		0.052	0.003	**	0.018	0.005	**	0.043	0.003	**	0.018	0.004	**
Dummy For Non Permanent Resident	-0.351	0.034	**	-0.358	0.013	**	-0.339	0.029	**	-0.297	0.008	**	-0.337	0.017	**
Dummy For Mostly Parttime Last Year	-0.670	0.008	**	-0.591	0.004	**	-0.751	0.007	**	-0.722	0.004	**	-0.630	0.005	**
Hi-Tech By Sector or Occupation	0.110	0.008	**	0.125	0.004	**	0.099	0.006	**	0.102	0.004	**	0.106	0.007	**
Hi Tech Immigrant By Sector or Occupation	0.042	0.018	*	0.036	0.010	**	0.017	0.014		-0.019	0.006	**	0.046	0.012	**
Dummy For Immigrant	-0.043	0.008	**	-0.018	0.004	**	-0.013	0.007		-0.004	0.003		-0.027	0.005	**
N	70,145			258,372			84,733			338,117			138,924		
Adjusted R-square	0.310			0.277			0.350			0.270			0.274		

Dependent variable is ln (weekly wages and salaries).

* Indicates significance at 5%

** Indicates significance at 1%

Source: Authors analysis of Census micro-data

Table 17:
Determinants of weekly wages of immigrants in hi-tech sector, selected cities, 1995

	Calgary			Montreal			Ottawa			Toronto			Vancouver		
	B	Std. Error		B	Std. Error		B	Std. Error		B	Std. Error		B	Std. Error	
(Constant)	4.702	0.018	**	4.945	0.008	**	4.756	0.015	**	5.125	0.007	**	5.152	0.012	**
Years In Canadian Labour Force	0.048	0.001	**	0.039	0.000	**	0.043	0.001	**	0.044	0.000	**	0.045	0.001	**
Years In Canadian Labour Force Squared	-0.001	0.000	**	-0.001	0.000	**	-0.001	0.000	**	-0.001	0.000	**	-0.001	0.000	**
Dummy For Female	-0.300	0.005	**	-0.251	0.003	**	-0.197	0.004	**	-0.209	0.002	**	-0.232	0.004	**
Dummy For Married	0.166	0.006	**	0.133	0.003	**	0.127	0.005	**	0.136	0.003	**	0.145	0.004	**
Years Of Education	0.087	0.001	**	0.071	0.001	**	0.088	0.001	**	0.067	0.000	**	0.062	0.001	**
Dummy For Visible Minority	-0.117	0.010	**	-0.141	0.006	**	-0.127	0.010	**	-0.129	0.003	**	-0.104	0.006	**
Dummy For Aboriginal	-0.181	0.022	**	-0.108	0.026	**	-0.054	0.022	*	-0.162	0.019	**	-0.187	0.014	**
Dummy For Internal Migrant	-0.022	0.007	**	0.032	0.003	**	-0.006	0.005		0.025	0.003	**	-0.007	0.004	
Dummy For Non Permanent Resident	-0.095	0.040	*	-0.409	0.017	**	-0.352	0.035	**	-0.291	0.013	**	-0.292	0.019	**
Dummy For Mostly Parttime Last Year	-0.729	0.007	**	-0.604	0.004	**	-0.777	0.006	**	-0.758	0.004	**	-0.665	0.005	**
Hi-Tech By Sector or Occupation	0.130	0.008	**	0.153	0.004	**	0.138	0.006	**	0.106	0.004	**	0.113	0.007	**
Hi Tech Immigrant By Sector or Occupation	0.036	0.017	*	0.054	0.010	**	0.059	0.014	**	-0.009	0.006		0.004	0.011	
Dummy For Immigrant	-0.047	0.008	**	-0.043	0.005	**	-0.028	0.008	**	-0.036	0.003	**	-0.038	0.005	**
N	72,010			253,078			83,940			335,506			145,026		
Adjusted R-square	0.342			0.270			0.376			0.295			0.294		

Dependent variable is ln (weekly wages and salaries).

* Indicates significance at 5%

** Indicates significance at 1%

Source: Authors analysis of Census micro-data

Table 18:
Determinants of weekly wages of immigrants in hi-tech sector, selected cities, 2000

	Calgary			Montreal			Ottawa			Toronto			Vancouver		
	B	Std. Error		B	Std. Error		B	Std. Error		B	Std. Error		B	Std. Error	
(Constant)	4.839	0.017	**	4.989	0.009	**	4.697	0.016	**	5.184	0.008	**	5.192	0.012	**
Years In Canadian Labour Force	0.046	0.001	**	0.034	0.000	**	0.043	0.001	**	0.042	0.000	**	0.044	0.001	**
Years In Canadian Labour Force Squared	-0.001	0.000	**	-0.001	0.000	**	-0.001	0.000	**	-0.001	0.000	**	-0.001	0.000	**
Dummy For Female	-0.283	0.005	**	-0.230	0.003	**	-0.162	0.005	**	-0.214	0.002	**	-0.191	0.004	**
Dummy For Married	0.168	0.005	**	0.128	0.003	**	0.138	0.005	**	0.136	0.003	**	0.135	0.004	**
Years Of Education	0.090	0.001	**	0.079	0.001	**	0.098	0.001	**	0.072	0.000	**	0.066	0.001	**
Dummy For Visible Minority	-0.116	0.009	**	-0.157	0.006	**	-0.123	0.009	**	-0.140	0.003	**	-0.119	0.005	**
Dummy For Aboriginal	-0.195	0.017	**	-0.178	0.024	**	-0.080	0.020	**	-0.175	0.017	**	-0.221	0.013	**
Dummy For Internal Migrant	-0.012	0.006		0.026	0.003	**	0.003	0.006		0.056	0.003	**	0.017	0.005	**
Dummy For Non Permanent Resident	-0.030	0.029		-0.253	0.017	**	-0.170	0.031	**	-0.195	0.012	**	-0.198	0.019	**
Dummy For Mostly Parttime Last Year	-0.727	0.007	**	-0.642	0.004	**	-0.766	0.007	**	-0.761	0.004	**	-0.679	0.005	**
Hi-Tech By Sector or Occupation	0.172	0.007	**	0.177	0.004	**	0.207	0.006	**	0.174	0.004	**	0.159	0.006	**
Hi Tech Immigrant By Sector or Occupation	0.031	0.015	*	0.049	0.009	**	0.095	0.013	**	-0.018	0.006	**	0.031	0.010	**
Dummy For Immigrant	-0.049	0.008	**	-0.043	0.005	**	-0.045	0.009	**	-0.046	0.003	**	-0.050	0.005	**
N	86,581			266,640			88,393			377,939			154,235		
Adjusted R-square	0.332			0.264			0.337			0.288			0.294		

Dependent variable is ln (weekly wages and salaries).

* Indicates significance at 5%

** Indicates significance at 1%

Source: Authors analysis of Census micro-data

EMPLOYMENT EXPERIENCES OF NEWLY ARRIVING HIGHLY SKILLED IMMIGRANTS IN CANADA'S HI-TECH CLUSTERS

In the previous section we confirmed that the geographic distribution of immigrants in hi-tech employment follows the geography of hi-tech clustering and general immigrant settlement; in Canada today, this is a big city phenomenon. We also showed that hi-tech immigrants tend to worse relative to native-born Canadians in the largest cities. However these results did not fully address the conditions of employment of immigrants. If it is true that recent institutional, social and economic changes, especially those found in the hi-tech sector, have created a labour market characterized by greater churning, flexibility and uncertainty, it is reasonable to assume that under these conditions there will be more of a premium on portable and certifiable skills, credentials and experience. These labour market conditions challenge all new labour market entrants, but especially newly arriving immigrants. In this section we examine the labour market absorption experiences of newly arriving immigrants in Canada's hi-tech clusters. We focus particularly on the experiences of those who reported having hi-tech experience, which we take to be an indicator of a highly skilled immigrant.

The data source for the analysis that follows is the first wave of the Longitudinal Survey of Immigrants to Canada (LSIC hereinafter), collected during 2001 and 2002 from immigrants, approximately six months after their landing in Canada. The survey is specifically designed to examine the initial labour market adjustment process of new immigrants to Canada. The LSIC data files contain data on 12,040 individual immigrant respondents, both in and out of the labour force. A separate Employment Module contains data on the 7,554 different jobs held by all the surveyed individuals since their arrival in Canada. Of these, 5,286 jobs were actually held by 5,023 different individuals at the survey date.

Data treatment involved various steps (full details of the data treatment are provided in Appendix C). First, we excluded respondents aged less than 18 or more than 50 years, providing an effective unweighted sample of 10,105 individuals and 4,664 current jobs. We then identified 'matched' jobs, where the immigrant was employed in a job matching their previous work experience, stated work preference or desired training. Next, we merged the LSIC Employment Module, which provides information on the characteristics of all jobs secured by immigrants, with the LSIC Master Microdata file, which provides information on the demographic, educational and previous work experiences of immigrants. This step involved allocating one dominant job to each immigrant who held more than one job at the survey date. This step was required for fewer than 5% (263) of cases. Finally, hi-tech industry sectors and occupations were identified which served as a basis for labelling an immigrant as hi-tech experienced or employed (for a full details of the sectors identified as hi tech, refer to Appendices D and E).

In what follows, we examine the demographic characteristics, immigration circumstances, and human capital attributes of respondents to the LSIC wave 1 interview, and employ logistic regression analysis to examine the factors determining their success in securing employment during the months immediately following their arrival in Canada.

DEMOGRAPHIC CHARACTERISTICS, IMMIGRATION CIRCUMSTANCES & HUMAN CAPITAL ATTRIBUTES OF THE SAMPLE POPULATION

In this section we present a profile of the population of recent immigrants as contained in the LSIC database. We are especially interested in immigrants employed in the hi-tech sector, and understanding what role previous hi-tech experience plays in the employment adjustment process – recall that the LSIC Wave 1 surveyed immigrants approximately 6 months after their arrival in Canada. Table 19 contains the demographic characteristics of the sample population most relevant to this research in a tabular form, together with their immigration circumstances and human capital attributes.

When we compare highly skilled immigrants to all other immigrants, we are referring to a sub-group of what is an already highly select population. Permanent immigrants to Canada share several characteristics, reflecting both which people are internationally mobile and how immigration regulations select from within the available group. Many immigrants are in their prime productive years with an average age of 33. Most immigrants (82.5%) have previous work experience and many have tertiary education; on average recent immigrants have over 16 years of education, which is equivalent to slightly more than a bachelor's degree. Approximately half (48.4%) of all immigrants are working within 6 months of arriving in Canada.

There are no significant differences between immigrants overall, immigrants in employment and those in hi-tech employment in terms of age, marital status, and immigration intentions (see Table 19). However, we note the following differences:

- Employed and hi-tech employed immigrants are more likely to be male.
- Employed and hi-tech employed immigrants are also more likely to have previously received instruction on one of the official languages.
- Employed and hi-tech employed immigrants are less likely to be members of visible minorities.
- Immigrants employed in the hi-tech sector are clustered in the Toronto CMA; however, while this city receives just under half (44.2%) of all immigrants, 90% of those who find work in the hi-tech sector live there.
- Immigrants employed in the hi-tech sector are more likely to have immigrated in the skilled category, and they are more likely to have immigrated for 'economic reasons'.
- Employed and hi-tech employed immigrants do possess more human capital, especially in the form of work experience.
- Immigrants in hi-tech employment are more likely to have had their previous work experience evaluated and accepted than all employed immigrants (53.5% vs 34.3% evaluated and accepted). This supports the notion that hi-tech employers are more concerned about previous work experience than other employers. Immigrants in hi-tech employment are only slightly less likely than all employed immigrants to have had their previous experience rejected by an employer (9.0% vs 10.3% rejection).

To further explore the significance of experience, we identify the following similarities and differences between those with and without hi-tech experience (see Table 19):

- Those with hi-tech experience are more likely to be male, and less likely to be members of a visible minority group; however they are not significantly older, or more likely to be married than those without hi-tech experience.
- Immigrants employed with hi-tech experience are more likely to settle in the Toronto CMA.
- Immigrants employed with hi-tech experience are more likely to have immigrated in the skilled category, and they are more likely to have immigrated for 'economic reasons'.
- Immigrants with hi-tech experience are significantly more likely to be in the labour force than those without such experience; hence the active employment and unemployment rates for immigrants with hi-tech experience are higher.
- Immigrants with hi-tech experience have a slightly higher overall level of education.
- Immigrants with hi-tech experience are also more likely to have professional and technical credentials.

How important are these demographic, immigration circumstances and human capital attributes in securing employment? In the following section we take up this question using logistic regression to model the likelihood that an immigrant will secure employment within six months of arriving in Canada. In Table 20 we present tabulations that focus further on the employment outcomes for immigrants with and without hi-tech experience. About one-third (31.1%) of employed immigrants have some hi-tech experience.

- Immigrants with hi-tech experience are more likely to have secured a matched job, that is a job which matches their previous experience, the field in which they desire to be trained or for which they indicated a preference at the time of immigration. They are even more likely to be in a matched, full-time job.
- Over 60% of the hi-tech jobs secured by immigrants are taken by those with prior hi-tech experience.
- Given their higher likelihood of securing matched and/or full-time employment, it is not surprising that immigrants with hi-tech experience were less likely to be in training at the time of the survey.
- Immigrants with hi-tech experience are also somewhat more likely to possess professional and/or technical credentials, to have tried to have those credentials accepted, and to have had them accepted by a Canadian employer.

In the lower panel of Table 20 we also present tabulations comparing the role hi-tech experience plays in securing a job that matches previous experience, desired training or job preference. There are indications here that hi-tech experience is highly sought after by employers, and that it may be rewarded with employment even though those with hi-tech experience may lack foreign professional credentials. While 31% of employed immigrants have hi-tech experience, 40% of immigrants in matched jobs have hi-tech experience. This is despite the fact that, among those with matched jobs, those with foreign hi-tech experience are less likely to have foreign credentials.

Our descriptive analysis of the characteristics and employment outcomes of newly arrived immigrants indicates that hi-tech experience may be highly desired by employers. In the following section we explore this notion in greater detail in a multivariate analysis.

Table 19: Tabular depiction of the sample population's demographic characteristics, immigration circumstances and human capital attributes

	All LSIC respondents*	Employed	HT Job*	HT experienced*	Non HT experienced*
Mean Age (Std. deviation)	32.9 (7.6)	32.7 (7.4)	32.8 (6.3)	33.6 (6.2)	32.7 (8.1)
Male	49.8%	60.4%	70.9%	67.2%	43.3%
Female	50.2%	39.6%	29.1%	32.8%	56.7%
Married	78.8%	76.5%	74.9%	78.9%	78.8%
Visible minority	79.9%	77.4%	71.3%	76.8%	81.1%
English/French – language of instruction	47.6%	55.3%	62.8%	48.7%	47.3%
CMA of residence #					
Calgary	4.2%	5.2%	4.7%	4.0%	4.3%
Vancouver	11.0%	9.7%	8.0%	11.2%	11.0%
Toronto	44.2%	47.0%	90.0%	50.5%	41.9%
Ottawa	3.5%	3.2%	4.3%	4.5%	3.1%
Montréal	11.7%	8.7%	9.9%	10.6%	12.1%
Immigration class:					
Family	20.5%	21.5%	9.1%	7.4%	25.4%
Skilled	67.3%	70.9%	88.0%	89.1%	59.1%
Business	5.2%	2.8%	1.1%	1.6%	6.6%
Refugee	5.8%	2.9%	0.7%	1.2%	7.5%
Other (provincial nominee, etc)	1.2%	1.9%	1.2%	0.7%	1.4%
Migrating for economic reasons	34.2%	38.5%	50.2%	45.1%	30.1%
Intention to permanently settle	90.8%	90.5%	89.0%	90.0%	91.0%
International exposure (lived in another country > 6mths)	27.7%	26.5%	32.5%	28.0%	27.5%
Current Employment status:					
Not in labour force	42.1%	†	†	29.7%	46.8%
Unemployed	9.4%	†	†	15.0%	7.4%
Working:	48.4%	100.0%	100.0%	55.3%	45.9%
Self employed	1.8%	3.7%	3.6%	1.9%	1.7%
Fulltime	38.5%	79.5%	88.3%	47.4%	35.2%
Part time	8.2%	16.8%	8.1%	5.9%	9.0%
Mean years of education, all respondents (Std. deviation) #	15.2 (3.2)	15.5 (3.1)	16.4 (2.5)	16.4 (2.2)	14.8 (3.3)
Mean years of education, those with higher education (Std. deviation) #	16.6 (2.1)	16.7 (2.2)	16.8 (2.0)	16.7 (1.9)	16.5 (2.1)
Currently in training	9.1%	6.6%	4.7%	7.3%	9.7%
Has previous work experience	82.5%	88.2%	96.4%	100.0%	75.9%
Previous work experienced accepted within Canada (not accepted)	21.6% (2.9%)	34.3% (3.9%)	53.5% (5.3%)	33.4% (3.6%)	17.2% (2.6%)
Possessing hi-tech experience	27.3%	31.1%	61.6%	100.0%	0.0%
Possessing professional /technical credential received outside Canada	16.2%	17.5%	19.0%	20.2%	14.7%
Sample n (for most variables, see #)	10,105	4,664	1,162	2,456	7,649
Percentage of all LSIC respondents	100.0%	48.4%	12.8%	27.3%	72.7%

** Accounting for respondents between the ages of 18-50.*
† Not accounted for since the population being analyzed is 'currently employed.
 # Largest sample n for CMA of residence is 9,158; largest sample n for mean years education is 10,038.
Source: Authors analysis of weighted LSIC data.

Table 20: Comparison of employment outcomes for immigrants with and without prior hi-tech experience

CATEGORY		Has Prior HT experience	Has No prior HT experience	Weighted n
All employed immigrants		*31.14%*	*68.86%*	67,592
Securing a matched job	Currently employed in a matched job	40.37%	59.63%	21,888
	Currently employed in an unmatched job	26.71%	73.29%	45,704
Securing a fulltime matched job	Employed fulltime in a matched job	43.18%	56.82%	19,271
	Employed part-time in a matched job	19.72%	80.28%	48,321
Securing a Hi tech job	Currently employed in a HT Job	61.58%	38.42%	17,794
	Currently employed in a non HT job	20.26%	79.74%	49,798
Currently in training	Currently in training	23.45%	76.55%	4,452
	Currently not in any training	31.68%	68.32%	63,141
Possession of professional /technical credential received outside Canada	Possesses professional credentials	34.82%	65.18%	11,816
	Does not possess professional credentials	30.34%	69.66%	55,777
Professional /technical credential received outside Canada and/or previous work accepted within Canada	Previous credential/experience accepted	42.72%	57.28%	23,188
	Previous credential/experience not accepted	34.17%	65.83%	14,723
	Previous credential/experience partially accepted	33.85%	66.15%	2,659
	Have not tried to get previous credential/experience accepted	22.96%	77.04%	13,513
	In the process of getting previous credential/experience accepted	41.01%	58.99%	4,140
	Has not looked for job requiring the acceptance of previous credential/experience	27.23%	72.77%	1,407
All immigrants employed in a matched job		*40.37%*	*59.63%*	21,888
Possession of professional /technical credential received outside Canada	Possesses professional credentials	37.95%	62.05%	3,874
	Does not possess professional credentials OR don't know	40.83%	59.17%	18,014
Professional /technical credential received outside Canada and/or previous work accepted within Canada	Previous credential/experience accepted	46.93%	53.07%	14,071
	Previous credential/experience not accepted	33.20%	66.80%	2,515
	Previous credential/experience partially accepted	36.85%	63.15%	1,053
	Have not tried to get previous credential/experience accepted	25.40%	74.60%	2,449
	In the process of getting previous credential/experience accepted	35.97%	64.03%	795
	Has not looked for job requiring the acceptance of previous credential/experience OR don't know	39.30%	60.70%	313

Note: Rows add to 100%.
Source: Authors analysis of LSIC

DETERMINANTS OF THE SUCCESS OF NEWLY ARRIVED IMMIGRANTS IN SECURING EMPLOYMENT

In order to examine the differential employment prospects of immigrants, with a specific focus on immigrants with hi-tech experience, interest or skills, we employ a logistic regression analysis. We model the probability of securing employment (variously defined) as a function of independent variables including demographic characteristics, immigration circumstances and human capital attributes. We also included various independent variables to differentiate immigrants with hi-tech experience; the coefficients on these variables are of central interest in this study.

The logistic regression model is specified thus:

$$\text{Log } [P(E)/P(\text{not } E)] = \alpha + \beta_1 X_1 + \ldots. + \beta_i X_i + \varepsilon,$$

where P(E) is the probability of being employed (as defined); P(not E) is the probability of not being employed; α is the intercept; and β_i is the change in the log odds ratio of being employed (E) for every unit of change in the independent variable X_i, with all other independent variables taken into account.

In the tables that follow we report the odds ratio (i.e. $\text{Exp}(\beta_i)$), which may be interpreted as the change in the odds ratio of an individual being employed for every unit increase in independent variable. Hence odds ratios greater than one indicate that an increase in the dependent variable will increase the probability of employment, while those less than one indicate a decreased probability of employment.

The dependent employment variables modeled here are chosen to indicate different degrees of 'job quality', as indicated by whether the job is permanent, and whether it is matched to previous work experience, education or aspiration. We also model the determinants of whether the job is in the hi-tech sector. Hence, each column in Table 22 corresponds to the following dependent variables:

A. Employed vs. all not employed
B. Employed Fulltime vs. all employed part-time
C. Employed in a matched job vs. all other employed
D. Employed fulltime in a matched job vs. all other employed
E. Employed in a hi-tech job vs. all other employed
F. Employed in a matched hi-tech job vs. all other employed
G. Employed fulltime in a matched hi-tech job vs. all other employed

In the discussion of the results presented in Table 22 that follows, we refer to column A, as indicating the *likelihood of being employed*, columns B-D as indicating the *likelihood of being employed in a quality job*, and columns E-G as indicating the *likelihood of being employed in the hi-tech sector*.

Because we include only those immigrants aged 18-50, and education and place of residence data are missing for some individuals, the largest effective sample for the dependent variable "employed" is 9,096. The largest effective sample for comparisons of employment quality (where the comparison group is all other employed immigrants) is 4,272. We use a standardized weight which is the individual survey weight divided by the average weight. The sum of standardized weights equals the unweighted sample size.

The independent variables used during the analysis can be broadly categorized in three sets: demographic characteristics, circumstances of immigration, and human capital attributes. As independent variables of the first set, we included standard demographic variables commonly used in wage equation and other labour market analyses: age in the quadratic form, and dummies for sex, marital status, and membership of a visible minority.

Three variables indicating the ability of the immigrant to use either or both of the official languages were available in the data files, namely language spoken at home, mother tongue, and language of instruction. We chose the variable, 'language of instruction' for the regression analysis, since this was deemed especially relevant for hi-tech employment. The acquisition, retention, dissemination and communication of the technical knowledge and information in one of the official languages is presumably (and apparently in the results) central in professional advancement of hi-tech fields.[11]

The next group of independent variables addressed the circumstances of immigration. These dummy variables indicated immigration class (with the skilled class omitted), whether the immigrant had any family and/or friends in Canada prior to immigration, whether they immigrated for economic reasons, whether they intended to settle permanently in Canada, whether they intended to enter the labour force upon arrival in Canada, and whether they had any international exposure prior to migration (defined as residence for at least 6 months in a country other than native country).

The final group of independent variables addressed the human capital attributes of the immigrants, specifically, years of education as well as dummy variables indicating whether they had obtained any education in Canada prior to immigration, whether they had been engaged in any voluntary work since arrival, previous work experience as well as whether they had obtained any work experience in Canada prior to migration, and last but most important, whether they possess any hi-tech experience.[12]

Table 21 provides a textual summary of the independent variables that we used in the logistic regressions. Table 22 presents the basic results of the logistic regression to identify the determinants of the odds of a newly arrived immigrant being employed (variously defined).

The coefficients on the demographic variables are as expected. Age does not significantly increase the likelihood of being employed, employed in a quality job or in the hi-tech sector. However, older immigrants are more likely to be employed full-time. Although age is an indicator of tenure and life cycle stage, both which would influence labour market attachment, the typical relationship between age and employment would not necessarily hold for the newly arrived. Over time, we would expect age to become more closely correlated with employment.

[11] Results of the regression using language of instruction in English or French were compared with the other indicators of ability in the official languages. Although there were no noticeable differences in the results obtained, the coefficient on language of instruction was marginally greater than those for other indicators of official language ability. All other variables retained the same sign and significance regardless of language ability indicator used.

[12] We also examined whether possessing a foreign professional and/or technical credential changed the likelihood of securing employment, and found that it did not. Further analysis of the determinants of the acceptance of foreign credentials may deliver useful insights.

Table 21: Broad identification of the *predictor* variables for the likelihood of securing employment in the first 6 months of immigration

BASIC DEMOGRAPHICS	• Age (18-50), marital status, membership to a visible minority group, • Knowledge of either or both of the official language (under the category of language of instruction), • CMA of residence, on securing employment during the first six months of landing in Canada (included in the analysis are the five major CMAs: Calgary, Vancouver, Toronto, Ottawa, and Montréal)
PRE IMMIGRATION CIRCUMSTANCES AND POST IMMIGRATION INTENTIONS	• The class of the immigrant – whether immigrant applied under family class, business class, skilled class, or as refugee. • Economic reason for migration: whether migration was driven by better job opportunities, business climate, etc. • Possession of friends and family in Canada • Intention to permanently settle in Canada • Intention to seek employment • Prior residence in Canada (work or study) • International exposure: any residence abroad (other than Canada) for more than 6 months.
HUMAN CAPITAL ATTRIBUTES	• Years of education, both in native country and if any in Canada. • Voluntary work experience since migration • Previous engagement in the labour force – either part-time or full-time, both in native country and if any in Canada. • Possession of hi-tech experience.

Female immigrants are significantly less likely than male immigrants to be employed, although they are not necessarily less likely to be employed in a matched job. Married immigrants are also less likely to be employed, but are no less likely to be in quality or hi-tech jobs. Visible minorities are significantly less likely to be employed, to be employed in quality jobs and hi-tech jobs. This finding is robust to all alternative specifications of the model. Equally robust and significant is the positive relationship between having previously received instruction in English and/or French and likelihood of being employed, at all or in quality or hi-tech jobs.

Immigrant likelihood of being employed within the first six months of arriving in Canada does appear to be affected by geography. The LSIC sample is large enough for us to report results for the five largest CMAs in comparison to all other locations in Canada. Calgary is the only city in which immigrants are more likely to be employed than those in the rest of Canada; immigrants in Vancouver, Ottawa and Montreal are less likely to be employed, while there is no statistical difference in the likelihood of being employed for immigrants in Toronto. This unsurprising pattern, given Toronto's dominance as a settlement site for immigrants and Calgary's recent robust growth, also holds for the likelihood of being in full-time employment. However, employed immigrants in Toronto (and in Montreal with respect to matched jobs) are less likely to be employed in matched and full-time matched jobs.

Conversely, when it comes to the likelihood of being employed in the hi-tech sector, the geographic concentration of employment opportunities in this sector in the largest cities becomes apparent; employed immigrants are more likely to be employed in the hi-tech sector in all the largest cities, significantly more so in Toronto, Montreal and Ottawa. Toronto and Ottawa locations also increase the likelihood that an immigrant will be employed in a matched (and matched full-time) job in the hi-tech sector. The large positive coefficient for Ottawa suggests that the hi-tech sector in this city is especially

good at creating full-time jobs for immigrants. These findings are consistent with results reported in the first section of this paper.

Table 22:
Determinants of the odds of newly arrived immigrants to Canada being employed

	A	B	C	D	E	F	G
	EMPLOYED	FULLTIME	MATCHED JOB	FULLTIME MATCHED	HT JOB	HT MATCHED	FULLTIME IN MATCHED HT
	Exp(B)	Exp(B)	Exp(B)	Exp(B)	Exp(B)	Exp(B)	Exp(B)
BASIC DEMOGRAPHICS							
Age	1.017	1.341 **	1.066	1.089	1.075	1.037	1.041
Age^2	1.000	0.996 **	0.999	0.999	0.998 *	0.999	0.999
Female	0.500 **	0.390 **	0.892	0.744 **	0.650 **	0.457 **	0.423 **
Married	0.758 **	1.041	1.001	1.027	0.947	0.961	1.031
Visible minority	0.729 **	0.774 *	0.416 **	0.393 **	0.643 **	0.557 **	0.543 **
Engl/Frch – lang of instruction	1.677 **	1.151	1.480 **	1.577 **	1.392 **	1.246 *	1.242 *
CMA of residence - Calgary	1.463 **	0.828	0.743	0.800	1.505 *	1.467	1.461
CMA of residence – Vancouver	0.784 **	0.801	0.762 *	0.770	1.383 *	1.538 *	1.521 *
CMA of residence – Toronto	0.903	1.028	0.746 **	0.774 *	1.922 **	1.777 **	1.807 **
CMA of residence – Ottawa	0.634 **	0.523 **	0.906	0.815	2.198 **	2.654 **	3.013 **
CMA of residence – Montréal	0.378 **	0.931	0.776	0.837	1.693 **	1.376	1.480 *
PRE IMMIGRATION CIRCUMSTANCES & POST IMMIGRATION INTENTIONS							
Immigration category - family	1.347 **	1.489 **	0.770 *	0.742 *	0.492 **	0.366 **	0.350 **
Immigration category - Business	0.565 **	0.925	2.245 **	2.319 **	0.424 **	0.205 **	0.226 **
Immigration category - refugee	0.365 **	0.731	0.256 **	0.218 **	0.230 **	0.012 *	0.000
Family / friends in Canada	1.236 **	1.168	0.851	0.864	0.769 *	0.803	0.888
Migrating for economic reasons	1.113 *	1.337 **	1.080	1.102	1.370 **	1.373 **	1.393 **
Intention to permanently settle	1.058	1.426 **	1.171	1.165	0.940	0.906	0.856
Intention to enter labour force	4.179 **	1.124	2.087 *	2.017 *	0.723	0.807	0.718
International exposure	0.846 **	0.813 *	1.854 **	1.766 **	1.257 **	1.358 **	1.428 **
HUMAN CAPITAL ATTRIBUTES							
Years of education (1-26)	0.979 *	0.961 *	1.045 **	1.033 *	1.070 **	1.089 **	1.083 **
Canadian education†,	1.721 **	0.698 *	2.326 **	1.818 **	0.704 *	0.742	0.744
Voluntary experience	0.603 **	0.525 **	0.967	0.923	1.353	1.255	1.240
Previous work experience	1.674 **	0.809	3.156 **	2.617 **	2.325 **	5.105 **	4.562 **
Canadian work experience†,	2.222 **	2.259 **	4.244 **	4.089 **	1.598 **	1.854 **	1.910 **
Hi-tech experience	1.010	1.706 **	1.381 **	1.599 **			
Constant	0.364 *	0.057 **	0.024 **	0.019 **	0.044 **	0.025 **	0.029 **
Nagelkerke R^2	0.185	0.121	0.212	0.214	0.164	0.215	0.217
-2log likelihood	11523.767	3879.041	4930.006	4640.889	4661.376	3752.882	3584.813
Sample N #	9,096	4,272	4,272	4,272	4,272	4,272	4,272

* Indicates significance at 5%

** Indicates significance at 1%

† obtained prior to migration

Standardized weight (=individual survey weight/average survey weight) has been used.

Source: Authors analysis of LSIC data.

With reference to the variables indicating immigration circumstances, we note that the influence of these variables changes as we move across the spectrum of 'employment quality'. Whereas immigrating under the family class may have a positive influence in an immigrant securing employment, or fulltime (unspecialized) employment, it ceases to be of importance, and even negatively influence the odds of being employed in a quality job, or a hi-tech job.

People immigrating under the business class have a higher likelihood of being engaged in matched and matched fulltime employment. This trend was expected as these immigrants most likely engaged in the management of business related activity prior to migration and established similar activities with the funds they brought along at the time of migration. However these immigrants are significantly less likely to be employed in the hi-tech sector.

Having family and friends in Canada prior to migration helps in securing employment. However, this factor is insignificant in securing quality (matched and/or full-time) or hi-tech employment. Having had prior international exposure helps a newly arrived immigrant in securing hi-tech and quality jobs (particularly 'matched' jobs). These immigrants may offer employers connections to external markets, knowledge and other scarce resources.

What is the role of human capital, and particularly experience, as a determinant of the likelihood of employment among newly arrived immigrants? In general terms our findings are consistent with the notion that immigrants face significant barriers to the recognition of their human capital. However, we also find that certain forms of previous work experience, especially pre-immigration Canadian work experience and hi-tech experience (obtained anywhere), is rewarded with increased likelihood of employment. There are also indications that education and experience are more strongly rewarded in securing employment in the hi-tech sector as compared to employment in other sectors.

A higher level of education is associated with a decreased likelihood of an immigrant being employed per se. This finding is consistent with the notion that more highly educated immigrants may face prolonged initial job searches because of information asymmetries, be they because of unrealistic expectations on the part of the immigrant or because Canadian employers fail to recognise foreign qualifications.[13] More education does however increase the likelihood of immigrants securing quality and hi-tech employment. In contrast, while pre-immigration Canadian education increases the likelihood of finding employment, especially matched employment, it does not increase the likelihood of finding hi-tech employment. Together these findings suggest that hi-tech employers reward foreign qualifications in a way that employers in other sectors do not.

Previous work experience, pre-immigration Canadian work experience and hi-tech work experience all increase the likelihood that an immigrant will be employed, but in differing ways. Hi-tech experience does not change the prospects of being employed per se, but immigrants with hi-tech experience are more likely to be engaged in jobs matching previous experience, skills, or stated interest, or jobs with a full time status. This result is especially robust as we walk along the spectrum of 'quality' of employment (compare columns B through D in Table 22). In other words, previous hi-tech experience or skills

[13] Although not reported in Table 13, we also examined whether possessing a foreign professional and/or technical credential changed the likelihood of securing employment, and found that it did not.

become more significant as the definition of what constitutes 'employment' becomes more tightly defined.

As with foreign education, we find evidence that hi-tech sector employers are able to recognise foreign experience more readily than other employers. While pre-immigration Canadian experience strongly increases the likelihood of being employed overall, and being in 'quality' employment, it is less strongly associated with hi-tech employment. Instead, the likelihood of hi-tech sector employment is more strongly related to work experience in general. These findings are also consistent with the notion that immigrants secure employment in the hi-tech sector as connectors to external networks, resources, knowledge and contacts.

HOW ROBUST ARE THE FINDINGS?

In this section we discuss three potential sources of bias to our core findings. The complex dynamics of a new immigrants' adjustment to life in Canada may give rise to expedient employment choices for various reasons, such as the need to generate income immediately or to undergo retraining in the short term while postponing looking for employment more suited to previous skills and experience. Likewise, some in the immigrant sample may not intend to settle permanently in Canada, or may voluntarily not intend to engage in employment for unobserved reasons. Given that the LSIC includes data on immigrants in the first 6 month of arrival in Canada, chances are that some of these factors may skew the results that the research intends to observe.

For this reason, we also conducted a series of logistic regressions where we selectively excluded immigrants whose current employment outcome may simply be an artifact of their recent arrival, rather than their long-term career objectives. In these regressions we excluded the following categories:

- Immigrants who are not planning to work;
- Immigrants in training; and
- Immigrants not intending to settle in Canada[14].

Additionally, to account for the possibility that unobserved characteristics influencing pre-immigration employment behaviour might also influence labour force participation in Canada, we also conducted regressions excluding the following categories:

- Immigrants with no previous work experience; and
- Immigrants with no higher education[15].

The overall conclusion of the logistic regressions conducted with the restricted samples is that that our initial findings are robust. Immigrants face considerable barriers to the recognition of foreign education, but hi-tech employers may be more willing to recognize foreign education and experience than those in other sectors. In Table 23 we report

[14] This exclusion was determined on the premise that immigrants with the intention of leaving Canada within the first 5 years are not likely to engage in employment directed towards a long-term career in Canada.
[15] Given the interest in hi-skill immigrants in this study, this exclusion was determined on the premise that immigrants with higher education (defined as education over 14 years) would be most suited for and looking for specialized employment (specifically hi-tech employment).

results of these regressions for the selected groups, for the determinants of likelihood of newly arrived immigrants being employed (vs not being employed).

TABLE 23
DETERMINANTS OF THE LIKELIHOOD OF NEWLY ARRIVED IMMIGRANTS TO CANADA BEING EMPLOYED VERSUS NOT BEING EMPLOYED, SUBJECT TO SELECTION CRITERIA

Logistic regression for 'employed', with selection variables	Plan to work Exp(B)		Not in training Exp(B)		Intends to settle Exp(B)		Previous work exp Exp(B)		Obtained higher education Exp(B)	
BASIC DEMOGRAPHICS										
Age	1.008		1.019		1.008		1.045		0.986	
Age^2	1.000		1.000		1.000		0.999		1.000	
Female	0.499	**	0.509	**	0.515	**	0.500	**	0.544	**
Married	0.773	**	0.764	**	0.774	**	0.793	**	0.780	**
Visible minority	0.725	**	0.706	**	0.739	**	0.674	**	0.617	**
Engl/Frch – lang of instruction	1.684	**	1.643	**	1.660	**	1.789	**	1.871	**
CMA of residence - Calgary	1.585	**	1.372	*	1.465	**	1.438	**	1.498	**
CMA of residence – Vancouver	0.840	*	0.765	**	0.813	*	0.777	**	0.836	
CMA of residence – Toronto	0.942		0.924		0.905		0.935		0.976	
CMA of residence – Ottawa	0.636	**	0.651	**	0.590	**	0.654	**	0.709	*
CMA of residence – Montréal	0.400	**	0.368	**	0.394	**	0.353	**	0.294	**
PRE IMMIGRATION CIRCUMSTANCES & POST IMMIGRATION INTENTIONS										
Immigration category - family	1.321	**	1.318	**	1.310	**	1.136		1.150	
Immigration category - Business	0.567	**	0.554	**	0.551	**	0.542	**	0.620	*
Immigration category - refugee	0.352	**	0.382	**	0.385	**	0.310	**	0.363	**
Family / friends in Canada	1.215	**	1.217	**	1.283	**	1.171	*	1.023	
Migrating for economic reasons	1.111	*	1.111	*	1.123	*	1.062		1.065	
Intention to permanently settle	1.063		1.091				1.024		1.028	
Intention to enter labour force			3.966	**	4.292	**	4.852	**	3.643	**
International exposure	0.871	*	0.830	**	0.827	**	0.888	*	0.851	*
HUMAN CAPITAL ATTRIBUTES										
Years of education (1-26)	0.973	**	0.979	*	0.975	**	0.963	**		
Canadian education†,	1.583	**	1.669	**	1.732	**	1.778	**	1.886	**
Voluntary experience	0.591	**	0.599	**	0.641	**	0.582	**	0.583	**
Previous work experience	1.728	**	1.660	**	1.701	**			1.605	**
Canadian work experience†,	2.298	**	2.251	**	2.164	**	2.169	**	2.360	**
Hi-tech experience	1.003		1.012		0.978		0.999		1.024	
Constant	1.817		0.396	*	0.434		0.477		0.700	
Nagelkerke R^2	0.138		0.181		0.178		0.159		0.157	
-2log likelihood	10930.962		10496.206		10508.475		9687.619		7707.776	
Sample N #	8,321		8,238		8,273		7,364		5,501	

* Indicates significance at 5%

** Indicates significance at 1%

† obtained prior to migration

Standardized weight (=individual survey weight/average survey weight) has been used.

Source: Authors analysis of LSIC data.

A second potential source of bias is that the CMA of residence variable refers only to the place in which the immigrant first settled on landing in Canada. The results reported in Table 22 do not include those immigrants who had moved since landing, or for whom the CMA of residence upon landing was unknown. It is possible that immigrants who moved shortly after landing could have been a select group, whether they moved because they could not find work, or because they moved to take advantage of an employment opportunity.

In order to determine whether the exclusion of these immigrants might have influenced the results, we conducted two tests. First, we included all cases for which the place of landing is known. Second, we created a dummy variable to indicate those immigrants who had moved since their landing. We repeated all the logistic regressions reported in Table 22, but report only the determinants of being employed versus not employed in Table 24.

Comparing columns A, B and C in Table 24, it can be seen that the inclusion of these respondents do not change the sign or significance of the coefficients. Note that recent immigrants who have moved have a significantly lower likelihood of being employed suggesting that the initial move of landed immigrants is not undertaken in response to an (immediate) employment opportunity (Column C).

The third potential source of bias is that we compared employed immigrants with all other immigrants, thus including immigrants who declared themselves to be outside the labour force. To determine whether this may bias our results, we examined the determinants of immigrants being employed relative to all others in the labour force, and immigrants being employed in full-time jobs, relative to all others in the labour force. We report these results in Table 25.

As we would expect, because of the different sample sizes, the redefinition of the comparison group does change the significance of various coefficients. However, it changes the sign and significance of the coefficients on only one variable. While Canadian education prior to immigration decreases the chances that immigrants are employed full-time relatively to being employed part-time (Column C), it apparently increases the chances of being employed relative to all others in the labour force (Column D). This is consistent with the notion that immigrants with Canadian education have some advantage in securing part-time employment, that, other things being equal, those without Canadian education do not.

We conclude that these potential sources of bias have not influenced our core findings.

Table 24:

Determinants of the odds of newly arrived immigrants to Canada being employed, with movers included

	A		B		C	
	EMPLOYED		EMPLOYED INCLUDING MOVERS AND THOSE WITH UNKNOWN CMA OF LANDING		EMPLOYED INCLUDING MOVERS AND THOSE WITH UNKNOWN CMA OF LANDING	
	Exp(B)		Exp(B)		Exp(B)	
BASIC DEMOGRAPHICS						
Age	1.017		1.023		1.022	
Age^2	1.000		0.999		0.999	
Female	0.500	**	0.489	**	0.488	**
Married	0.758	**	0.756	**	0.756	**
Visible minority	0.729	**	0.701	**	0.707	**
Engl/Frch – lang of instruction	1.677	**	1.656	**	1.658	**
Moved CMA since landing					0.675	**
CMA of residence - Calgary	1.463	**	1.635	**	1.509	**
CMA of residence – Vancouver	0.784	**	0.880		0.811	*
CMA of residence – Toronto	0.903		1.012		0.932	
CMA of residence – Ottawa	0.634	**	0.710	**	0.654	**
CMA of residence – Montréal	0.378	**	0.419	**	0.387	**
PRE IMMIGRATION CIRCUMSTANCES & POST IMMIGRATION INTENTIONS						
Immigration category - family	1.347	**	1.413	**	1.386	**
Immigration category - Business	0.565	**	0.592	**	0.588	**
Immigration category - refugee	0.365	**	0.368	**	0.361	**
Family / friends in Canada	1.236	**	1.237	**	1.236	**
Migrating for economic reasons	1.113	*	1.136	**	1.139	**
Intention to permanently settle	1.058		1.033		1.035	
Intention to enter labour force	4.179	**	4.178	**	4.197	**
International exposure	0.846	**	0.851	**	0.854	**
HUMAN CAPITAL ATTRIBUTES						
Years of education (1-26)	0.979	*	0.981	*	0.981	*
Canadian education†	1.721	**	1.670	**	1.664	**
Voluntary experience	0.603	**	0.612	**	0.610	**
Previous work experience	1.674	**	1.651	**	1.654	**
Canadian work experience†	2.222	**	2.179	**	2.161	**
Hi-tech experience	1.010		1.001		1.005	
Constant	0.364	*	0.306	**	0.329	*
Nagelkerke R^2	0.185		0.188		0.189	
-2log likelihood	11523.767		12564.932		12551.869	
Sample N #	9,096		10,038		10,038	

* Indicates significance at 5%

** Indicates significance at 1%

† obtained prior to migration

Standardized weight (=individual survey weight/average survey weight) has been used.

Source: Authors analysis of LSIC data.

Table 25:

Determinants of the odds of newly arrived immigrants to Canada being employed versus not being in the labour force

	A		B		C		D	
	EMPLOYED VS ALL NOT EMPLOYED		EMPLOYED VS ALL OTHERS IN LABOUR FORCE		EMPLOYED FULL-TIME VS EMPLOYED PART-TIME		EMPLOYED FULL-TIME VS ALL OTHERS IN LABOUR FORCE	
	Exp(B)		Exp(B)		Exp(B)		Exp(B)	
BASIC DEMOGRAPHICS								
Age	1.017		1.039		1.341	**	1.155	**
Age^2	1.000		0.999		0.996	**	0.998	**
Female	0.500	**	0.755	**	0.390	**	0.554	**
Married	0.758	**	0.942		1.041		1.004	
Visible minority	0.729	**	0.666	**	0.774	*	0.654	**
Engl/Frch – lang of instruction	1.677	**	1.466	**	1.151		1.430	**
CMA of residence - Calgary	1.463	**	1.438	*	0.828		1.167	
CMA of residence – Vancouver	0.784	**	0.819	*	0.801		0.783	*
CMA of residence – Toronto	0.903		0.898		1.028		0.944	
CMA of residence – Ottawa	0.634	**	0.590	**	0.523	**	0.517	**
CMA of residence – Montréal	0.378	**	0.374	**	0.931		0.437	**
PRE IMMIGRATION CIRCUMSTANCES & POST IMMIGRATION INTENTIONS								
Immigration category - family	1.347	**	1.368	**	1.489	**	1.507	**
Immigration category - Business	0.565	**	0.837		0.925		0.824	
Immigration category - refugee	0.365	**	0.648	**	0.731		0.638	**
Family / friends in Canada	1.236	**	1.106		1.168		1.133	
Migrating for economic reasons	1.113	*	1.060		1.337	**	1.169	**
Intention to permanently settle	1.058		0.998		1.426	**	1.128	
Intention to enter labour force	4.179	**	1.156		1.124		1.180	
International exposure	0.846	**	0.831	**	0.813	*	0.816	**
HUMAN CAPITAL ATTRIBUTES								
Years of education (1-26)	0.979	*	0.961	**	0.961	*	0.956	**
Canadian education†	1.721	**	2.022	**	0.698	*	1.316	*
Voluntary experience	0.603	**	0.447	**	0.525	**	0.420	**
Previous work experience	1.674	**	1.345	**	0.809		1.144	
Canadian work experience†	2.222	**	2.473	**	2.259	**	2.595	**
Hi-tech experience	1.010		0.896		1.706	**	1.094	
Constant	0.364	*	2.325		0.057	**	0.232	**
Nagelkerke R^2	0.185		0.082		0.121		0.101	
-2log likelihood	11523.767		8781.975		3879.041		9226.107	
Sample N #	9,096		6,652		4,272		6,652	

* Indicates significance at 5%

** Indicates significance at 1%

† obtained prior to migration

Standardized weight (=individual survey weight/average survey weight) has been used.

Source: Authors analysis of LSIC data..

CONCLUSIONS

In this paper we have analysed the labour market situation of highly skilled immigrants in Canada's hi-tech clusters, in light of the geography of immigrant settlement and overall regional economic development. What happens in the hi-tech sector today may be the harbinger of labour market outcomes to come, while immigrants represent the future of population growth in Canada. This study has examined the coincidence of these future-shaping trends.

First, we used census customized tabulations and micro-data to analyse the geography of hi-tech immigrant employment. Here we traced the coincident clustering of hi-tech economic activity and immigration settlement in Canada's largest cities. It is thus not surprising that we found the largest concentrations of immigrants employed in the hi-tech sector within a small group of large cities. The implication of this macro-level analysis is that to the extent that hi-tech immigrant flows provide advantages to the firms and regions in which they are employed, they will be an agglomerative force in the Canadian space-economy.

Over the 1990s, earnings of immigrants declined relative to those of the native-born working in the hi-tech sector. This trend was most pronounced in the largest cities. Using confidential Census micro-data to control for demographic and human capital characteristics, we find that hi-tech immigrants in Toronto do relatively worse than hi-tech immigrants employed elsewhere. In contrast, the Ottawa labour market of the 1990s appears to have been more favourable for immigrants in the hi-tech sector.

In the second empirical section of the paper we focused on the employment experiences of newly arrived immigrants to Canada, using a sample survey of immigrants interviewed six months after arrival. We examined the likelihood of immigrant employment, highlighting in particular the role of geography and previous work experience in the hi-tech sector. Immigrants with more education are less likely to be employed shortly after arrival than those with less education. This finding is consistent with the notion that immigrants face challenges in having their qualifications recognized by employers, but this finding could also be explained by other factors. We also find that certain forms of previous work experience, especially pre-immigration Canadian work experience and hi-tech experience (obtained anywhere), is rewarded with increased likelihood of employment. At the same time, hi-tech employers are more likely than others to recognize and reward foreign education and pre-immigration hi-tech work experience.

REFERENCES CITED

Alboim, Naomi, Ross Finnie, and Ronald Meng.2005. “The Discounting of Immigrants' Skills in Canada: Evidence and Policy Recommendations.” *IRPP Choices* 11, no. 2.

Amin, A. 1999. “An Institutionalist Perspective on Regional Economic Development” *International Journal of Urban and Regional Research* v 23, n 2, June 1999

Anisef, P, Sweet, R and Frempong, G. 2003. Labour Market Outcomes of Immigrant and Racial Minority University Graduates in Canada. CERIS Working Paper No. 23

Aydemir, A and Skuterud, M. 2005. “Explaining the deteriorating entry earnings of Canada’s immigrant cohorts, 1966 – 2000”, Canadian Journal of Economics, Vol. 38, No. 2: 641-672.

Bathelt, H and Hecht, A. 1990. “Key technology industries in the Waterloo region: Canada's technology triangle (CTT)”, *Canadian Geographer*,

Bauder, H. 2003. “‘Brain Abuse’, or the devaluation of immigrant labour in Canada”, *Antipode* 619-717.

Bendavid-Val, A. 1991. *Regional and Local Economic Analysis for Practitioners*, 4th Edition. Wesport: Praeger.

Benner, C. 2002. *Work in the New Economy*. Oxford: Blackwell Press.

Boothby, D. and Rainville, B. 2004. *Adjustments in Labour Markets for Skilled Workers in Canada*. Ottawa: Skills Research Initiative (Working Paper 2004 C-01).

Borjas, GJ. 1994. “The Economics of Immigration”, *Journal of Economic Literature*, 32: 1667-1717.

Card, D. 1990. “The Impact of the Mariel Boatlift on the Miami Labor Market”, *Industrial and Labor Relations Review*, 43(2): 245-257.

Chapple, K, Markusen, A, Shrock, G, Yamamoto, D and Yu, P. 2004. “Gauging metropolitan ‘high-tech’ and i-tech’ activity”, *Economic Development Quarterly*, vol 18(1): 10-29.

Cranford, CJ, Vosko, LF and Zukewich, N. 2003. “Precarious employment in the Canadian Labour Market: a statistical portrait”, *Just Labour*, vol 3: 6-22.

Fernandez, M. 1998. “Asian Indian Americans in the Bay Area and the Glass Ceiling”, *Sociological Perspectives*, 42(1): 119-149.

Florida, R. 2002. *The Rise of the Creative Class: And How It's Transforming Work, Leisure, Community and Everyday Life*. Basic Books.

Frennette, M. 2002. *Do the falling earnings of immigrants apply to self-employed immigrants?* Ottawa, Analytical Studies Branch Research Paper 195, Statistics Canada.

Frennette, M and Morissette, R. 2003. *Will they ever converge? Earnings of immigrants and Canadian-born workers over the last two decades*. Ottawa, Analytical Studies Branch Research Paper 215, Statistics Canada.

Gera, S. Laryea, S.A. and Songsakul, T. 2004. *International Mobility of Skilled Labour: Analytical and Empirical Issues, and Research Priorities*. Ottawa: Skills Research Initiative (Working Paper 2004 D-01).

Gera, S, Gu, W. and Lee, FC. 1999. "Information Technology and Labour Productivity Growth: An empirical analysis for Canada and the United States". *Canadian Journal of Economics*, 32(3): 394-407.

Gertler, M. 2001. "Urban economy and society in Canada: Flows of People, Capital and Ideas", Isuma, Autumn 2001: 119-130.

Gertler, M. Florida, R, Gates, G and Vinodrai, T. 2002. *Competing on Creativity: placing Ontario's Cities in North American Context*. Toronto: A report prepared for the Ontario Ministry of Enterprise, Opportunity and Innovation, and the Institute for Competitiveness and Prosperity.

Guellec, D and Cervantes, M. 2001. "International Mobility of Highly Skilled Workers: From Statistical Analysis to Policy Formation". In *International Mobility of the Highly Skilled*. Paris: OECD. (p71-99).

HRSDC. 2003. *Knowledge Matters*. Ottawa: Human Resources and Skills Development Canada.

Harris, R.G. 2004. *Labour Mobility and the Global Competition for Skills: Dilemmas and Options*. Ottawa: Skills Research Initiative (Working Paper 2004 D-02).

Head, K and Ries, J. 1998. "Immigration and Trade Creation", Canadian Journal of Economics, Vol. 31 (1): 47-62.

Hiebert, D. 2000a. Immigration and the Changing Canadian City. *The Canadian Geographer,* Vol. 44, No. 1, pp.25- 43.

Hiebert, D. 2000b. "The Social Geography of Immigration and Urbanization in Canada: A Review and Interpretation", RIIM Working Paper #00-12.

Hum, D and Simpson, W. 1999. "Wage Opportunities for Visible Minorities in Canada", *Canadian Public Policy*, 25(3): 379-394.

Hum, D and Simpson, W. 2004. "Economic integration of immigrants to Canada: a short survey", *Canadian Journal of Urban Research*, 13(1): 46-62.

ICP. 2003. *Investing for Prosperity*. 2nd Annual Report of the Task Force on Competitiveness, Productivity and Economic Progress. Toronto: The Institute for Competitiveness and Prosperity.

Kazemipur, A. and Halli, S.S. 2001. Immigrants and 'New Poverty': The Case of Canada. *International Migration Review*, pp. 1129-1152.

Laryea, S. 1998. "The Impact of Foreign-Born Labor on Canadian Wages: A Panel Analysis", RIIM working Paper #98-06

Lewis, E. 2004. *How did the Miami Labor Market Absorb the Mariel Immigrants*. Federal Reserve Bank of Philadelphia, Working Paper 04-3.

Li, PS. 2001. "Immigrants' Propensity to Self-Employment: Evidence from Canada", *International Migration Review*, 35(4): 1106-1128.

Lorenzen, M. 2005. *Localized Learning and Social Capital: The Geography Effect in Technological and Institutional Dynamics*. Danish Research Unit of Industrial Dynamics (DRUID), Working Paper No. 05-22.

Maskell, P and Malmberg, A. 1999. "Localised learning and industrial competitiveness", *Cambridge Journal of Economics*, 23(2): 167-185.

McDonald, T. 2004. "Toronto and Vancouver Bound: the location choice of new Canadian immigrants", *Canadian Journal of Urban Research,* 13(1): 85-101.

Morgan, K. 1997. "The learning region, institutions, innovation and regional renewal", *Regional Studies*, 31, pp. 491-503.

Parker, P. 2001 "Local-Global Partnerships for High-Tech Development: Integrating Top-Down and Bottom-Up Models" *Economic Development Quarterly* 15 (2), 149-167.

Picot, G. 2004. "The deteriorating economic welfare of Canadian immigrants", *Canadian Journal of Urban Research*, 13(1): 25-46.

Porter, M. 1998. *On Competition*. Boston: Harvard Business School Publishing

Putnam, R.1993. *Making Democracy Work: civic traditions in modern Italy*. Princeton University Press.

Reitz, JG. 2001. "Immigrant success in the knowledge economy: Institutional change and the immigrant experience in Canada, 1970-1995", *Journal of Social Issues*, 57(3): 579-614.

Reitz, Jeffrey G. 2005. "Tapping Immigrants' Skills: New Directions for Canadian Immigration Policy in the Knowledge Economy." *IRPP Choices* 11, no. 1.

Rigby, DL and Haydamack, B. 1998. "Regional Trajectories of Technological Change in Canadian Manufacturing", *The Canadian Geographer*, 42(1): 2-13.

Rigby, DL and Essletzbichler, J. 2006. “Technological variety, technological change and a geography of production techniques”, J*ournal of Economic Geography,* 6: 45-70.

Romer, P. 1992. “Two strategies for Economic Development: using ideas and producing ideas”. Proceedings of the World Bank Conference on Development Economics.

Saxenian, A. 1994. *Regional advantage: culture and competition in Silicon Valley and Route 128*. Cambridge, MA: Harvard University Press.

Saxenian, A. 1999. *Silicon Valley’s New Immigrant Entrepreneurs*. San Francisco: Public Policy Institute of California.

Saxenian, A. 2002. *Local and Global Networks of Immigrant Professionals in Silicon Valley*. San Francisco: Public Policy Institute of California.

Schaafsma, J and Sweetman, A, 2001. “Immigrant Earnings: age at immigration matters”, Canadian Journal of Economics, Vol. 34 (4): 1066-1099.

Storper, M. 1997. *The Regional World: territorial development in a global economy*. New York: The Guildford Press.

Sweetman, A. 2004. “Introduction to economic and urban issues in Canadian immigration policy”, *Canadian Journal of Urban Research*, 13(1):1-25*.*

Tang, J. 1993. “The career attainment of Caucasian and Asian Engineers”, *Sociological Quarterly*, 34(3): 467-496.

Torjman, S and Leviten-Reid, E. 2003. *Innovation and poverty-reduction*. Ottawa: Caledon Institute for Social Policy.

Vernon, R. 1979. “The Product Cycle Hypothesis in a New International Environment”. *Oxford Bulletin of Economics and Statistics*, v4.

Warman, CR and Worswick, C. 2004. “Immigrant earnings performance in Canadian cities: 1981 through 2001”, *Canadian Journal of Urban Research,* 13(1): 62-85.

Wolfe, D. (ed) 2003. *Clusters Old and New: The Transition to a Knowledge Economy in Canada's Regions*. Queens University Press.

APPENDICES

APPENDIX A

DATA NOTES FOR ANALYSIS OF CUSTOMIZED CENSUS TABULATIONS

This Statistics Canada data acquired for this analysis consisted of a special tabulation of the 1991, 1996 and 2001 population censuses, indicating the number and average earnings of immigrants and natives in 12 hi-tech sub-sectors and 2 hi-tech aggregate sectors, for the 50 largest CMAs and CAs by 2001 population.

Seven CA's were removed from the analysis because the number of immigrants employed in the hi-tech sector is too small for reliable reporting, namely Cape Breton, Chicoutimi – Jonquière, Drummondville, Medicine Hat, North Bay, Saint-Jean-sur-Richelieu, Trois-Rivière. Hence the analysis refers to only 43 CMAs/CAs.

One of the two aggregated hi-tech sectors for which we acquired data matches the Techpole Index as defined by Gertler et al (2002). For our definition of the hi-tech sector we added various sub-sectors, namely office, store and business machines, electrical and electronic equipment wholesale, employment agencies and personnel suppliers and management consulting and business services. Table A1 lists the 3-digit industrial sectors included in the hi-tech category.

Table A1: Hi-tech sector definition

Description	1980 3-digit SIC-E
Aircraft and aircraft parts industry	321
Communication and other electronic equipment industries	335
Office, store and business machine industries	336
Pharmaceutical and Medicine Industry & Medical and other health Laboratories.	374, 868
Scientific and professional equipment industries	391
Telecommunication Carriers Industry & other telecommunication industries	482, 483
Electrical and Electronic machinery, equipment and Supplies, Wholesale & Other Machinery, Wholesale	574, 579
Employment agencies and personnel suppliers	771
Computer and related services	772
Architectural, engineering and other scientific and technical services	775
Management consulting services & Other business services	777, 779
Motion picture, audio and video production and distribution	961
Tech pole index	335, 321, 374, 868, 391, 482, 483, 772, 775, 961
All high-tech	335, 336, 321, 374, 868, 391, 482, 483, 574, 579, 771, 772, 775, 777, 779, 961

We then generated a series of employment concentration indices:

LQ1: Basic specialization index

Iij = (Eij/Ej)/(Ei/E)

Where, Eij denotes employment in sector i in place j

Ej is the total employment in place j

Ei is employment in sector i in all places

E is the total employment in all places.

Greater than 1 means that the hi-tech sector employment is over-represented in this place relative to the proportion of hi-tech sector employment in the economy overall.

LQ1A: Adjusted hi-tech specialization index: the basic hi-tech specialization index (LQ1) is multiplied by the percentage of national employment in that sector (i.e. by a number between 0 and 100).

LQ3: Immigrant in city specialized in hi-tech index

Ifij = (Efij/E.ij)/(Ef.j/E..j),

Where, Efij denotes employment of immigrants f in sector i in place j

E.ij is total employment in sector i in place j,

Ef.j is employment of immigrants f in all sectors in place j, and

E..j is total employment in all sectors in place j.

Greater than 1 means that immigrants are over-represented in the hi-tech sector in place j relative to all immigrant employment in that place.

LQ4: Immigrant Specialization in City Index

Ifj = (Efj/Ej)/(Ef/E),

Where, Efj is the employment of immigrants f in place j,

Ej is total employment in place j,

Ef is employment of immigrants all places

E is total employment all places.

Greater than 1 means that immigrant employment is over-represented in the city relative to immigrant employment of all the country.

LQ5: Immigrant in hi-tech specialized in city index

Ifji = (Efji/Efj)/ (Efi/Ej)

Where, Efji is the employment of immigrants in sector i in place j,

Efj is the employment of all immigrants in place j,

Efi is the employment of immigrants in sector i in all places

Ej is the employment of all immigrants in all places.

Greater than 1 means that there is an over representation of immigrant employed in the hi-tech sector relative to the concentration of immigrants population in the hi-tech sector of all places.

APPENDIX B

DESCRIPTIVE STATISTICS, 20% CENSUS SAMPLE

	2001		1996		1991	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Log Of Total Earnings	10.011	1.177	9.837	1.178	9.798	1.097
Log Of Total Non-Farm Self-Employment Income	9.379	1.513	9.194	1.536	9.350	1.511
Log Of Total Wages	10.015	1.174	9.842	1.172	9.788	1.093
Log Of Weekly Wages	6.302	1.006	6.169	0.971	6.113	0.910
Years In Canadian Labour Force	20.012	12.585	19.364	12.369	18.846	12.812
Years In Canadian Labour Force Squared	558.870	606.213	527.947	600.987	519.314	639.885
Dummy For Female	0.468	0.499	0.461	0.498	0.456	0.498
Dummy For Married	0.680	0.466	0.688	0.463	0.700	0.458
Years Of Education	13.456	2.551	13.196	2.694	12.865	2.818
Dummy For Visible Minority	0.123	0.329	0.102	0.302	0.089	0.285
Dummy For Aboriginal	0.026	0.159	0.021	0.143	0.029	0.169
Dummy For Internal Migrant	0.179	0.384	0.189	0.392	0.220	0.414
Dummy For Non Permanent Resident	0.005	0.071	0.004	0.066	0.008	0.089
Dummy For Mostly Part-time Last Year	0.164	0.370	0.175	0.380	0.144	0.352
Hi-Tech By Sector Or Occupation	0.132	0.338	0.109	0.312	0.101	0.301
Hi Tech Immigrant By Sector And Occupation	0.035	0.183	0.026	0.160	0.023	0.151
Dummy For Immigrant	0.206	0.405	0.200	0.400	0.193	0.394
Dummy For Maritimes	0.073	0.260	0.077	0.266	0.080	0.271
Dummy For Quebec	0.233	0.423	0.240	0.427	0.246	0.431
Dummy For Ontario	0.381	0.486	0.373	0.484	0.375	0.484
Dummy For Prairies	0.177	0.382	0.173	0.378	0.173	0.378
Dummy For British Columbia	0.132	0.339	0.134	0.341	0.123	0.328
Dummy For North	0.003	0.057	0.003	0.059	0.003	0.057
Dummy For Abbotsford	0.005	0.069	0.005	0.068	0.004	0.063
Dummy For Barrie	0.005	0.071	0.004	0.064	0.003	0.059
Dummy For Belleville	0.003	0.053	0.003	0.055	0.003	0.058
Dummy For Brantford	0.003	0.053	0.003	0.058	0.003	0.058
Dummy For Calgary	0.036	0.186	0.032	0.175	0.030	0.171
Dummy For Chatham	0.004	0.059	0.002	0.047	0.002	0.044
Dummy For Chilliwack	0.002	0.046	0.002	0.047	0.002	0.046
Dummy For Edmonton	0.033	0.179	0.031	0.175	0.032	0.176
Dummy For Fredericton	0.003	0.053	0.003	0.054	0.003	0.051
Dummy For Guelph	0.004	0.064	0.004	0.061	0.004	0.060
Dummy For Halifax	0.012	0.110	0.012	0.108	0.012	0.109
Dummy For Hamilton	0.022	0.146	0.021	0.144	0.022	0.147
Dummy For Kamloops	0.003	0.054	0.003	0.055	0.002	0.050
Dummy For Kawartha Lakes/Lindsay	0.002	0.046	0.001	0.026	0.001	0.027
Dummy For Kelowna	0.005	0.069	0.005	0.069	0.004	0.062
Dummy For Kingston	0.005	0.068	0.005	0.068	0.005	0.069
Dummy For Kitchener	0.014	0.119	0.014	0.117	0.013	0.115

	2001		1996		1991	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Dummy For Lethbridge	0.002	0.047	0.002	0.046	0.002	0.046
Dummy For London/Strathroy	0.014	0.118	0.014	0.118	0.014	0.118
Dummy For Moncton	0.004	0.064	0.004	0.063	0.004	0.062
Dummy For Montreal	0.112	0.316	0.114	0.317	0.115	0.320
Dummy For Nanaimo	0.003	0.052	0.003	0.054	0.003	0.051
Dummy For Oshawa	0.010	0.100	0.009	0.096	0.009	0.094
Dummy For Ottawa-Hull	0.036	0.187	0.036	0.187	0.036	0.185
Dummy For Peterborough	0.003	0.056	0.003	0.056	0.003	0.057
Dummy For Prince George	0.003	0.055	0.003	0.054	0.003	0.052
Dummy For Quebec City	0.022	0.148	0.023	0.151	0.023	0.151
Dummy For Red Deer	0.002	0.050	0.002	0.047	0.002	0.047
Dummy For Regina	0.007	0.081	0.007	0.083	0.007	0.084
Dummy For Saint John Nb	0.004	0.063	0.004	0.065	0.004	0.065
Dummy For Sarnia	0.003	0.053	0.003	0.053	0.003	0.055
Dummy For Saskatoon	0.008	0.086	0.008	0.087	0.008	0.087
Dummy For Sault St Marie	0.002	0.049	0.003	0.051	0.003	0.053
Dummy For Sherbrooke	0.005	0.070	0.005	0.069	0.005	0.069
Dummy For St Catherines-Niagara	0.012	0.109	0.012	0.110	0.013	0.112
Dummy For St Johns Nfl	0.006	0.074	0.006	0.076	0.006	0.078
Dummy For Sudbury	0.005	0.069	0.005	0.072	0.005	0.073
Dummy For Thunder Bay	0.004	0.062	0.004	0.065	0.004	0.067
Dummy For Toronto	0.161	0.368	0.152	0.359	0.153	0.360
Dummy For Vancouver	0.069	0.253	0.068	0.252	0.063	0.242
Dummy For Victoria	0.010	0.102	0.011	0.103	0.010	0.101
Dummy For Windsor	0.010	0.099	0.009	0.096	0.009	0.094
Dummy For Winnipeg	0.023	0.150	0.024	0.152	0.024	0.154

Note: Universe for descriptive statistics is all Canadians in the Labour Force (employed, self-employed or unemployed) and not in full-time schooling, in the year prior to the Census.

APPENDIX C

DATA NOTES FOR ANALYSIS OF LONGITUDINAL SURVEY OF IMMIGRANTS TO CANADA

The Longitudinal Survey of Immigrants to Canada (LSIC), conducted jointly by Statistics Canada and Citizenship and Immigration Canada under the Policy Research Initiative, is a comprehensive survey designed to study the process by which new immigrants adapt to Canadian society. Although full integration may take several generations to achieve, the Longitudinal Survey of Immigrants to Canada is designed to examine the process during the critical first four years of settlement, a time when newcomers establish economic, social and cultural ties to Canadian society.

The survey involves a longitudinal design with immigrants being interviewed at three different times: at six months, two years, and four years after landing in Canada. The sample design has been developed using a "funnel-shaped" approach; therefore only immigrants that respond to the Wave 1 interview will be traced for the Wave 2 interview and only those that respond to the Wave 2 interview will be traced for the Wave 3 interview. The first wave of collection for the LSIC was conducted between April 2001 and March 2002 by Statistics Canada, and this data was available for this study.

To produce reliable estimates, a representative sample of approximately 20,300 new immigrants to Canada was selected. The target population for the survey consists of immigrants who meet all of the following criteria:

- Arrived in Canada between October 1, 2000 and September 30, 2001;
- Were age 15 or older at the time of landing;
- Landed from abroad, must have applied through a Canadian Mission Abroad.

The LSIC data files contain data on 12,040 individual immigrant respondents, both in and out of the labour force. The topics covered by the survey include language proficiency, housing, education, foreign credentials recognition, employment, health, values and attitudes, the development and use of social networks, income, and impressions about life in Canada. The questions address respondents' situation before coming to Canada and their current situation since their arrival. The unit of analysis for the survey is the selected immigrant, referred to as the longitudinal respondent (LR).

In addition to the master microdata file of the LSIC, data from the Employment module was also used in this study. The employment roster within the employment module of the survey provides detailed information on all jobs or businesses that the LR has had since coming to Canada. It includes information on: type of worker; type of work (industry and occupation); number of hours usually worked per week; wages; start and end dates; if the job / business has ended, reasons why it came to an end; how the job was found; and information on union membership. A maximum of 6 jobs or businesses was collected for each LR. The Employment roster contained data on the 7,554 different jobs held by all the surveyed individuals since their arrival in Canada. Of these, 5,286 jobs were actually held at the survey date by 5,023 individual immigrants.

IDENTIFICATION OF HI TECH INDUSTRY SECTORS AND OCCUPATIONS:

The research uses a combination of industry and occupation classes to define and identify a 'hi-tech' employment. In light of recent debates about the sectoral and

occupational nature of the hi-tech economic activity (see Chapple et al, 2004), we have chosen to identify an individual as engaged in 'hi-tech' if either the industry codes, or occupations codes match the corresponding fields of employment. The LSIC database does not classify individuals according to the Standard Industrial Classification scheme of 1980 used in the Census data; instead it uses the North American Industry Classification System (NAICS) of 1997. Every effort was however made to ensure comparability between the hi-tech sectors as defined under each system; however, they are not strictly equivalent. We followed Chapple et al (2004) in defining hi-tech occupations within the Standard Occupational Classification (SOC) of 1991. Appendices D and E provide detailed definitions of the hi-tech industries and occupations of interest respectively.

The two groups of hi-tech industries and hi-tech occupations served to identify whether or not an immigrant has hi-tech work experience, job aspirations and/or training, and whether an immigrant actually is engaged in a hi-tech employment.

EXTRACTION AND PREPARATION OF VARIABLES FOR ANALYSIS:

The LSIC master microdata file includes some 1290 variables that address issues of citizenship, social interactions, group organizations, language skills, housing, education, employment, values and attitudes, income, and perceptions of settlement. Of these 1290 variables, 171 variables were identified a relevant for this research. A further 54 variables in the employment module that addressed job related issues were included in the analysis. In what follows, we describe how key variables extracted from the LSIC master microdata file were merged with the Employment module's variables to create a single database of immigrants and their employment status.

Appendix F contains a list of all variables created through recoding. The numbers indicated in parentheses (i.e. F20) after each variable name correspond to the variable numbers indicated in Appendix F.

1. *Identify labour force status.* This step identifies which of the 12,040 individuals in master file are currently employed, some 5,023 individuals:
    a. Employed (F51): Immigrants employed or self employed at the time of the interview were divided into:
        i. Full-time workers (F54): persons who usually worked 30 hours per week at their main or only job; and
        ii. Part-time worker (F55): persons who usually worked less than 30 hours per week at their main or only job.
    b. Unemployed (F69): immigrants who had not worked since they came to Canada but have looked for work at some point between their arrival and the Wave 1 interview. It also includes persons who had a job between their arrival and the Wave 1 interview, but who were not working at the time of the interview.
2. *Identify and determine if an employed immigrant was in a 'Matched' job' (F3).* This step classifies the 5,286 currently held jobs in the Employment Module according to whether they match immigrants previous experience, desired training or stated employment aspiration. A Matched job was recognized as the current job being at least one of the following:

a. One in which the immigrant has previous experience;

b. One that the immigrant desires to be trained in; or

c. One that the immigrants wanted to engage in at the time of immigration.

Each of these matching criteria were based on occupation or industry match. This was possible because the LSIC codes the answers to each of the following questions by both the SOC and NAICS classification: (a) "What was your past job before arriving in Canada?", (b) "In what type of occupation do you want to be trained?", and (c) "What kind of job did you want when you came to Canada?".

3. *Associate one job to each person by defining and determining a 'dominant job'.* We call this job the dominant job. In this step we associate each of the 5,023 employed individuals with one and only one job. In other words, we eliminate 263 secondary/tertiary/etc jobs. This was an iterative step, where a 'dominant job' was determined as follows:

    a. If the immigrant was engaged in *only one* job, that was determined to be the dominant job. This was the case for 95% of individuals (4,760 of 5,023).

    b. If the immigrant was engaged in more than one job, then the job that had been identified as a 'matched job' was determined to be the dominant job.

    c. If the immigrant was employed in more than one job, and more than one job was identified as a 'matched job', then the matched job with the most hours was determined to be the dominant job.

    d. If the immigrant was employed in more than one job, and more than one job was identified as a 'matched' job, and more than one matched job had the same hours of work associated with it, then the matched job in which the immigrant had been for the longest number of weeks was determined to be the dominant job.

4. *Identify additional job and individual characteristics*:

    a. Immigrants who had previous hi-tech experience (F15). This constituted all immigrants who were, prior to immigrating, employed in either the industry sectors or the occupations that were identified as hi-tech (see Appendices D and E). This provided a much broader definition of those engaged in a matched hi-tech field since the definition was not restricted to the exact field match, but came with a freedom to float among and between all fields recognized as hi-tech.

    b. Identify immigrants by the following definition of 'employment', which served as the key dependent variables in the analysis:
        i. Employed (F51), in labour force, regardless of the hours employed
        ii. Employed Fulltime (F54), in labour force and working 30 or more hours per week
        iii. Employed in a matched job (F3)
        iv. Employed fulltime in a matched job (F4)
        v. Employed in a hi-tech job (F8)
        vi. Employed in a matched hi-tech job (F21)
        vii. Employed full-time in a matched hi-tech job (F22)

APPENDIX D

HI-TECH INDUSTRY SECTOR CODES

[North American Industry Classification System (NAICS) 1997]

1.	3254	Pharmaceutical and Medicine Manufacturing
2.	3329	Other Fabricated Metal Product Manufacturing
3.	3332	Industrial Machinery Manufacturing
4.	3333	Commercial and Service Industry Machinery Manufacturing
5.	3336	Engine, Turbine and Power Transmission Equipment Manufacturing
6.	3339	Other General-Purpose Machinery Manufacturing
7.	3341	Computer and Peripheral Equipment Manufacturing
8.	3342	Communications Equipment Manufacturing
9.	3343	Audio and Video Equipment Manufacturing
10.	3344	Semiconductor and Other Electronic Component Manufacturing
11.	3345	Navigational, Measuring, Medical and Control Instruments Manufacturing
12.	3346	Manufacturing and Reproducing Magnetic and Optical Media
13.	3359	Other Electrical Equipment and Component Manufacturing
14.	3364	Aerospace Product and Parts Manufacturing
15.	3391	Medical Equipment and Supplies Manufacturing
16.	4173	Computer and Communications Equipment and Supplies Wholesaler-Distributors
17.	4179	Other Machinery, Equipment and Supplies Wholesaler-Distributors
18.	5111	Newspaper, Periodical, Book and Database Publishers
19.	5112	Software Publishers
20.	5121	Motion Picture and Video Industries
21.	5122	Sound Recording Industries
22.	5133	Telecommunications
23.	5141	Information Services
24.	5142	Data Processing Services
25.	5413	Architectural, Engineering and Related Services
26.	5415	Computer Systems Design and Related Services
27.	5416	Management, Scientific and Technical Consulting Services
28.	5417	Scientific Research and Development Services
29.	5419	Other Professional, Scientific and Technical Services
30.	5613	Employment Services
31.	5614	Business Support Services
32.	7115	Independent Artists, Writers and Performers
33.	8112	Electronic and Precision Equipment Repair and Maintenance

APPENDIX E

HI-TECH OCCUPATION CODES

Standard Occupational Classification (SOC) 1991

1.	A121	Engineering, Science and Architecture Managers
2.	A122	Information Systems and Data Processing Managers
3.	B022	Professional Occupations in Business Services to Management
4.	B521	Computer Operators
5.	B522	Data Entry Clerks
6.	C011	Physicists and Astronomers
7.	C012	Chemists
8.	C013	Geologists, Geochemists and Geophysicists
9.	C015	Other Professional Occupations in Physical Sciences
10.	C021	Biologists and Related Scientists
11.	C033	Electrical and Electronics Engineers
12.	C041	Industrial and Manufacturing Engineers
13.	C046	Aerospace Engineers
14.	C047	Computer Engineers
15.	C062	Computer Systems Analysts
16.	C063	Computer Programmers
17.	C111	Applied Chemical Technologists and Technicians
18.	C121	Biological Technologists and Technicians
19.	C132	Mechanical Engineering Technologists and Technicians
20.	C133	Industrial Engineering and Manufacturing Technologists and Technicians
21.	C141	Electrical and Electronics Engineering Technologists and Technicians
22.	C143	Industrial Instrument Technicians and Mechanics
23.	C144	Aircraft Instrument, Electrical and Avionics Mechanics, Technicians and Inspectors
24.	C161	Nondestructive Testers and Inspectors
25.	D211	Medical Laboratory Technologists and Pathologists' Assistants
26.	D212	Medical Laboratory Technicians
27.	D215	Medical Radiation Technologists
28.	D218	Electroencephalographic and Other Diagnostic Technologists, n.e.c.
29.	H211	Electricians (except Industrial and Power System)
30.	H212	Industrial Electricians
31.	H214	Electrical Power Line and Cable Workers
32.	H215	Telecommunications Line and Cable Workers
33.	H216	Telecommunications Installation and Repair Workers

APPENDIX F

DESCRIPTION OF RECODES

Variables recoded from the LSIC merged file derived from the main and employment modules

	VARIABLE	DESCRIPTION
JOB MATCHING: ENGAGED FULL-TIME, OR PART-TIME IN A MATCHED JOB		
1.	m_NAICS	Current job in a matched occupation NAICS – specific code definition
2.	m_SOC	Current job in a matched industry SOC - specific code definition
3.	mjob	Current job in either a matching occupation or industry -NAICS or SOC - specific code definitions
HITECH JOB MATCHING: ENGAGED FULL-TIME, OR PART-TIME IN A MATCHED JOB		
4.	FT_matched	Employed fulltime (30 or more hours per week) in matched job (mjob).
5.	PT_matched	Employed part-time (less than 30 hours per week) in matched job (mjob)
6.	HT_job_NAICS	Current job is in a hi-tech industry – NAICS codes identified in appendix D
7.	HT_job_SOC	Current job is in a hi-tech occupation – SOC codes identified in appendix E
8.	HT_Job	Current job is in either a hi-tech industry or occupation
9.	HT_exp_NAICS	Past experience in any of the NAICS codes identified in appendix D
10.	HT_exp_SOC	Past experience in any of the SOC codes identified in appendix E
11.	HT_desired_NAICS	Desire to be employed in any of the NAICS codes identified in appendix D
12.	HT_desired_SOC	Desire to be employed in any of the SOC codes identified in appendix E
13.	HT_knew_NAICS	Knew at the time of immigration to engage in one of the NAICS codes identified in appendix D
14.	HT_knew_SOC	Knew at the time of immigration to engage in one of the SOC codes identified in appendix E
15.	HT_Exp	Past experience in either a hi-tech industry or occupation – broad code definition
16.	matched_HT_exp	Current hi-tech employment, in either industry or occupation, matched with previous hi-tech experience, in either industry or occupation – broad code definition
17.	HT_Knew	Knew at the time of immigration to engage in either a hi-tech industry or occupation – broad code definition
18.	matched_HT_knew	Current hi-tech employment, in either industry or occupation, matched with knowing at the time of immigration to engage in a hi-tech industry or occupation – broad code definition
19.	HT_Desired	Desire to be employed in either a hi-tech industry or occupation – broad code definition
20.	matched_HT_desired	Current hi-tech employment, in either industry or occupation, matched with a desire to be employed in a hi-tech industry or occupation – broad code definition
21.	matched_HT	Current hi-tech employment, in either industry of occupation, matched with either

		previous hi-tech experience, knowing at the time of immigration what to be employed in, or a desire to be employed in a hi-tech industry or occupation – broad code definition.
22.	FT_matched_HT	Employed full time (30hours or more per week) in a matched hi-tech job – defined broadly by any of the NAICS or SOC codes identified in appendixes D and E respectively
23.	PT_matched_HT	Employed part time (less than 30hours per week) in a matched hi-tech job – defined broadly by any of the NAICS or SOC codes identified in appendixes D and E respectively
24.	mjobHT_specific	Employed in a matching hi-tech job, defined by specific NAICS and SOC codes.
BASIC DEMOGRAPHICS		
25.	age	Age (18-50 only)
26.	age_sqr	Age squared
27.	female_d	Female (dummy)
28.	married	Marital status – accounts for married and common law partners
29.	minority	Member of a visible minority
30.	D_MONTRE	Montreal resident, if LR reported still living in same CMA as when they arrived
31.	D_TORONT	Toronto resident, if LR reported still living in same CMA as when they arrived
32.	D_OTTAWA	Ottawa-Hull resident, if LR reported still living in same CMA as when they arrived
33.	D_CALGAR	Calgary resident, if LR reported still living in same CMA as when they arrived
34.	D_VANCOU	Vancouver resident, if LR reported still living in same CMA as when they arrived
35.	region	4 regional dummy variables (Maritime, Quebec, Prairie, and BC; Ontario omitted)
36.	cnd_fam_frds	Presence of family and friends in Canada, prior to immigration
37.	int_exposure	Degree of international exposure, accounted by living in a foreign country for more than six months
KNOWLEDGE OF OFFICIAL LANGUAGES		
38.	mlang_ef	Mother tongue: either English or French
39.	slang_ef	Language most spoken at home: either English or French
40.	ilang_ef	Language of instruction for highest level of schooling: either English or French
IMMIGRATION CLASS		
41.	IC_family	Immigrants sponsored by close relatives or family members already living in Canada
42.	IC_skill	Immigrants selected for their skills or other assets that will contribute to the Canadian economy. Includes skilled workers.
43.	IC_bus	Immigrants who qualify for certain types of jobs or have other important assets to bring to Canada. includes investors, entrepreneurs, and self-employed persons.
44.	IC_ref	Persons seeking protection in Canada
INTENTION TO SETTLE		
45.	permanent	Migrated to Canada with the intention to permanently settle

EDUCATION – CANADIAN EDUCATION - ATTAINED		
46.	yrs_ed	Number of years of education completed
47.	can_ed	Canadian education, if any, obtained prior to immigration
CURRENT & PREVIOUS LABOUR FORCE STATUS		
48.	planwork	plan to work, or seek employment, in Canada
49.	volun_exp	Post immigration volunteer engagement, if any
50.	laborfrc	Currently in labourforce – includes fulltime employed, part time employed, multiple job holders, currently unemployed individuals, who may have not worked since landing, but have been looking for work this variable excludes those immigrants who have neither worked nor looked for work since landing
51.	employed	Currently employed
52.	worker	Paid workers – excluding those who are self employed or involved in a family business
53.	self_empl	self employed
54.	FT	fulltime status-by hours worked in dominant job
55.	PT	part-time status by hours worked in dominant job
56.	fulltime	employed part-time-by status declared
57.	parttime	employed part-time-by status declared
58.	job_satis	Satisfied with current job
59.	prev_wrk_exp	In labour force prior to immigration
60.	prev_FT	Previous (pre-immigration) fulltime labour force status
61.	prev_PT	Previous (pre-immigration) part-time labour force status
62.	job_arranged	Job had been arranged on, or prior to, arrival
PRE IMMIGRATION CANADIAN LIFE EXPERIENCE		
63.	prev_work_cnd	Previously lived in Canada on a work visa
64.	prev_stdy_cnd	Previously lived in Canada on a student visa
65.	prev_live_cnd	Previously lived in Canada for a certain duration of time – excluding visits
ECONOMIC MIGRATION		
66.	econ_migration	Migrated for economic reasons – includes: better job opportunities, better pay, business climate/ free markets, lower taxes, to start a business,
ACTIVE / PASSIVE UNEMPLOYMENT		
67.	looking_4_work	Has been looking for work since landing in Canada
68.	looking_anth_job	Employed, but looking for another job
69.	active_UE	Engaged in active unemployment – actively seeking employment
70.	in_train	Currently in training