

**Geographies of Employment among Chinese High-Tech Immigrants in Canada:
An Ottawa-Gatineau case study**

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ABSTRACT

For a number of years, Canadian immigration selection policy has deliberately emphasized the human capital characteristics of applicants in determining admissibility for permanent residence. Largely due to these measures, Chinese immigrants today are overwhelmingly well-educated and skilled. This thesis examines the role of geography in shaping Chinese newcomers' post-arrival employment status, with an emphasis on working in the high-tech sector. Given that Ottawa is a leading node of high-tech employment in Canada, this project initially investigates the probability that Chinese newcomers will work in the high-tech sector in Ottawa-Gatineau relative to other cities. The project subsequently examines the degree to which employment in the high-tech sector in Ottawa-Gatineau is related to ethnic, social and demographic characteristics of local spaces where people live and work. All aspects of the study adopt a gender lens with respect to interpreting employment status. The study finds that Chinese immigrants in Ottawa-Gatineau are more likely to work in this sector than their counterparts in Vancouver and Toronto. They are also more likely to work in high-tech relative to individuals in other immigrant groups or the Canadian-born population. With respect to co-ethnic residential and work spatial configurations, as well as social and demographic characteristics of residential neighbourhoods, the study finds that these factors exert quite different influences on the likelihood that Chinese women and men will work in Ottawa-Gatineau's high-tech sector. The results are quite distinctly different for women and men, and underline the importance of a gendered analysis of relationships between geographic location/place and employment status.

RÉSUMÉ

Depuis un certain nombre d'années, la politique de sélection de l'immigration canadienne a délibérément mis l'accent sur les caractéristiques du capital humain des demandeurs pour déterminer l'admissibilité à la résidence permanente. Grâce en grande partie à ces mesures, les immigrants chinois sont aujourd'hui massivement instruits et qualifiés. Cette thèse examine le rôle de la géographie dans la formation du statut d'emploi des nouveaux arrivants chinois après l'arrivée, en mettant l'accent sur le travail dans le secteur des hautes technologies. Étant donné que Ottawa est un important centre d'emploi dans ce secteur au Canada, le projet étudie tout d'abord la probabilité que les nouveaux arrivants chinois travailleront dans le secteur des hautes technologies à Ottawa-Gatineau par rapport à d'autres villes. Ensuite, le projet examine la mesure dans laquelle l'emploi dans ce secteur à Ottawa-Gatineau est liée aux caractéristiques ethniques, sociales et démographiques des espaces locaux où les gens vivent et travaillent. Tous les aspects de cette étude adoptent une perspective de genre concernant l'interprétation du statut d'emploi. L'étude conclut que les immigrants chinois à Ottawa-Gatineau sont plus susceptibles de travailler dans ce secteur que leurs homologues à Vancouver et à Toronto. Ils sont également plus susceptibles de travailler dans les hautes technologies par rapport à des personnes appartenant à d'autres groupes d'immigrants ou la population née au Canada. En ce qui concerne la présence de la communauté chinoise dans les lieux de résidence et de travail, ainsi que les caractéristiques sociales et démographiques des quartiers résidentiels, l'étude constate que ces facteurs exercent différentes influences sur la probabilité que les femmes et les hommes chinois travailleront dans le secteur des hautes technologies à Ottawa-Gatineau. Les résultats sont nettement différents pour les femmes et les hommes, et ils soulignent la complexité des interactions entre les rapports sociaux de sexe, la géographie urbaine des communautés immigrantes et des entreprises, et le statut de l'emploi.

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CHAPTER 1

Research Background: Chinese Immigrants and their Employment Experiences in Canada

1.1 Overview and Research Objectives

Chinese immigration to Canada is marked by a history in which women and men have made significant economic and social contributions to the country's development (Gertler, 2001; Guo & DeVoretz, 2006; Li & Lo, 2012; Viia & Zhang, 2014; Wang & Lo, 2005), and simultaneously have experienced some of the most oppressive forms of state persecution and discrimination (Li P. , 2008). The Chinese community also has a long history of marking urban space, particularly through the formation of Chinatowns (Anderson, 1991) and more recently suburban settlement (Li W. , 2009; Ray, Halseth, & Johnson, 1997). The size and growth of the Chinese community in Canada, however, were controlled beginning in the late nineteenth century through the use of various forms of legislation intended to discourage immigration, most notably the implementation of a Chinese head tax as part of the Chinese Immigration Act of 1885 and culminating in the Chinese Exclusion Act (1923), which barred almost everyone of Chinese origin from settling in Canada. With the repeal of this Act in 1947 and especially the use of regulatory changes in the 1960s to by-pass some of the most egregious aspects of racial discrimination embodied in the Canadian Immigration Act of 1952, the numerical size and significance of Chinese immigrants in Canada have steadily grown. Today, Chinese immigrants constitute 12.0% of the total

foreign-born population living in Canada and approximately 10.5% of very recent immigrants (arrived 2006 to 2011) are from the People's Republic of China (PRC).¹

The recent flows of immigrants from China to Canada are distinguished by strong human capital characteristics and the fact that they are admitted under contemporary immigration laws and regulations as skilled and professional workers (Citizenship and Immigration Canada, 2016). One of the most important post-World War II migrations of Chinese to Canada began in the 1980s, when many individuals and families living in Hong Kong made the decision to leave before the return of the once-British colony to China in 1997 (Li P. , 2005). It is estimated that 146,000 Hong Kong Chinese moved to Canada between 1981 and 2000, although the number of people who still remain is difficult to determine. In more recent decades, the PRC's "open-door" policy, combined with other political, economic and social changes, have facilitated the emigration of many well-educated and middle-class Chinese to countries like Canada and the United States. Domestic policy changes in China have also been mirrored by policy and regulatory changes in Canada, such as the point system,² the Canadian Experience Class,³ and the more recently introduced Express Entry System,⁴ which have also encouraged growth in the size of the Chinese immigrant population overall, and especially of well-educated individuals. In many ways, Chinese immigrants are regarded as one way to strengthen human capital characteristics of Canada's aging labour force (Kustec, 2012; Reitz, 2004).

Due to the importance of Chinese immigrants in Canadian society, many researchers are interested in various aspects of their social and economic integration (Andersson, Musterd, & Galster, 2014; Guo S. , 2013; Picot, Hou, & Qiu, 2014; Wang & Lo, 2005). In

particular, the labour market performance and social mobility of Chinese immigrants, as well as other visible minority groups, relative to Canadian-born individuals have attracted considerable attention (Bauder, 2003; Godin, 2008; Girard & Smith, 2013; Li & Dong, 2007; Premjia & Lewchukb, 2014). Studies indicate that many immigrants face significant barriers in labour markets, with an insufficient knowledge of official languages, lack of Canadian experience, and devaluation of foreign credentials being most frequently seen as contributing to occupational downward mobility and lower employment earnings (Cao & Boyd, 2009; Frank, 2013; Reitz, Curtis, & Elrick, 2014). Many of these problems have been found to affect well-educated and professional Chinese immigrants, making their search for suitable employment very challenging (Kelly, et al., 2010; Nohl, Karin, Schmidtke, & Weib, 2014; Plante, 2010). Compared to the amount of attention that has been given to social, demographic and labour market characteristics in relation to earnings and social mobility, relatively little consideration has been given to the role of *location* – the industrial and occupational structure of the cities where Chinese newcomers settle, as well as the influence of residential location within cities in contributing to employment outcomes.

Research on Chinese immigrants' labour market experience in Canada often focuses on individuals who live in the three large metropolitan areas: Toronto, Montreal, and Vancouver (Barnes, Hutton, Klein, Tremblay, & Wolfe, 2010; Kelly, et al., 2010; Ooka & Wellman, 2006; Premjia & Lewchukb, 2014). Few studies examine the Chinese immigrant population in other cities or, more specifically, their employment patterns and experiences. Ottawa-Gatineau is a good case in point. Until the early 1990s, international migration to Ottawa-Gatineau after World War II was dominated by Europeans who joined earlier waves of mostly British and French migrants. In 1991, immigrants constituted only 14.6%

of the region's population and the largest proportion of immigrants was from Europe and the United Kingdom (49%). The ethno-racial diversity of the city's population, however, has changed significantly. By 2011, foreign-born permanent residents grew to constitute approximately 21 percent of the population and Asia now is the largest source region for newcomers (39.8%) (Ray & Gilbert, forthcoming). The research discussed here examines the Chinese population in the first decade of the present century, and by 2006 approximately 32,400 Chinese immigrants had come to live in the capital region and represented approximately 9 percent of the total foreign-born population in the metropolitan area. Unlike many immigrant groups living in the city, the overwhelming majority of Chinese immigrants were recent arrivals (70 percent arrived between 1991 and 2006), quite young (less than 40 years old), and highly educated (63 percent held at least a Bachelor's degree). The group also has a distinct geography, especially relative to most other immigrant groups, in that it is overwhelmingly located in Ottawa. In fact, less than 1,000 Chinese lived in Gatineau in 2006 and constituted less than 5.5 percent of the total Chinese population (Gilbert, Veronis, Brosseau & Ray, 2014). Moreover, the Chinese population living in Ottawa is strongly biased toward the city's western suburbs, which is also where a large proportion of the region's high-tech industry is located. As a geographic reference point, this thesis uses the Ottawa-Gatineau census metropolitan area (CMA), but it is important from the outset to appreciate that the Chinese immigrant population is far from evenly distributed across the metropolitan area.

In part because Ottawa-Gatineau, as Canada's Capital Region, has long been seen as a region of bureaucrats and it has not generally garnered the degree of research attention about immigrant integration relative to the country's three largest metropolises. Ottawa-

Gatineau's economy has been historically dominated by the federal government and its associated public and private institutions (Mosco & Mazepa, 2003). As the single largest user of information technologies, the federal government has provided a great number of opportunities and contracts to high-tech firms and, consequently, in the 1960s the high-tech sector began to develop in Ottawa, especially around information, communications, and security technologies. The sector has also experienced episodes of skilled-labour shortage, most notably when it expanded quickly during the "dot com" bubble in the late 1990s and early 2000s. In response, employers and the City of Ottawa tried to enhance the awareness of employment opportunities in the high-tech sector at both national and international scales, and deliberately targeted highly skilled and professional immigrants who were applying the independent economic class for permanent settlement in Canada. By the mid-2000s, it was estimated that one-third of the skilled immigrants who came to Ottawa worked in the high-tech sector and related occupations (Novakowski & Tremblay, 2007). Ottawa's reputation as the "Silicon Valley North" (Mosco & Mazepa, 2003) and exemplar of the creative economy (Gertler, 2001; Martin & Florida, 2009) makes it a particularly compelling case study for examining the employment experiences of well-educated and professional Chinese immigrants. Much has changed in Ottawa's high-tech sector since the heady days of the late 1990s when the sector flourished in Ottawa. The dotcom bust and subsequent demise of Nortel, the sector's largest employer, has significantly changed the importance of the high-tech sector as an engine of Ottawa's economy. It remains, however, an important component of the regional economy (Andrew, Ray, & Chiasson, 2011).

This research project focuses on Chinese immigrants who work in the high-tech sector, with an emphasis on Ottawa-Gatineau – a metropolitan area that has both a large high-tech sector and has seen a significant increase in the size of its Chinese immigrant population in recent decades. While there is strong anecdotal evidence that large numbers of Chinese newcomers work high-tech sector, the first phase of this research project asks whether Chinese immigrants living in Ottawa-Gatineau are any more likely to work in high-tech relative to their co-ethnic counterparts living in Toronto and Vancouver. To contextualize the significance of Chinese concentration in high-tech employment, the relative likelihood that Chinese work in this sector is compared to that of other immigrant groups and the Canadian-born population who also live in Ottawa-Gatineau. The second phase builds on the first, but focuses directly on geographies within Ottawa-Gatineau CMA, highlighting the ways in which configurations of spatial concentration within the Chinese population and neighbourhood-level socio-economic and demographic characteristics influence employment outcomes for women and men. Do Chinese residential settlement patterns affect the likelihood that Chinese women and men find employment in Ottawa-Gatineau's high-tech sector? In terms of types of employment, do women and men benefit equally from the social composition of their neighbourhoods and/or the density of co-ethnic neighbours in the immediate area? The primary objectives of this project are:

- To document the characteristics of employment among Chinese immigrant women and men living in Ottawa-Gatineau in relation to their counterparts in Toronto and Vancouver, with an emphasis on industry of employment, occupation characteristics, and employment earnings. This phase of the research seeks to: 1)

outline the propensity of Chinese women and men to work in the high-tech sector; and 2) establish the relative importance of Ottawa-Gatineau as a case study.

- To investigate the relationship between residential characteristics and the probability that Chinese immigrants work in Ottawa-Gatineau's high-tech sector.

Chinese newcomers are not randomly distributed across Ottawa-Gatineau; instead, they are strongly clustered in a relatively small number of areas (e.g., portions of the western suburbs and Kanata). How does residential spatial clustering, especially among Chinese newcomers who work in the high-tech sector, work in tandem with the overall social characteristics of neighbourhoods to influence Chinese newcomers' likelihood of employment in the high-tech sector?

1.2 Setting the Research Context: A High-Level Overview of Research about Chinese Immigrants and Employment in Canada

Several bodies of literature that inform this research project, and a discussion of pertinent studies leads each of the two substantive chapters in order to contextualize the analysis. The section, however, takes a somewhat broader approach by focusing on research about the challenges newcomers face in integrating into Canadian labour markets and achieving some degree of social mobility after arrival. Attention in particular is given to the challenges that Chinese immigrant women and men face in finding employment that aligns with their educational and work experiences. In this regard, the somewhat neglected role of geography, particularly in relation to the complex social and cultural characteristics of life in low-density and multi-ethnic cities, is discussed. This section concludes by underlining the fact that all analyses of labour market experiences need to acknowledge

the dissimilarities in outcomes between women and men, that work and workplaces are strongly gendered, and that the negotiation of roles at home and work can produce very different paid work experiences for women and men.

1.2.1 Employment Experiences of Immigrants

Research about immigrants and their employment experiences frequently examines the barriers and problems that newcomers face when seeking employment, integrating into the Canadian labour market, and achieving incomes that match their educational attainment and work experience (Godin, 2008; Kelly, et al., 2010; Man, 2004; Plante, 2010; Reitz, et al., 2014). Although immigrants to Canada are largely selected based on their human capital, they are often penalized by what is judged to be an insufficient knowledge of official languages and lack of Canadian work experience (Cao & Boyd, 2009; Frank, 2013; Reitz, et al., 2014). While attempts have focused on how individual characteristics affect labour market outcomes, studies suggest that structural barriers created by institutions are more influential factors (Guo S. , 2013; Pendakur & Pendakur, 2002; Salaff, Greve, & Ping, 2002; Shan, 2013). These institutional characteristics include, but are not limited to, discrimination based on racial origins or immigration status, credential recognition, and assessment of foreign work experience in accessing specific niches and regulated professions (Houle & Yssaad, 2010; Pendakur & Pendakur, 2002; Reitz, 2007; 2001; Zietsma, 2010). As a result of these employment barriers, immigrants often encounter strong competition in finding jobs that match their skills and qualifications in the Canadian labour market (Chen, Smith, & Mustard, 2010; Ooka & Wellman, 2006), especially among those who were well-educated and professionally trained in their home countries (Li P. , 2003; Stelcner, 2000).

Chinese immigrants, as one of the largest groups contributing to the growth of the skilled and professional immigrant population in Canada, are particularly affected by employment barriers (Salaff & Greve, 2006). Research shows that many of these immigrants suffer unemployment and face both social and institutional barriers in re-establishing careers or positions that match their skills and jobs they once held (Hou & Picot, 2003; Reitz, et al., 2014). Among these well-educated and professional immigrants, women encounter even more challenges in finding employment commensurate with their skills (Hall & Sadouzai, 2010; Phan, Banerjee, Deacon, & Taraky, 2015). Researchers have also emphasized that with an increasing number of recently arrived affluent middle-class Chinese immigrants, who come to Canada with strong socio-economic achievements and high levels of human and financial capital, it is no longer reasonable to regard Chinese immigrants as one homogeneous group (Li & Lo, 2012; Wang & Lo, 2005). In particular, recent studies have documented that Chinese immigrants are found in many different industries and occupations ranging from traditional ethnic retail niches to the high-tech sector (Guo & DeVoretz, 2006). Little is known, however, about the degree to which Chinese newcomers concentrate in a particular industry, such as the high-tech sector, and/or the role of geographic clustering of co-ethnics and neighbourhood social characteristics in influencing employment in particular economic sectors.

1.2.2 Geographies of Employment

Beyond focusing on the influence of individual characteristics and local institutional settings on immigrants' employment experiences, evidence demonstrates that the structure of the urban economic landscape can have an influence on employment experiences and outcomes among some population groups (Fernandez & Su, 2004; Massey,

1985; Shearmur, Coffey, Dube, & Barbonne, 2007). Given that most immigrants live and work in an array of central and inner-suburban neighbourhoods, the formation of so-called ethnic enclaves has attracted research attention (Fong & Ooka, 2002; Hou & Picot, 2003; Li & Dong, 2007; Logan, Alba, & Zhang, 2002). These neighbourhoods are not only physical spaces where newcomers find housing, but they also constitute important nodes where newcomers can find employment by drawing on the resources of a co-ethnic population, namely shared culture values, language, and social network supports. Living and working exclusively in ethnic enclaves, however, has been found to hamper access to a full range of job opportunities and negatively affect employment earnings (Warman, 2007).

The presence of ethnic employment enclaves is not the only significant change in the geographies of employment that immigrants face in North American cities. There is a general consensus in the literature that employment has been decentralized within North American's large metropolitan areas (Kneebone, 2009). The number and the proportion of jobs that were once concentrated in downtown cores have steadily declined and moved to suburbs (Filion & Gad, 2006; Harris, 2004). Paralleling this suburbanization of employment, occupational structures have also shifted from traditional manufacturing-related work to low-skill and low-wage service employment, as well as white-collar jobs associated with high-order services (Shearmur & Polese, 2005). As a result, inner-city residents, especially among those immigrants who live in traditional ethnic enclaves (e.g., Chinatowns), can be particularly affected by these changes in employment opportunities and may face difficulties in accessing available and suitable jobs in peripheral suburbs due to commuting challenges and accessing information about such opportunities (Preston & McLafferty, 2000).

This complex relationship between suburbanization of employment, residential location, and labour market outcomes is explicitly examined in the literature on spatial mismatch. According to this argument, in the context of economic restructuring and racialized housing markets, inner-city residents are increasingly concentrated in residential areas where they are less likely to find job opportunities commensurate with their skills and education levels, especially if they have a modest education and/or their work experience does not easily align with the skills demanded in a service-based economy (Chapple, 2006; Hellerstein, Neumark, & McInerney, 2008; Kain, 1968). At the same time, lack of efficient mass transit systems for bringing inner-city residents to available jobs in suburbs further denies their access to work opportunities (Ihlanfeldt, 1993). Evidence also demonstrates that some groups, such as immigrants, racial minorities, and women, are less likely than others to access a full range of employment opportunities. Preston and McLafferty (2000) in particular have drawn attention to the disadvantages experienced by ethnic minorities who are more likely to be influenced by long travel distances and commuting times when accessing suburban jobs.

Despite growing racial and ethnic diversity in North America, the spatial mismatch literature focuses predominantly on the disadvantages experienced by African Americans (Gobillon, Selod, & Zenou, 2007; Kain, 2004; 1992; Weinberg, 2000). Aponte (1996) finds that African Americans are highly likely to suffer the adverse effects of spatial mismatch. Some research has shown that spatial mismatch may also be experienced by a number of lower-income ethnic and immigrant groups (McLafferty & Preston, 1997). Little attention has been given to how spatial mismatch may influence a specific immigrant group's (e.g., Chinese immigrants) labour market outcomes, especially in a context of ethnic residential

concentration in suburban areas. A recent study about immigrant settlement patterns has suggested that many highly educated immigrants working in professional occupations, and who have financial resources are settling directly in the suburbs without ever experiencing life in the inner city where traditional ethnic enclaves developed (Li W. , 2009). Yet little is known about the types of industries and kinds of work in which such ‘suburban’ immigrants find employment. How does the residential concentration of recent immigrants in ethnoburbs influence their employment opportunities and labour market outcomes?

In addition to insufficient attention to the particular geographies and experiences of immigrant groups, spatial mismatch research has often paid insufficient attention to the impact of gender on access to employment (Preston & McLafferty, 2000). Indeed, evidence indicates that more limited access to cars among women and dependence on public transit limits women’s access to jobs in distant suburban locations (Ong & Miller, 2005) and can lead to higher unemployment rates. Moreover, in a series of publications, McLafferty and Preston (1997; 1996) note that minority women also experience longer commuting times and travel distances than white women and minority men. In the next section, a review of the literature on gender and employment is presented to demonstrate how access to employment is differently shaped for women and men.

1.2.3 Geographies of Gender and Employment

Research about gender and work seeks to investigate how the social construction of women and men’s identities and roles influence spatial access to jobs, gender-specific job search patterns, and ultimately occupational segmentation (Preston & McLafferty, 2000). It

has long been established that many women tend to work in different types of jobs than men (Becker, 1985), and that their jobs are more likely to be semi- or low-skilled, part-time or with flexible working hours, in unfavourable working environments, and often low-pay (Bauder, 2003; Hanson & Pratt, 1995; Wang Q. , 2010). In industrialized economies, women are over-represented in low-paid service and sales positions and underrepresented in professional and managerial occupations (Cohen & Huffman, 2003; Gauchat, Kelly, & Wallace, 2012). This is particularly true of immigrant women, since they are often “deskilled” after arrival by a lack of recognition of education and work experience by employers (Man, 2004; Preston & Man, 1999; Salaff & Greve, 2003).

Research also suggests that women’s occupational segregation is shaped by their social roles and domestic responsibilities, regardless of ethnic identity. Women’s disproportionate share of domestic responsibilities, such as child care and housework, has an important impact on women’s employment and decisions about whether and where to work. For example, McLafferty and Preston (1997) demonstrate that marital status and the number of children living at home have a significant influence on women’s employment.

In addition to women’s domestic responsibilities, research on gender and work also demonstrates that women’s employment segmentation is a spatial phenomenon (Ellis, Wright, & Parks, 2004; Hanson & Pratt, 1995). In response to long commute times and distance, women tend to look for jobs that are close to home. Often women compromise on the quality of employment (e.g., skill levels, wages, and responsibilities) in order to minimize travel times and costs, as well as to respond effectively to household and child care demands (Hanson & Pratt, 1995). Moreover, women are more likely than men to rely on informal networks for job information, as well as personal contacts within

neighbourhoods or ethnic communities, to locate jobs in local areas (Ellis, et al., 2004). However, it is important to note that most of these studies focus on the experiences of minority women with low human capital, and very few studies examine professional and skilled immigrant women's labour market experiences. Beyond questioning spatial constraints and family responsibilities, it is necessary to better understand how skilled and professional Chinese immigrants' geographies of employment are shaped by gender roles, labour market structures and opportunities, and the ways in which urban space is organized and accessed in daily life.

As suggested by this high-level literature review, geographies of employment among immigrants are shaped not only by individuals' human capital and institutional structures, but also by spatial relationships between work and home. Relatively, little research has addressed the experiences of well-educated and middle-class immigrants' employment opportunities in key industries of Canada's economy, such as the high-tech sector. This study applies a geographic approach to investigate Chinese immigrants' labour market outcomes in the high-tech sector, with a focus on how living in a particular metropolitan area or a neighbourhood influence high-tech employment opportunities. To better understand Chinese newcomers' employment in the high-tech sector, the next section reviews research about the qualities and characteristics of high-tech employment and provides a methodological explanation of how this sector is defined in this research.

1.3 Defining High-tech Employment

The high-tech sector is organized around knowledge-based activities and the use of modern technologies and information. There are various ways to define the high-tech

sector, each relating to different understandings of high-tech activities as well as different research contexts and purposes (Chapple, Markusen, Schrock, Yamamoto, & Yu, 2004; Hall & Khan, 2008; Hall & Sadouzai, 2010). For studies examining the geography of high-tech economic clusters, a standard industrial classification often is used to define the high-tech sector (Atkinson & Gottlieb, 2001; DeVol, 1999). However, when examining individuals' high-tech employment characteristics and earnings, defining such work activities solely in terms of industrial category can be problematic (Hall & Khan, 2008). A significant number of individuals who work in high-tech occupations may not necessarily be employed in industries that are commonly regarded as being "high-tech". Therefore, it is important also to incorporate occupation-based definitions of work when evaluating individuals' high-tech employment status (Chapple, et al., 2004).

This study adopts a broad definition of high-tech employment that includes individuals who either hold high-tech occupations or work in high-tech industries. More specifically, this definition of high-tech employment captures those performing work that requires high-tech related skills and experience, regardless of where they fall in an industrial classification scheme (e.g. a computer technician who works in the public service sector). At the same time, this definition includes all individuals who work in high-tech industries primarily because an understanding of the industry is required regardless of occupational type (e.g. an executive assistant who works at IBM). Accordingly, an individual who is either employed in a high-tech occupation or works in a high-tech industry is considered to be working in the high-tech sector for the purposes of this study. It is important to note that although some research focuses exclusively on occupational status (Hall & Sadouzai, 2010; Jenkins & Leicht, 2008), while other studies examine

Table 1.1 High-tech Occupations by Labour Market Activities: Occupation (NOCS2006)

Census Code	Occupational Description
11	A121 Engineering managers
12	A122 Computer and information systems managers
50	B022 Professional occupations in business services to management
77	B522 Data entry clerks
101	C011 Physicists and astronomers
102	C012 Chemists
103	C013 Geologists, geochemists and geophysicists
105	C015 Other professional occupations in physical sciences
106	C021 Biologists and related scientists
111	C033 Electrical and electronics engineers
113	C041 Industrial and manufacturing engineers
118	C046 Aerospace engineers
119	C047 Computer engineers (except software engineers)
126	C071 Information systems analysts and consultants
127	C072 Database analysts and data administrators
128	C073 Software engineers and designers
129	C074 Computer programmers and interactive media developers
130	C075 Web designers and developers
131	C111 Chemical technologists and technicians
134	C121 Biological technologists and technicians
140	C132 Mechanical engineering technologists and technicians
141	C133 Industrial engineering and manufacturing technologists and technicians
143	C141 Electrical and electronics engineering technologists and technicians
145	C143 Industrial instrument technicians and mechanics
146	C144 Aircraft instrument, electrical and avionics mechanics, technicians and inspectors
152	C161 Non-destructive testers and inspectors
179	D211 Medical laboratory technologists and pathologists' assistants
180	D212 Medical laboratory technicians
183	D215 Medical radiation technologists
186	D218 Electroencephalographic and other diagnostic technologists, n.e.c.
345	H211 Electricians (except industrial and power system)
346	H212 Industrial electricians
348	H214 Electrical power line and cable workers
349	H215 Telecommunications line and cable workers
350	H216 Telecommunications installation and repair workers

Source: Chapple *et al.* (2003) and Hall & Khan (2008).

employment in a number of “high-tech” industrial sectors (Hecker, 2005), it is not unprecedented for research to utilize a combination of the two approaches (Hall & Khan, 2008; Markusen, Wassall, & DeNatale, 2008).

High-tech occupations include a wide range of high-tech activities and related advanced service positions, such as scientists, engineers, and technicians (Hall & Sadouzi, 2010). Based on the National Occupational Classification for Statistics 2006 (NOCS 2006), a total of 35 four-digit NOCS occupations are identified as high-tech occupations based on previous studies about high-tech workers in Canada (Chapple, et al., 2004; Hall & Khan, 2008) (see Table 1.1). Individuals employed in these occupations are collectively referred to as high-tech workers. Some high-tech workers are engaged in Research and Development (R&D) as they develop and design technological products; others apply technology in other activities, such as computer applications, quality management, sales and marketing activities.

High-tech industries are defined using a human capital based measurement. The intent is to capture the nature of high-tech activities in each industry by the “intensity” (i.e., number and proportion) of technology-oriented workers (Hecker, 2005). An industry is considered high-tech if the share of high-tech occupations in the industry is three times or more than the proportion of high-tech workers in all industries (Chapple, et al., 2004; Hall & Khan, 2008). At the national level, the share of high-tech occupations in all industries is 3.1% based on 2006 census data calculations. Ranking all the industries of the four-digit NAICS02⁵ industry classification by their share of high-tech occupations, 56 industries have a share that equals or exceeds 9.3% (three times the national value). However, according to

this ranking, some of these industries are not well-known as high-tech, such as pipeline transportation of oil and gas, oil and gas extraction, iron and steel mills, ferro-alloy manufacturing, and pesticide, fertilizer and other agricultural chemical manufacturing. These industries may have a higher share of high-tech occupations in some provinces and Census Metropolitan Areas (CMAs), but not all these industries are distributed evenly throughout the country. For example, pipeline transportation and the oil industry are more significant in the economic structure of Calgary than Ottawa-Gatineau. Since the focus of this study is to understand the employment outcomes of Chinese immigrants in Ottawa-Gatineau in relation to Toronto and Vancouver, the share of high-tech occupations in all industries in these three CMAs is considered as the threshold for defining the high-tech industries instead. Accordingly, a more precise list of 43 high-tech industries is presented in Table 1.2 as the share of high-tech occupations in these industries matches or exceeds 13.5%, which is three times greater than the average (4.5%) of high-tech occupations in all industries of the three CMAs (see Table 1.2).

Combining the definitions of high-tech occupations and high-tech industries, an individual who either holds a high-tech occupation or is employed in a high-tech industry, is considered to be a high-tech worker. This method of defining high-tech employment is intentionally broad and includes not only people perform high-tech activities but also those whose jobs require high-tech related skills and knowledge. This is especially important in examining high-tech employment in Ottawa-Gatineau as many people who hold high-tech jobs, work either directly or indirectly, for the federal government, the region's most significant employer.

Table 1.2 High-tech Industries by High-tech Occupational Proportion (NAICS02)

Code	NAICS02 Description	HT occupations %
235	5415 Computer systems design and related services	62.9%
197	5112 Software publishers	59.5%
263	6215 Medical and diagnostic laboratories	53.7%
182	4869 Other pipeline transportation	50.0%
237	5417 Scientific research and development services	48.0%
210	5182 Data processing, hosting and related services	46.7%
93	3342 Communications equipment manufacturing	39.6%
95	3344 Semiconductor and other electronic component manufacturing	38.4%
203	5171 Wired telecommunications carriers	36.1%
96	3345 Navigational, measuring, medical & control instruments manufacturing	35.9%
181	4862 Pipeline transportation of natural gas	33.3%
92	3341 Computer and peripheral equipment manufacturing	32.1%
202	5161 Internet publishing and broadcasting	31.4%
209	5181 Internet service providers, web search portals	31.2%
132	4173 Computer & communications equipment & supplies wholesaler-distributors	29.5%
25	2382 Building equipment contractors	28.7%
15	2211 Electric power generation, transmission and distribution	28.6%
60	3254 Pharmaceutical and medicine manufacturing	28.2%
236	5416 Management, scientific and technical consulting services	27.9%
105	3364 Aerospace product and parts manufacturing	27.6%
94	3343 Audio and video equipment manufacturing	26.7%
205	5173 Telecommunications resellers	26.0%
212	5211 Monetary authorities - central bank	25.7%
206	5174 Satellite telecommunications	25.3%
208	5179 Other telecommunications	25.0%
204	5172 Wireless telecommunications carriers (except satellite)	23.5%
100	3353 Electrical equipment manufacturing	21.9%
217	5232 Securities and commodity exchanges	21.1%
207	5175 Cable and other program distribution	21.0%
106	3365 Railroad rolling stock manufacturing	20.7%
13	2131 Support activities for mining and oil and gas extraction	20.6%
233	5413 Architectural, engineering and related services	20.3%
101	3359 Other electrical equipment and component manufacturing	19.6%
57	3251 Basic chemical manufacturing	19.4%
11	2122 Metal ore mining	18.8%
97	3346 Manufacturing and reproducing magnetic and optical media	17.2%
9	2111 Oil and gas extraction	17.1%
86	3332 Industrial machinery manufacturing	16.5%
230	5331 Lessors of non-financial, intangible assets (except copyrighted works)	16.0%
289	8112 Electronic and precision equipment repair and maintenance	14.6%
87	3333 Commercial and service industry machinery manufacturing	14.6%
63	3259 Other chemical product manufacturing	14.5%
303	9112 Other federal services (9112 to 9119)	14.3%
<i>HT occupations % in all industries in CMAs of Ottawa-Gatineau, Toronto, and Vancouver</i>		<i>4.5%</i>

Data Source: calculated by the author of the 2006 Census of Canada.

1.4 Organization of the Thesis

This thesis is organized into four chapters, including this introductory chapter, two empirical research articles address the research objectives that have been outlined here, and a concluding chapter. The second chapter examines whether Chinese immigrants are more likely to work in the high-tech sector in Ottawa-Gatineau relative to co-ethnics in Toronto and Vancouver, as well as whether Chinese newcomers are any more likely than other immigrants of the Canadian-born population to work in high-tech. Specifically, Chapter 2 investigates the importance of ethno-racial identity in relation to a number of other social and demographic characteristics in influencing the likelihood that Chinese immigrants work in the high-tech sector. Similarities and/or differences between Chinese women and men with regard to their likelihood of high-tech employment are also evaluated in this phase of the research. The third chapter moves on to focus directly on Ottawa-Gatineau CMA and evaluates the relative importance of the ethno-racial composition of residential location versus neighbourhood-level social characteristics in determining the likelihood that Chinese women and men work in the high-tech sector. Chapter 3 argues that configurations of Chinese immigrants' residential concentration, as well as social and demographic characteristics of neighbourhoods where individuals reside, influence Chinese men and women's likelihood of working in the high-tech sector. These two chapters are based entirely on analysis of 2006 census data. The final chapter concludes the thesis by summarizing the results and key findings, as well as presenting research limitations and recommendations for future research.

Endnotes

1. Data source: <https://www12.statcan.gc.ca/nhs-enm/2011/dp-pd/dt-td/Rp-eng.cfm?LANG=E&APATH=3&DETAIL=0&DIM=0&FL=A&FREE=0&GC=0&GID=0&GK=0&GRP=1&PID=105411&PRID=0&PTYPE=105277&S=0&SHOWALL=0&SUB=0&Temporal=2013&THEME=95&VID=0&VNAMEE=&VNAMEF=>
2. The points system was first introduced in 1967, which aims to select skilled and professional principal applicants based on their labour market attributes. Selection criteria for skilled and professional immigrants comprises education level, language ability in official languages, employment experience, age, arranged employment in Canada prior to landing, and some form of adaptability. Principal applicants with higher points are selected as skilled-workers and admitted to Canada with their spouse and dependents.
3. The Canadian Experience Class (CEC) is an immigration category introduced in 2008, for Canada's foreign worker and international students to become permanent residents. Candidates need to obtain at least one year of skilled professional or technical work experience in Canada and meet the Canadian language Benchmark at the time of application.
4. The Express Entry System was first introduced in 2015, which is used to manage applications for permanent residence under several federal economic immigration programs, including the Federal Skilled Worker Program, the Federal Skilled Trades Program, and the Canadian Experience Class. Potential candidates have to complete an online Express Entry profile. Those who meet the criteria of one of the federal immigration programs listed above will be accepted into a pool of candidates. Similarly to the point-system, a Comprehensive Ranking System is applied to rank all candidates based on the information in the profile. The highest –ranking candidates in the pool will be invited to apply for permanent residence.
5. NAICS – The North American Industry Classification System (NAICS) is the standard used by Statistics Canada in classifying business establishments for the purpose of collecting, analyzing, and publishing statistical data related to the Canadian economy.

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CHAPTER 2

Variations in High-tech Labour Market Outcomes among Chinese Immigrants in Canadian Cities

Abstract: A considerable amount of research has focused on Chinese immigrants' integration into the Canadian labour market by examining their labour market outcomes relative to other immigrant groups and the Canadian-born population. However, little research has examined geographic variations in Chinese immigrants' labour market experiences, especially among well-educated and professionally trained individuals. Using 2006 census microdata files, this study examines the metropolitan variations in labour market status among Chinese high-tech immigrants in three Canadian cities: Ottawa-Gatineau, Toronto and Vancouver. Using logistic regression analyses, this study investigates the degree to which various social and demographic characteristics influence Chinese immigrants' likelihood of working in the high-tech sector across the three cities. The paper also examines the similarities and differences between Chinese women and men with regard to their likelihood of employment in the high-tech sector in each city. Findings indicate that the determinants of Chinese immigrants' high-tech employment vary across metropolitan areas, which suggest that where well-educated and professionally trained Chinese immigrants are located, as well as the structure of local labour markets, play important roles in determining the labour market experiences and status of newcomers.

Keywords: geographic variations, Chinese immigrants, high-tech workers, labour market outcomes, gender

2.1 Introduction

Over the last two decades, many Chinese immigrants have been admitted to Canada as skilled and professional workers (Statistics Canada, 2015). With higher educational attainment and relevant employment experience, Chinese immigrants are finding employment in the high-tech sector (Hall & Sadouzaï, 2010). Despite the fact that the majority of Chinese immigrants have chosen to settle in Canada's largest three CMAs – Toronto, Vancouver, and Montréal – a growing number are attracted to cities other than the three largest. Ottawa-Gatineau in particular, as the 'Silicon Valley North' (Mosco & Mazepa, 2003) and exemplar of the creative economy (Gertler, 2001; Martin & Florida, 2009), has attracted a large number of highly skilled and professional immigrants. In the mid-2000s, it was estimated that one-third of the skilled immigrants who came to Ottawa-Gatineau worked in the high-tech sector (Novakowski & Tremblay, 2007). Much has changed in Ottawa's high-tech sector since the heady days of the late 1990s, when the sector flourished in Ottawa. The dotcom bust, followed by the demise of Nortel in 2009, has significantly changed the importance of the high-tech sector as an engine of the capital region's economy, although it remains an important component of the regional economy (Andrew, Ray, & Chiasson, 2011). It is within this broad context of change in the local high-tech sector that this study investigates the likelihood of employment in the high-tech sector among Chinese immigrants who reside in Ottawa-Gatineau relative to co-ethnic Chinese living in Toronto and Vancouver.

In a broad sense, despite the growing interest in the barriers that immigrants face in labour markets such as insufficient knowledge of official languages, lack of Canadian experience, and devaluation of foreign credentials (Cao & Boyd, 2009; Frank, 2013; Reitz,

Curtis, & Elrick, 2014), only a small number of studies have considered the geographic variation in immigrants' labour market outcomes. In addition, most research on economic integration tends to focus on the national or provincial scales (Plante, 2010; Zietsma, 2010). Given that work opportunities are strongly influenced by factors that are local, this study begins by questioning whether there are differences in the likelihood of working in the high-tech sector among Chinese immigrants in Ottawa-Gatineau compared to the two principal destinations for Chinese newcomers – Toronto and Vancouver. The analysis also investigates whether Chinese immigrants are more likely to hold high-tech employment than other immigrant groups and the Canadian-born population in each city. In this regard, the research examines the relative importance of a number of factors that influence the Chinese population's probability of employment in the high-tech sector. Given the highly gendered qualities of high-tech work (Walby, 2011)¹, all parts of this study examine similarities and differences between men and women in their employment outcomes.

To examine these issues, the article begins with a brief review of the relevant literature about the geographies of employment among highly skilled immigrants. The structure of the labour market in Ottawa-Gatineau, Toronto and Vancouver is briefly described, with an emphasis on the principal industries in each location and the types of occupations. Subsequently, the data sources and methods used in the analysis are outlined. The empirical sections begin with an examination of the social, demographic and employment characteristics of Chinese immigrants compared to other immigrant and Canadian-born groups in Ottawa-Gatineau, Toronto, and Vancouver. This leads into a multivariate statistical analysis of the relative influence of social, demographic and metropolitan variables, as well as location, on the likelihood of high-tech employment

among Chinese immigrants. Implications of the research regarding the importance of location for Chinese immigrants' employment in the high-tech sector are discussed in the conclusion.

2.2 Immigrants and their High-tech Employment Experiences in Canadian Cities

Given Canada's pursuit to develop a knowledge-based economy, it is not surprising that large flows of highly skilled immigrants come to Canada and become concentrated in large urban centers, where the majority of the country's economic and service activities are clustered (Ferrer, Picot, & Riddell, 2014; Guo S. , 2013; Reese, 2012; Reitz, et al., 2014; Wolfe & Gertler, 2004). It has been long recognized that well-educated and professional immigrants play an important role in innovation and economic development in Canadian cities (Gertler, 2001). Yet, many scholars are raising concerns about immigrants' social and economic integration, and in particular about highly skilled immigrants' labour market outcomes and employment opportunities (Kelly, Damsbaek, Lemoine, Fang, Valerie, & Tufts, 2010; Nohl, Karin, Schmidtke, & Weib, 2014; Plante, 2010). Accordingly, what is the inter-relationship between highly skilled immigrants' economic integration, settlement patterns, and labour market status in the Canadian urban context?

Research has documented that, although the majority of recently arrived immigrants come to Canada with strong human capital characteristics, some of them are still penalized by their insufficient knowledge of official languages and lack of relevant Canadian work experience when entering the Canadian labour market (Cao & Boyd, 2009; Kelly, et al., 2010; Plante, 2010). A number of studies suggest that structural barriers, including discrimination based on 'race' or immigration status and credential recognition,

also play an influential role in immigrants' labour market outcomes (Guo S. , 2013; Pendakur & Pendakur, 2002). As a result of these barriers, research has found that some highly skilled immigrants are over-qualified for the jobs they hold (Chen, Smith, & Mustard, 2010) or even experience 'deskilling' in the Canadian labour market (Man, 2004).

Despite the fact that the labour market integration of some immigrants is challenged by these employment barriers, a number of studies also point out that some newcomers who arrived with high-tech related skills and work experience are more likely to hold employment that matches their prior experience and to work in the high-tech sector (Hall P. , 2006; Hall & Sadouzai, 2010). More specifically, Hall and Sadouzai (2010) show that Canadian employers are likely to accept high-tech experience attained somewhere else in unregulated high-tech occupations. In addition, they argue that the transferability of high-tech skills and the relative absence of institutional barriers are the key factors contributing to immigrants' employment success in the high-tech sector. These findings have found support across a few empirical studies in various contexts (Novakowski & Tremblay, 2007; Richardson, 2014), and it has become well accepted that well-educated and professional immigrants play a significant role in the development of high-tech industries in Canada, and thus represent a large proportion in the Canadian high-tech workforce (Hari, 2013; Li & Lo, 2012).

High-tech industries, an important component of the Canadian economy, tend to be located in or near the largest metropolitan areas, namely Toronto, Montreal and Vancouver, which are closely connected to global economic and technology markets (Wolfe & Gertler, 2004). These places are also major destinations for highly skilled immigrants, who are attracted by potential employment opportunities, as well as for large and well-

established ethnic communities (Fong & Shen, 2011; Hyndman, Schuurman, & Fiedler, 2006). According to data from the 2011 National Household Survey (NHS), nearly two-thirds of the very recent immigrants, who arrived between 2006 and 2011, live in the three largest CMAs, and the majority of them was admitted to Canada based on their human capital characteristics and labour market skills (Statistics Canada, 2013). Moreover, King (2009) argues that the concentration of recent immigrants in large urban centers is not simply a concentration of people, but also of well-educated and professional individuals, who are the sources of new ideas for innovation.

The question of how highly skilled immigrants integrate into local labour markets continues to be a topic of debate. Previous research by Saxenian (1999; 2002; 2005) has shown that well-educated and professional immigrants significantly contribute to the economic growth of California's Silicon Valley high-tech sector by fostering international trade and global interactions. She also points out that although Chinese and Indian-born immigrants in Silicon Valley face barriers to upward their occupational mobility, they do not earn significantly less than their native-born counterparts (Saxenian, 1999). Similarly, in Canada, researchers such as Florida, et al. (2010) and Gertler (2001) also have argued that highly skilled immigrants play a positive role in the high-tech sector and have a strong direct effect on technology development and income growth in large Canadian urban centers.

Geographers have found that highly skilled immigrants' labour market outcomes are strongly differentiated geographically (Hall & Khan, 2008; Parks, 2012; Plante, 2010). In a study of high-tech immigrants' earnings and wage differences across Canadian cities during the high-tech boom in the late 1990s, Hall and Khan (2008) show that immigrants in the

largest and most tech-intensive cities earn significantly less relative to non-immigrants, when compared with those living in mid-size and smaller cities. More specifically, Hall and Khan (2008) find that in Toronto, immigrants in the high-tech sector have lower incomes than immigrants in other sectors, while in Ottawa-Gatineau CMA, immigrants in the high-tech sector have higher incomes than immigrants in other sectors, and their incomes are about the same as non-immigrants in the high-tech sector.² Furthermore, Frank (2013) find that well-educated immigrants who live in major Canadian cities (Toronto, Vancouver, and Montreal) are significantly less likely to obtain jobs that match their educational background and experiences than those who settle in smaller cities, which could be explained by the strong competition for jobs from new native-born labour market entrants in larger cities (Reitz, 2005). In sum, this line of research points to geographic variation being an important factor that influences highly skilled immigrants' labour market outcomes.

For the most part, these studies point out the influence of place on highly skilled immigrants' labour market outcomes. They also demonstrate the need to consider location when examining labour market outcomes among well-educated and professional immigrants. Such studies, however, often examine geographic variation solely in terms of the overall income earnings between immigrants and non-immigrants, and neglect to investigate whether there are geographic differences in immigrants' likelihood of employment in particular sectors. For this reason, this study focuses on geographic variations in the likelihood of Chinese immigrants' working in the high-tech sector in Ottawa-Gatineau, Toronto and Vancouver metropolitan areas (CMAs) in relation to a

number of social, economic, and demographic factors that have been shown to influence employment status.

2.3 Chinese Immigrants and Local Labour Markets in Ottawa-Gatineau, Toronto and Vancouver

Chinese immigrants are an important segment of the skilled and professional immigrant population in Canada. In 2013, one in five landed immigrants (20.6%), who were admitted to Canada as economic immigrants³, came from China (Statistics Canada, 2015). The majority of these recent arrivals was attracted to Canada's three largest CMAs, namely Toronto, Montreal and Vancouver. In addition to co-ethnic ties, many Chinese immigrants choose to live in these three cities because of economic opportunities that are offered in highly diversified labour markets (Picot & Sweetman, 2012). In recent years, some Chinese immigrants have been drawn to places other than the three largest CMAs (Walton-Roberts, 2007). Ottawa-Gatineau in particular, as the "Silicon Valley North", has attracted a large number of Chinese immigrants who are well educated, skilled, and keen to work in the high-tech sector.

Local labour market structures and employment opportunities are key factors in attracting people, especially internationally trained individuals (Shearmur, 2007). Therefore, it is important to review the structure of local labour markets to appreciate the opportunities and constraints that newcomers encounter in the three cities. First, nearly three quarters of workers are employed in the service sector in Ottawa-Gatineau, whereas the proportion of workers similarly employed is slightly lower in Toronto and Vancouver: 59% and 61.1% respectively (Table 2.1). Although the goods-producing sector, which

Table 2.1 Labour Market Structure in Ottawa-Gatineau, Toronto, and Vancouver, 2006:
Proportion of Employed Workers by Industrial Sector (age ≥15)

	Ottawa- Gatineau	Toronto	Vancouver
Total employed workers by industry (NAICS 02)	678,165	3,003,505	1,263,380
Services Sector			
Information industries	2.0%	1.8%	1.8%
Scientific services	5.2%	3.9%	3.5%
Technical services	0.8%	0.7%	0.5%
Professional services	3.4%	5.0%	5.1%
Culture industries	0.9%	1.9%	1.7%
Finance and insurance	3.0%	6.8%	4.7%
Real estate and rental and leasing	1.7%	2.4%	2.6%
Management of companies and enterprises	0.1%	0.2%	0.2%
Administrative services and business support	1.8%	2.5%	1.7%
Security and building services	2.6%	2.2%	2.5%
Waste and remediation; other services	0.4%	0.6%	0.5%
Educational services	7.3%	6.5%	7.5%
Health care	5.4%	4.6%	5.5%
Social assistance	4.4%	3.4%	3.6%
Arts, entertainment and recreation	2.3%	2.2%	2.5%
Accommodation and food services	6.3%	6.0%	8.1%
Other services (except public administration)	4.9%	4.7%	5.1%
Public administration	21.0%	3.6%	4.0%
Goods Producing Sector			
Utilities	0.4%	0.6%	0.5%
Construction	4.9%	5.3%	6.3%
Manufacturing	4.5%	13.2%	8.4%
Wholesale trade	2.4%	5.9%	5.3%
Retail trade	10.4%	10.8%	10.9%
Transportation and warehousing	3.3%	4.9%	5.5%
Primary Sector			
Agriculture, forestry, fishing and hunting	0.6%	0.4%	1.4%
Mining and oil and gas extraction	0.1%	0.2%	0.4%

Data Source: calculated by the author of the 2006 Census of Canada.

includes secondary manufacturing, construction, transportation, warehousing, and utilities, has been declining in relative terms since the end of World War II, a large number of people are still employed in this sector in Toronto (40.7%) and Vancouver (36.9%). The same is less true in Ottawa-Gatineau (25.9%) where the number of people employed in the goods-producing sector has declined markedly over the last thirty years (Andrew, et al., 2011).

A striking feature of Ottawa-Gatineau's workforce is the high proportion (21.0%) of people employed in public administration (Table 2.1). In contrast, much smaller proportion of workers in Toronto (3.6%) and Vancouver (4.0%) work in public administration. Ottawa-Gatineau's economy has long been dominated by the federal government and its associated public institutions (Mosco & Mazepa, 2003). It is important to note that the federal government, as a significant user of information technologies, has encouraged the development of a large high-tech industry in the capital region. As a consequence, a slightly larger share of Ottawa-Gatineau's labour force is employed in information industries, scientific services, and technical services (8.0%), relative to Toronto (6.4%) and Vancouver (5.8%). Although much has changed in Ottawa's high-tech sector since the days of rapid expansion in the late 1990s – namely the sector's sharp downturn in the early 2000s and subsequent demise of Nortel – the sector nevertheless remains important (Andrew, et al., 2011).

Labour market structures vary greatly across Ottawa-Gatineau, Toronto and Vancouver. As discussed, the economic structure within each metropolitan area offers different employment opportunities and in turn attracts people with skills that fit this context. Therefore, it is important to consider metropolitan variations when assessing immigrants' probability of employment in a particular sector.

2.4 Data and Methodology

The analysis draws on the full 2006 Census to investigate geographic variations in the probability of high-tech employment among Chinese immigrants. The census microdata file⁴ captures detailed information about individuals' social, demographic and employment characteristics, such as place of birth, ethnicity, level of education, occupation, industry of work, and employment income (Statistics Canada, 2008). In addition, access to the full 20% individual data file enables comparison of immigrants' employment status in Ottawa-Gatineau relative to Toronto and Vancouver, as well as other factors that affect their employment probability in the high-tech sector. The analysis uses the 2006 census data because it captures the high-tech employment situation after the high-tech bubble burst in the beginning of 2000s, and provides a picture that is more reflective of the sector's importance of today than at the height of the boom. In addition, this study favours the 2006 census over the 2011 census/NHS data, because many of the variables useful for this study were collected as part of the National Household Survey. The NHS departs significantly from earlier census methodologies, most notably in terms of relying on voluntary respondents, which has led to a much higher non-response rate. The non-response rate is especially significant for groups that are numerically small and/or whose first language is neither English nor French (e.g., unemployed, low-income groups and immigrants).⁵ Due to issues related to the reliability of the 2011 census/NHS, this analysis uses the 2006 census to investigate Chinese immigrants' employment status and to estimate the likelihood of employment in the high-tech sector.

The analysis is restricted to individuals who are between 23 to 70 years old. This age range is considered to be the "working age population" in the research literature as it

includes people who have completed most, if not all of their formal education, and relatively few individuals older than 70 are active in today's labour force (Frank, 2013; Li P., 2008). Second, only those who are in the labour force – people who are employed or unemployed and actively looking for work – are included in this study. Lastly, this study focuses on Chinese immigrants who were born in mainland China (People's Republic of China), Hong Kong, and Taiwan⁶. Although their pre-migration political and social values and economic behaviors may be different, these recently arrived immigrants are broadly similar in education levels, as well as employment rates and incomes after arrival (Lien, 2010; Lin, 2013). The important cultural and linguistic differences that exist between these groups are also largely ignored by the Canadian-born population of European origins.

The high-tech sector is organized around knowledge-based activities and the use of sophisticated technologies and forms of information. There are various ways to define the high-tech sector, each relating to different understandings of high-tech activities as well as different research contexts and purposes (Chapple, Markusen, Schrock, Yamamoto, & Yu, 2004; Hall & Khan, 2008; Hall & Sadouzai, 2010). This study adopts a broad definition of the high-tech sector that includes individuals who either hold high-tech occupations or work in high-tech industries. More specifically, this definition of high-tech sector captures those performing work that requires high-tech related skills and experience, regardless of where they fall in an industrial classification scheme (e.g. a computer technician who works in the public service sector). At the same time, this definition includes all individuals who work in high-tech industries, primarily because an understanding of the industry is required regardless of the occupational type (e.g. an executive assistant who works at IBM). In short, the high-tech sector requires a broader range of employees than just computer

scientists or engineers to function. Accordingly, an individual who either holds a high-tech occupation or works in a high-tech industry is considered to be working in the high-tech sector.⁷

The first part of the analysis documents the social, demographic and employment characteristics of Chinese immigrants living in Ottawa-Gatineau relative to their counterparts in Toronto and Vancouver. The analysis controls for sex and age, as prior research has demonstrated that these factors have a fundamental influence on employment status (Fernandez & Campero, 2012; Shields, Phan, Yang, Kelly, & Lemoine, 2010; Tastsoglou & Preston, 2005). In addition, to place the status of Chinese immigrants into a broader context, their social, demographic and employment characteristics are compared with several other groups, namely South Asian immigrants, 'all other visible minorities' immigrants, white immigrants, and the Canadian-born population. Immigrants from South Asia, namely Indians, Pakistanis, and Sri Lankans, are included for comparison because they are also a large and important segment of high-tech workers in Canada (Hari, 2013; Li & Lo, 2012; Wang & Lo, 2005). The intent of this analysis is to establish whether Chinese immigrants are better off in the high-tech sector in Ottawa-Gatineau relative to their counterparts and other immigrant groups in Toronto and Vancouver.

The second part of the analysis investigates the probability of high-tech employment among Chinese immigrants across the three cities, controlling for a number of social, demographic and employment factors. Based on the nature of high-tech activities and work, it is not surprising that educational attainment has a significant influence on the probability of immigrants' employment in the high-tech sector (Florida, 2012). People with post-secondary education are expected to be more likely to hold high-tech positions than those

with only a high school diploma. However, it is important to consider nuances in immigrants' educational attainment in the analysis. Although immigrants are more likely to have received an advanced education in their home countries, it is important to note that not all immigrants came to Canada through the same immigration selection "categories" – some came with their parents during childhood and some became permanent residents after studying full time as international students at a Canadian institution. A number of studies show that immigrants who obtain Canadian credentials are more likely to find employment that matches their field of study and are more likely to access regulated professions (Anisef, Sweet, & Adamuti-Trache, 2010; Girard & Smith, 2013). The type of household in which people live is also expected to have an influence on their employment in the high-tech sector. Many skilled immigrants, especially those who recently arrived and live in families with children, experience difficulties in pursuing their career (Phan, Banerjee, Deacon, & Taraky, 2015). This is particularly problematic among recently arrived immigrant mothers who are caring for young children (Martins & Reid, 2007). Period of migration is another important variable in determining employment outcomes. It is not only the length of residence in Canada that influences the immigrants' economic integration, but also when individuals arrive, especially if their arrival coincides with an economic recession and downturn (Abbott & Beach, 2011; Picot & Sweetman, 2012). In addition, those who are employed full-time are expected to be more likely to hold employment that matches their skills and experience. It has been argued that the emergence of precarious work (e.g., contract, temporary, part-time, and shift work with little or no job security) during the beginning of the 21st century has had a dramatic impact on racialized immigrants' economic integration, especially among women (Galabuzi, 2006).

Therefore, those who are full-time employed are expected to be more likely to have stronger labour market outcomes compared to those who work on a part-time basis.

To examine the effects of location on the probability of high-tech employment among Chinese immigrants, a series of logistic regression analyses was undertaken. Logistic regression analysis is favoured when the objective is to analyze *binary* outcome dependent variables (Sturdivant, Lemeshow, & Hosmer, 2013). Specifically, in this study, the dependent variable is whether an individual works in the high-tech sector (1) or not (0). Logistic regression analyzes relationships in terms of odds ratios that represent the constant effect of each independent variable on the probability of high-tech employment while controlling for the effects of all other determinants in a model. A greater odds ratio indicates a stronger effect of one category of an independent variable relative to a comparison or reference category on the outcome variable. The first set of the three logistic regression models focuses on all individuals who are in the labour force and between the ages of 23 and 70 living in Ottawa-Gatineau, Toronto and Vancouver (women and men are not analyzed in separate models, although gender effects are considered). The second set of logistic regression models focuses only on the Chinese population in the three cities, but does disaggregate into separate models for women and men. These models provide insight about the significance of a metropolitan location relative to that of other social, demographic and employment factors in interpreting the likelihood of high-tech employment. The section emphasizes the degree to which employment in the high-tech sector changes from city to city and, importantly, varies between women and men.

2.5 Social and Demographic Characteristics of Chinese Immigrants

To describe the Chinese immigrant community in Ottawa-Gatineau, Toronto and Vancouver, a number of their social and demographic characteristics are compared to other immigrant groups and the Canadian-born population (Table 2.2). Similar to South Asian and All Other Visible Minority immigrants, the Chinese community in Ottawa-Gatineau has a larger proportion of individuals in the young adult cohort (23-40) (45.3%) compared to white immigrants (28.0%) and the Canadian-born population (39.2%). However, proportionately fewer Chinese immigrants in Toronto and Vancouver are in the same the young adult category relative to their co-ethnic counterparts in Ottawa-Gatineau. The proportion of Chinese immigrants in Ottawa-Gatineau in the young adult category is comparable to that among the South Asians and All Other Visible Minority groups in Ottawa-Gatineau, Toronto and Vancouver. The Canadian-born population in Ottawa-Gatineau is slightly older than the Chinese, whereas in Toronto and Vancouver a comparable proportion of Chinese and Canadian-born individuals fall into the young adult category (Table 2.2). Given that important age differences exist among Chinese in the three cities, it is not surprising that other social characteristics vary by location.

Educational attainment, location of highest educational attainment, and period of immigration further differentiate the Chinese from the rest of the population in each of the three cities. Chinese immigrants have a relatively higher level of educational attainment compared to other immigrant groups and the Canadian-born population (Table 2.2). In particular, more than 63% of Chinese immigrants in Ottawa-Gatineau hold at least a bachelor's degree, which is slightly higher than the percentage for South Asian (57.9%), and is significantly higher than all other visible minority immigrants (35.6%), white

Table 2.2 Social and Demographic Characteristics of Individuals in the Labour Market, age between 23 and 70, in Ottawa-Gatineau, Toronto, and Vancouver, 2006

	Chinese* Immigrants			South Asian Immigrants			All Other Visible Minority Immigrants			White Immigrants			Canadian-born			Total Population		
	Ottawa- Gatineau	Toronto	Vancouver	Ottawa- Gatineau	Toronto	Vancouver	Ottawa- Gatineau	Toronto	Vancouver	Ottawa- Gatineau	Toronto	Vancouver	Ottawa- Gatineau	Toronto	Vancouver	Ottawa- Gatineau	Toronto	Vancouver
	%			%			%			%			%			%		
Age Groups																		
23 – 40	45.3	39.2	34.6	44.6	47.2	43.0	48.6	42.9	44.8	28.0	25.1	26.7	39.2	47.9	42.7	39.1	41.7	39.5
41 – 60	44.1	50.4	54.1	40.2	43.0	42.8	43.6	47.2	46.9	51.1	52.1	50.0	49.3	43.6	46.7	48.7	46.4	48.0
61 – 70	10.7	10.4	11.3	15.2	9.9	14.2	7.7	9.9	8.3	20.9	22.8	23.3	11.5	8.5	10.6	12.2	11.9	12.4
Education																		
University degree & above	63.3	42.5	36.0	57.9	36.6	22.8	35.6	28.2	38.5	44.3	28.0	33.2	31.8	33.5	26.1	34.6	32.5	29.7
High school, college, & some education	28.4	44.1	49.9	36.6	49.5	53.0	51.5	59.8	52.6	46.1	52.6	58.5	56.7	56.8	64.4	54.2	54.5	59.1
Not high school graduate	8.3	13.3	14.2	5.5	13.9	24.3	12.9	12.0	8.9	9.6	19.4	8.3	11.4	9.6	9.5	11.2	13.0	11.2
Location of Education																		
Canada	38.1	28.8	24.4	35.7	20.3	20.4	37.9	30.8	24.1	41.1	28.5	32.7	-	-	-	-	-	-
Other	61.9	71.2	75.6	64.3	79.7	79.6	62.1	69.2	75.9	58.9	71.4	67.3	-	-	-	-	-	-
Period of Immigration																		
1996-2006	48.1	41.0	40.1	35.0	46.8	34.0	31.3	30.5	37.6	17.3	17.3	18.0	-	-	-	-	-	-
1981-1995	29.6	41.0	40.2	30.7	34.8	36.6	45.1	41.5	37.5	23.9	24.2	20.7	-	-	-	-	-	-
1980 & before	22.3	18.0	19.7	34.3	18.4	29.4	23.6	28.0	24.9	58.8	58.5	61.3	-	-	-	-	-	-

Data Source: calculated by the author of the 2006 Census of Canada.

immigrants (44.3%) and the Canadian-born population (31.8%). In addition to a higher level of educational attainment, the proportion of Chinese immigrants who acquired their highest degree in Canada is also substantially higher in Ottawa-Gatineau (38.1%) relative to their counterparts in Toronto (28.8%) and Vancouver (24.4%).

In contrast to white and visible minority immigrants, the Chinese immigrant community is largely composed of recent arrivals. Close to 50% of the Chinese immigrants in Ottawa-Gatineau arrived in Canada between 1996 and 2006; whereas 35% of the South Asian immigrants, 31.3% of the all other visible minority immigrants, and only 17.3% of the white immigrants arrived during the same period (Table 2.2). This proportion of recent Chinese immigrants is also higher compared to Chinese who fall into the same period of arrival cohort in Toronto (41.0%) and Vancouver (40.1%). The increasing number of Chinese immigrants in Ottawa-Gatineau during this time period may well be attributable in part to the strong demand for workers during Ottawa's high-tech boom in the late 1990s (Picot & Hou, 2009).

These statistics underline some of the unique characteristics of Chinese immigrants in Ottawa-Gatineau compared to their counterparts in other cities, as well as other immigrant groups. Since immigrants' human capital is often used to explain their socioeconomic status, do the employment characteristics of Chinese immigrants in Ottawa-Gatineau differ greatly from those who live in Toronto and Vancouver? Do they have a higher participation rate in the high-tech sector in Ottawa-Gatineau relative to other immigrant groups and the Canadian-born population in Ottawa-Gatineau? The next section of the paper examines these questions by describing the employment characteristics among the Chinese immigrants in each of the three cities.

2.6 Employment Characteristics of Chinese Immigrants

Although immigrants overall face an array of difficulties and opportunities in achieving labour market integration and social mobility, labour market characteristics do vary between different groups and cities. A number of employment characteristics, including labour force participation rates, unemployment rates, full-time employment rates, average employment income, and the proportion of individuals employed in high-tech tend to distinguish Chinese immigrants from the other immigrant groups and the Canadian-born population. Chinese immigrants in Ottawa-Gatineau have a slightly higher labour force participation rate (72.9%) compared to their counterparts in Toronto (71.6%) and especially Vancouver (64.6) (Table 2.3). However, compared to other immigrant groups and the Canadian-born population, Chinese immigrants' labour force participation rate in Ottawa-Gatineau is among the lowest (72.9%, which is only slightly higher than the rate for white immigrants – 72.7%). Meanwhile, Chinese immigrants in Ottawa-Gatineau have a higher unemployment rate (6.8%) compared to the Canadian-born population (3.9%) and white immigrants (4.7%). However, the rate of unemployment for the Chinese is substantially lower relative to other visible minority immigrants (9.1%). This is not the case in either Toronto or Vancouver where the unemployment rate is higher among Chinese immigrants' relative to the rest of the visible minority immigrant population (Table 2.3).

Compared to the Canadian-born population and the white immigrants, Chinese immigrants have lower average employment incomes regardless of where they are living. However, the employment income of Chinese immigrants is slightly higher than that of South Asian immigrants and is substantially higher relative to other visible minority

Table 2.3 Employment Characteristics of Individuals in the Labour Market, age between 23 and 70, in Ottawa-Gatineau, Toronto, and Vancouver, 2006

	Chinese* Immigrants			South Asian Immigrants			All Other Visible Minority Immigrants			White Immigrants			Canadian-born			Total Population		
	Ottawa- Gatineau	Toronto	Vancouver	Ottawa- Gatineau	Toronto	Vancouver	Ottawa- Gatineau	Toronto	Vancouver	Ottawa- Gatineau	Toronto	Vancouver	Ottawa- Gatineau	Toronto	Vancouver	Ottawa- Gatineau	Toronto	Vancouver
	%			%			%			%			%			%		
Labour Force in General																		
Labour Force Participation Rate ¹	72.9	71.6	64.6	75.9	75.0	74.2	74.2	77.0	73.7	72.7	71.4	73.0	78.8	82.5	80.2	77.6	77.6	75.7
Unemployment Rate	6.8	7.3	7.2	6.5	7.7	6.2	9.1	7.0	6.2	4.7	4.6	3.9	3.9	4.5	4.0	4.5	5.5	4.8
Full-time Employment Rate ²	87.7	88.1	80.5	84.4	89.7	88.5	82.5	87.5	80.8	85.3	87.1	82.6	88.8	88.0	83.8	87.9	88.0	83.3
Average Employment Income (in \$1,000)	41.8	33.1	25.9	40.9	30.4	30.2	28.5	30.1	26.5	48.1	47.9	45.8	49.2	57.2	46.6	47.7	47.1	41.1
- High-tech Employment																		
Proportion of HT Workers	49.5	23.6	15.8	38.8	17.2	9.5	25.5	13.8	11.7	33.0	17.6	18.3	33.3	16.8	15.7	33.1	17.0	15.1
<i>Women</i>	40.1	17.8	11.0	30.6	12.6	6.8	21.1	10.5	8.5	26.6	12.7	12.1	31.2	12.9	12.1	30.2	12.8	11.1
<i>Men</i>	58.4	29.3	20.4	45.3	20.6	11.7	29.5	17.3	15.2	38.4	21.8	23.4	35.2	20.5	18.9	35.8	20.9	18.7
HT Workers' Average Income (in \$1,000)	59.7	49.4	39.2	58.5	43.8	47.9	47.8	43.8	39.9	67.8	63.7	59.3	63.9	67.0	59.9	63.3	59.4	55.4
<i>Women</i>	50.3	41.3	33.7	48.7	34.1	35.1	39.9	37.7	32.8	52.9	47.5	42.7	55.9	54.2	46.5	54.7	47.8	43.1
<i>Men</i>	65.9	54.1	42.0	63.8	48.3	54.6	53.0	47.7	44.1	76.7	71.6	66.4	70.7	74.5	67.7	70.1	65.9	62.8

¹ Labour force participation rate is calculated as the ratio of people who are in the labour force (employed and unemployed) compared to the overall population, between the age of 23 and 70.

² Full-time employment rate is calculated as the proportion of employed individuals with full-time work compared to the total population in the labour force, between the age of 23 and 70.

Data Source: calculated by the author of the 2006 Census of Canada.

immigrants (Table 2.3). Moreover, employment income variation across the three cities is more significant among Chinese immigrants compared to that for South Asian and other visible minority immigrants (see Figure 2.1). Specifically, Chinese immigrants in Ottawa-Gatineau have an average employment income of \$41,800 which is significantly higher relative to their counterparts in Toronto (\$33,100) and Vancouver (\$25,900).

What contributes to Chinese immigrants' higher incomes in Ottawa-Gatineau can be partially explained by their employment in the high-tech sector (Hall & Khan, 2008). In Ottawa-Gatineau, approximately 50% of the Chinese immigrants work in the high-tech sector compared to 38.8% of South Asians and 33.3% of the Canadian-born population (Table 2.3). The proportion of high-tech workers is substantially smaller for all immigrant groups in Toronto and Vancouver compared to Ottawa-Gatineau, although a considerable proportion of Chinese immigrants hold high-tech employment in these two cities (23.6% and 15.8% for Toronto and Vancouver respectively). In addition, there are significant gender differences in terms of proportional representation of individuals working in the high-tech sector, especially among the immigrant groups (Table 2.3). In Ottawa-Gatineau, only 40.1% of Chinese women work in high-tech compared to 58.4% of men. In contrast, the gender difference in high-tech employment is much smaller for Canadian-born men (35.2%) and women (31.2%), although this says little about the types of occupations held by each gender within the sector.

Although visible minority immigrants overall earn less than white immigrants and the Canadian-born population in the high-tech sector, such income differences are less significant in Ottawa-Gatineau than Toronto or Vancouver (Table 2.3). For instance, in Ottawa-Gatineau, Chinese immigrants' average employment income in the high-tech sector

(\$59,700) is lower than that for Canadian-born population (\$63,900). In contrast, the income gap between Chinese immigrants and the Canadian-born population in the high-tech sector is much greater in Toronto (\$41,300 and \$54,200 respectively). In addition, it must be noted that the high-tech employment income difference across the three cities is much more significant for Chinese immigrants than that for all other visible minority immigrants (see Figure 2.1). Specifically, Chinese high-tech workers' average employment income in Ottawa-Gatineau is more than \$20,000 higher than that for Chinese high-tech workers living in Vancouver. In addition, it is important to mention that among all immigrant groups and the Canadian-born population, men enjoy higher incomes on average than women in the high-tech sector in all three cities (Table 2.3).

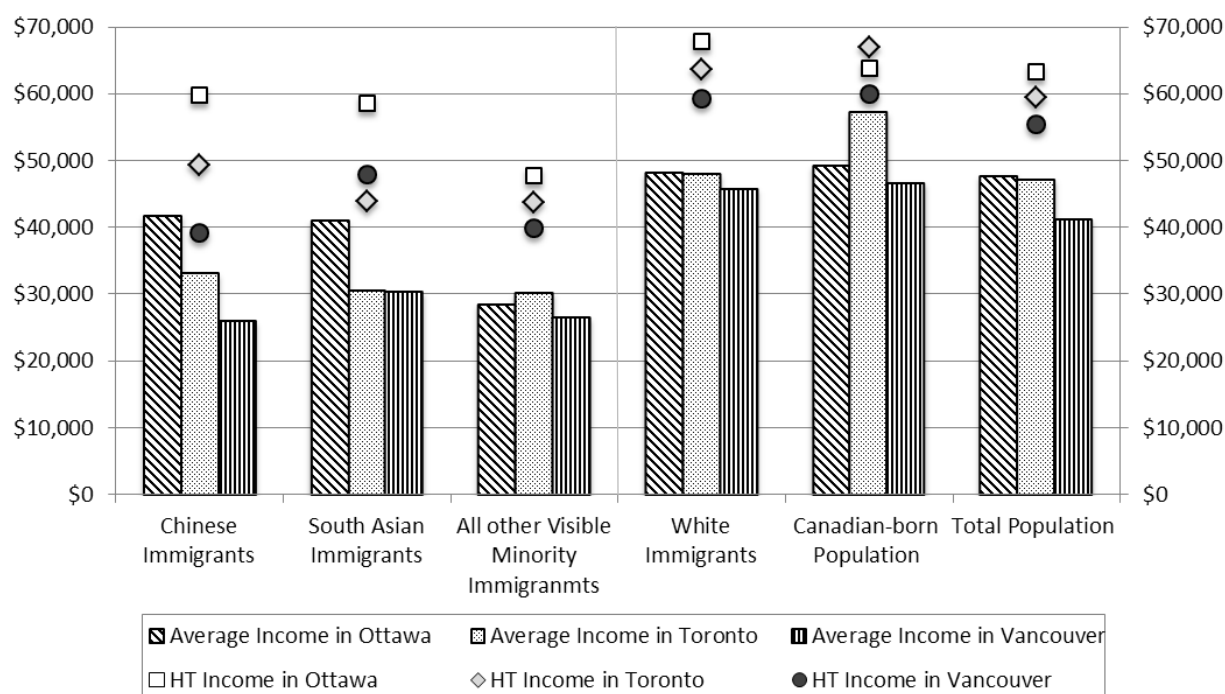


Figure 2.1 Average Employment Income and High-tech Employment Income of Individuals in the Labour Market, between the age of 23 and 70, in Ottawa-Gatineau, Toronto, and Vancouver, 2006.

In very broad terms, these descriptive findings about social, demographic and employment characteristics suggest that Chinese immigrants, with strong human capital characteristics, enjoy better employment outcomes than other immigrant groups across the three cities. Chinese immigrants in Ottawa-Gatineau have higher incomes than most visible minority groups, although their earnings lag behind white immigrants and the Canadian-born population. For those Chinese immigrants who work in the high-tech sector, employment income is significantly better in Ottawa-Gatineau relative to their counterparts in Toronto and Vancouver. To further examine the degree to which metropolitan location plays a role in determining the probability of Chinese men and women's employment in the high-tech sector, a series of logistic regression analyses examining the importance of location relative to other social, demographic and labour force factors in relation to the likelihood of working in high-tech. Binomial logistic regression analysis requires reference categories for the outcome variable and each of the independent variables. In this study, reference categories are selected by a characteristic that is frequently regarded as normative (e.g. born in Canada, high school education, or educated internationally) (Ray & Preston, 2009). The same reference categories were applied in each logistic regression analysis, which enable comparison across the three locations as well as between Chinese immigrant women and men.

2.7 Determinants of High-tech Employment

The results of the logistic regression analyses underline an important fact in the high-tech sector: the most influential factor in determining the probability of high-tech employment is working full-time. Due to the research and innovation qualities of work in

high-tech and that these activities are frequently time sensitive, very few people in this sector work part-time (Kunda, 2006). The first set of the logistic regression models also highlights that the probability of high-tech employment is strongly associated with immigrant ethnic origin, although the influence of this variable varies between the three cities. Simply, compared with the Canadian-born population, Chinese immigrants are more likely to be employed in the high-tech sector in Ottawa-Gatineau and Toronto (odds ratio = 1.290 and 1.218 respectively) and are less likely to work in the same sector in Vancouver (odds ratio = 0.896) (Table 2.4). No other immigrant group is as strongly associated with high-tech employment. In fact, South Asian and all other visible minority immigrants have lower probabilities of holding high-tech employment than the Canadian-born population in all three cities. In Vancouver, however, white immigrants have a slightly higher probability than the Canadian-born population to work in the high-tech sector. As reported in other studies (Guo & DeVoretz, 2006; Waters, 2002), many Chinese immigrants have been attracted to Vancouver for non-economic reasons (e.g., the environment, education opportunities, and citizenship), which may explain their lower probability of being employed in the high-tech sector than their counterparts in Ottawa-Gatineau and Toronto.

Several social and demographic factors also play important roles in determining the likelihood of high-tech employment. It is not surprising that women are significantly less likely to work in the high-tech sector in all three cities since this sector is dominated by men (Gray & James, 2007; Raghuram, 2008). There are, however, small variations in women's probability of high-tech employment across the three cities (Table 2.4). Women in Ottawa-Gatineau have a slightly stronger likelihood of high-tech employment (odds ratio = 0.814) than their counterparts in Toronto and Vancouver (odds ratio = 0.569 for both cities).

Table 2.4 Logistic Regression Results for High-tech Employment among Individuals in the Labour Market, age between 23 and 70, in Ottawa-Gatineau, Toronto, and Vancouver, 2006

Independent variables	Ottawa-Gatineau		Toronto		Vancouver	
	Odds ratio	Standard error	Odds ratio	Standard error	Odds ratio	Standard error
Ethnic Groups (by visible minority)						
Chinese	1.290***	0.050	1.218***	0.014	0.896***	0.020
FB-South Asian	0.796***	0.051	0.812***	0.014	0.548***	0.023
FB-All other visible minorities	0.540***	0.048	0.713***	0.014	0.666***	0.021
White immigrants	0.659***	0.047	0.939***	0.014	1.054**	0.020
Canadian born						
Social Characteristics						
Gender						
Women	0.814***	0.006	0.569***	0.004	0.569***	0.006
Men						
Education						
University degree and above	1.893***	0.007	1.751***	0.004	1.761***	0.019
Not a high school graduate	0.289***	0.018	0.378***	0.010	0.345***	0.018
High school						
Location of Education						
Canada	1.260***	0.007	1.374***	0.004	1.466***	0.007
Foreign						
Period of Migration						
Immigrated 1996-2006	1.347***	0.048	1.532***	0.014	1.474***	0.021
Immigrated 1981-1995	1.449***	0.047	1.275***	0.014	1.090***	0.020
Immigrated before 1980	1.476***	0.047	1.233***	0.014	1.154***	0.020
Born in Canada						
Household Type						
Couple family household	1.003	0.008	1.090***	0.005	1.079***	0.007
Lone-parent household	0.901***	0.013	0.978**	0.008	0.886***	0.013
Non-family and multi-family household						
Labour force engagement						
Full-time	3.428***	0.010	2.006***	0.006	1.845***	0.008
Part-time						
N (weighted)	555,051		2,495,854		1,032,843	
LR Chi ² (d.f.)	51703.284 (14) ***		127998.653 (14) ***		51254.553 (14) ***	
Overall prediction success	68.5%		83.1%		84.8%	

*p<0.05 **p<0.01 ***<0.001

N = All individuals who are in the labour force, between the age of 23 and 70, in each city.

Data Source: calculated by the author of the 2006 Census of Canada.

Their stronger probability of high-tech employment in Ottawa-Gatineau can be explained by women's representation in the federal public service sector where some positions often require a higher level of technical skills and knowledge in professional fields, as well as employment equity measures within the civil service that facilitate the entry of women (Andrew & Doloreux, 2012).

Educational attainment plays a strong role in determining who works in the high-tech sector. The logistic regression results indicate that individuals holding a university degree or above are more likely to work in the high-tech sector than those with only a high school diploma (Table 2.4). What is more significant about the role of educational attainment in determining the probability of high-tech employment is the importance of *where* the highest degree is obtained. Quite simply, being educated in Canada increases the probability of working in the high-tech sector for individuals in each city. For example, Canadian graduates in Ottawa-Gatineau are 1.260 times more likely to work in the high-tech sector than those who are educated internationally (Table 2.4).

Immigrants in general are more likely to work in the high-tech sector than those who are born in Canada (Table 2.4). More recent immigrants, who arrived between 1996 and 2006, are approximately between 1.3 and 1.5 times more likely to work in high-tech than the Canadian-born population in all three cities. Among immigrants however, period of migration has very little influence on determining high-tech employment, especially in Ottawa-Gatineau. Other social characteristics also have small but significant effects on explaining the probability of high-tech employment. Individuals living in couple households are slightly more likely to work in the high-tech sector than those live in non-family and multi-family households, but this effect is statistically insignificant in Ottawa-Gatineau

(Table 2.4). Individuals living in lone parent households are also less likely to work in the high-tech sector, and this may well reflect the fact that the time demands of the sector are incompatible with childcare responsibilities for women and men raising children on their own.

There are considerable variations in the probability of high-tech employment among immigrant groups and across the three cities. This set of the logistic regression analyses highlights important factors that influence the likelihood of the high-tech employment among all individuals. First, Chinese immigrants have a significantly higher likelihood of high-tech employment compared to the Canadian-born population. Their probability of high-tech employment varies across the three cities with the highest likelihood in Ottawa-Gatineau. In addition, although women are less likely to participate in the high-tech labour force compared to men, their probability of high-tech employment is relatively stronger in Ottawa-Gatineau than in the other two cities. These findings raise questions about the importance of location and the unique qualities of Chinese immigrants' high-tech employment in Canadian cities. Therefore, the second set of logistic regression analyses focuses solely on Chinese immigrants in the three locations. Given the very different labour market experiences of women and men in general, and the lower probabilities of women being employed in the high-tech sector, the analysis also pays particular attention to gender differences.

2.8 Metropolitan and Gender Variations among Chinese Immigrants

The odds ratios highlight the important influence of location on Chinese immigrants' probability of high-tech employment (Table 2.5). Where Chinese immigrants reside is one

of the most important predictors of their high-tech employment probability. The logistic regression analyses indicate that Chinese immigrants in Ottawa-Gatineau are over two times more likely to work in the high-tech sector than their counterparts in Toronto (odds ratio = 2.674), while those who live in Vancouver are much less likely to work in the sector (odds ratio = 0.636) (Table 2.5). Similar patterns are found when considering Chinese immigrant men and women separately. These findings underline the important role of metropolitan locations for Chinese immigrants' employment in the high-tech sector, and this result is consistent with earlier research examining Chinese immigrants' high-tech employment earnings (Hall & Khan, 2008).

Educational attainment plays a much stronger role in determining the probability of high-tech employment among Chinese immigrants. Having at least a university degree raises the chance of working in the high-tech sector among Chinese immigrants by more than three times relative to those who have only a high school degree. The effect is virtually identical for Chinese immigrant men and women (Table 2.5). It is important to note that the majority of Chinese immigrants was admitted to Canada as professionals and skilled workers whose educational background is already an important factor in the immigration selection criteria. Therefore, it is not surprising that higher educational attainment is strongly related to high-tech employment. In addition, having formal education in Canada significantly increases the probability of high-tech employment for both Chinese men and women, although the effect is slightly stronger for men (odds ratio = 1.592 versus 1.259 for women).

Table 2.5 Logistic Regression Results for High-tech Employment among Chinese Immigrants in the Labour Market, age between 23 and 70, in Ottawa-Gatineau, Toronto, and Vancouver, 2006

Independent variables	Total Chinese		Chinese women		Chinese men	
	Odds ratio	Standard error	Odds ratio	Standard error	Odds ratio	Standard error
CMA						
Ottawa-Gatineau	2.674***	0.022	2.600***	0.031	2.759***	0.031
Vancouver	0.636***	0.010	0.608***	0.016	0.652***	0.013
Toronto						
Social Characteristics						
Gender						
Women	0.539***	0.010	-	-	-	-
Men						
Education						
University degree and above	3.023***	0.011	2.823***	0.016	3.158***	0.014
Not a high school graduate	0.275***	0.032	0.413***	0.042	0.187***	0.049
High school						
Location of Education						
Canada	1.424***	0.011	1.259***	0.017	1.592***	0.015
Foreign						
Period of Migration						
Immigrated 1996-2006	1.179***	0.015	0.965	0.023	1.380***	0.019
Immigrated 1981-1995	0.942***	0.014	0.858***	0.022	1.016	0.018
Immigrated before 1980						
Household Type						
Couple family household	1.213***	0.016	1.113***	0.023	1.298***	0.022
Lone-parent household	0.990	0.024	0.980	0.032	0.940	0.037
Non-family and Multi-family household						
Labour force engagement						
Full-time	2.444***	0.023	2.146***	0.035	2.699***	0.031
Part-time						
N (weighted)	308,344		151,498		156,848	
LR Chi ² (d.f.)	39919.073 (11)***		11702.129 (10)***		23267.878 (10)***	
R ² (Nagelkerke)	0.188		0.127		0.201	
Overall prediction success	79.20%		84.3%		74.3%	

*p<0.05 **p<0.01 ***<0.001

N = Total Chinese immigrant men and women who are in the labour force, between the age of 23 and 70, in all three cities.

Data Source: calculated by the author of the 2006 Census of Canada.

When considering only the foreign-born Chinese population, period of migration does have an influence on the probability of high-tech employment (Table 2.5). Recently arrived Chinese (arrived between 1996 and 2006) are slightly more likely to work in the high-tech sector (odds ratio = 1.179) compared to those who immigrated before 1980. This relationship is stronger for Chinese immigrant men – those who arrived in Canada between 1996 and 2006 are 1.38 times more likely to hold high-tech employment than Chinese men who immigrated before 1980. The same period of arrival, however, has little influence on the likelihood of high-tech employment for Chinese immigrant women (odds ratio = 0.965; not statistically significant). The strong likelihood of high-tech employment among Chinese immigrant men who arrived in Canada between 1996-2006 has also been noted in earlier research and has been attributed to the employment opportunities associated with the high-tech boom of the late 1990s (Picot & Hou, 2009).

The Chinese immigrants' probability of high-tech employment is also influenced by a number of social characteristics. Household type plays a minor role in explaining who works in the high-tech sector among Chinese immigrants. As noted in the earlier analysis, immigrants living in couple households are slightly more likely to hold high-tech jobs than those who live in non-family and multi-family households (odds ratio = 1.213). The effect may reflect the influence of age, given that many Chinese living in couple households are slightly older and have relatively more experience in the high-tech sector both internationally and in Canada. The effect of household type, however, is actually indistinguishable between men and women (odds ratio = 1.298 and 1.113 respectively). In addition, consistent with findings for all individuals, full-time employment status also influences Chinese immigrants' employment in the high-tech sector. This finding not only

highlights the particular characteristics of work in high-tech, but also how the nature of employment may influence the interest and/or ability of women and men with significant familial responsibilities to work in the sector.

2.9 Summary and Conclusion

The probability that Chinese immigrants will work in the high-tech sector varies significantly across Canada. It is also clear that Chinese immigrants are more likely to work in this sector relative to other visible minority immigrant groups and the Canadian-born population, especially in Ottawa-Gatineau. At the very least, this study highlights the importance of where Chinese immigrants live with respect to the likelihood of working in high-tech, and this influence is stronger for Chinese men than women. Although Chinese women are less likely to hold high-tech jobs in general, their likelihood of employment in the sector is stronger in Ottawa-Gatineau than in other locations. The geographic variations in the likelihood of high-tech employment identified in this study highlight the importance of location and local labour market conditions for understanding Chinese immigrants' economic integration, especially among those who are well-educated and professionally trained.

This study also confirms the influence of many determinants of high-tech employment identified by previous research (Adamuti-Trache, et al., 2013; Nohl, et al., 2014). Factors such as country of origin, gender, period of migration, and educational attainment are all important determinants of individuals' high-tech employment. Importantly, this study finds that these factors influence the probability of employment in the high-tech sector differently in the three metropolitan areas. For example, in addition to

the influence of educational attainment, this study shows that having Canadian educational credentials has a significant and positive effect on the likelihood of high-tech employment. Additional research is needed to further investigate the Ottawa-Gatineau labour market context in order to uncover the factors that underlie Chinese immigrants' employment in this sector.

The results of this study emphasize the importance of metropolitan locations on immigrants' labour market integration. In short, immigrants confront particular labour market structures and opportunities in the cities where they live, which in turn influence the kinds of jobs they can obtain and ultimately their employment incomes. While it is clear that a large proportion of Chinese immigrants in Ottawa-Gatineau work in the high-tech sector, especially compared to their co-ethnics in Toronto and Vancouver, a number of interesting questions can be asked about local labour market conditions and social networks within the Chinese community that may lead some individuals to high-tech employment. Is it simply that there are more high-tech jobs in Ottawa-Gatineau, and hence more Chinese newcomers find employment in this sector? Has the settlement of middle-class and highly-educated Chinese newcomers in Ottawa's western suburbs encouraged newcomers to target their job search to suburban high-tech employment nodes? Has the residential geography of Chinese immigrants encouraged the formation of co-ethnic social networks that facilitate job searches in the high-tech sector? Does it appear that women and men benefit equally from residential proximity to high-tech employment nodes in the suburbs? As Hall and Khan (2008) suggested, addressing all these questions requires further detailed case study research to understand the geographic selectivity of Chinese immigrants' settlement patterns and high-tech clustering in a particular place.

Endnotes

1. The gender composition of knowledge economy is well documented in the literature: high-tech and information related industries or occupations are predominantly dominated by men, whereas knowledge-intensive services are slightly more women's area of employment. See detailed discussion in a special issue of *Gender, Work & Organization* (2011, Vol.18, Issue 1) about "The Knowledge Society".
2. This study's findings are based on analysis of the 1991, 1996, and 2001 censuses.
3. Economic immigrants are people selected for their skills and their ability to contribute to Canada's economy; these immigrants include skilled workers, business immigrants, Canadian experience class, provincial nominees and live-in caregivers.
4. The public-use census microdata file offers researchers a good opportunity to explore the characteristics of a wide variety of immigrant groups; however, the 3% sample size is relatively small in some cities where the actual number of immigrants is small. This shortcoming of the public-use data file is especially problematic with regards to Chinese immigrants who work in Ottawa-Gatineau's high-tech sector. When Chinese immigrants' socio-economic characteristics are controlled, the number of Chinese individuals could be too small to produce a meaningful analysis. This research, therefore, intends to access the full 20% census microdata files.
5. See http://www12.statcan.gc.ca/NHS-ENM/2011/ref/about-apropos/nhs-enm_r005-eng.cfm and <http://www.statcan.gc.ca/eng/blog-blogue/cs-sc/2011NHSstory> for a discussion of Statistics Canada's analysis of data quality issues in relation to the National Household Survey.
6. According to the 2006 census, the approximate percentages of total foreign-born Chinese, by birthplace in Mainland China, Hong Kong, and Taiwan, are: 75, 22, and 3 percent for the Ottawa-Gatineau CMA respectively; 50, 44, and 6 percent for Toronto CMA respectively; and 44, 39, and 17 percent for the Vancouver CMA respectively.
7. Complete discussion and lists of high-tech occupations and industries are available from the author upon request.

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CHAPTER 3

Geographic Effects of Residential Location on Chinese Immigrants' High-tech Employment in Ottawa-Gatineau

Abstract: With the increasing number and influence of well-educated and experienced immigrant professionals settling in Canadian cities, urban geographies of employment have been significantly shaped by the ways in which immigrants negotiate between the places where they live and the kinds of jobs in which they are employed. Using 2006 Canadian census microdata files and multi-level regression methods, this study investigates the degree to which Chinese immigrants' residential location and neighbourhood-level social characteristics influence their likelihood of employment in Ottawa-Gatineau's high-tech sector. The paper argues that other than living in close proximity to high-tech employment nodes, neighbourhood social characteristics have a significant influence on Chinese men and women's likelihood of working in the high-tech sector. More importantly, this study finds that the Chinese women's likelihood of high-tech employment increases significantly among those who live in co-ethnic neighbourhoods or areas where there is a strong immigrant concentration. Chinese men, on the other hand, are more likely to work in high-tech employment if they live in areas with a large share of other high-tech workers. The study suggests that the social composition of where people live can play a strong role in influencing the likelihood of high-tech employment among well-educated immigrants.

Keywords: geographies of employment, residential location, neighbourhood-level social characteristics, Chinese immigrants, high-tech employment, gender

3.1 Introduction

Recent immigrants have significantly transformed urban space by actively participating in shaping new residential and employment geographies in North America (Ellis, Wright, & Parks, 2007; Farrell, 2014; Kobayashi, Li, & Teixeira, 2012). Chinese newcomers, as an important segment of highly skilled immigrant population in Canada, have helped to shape new home and work geographies in Canadian cities (Bonikowska, Hou, & Picot, 2016; Wang & Paul, 2013). The fact that Canadian immigration policy privileges individuals with high levels of human capital means that it is far from surprising that highly skilled Chinese immigrants gravitate to employment in the high-tech sector (Li & Lo, 2012). Meanwhile, it is undeniable that one of the most significant changes in Chinese immigrant settlement patterns in North American cities is the emergence of ethnoburbs – middle-class and upper-middle class suburbs where recent immigrants settle directly upon arrival. In these suburban areas, one specific newcomer group, such as the Chinese, may constitute a large proportion of residents and become influential in shaping both the residential and commercial landscapes (Li W. , 2009). The fact that Chinese immigrants' growing employment concentration in the high-tech sector and residential clustering in ethnoburbs raises important questions about their economic and social integration in contemporary Canadian cities. This paper, therefore, investigates the degree to which highly skilled Chinese immigrants' residential location and the social composition of the neighbourhoods in which they live influence their likelihood of employment in the high-tech sector.

Ottawa, the 'Silicon Valley North', has attracted a large number of highly skilled Chinese immigrants. It was found that a large proportion of Chinese in Ottawa-Gatineau

work in the high-tech sector, especially relative to their co-ethnics in Toronto and Vancouver – the two most important Canadian destinations for Chinese immigrants (see Chapter 2). Given that many Chinese settle in Ottawa’s western suburbs, where most of the city’s high-tech firms are located, it is valuable to ask whether there is a reciprocal relationship between residential location and the location of work. Is it just simply that there are a large number of high-tech jobs in Ottawa-Gatineau, and hence Chinese newcomers find employment in this sector? Alternatively, has Chinese residential settlement in the western suburbs of Ottawa created social environments that appear to influence the likelihood of working in high-tech? In terms of types of employment, do women and men benefit equally from the social composition of their neighbourhoods and/or living in close proximity to high-tech employment nodes?

This study initiates the process of responding to these questions using data from the 2006 Census of Canada. The paper begins with a brief review of immigrants’ geographies of employment, with an emphasis on characteristics of employment and residential settlement patterns among highly skilled immigrants. After outlining some of the most salient qualities of Ottawa-Gatineau’s high-tech sector, the next section describes the data and research methods used for the analysis. The analysis is presented in two parts: 1) a description of the configurations of Chinese immigrants’ residential geography and the social composition of neighbourhoods in which they live in Ottawa-Gatineau; and 2) an examination of the degree to which individuals’ residential location and neighbourhood-level social characteristics influence the likelihood of employment in the high-tech sector. Throughout the analysis, gender differences in outcomes are discussed. The conclusion summarizes the major findings and reflects on issues regarding where Chinese immigrants

live, and whether the social composition of neighbourhoods, influences the likelihood of employment in Ottawa-Gatineau's high-tech sector.

3.2 Geographies of Home and Work among Highly Skilled Immigrants

Newcomers often tend to settle in places where they have social contacts or networks based on shared culture and language (Logan, Alba, & Zhang, 2002). In cities with a significant number of immigrants, distinctive settlement patterns often emerge and create the so called residential enclaves (Logan & Zhang, 2004; Massey & Denton, 1988). These residential enclaves and co-ethnic social networks, in turn, have important implications for where individuals work and the types of jobs they hold (Topa & Zenou, 2014; Wang Q. , 2010; Wright, Ellis, & Parks, 2010). Research in general argues that living in ethnic enclaves can provide job opportunities to individuals, especially recently arrived immigrants, who may be challenged with finding employment in the larger labour market. Such employment niches or enclaves, however, appear to be associated with more limited income returns and occupational mobility (Borjas, 1992; 1995; Musterd, Andersson, Galster, & Kauppinen, 2008). Nevertheless, it is clear that many new immigrants settle directly in suburbs, known as ethnoburbs, or less ethnic concentrated neighbourhoods (Li W. , 2009). How highly skilled immigrants' employment status may be influenced by their residential location, however, remains unclear. This paper begins with a literature review that responds to this call for research by examining how settlement locations and work are connected among highly skilled immigrants.

Research has drawn attention to the changing geographies of recent immigrants' residential patterns in North American cities and the related influence on their social and

economic integration (Wang Q. , 2010; Wright, et al., 2010; Zhou & Lin, 2005). Unlike the traditional spatial assimilation theory that predicts immigrants first settle in inner-city ethnic enclaves and eventually move to more dispersed suburban environment after acculturating into the host society (Massey D. , 1985), many recent immigrants settle in suburban residential locations upon their arrival. The new immigrant suburban enclaves, including ethnoburbs, differ socially and economically from inner-city ethnic neighbourhoods primarily as a function of strong educational attainment and skilled work experience among residents, as well as by the new immigrants' financial capital (Li W. , 2009). In addition, a recent Canadian study confirms that many residents are also employed in professional and skilled occupations and are upwardly mobile socially (Fong & Shen, 2011). However, residential concentration in suburban community does not always necessarily bring newcomers closer to good jobs (Liu & Painter, 2011). How highly-skilled immigrants' residential location in the suburbs is related to employment opportunities and social mobility does beg research attention.

The roles of social capital and ethnic networks in linking immigrants' residential locations, workplaces, and types of employment has increasingly attained attention (Andersson, Burgess, & Lane, 2014; Avenarius, 2009; Patacchini & Zenou, 2012). Immigrants often find jobs based on information exclusively shared by co-ethnic members (Logan, et al., 2002; Musterd, et al., 2008). These studies demonstrate that bounded solidarity and ethnic affiliation are important for networking and are key factors influencing the kinds of work done by newcomers, as well as the location of the workplace (Ellis, Wright, & Parks, 2004; Portes & Zhou, 1992). Research also points to the importance of co-ethnic residential concentrations as an important social space for newcomers to

maintain social connections, which could potentially lead to information about employment opportunities (Fong & Hou, 2013; Topa & Zenou, 2014). A notable example is the analysis of the effect of social interactions among neighbours on individuals' labour market outcomes (Bayer, Ross, & Topa, 2008). These authors find that living in the same residential block increases individuals' probability of working together by over 33 percent compared to those living in nearby residential blocks. Moreover, this study indicates that the effect of social interactions among neighbours is stronger when individuals share similar socio-demographic characteristics, such as age, race, gender, educational level, and family structure.

Since social interactions are related to location, more recent studies have examined the influence of neighbourhood socio-demographic characteristics as a proxy for understanding the effect of social networks on immigrants' labour market outcomes (Andersson, García-Pérez, Haltiwanger, McCue, & Sanders, 2014; Hellerstein, McInerney, & Neumark, 2011). Most studies find negative effects of neighbourhoods characteristics, such as co-ethnic concentration, lower education levels and immigration status, on employment outcomes among individuals living in deprived areas (Cutler, Glaeser, & Vigdor, 2008; Wang Q. , 2010). These authors believe that living in deprived neighbourhoods offers limited social capital returns to residents and affects an individual's life chances, including labour market outcomes. Other studies however, demonstrate very limited or even no significant neighbourhood effects on economic outcomes among residents who are randomly selected and placed in wealthier neighbourhood (Ludwig, et al., 2008). A more recent study points to a major challenge in research on the impact of neighbourhoods on individuals' labour market outcomes: how to measure appropriate neighbourhood and

individual characteristics (Galster, 2008). Migration researchers have called for research about neighbourhood effects to focus more on newly arrived immigrants and the particularities of their social and demographic characteristics (Hedberg & Tammaru, 2013). Despite acknowledging the importance of individual-level characteristics, most current studies still focus on whether individuals live in 'disadvantaged' neighbourhoods with lower socio-economic status (Galster, 2008; Glasmeier & Farrigan, 2007). Given the growing prominence of ethnoburbs and similar suburban settlement patterns, as well as strong human and financial capital status among many individuals and households in some immigrant communities, examining the employment characteristics of newcomers will shed light on the challenges of social integration in contemporary cities.

When considering work status and social mobility, the reality of differential wage attainment for women and men demands an approach that recognizes the complex ways in which employment is gendered. Feminist scholars have long argued that the social construction of women's and men's identities and social roles influence occupational segmentation, spatial access to jobs, and gender-specific job search patterns (Phan, Banerjee, Deacon, & Taraky, 2015; Preston & McLafferty, 2000). Evidence also suggests that many women tend to work in different types of jobs than do men, and that their jobs are more likely to be semi- or low-skilled, part-time or with flexible working hours, in unfavourable working environments, and to be poorly paid (Hanson & Pratt, 1995). In industrialized economies, women are over-represented in low-paid service and sales positions and underrepresented in professional and managerial occupations relative to men (Jarman, Blackburn, & Racko, 2012). This is particularly true among immigrant women, since they are often "deskilled" after arrival by a lack of recognition of educational

credentials and work experience by employers (Guo, 2009). Other research also suggests that women's employment experiences are shaped by social reproduction obligations, regardless of ethnic identity (Budig & England, 2001). Women's disproportionate share of domestic responsibilities, such as child and elder care and housework, has an important impact on women's type of employment and decisions about where to work (Kwan, 2000).

In addition to women's domestic responsibilities, research on gender and work also demonstrates that women's labour market experiences are strongly influenced by location and distance (Ellis, et al., 2004; Hanson & Pratt, 1995). In husband and wife couple families, men often made the final decision about where to live and usually choose to live close to their workplaces. In response to possible long commute times and distance, women tend to look for jobs that are close to home. Often women compromise on the quality of employment in order to minimize travel times and costs, as well as to meet domestic and childcare demands (Hanson & Pratt, 1995). Moreover, women are more likely than men to rely on informal networks for job information, as well as personal contacts within neighbourhoods or ethnic communities, to find jobs in local areas (Ellis, et al., 2004). A Canadian study examining recent immigrants' integration experiences points out that traditional gender roles have an even stronger effect on professional immigrant women's employment opportunities than their human capital (Phan, et al., 2015). Therefore, beyond questioning spatial constraints and family responsibilities, it is necessary to better understand how skilled and professional Chinese immigrants' geographies of employment are shaped by gender roles and social contacts.

The present study investigates the effects of the ethnic composition of neighbourhoods, as well as the social characteristics of neighbourhoods in which Chinese immigrants reside, on the likelihood of employment in Ottawa's high-tech sector. Specifically, by examining the ethnic composition and social characteristics of neighbourhoods, the analysis will shed light on the role of local social context in influencing the likelihood of employment in the high-tech sector for women and men in a Canadian context. This project is fundamentally rooted in the notion that finding employment is a social process that extends beyond the human capital characteristics of individuals (Avenarius, 2009; Hagan, 1998; Sassen, 2012); in this regard where individuals live can be influential in shaping the nature of social contacts.

3.3 High-tech Employment in Ottawa-Gatineau and the Chinese Community: The Importance of Local Conditions

As a point of departure for the analysis, it is necessary to develop the context by describing Ottawa-Gatineau's high-tech sector and the Chinese community. The city's economy has long been dominated by the federal government and its associated public institutions (Mosco & Mazepa, 2003). The federal government, a significant user of information technologies, has long encouraged the development of high-tech industries in the capital region. As a consequence, a substantial share of Ottawa-Gatineau's labour force is employed in information industries, scientific services, and technical services. Although much has changed in Ottawa-Gatineau's high-tech sector since the days of rapid expansion in the late 1990s – namely the sector's sharp downturn in the early 2000s and the subsequent demise of the once industry leader Nortel – high-tech industries, nevertheless

remain important in part due to the demand created by the federal government (Andrew, Ray, & Chiasson, 2011).

The high-tech sector in Ottawa-Gatineau has attracted a large number of skilled foreign-born workers since the 1990s, including a high proportion of well-educated and professional immigrants who work and live in the suburban fringe of the city. The Kanata area in particular attracted a large number of foreign workers. As a suburban community, Kanata has a mix of commercial and residential areas, and is home to several major high-tech firms. Most of the high-tech industries are clustered along March Road, in the Kanata North Business Park and Kanata Research Park (Figure 3.1). It is important to note that Kanata is far from being the only place of high-tech employment in Ottawa-Gatineau, but it is the major high-tech employment node in the metropolitan area. In 2006, Kanata had a population of approximately 86,400, which is slightly less than one-tenth of the total population of Ottawa-Gatineau. The Kanata community stands apart from the city-at-large in a number of ways. Socio-economically, Kanata residents generally have higher levels of educational attainment, lower unemployment rates, and higher average employment income than individuals in the rest of the city (Andrew, et al., 2011).

According to the 2006 census, foreign-born population constituted approximately 20 percent of the total population in Ottawa-Gatineau. Approximately 32,400 Chinese immigrants lived in the capital region and represent about 9 percent of the total foreign-born population (Statistics Canada, 2008). This immigrant population is overwhelmingly made up of recent arrivals (over 70 percent arrived between 1991 and 2006), young adults (more than 45 percent are between 23 and 40 years old), and well educated

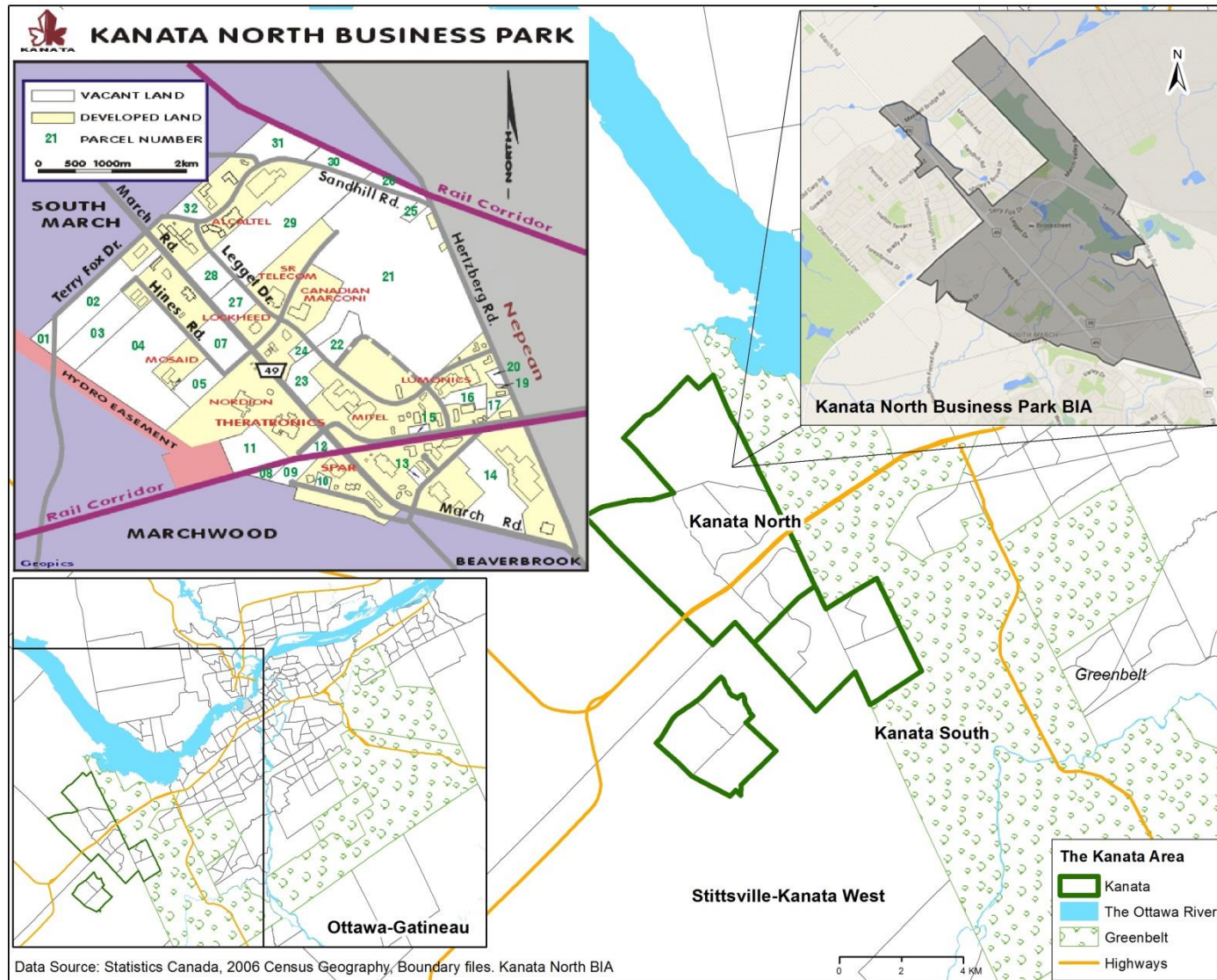


Figure 3.1 The Location of Kanata North Business Park, Ottawa-Gatineau CMA

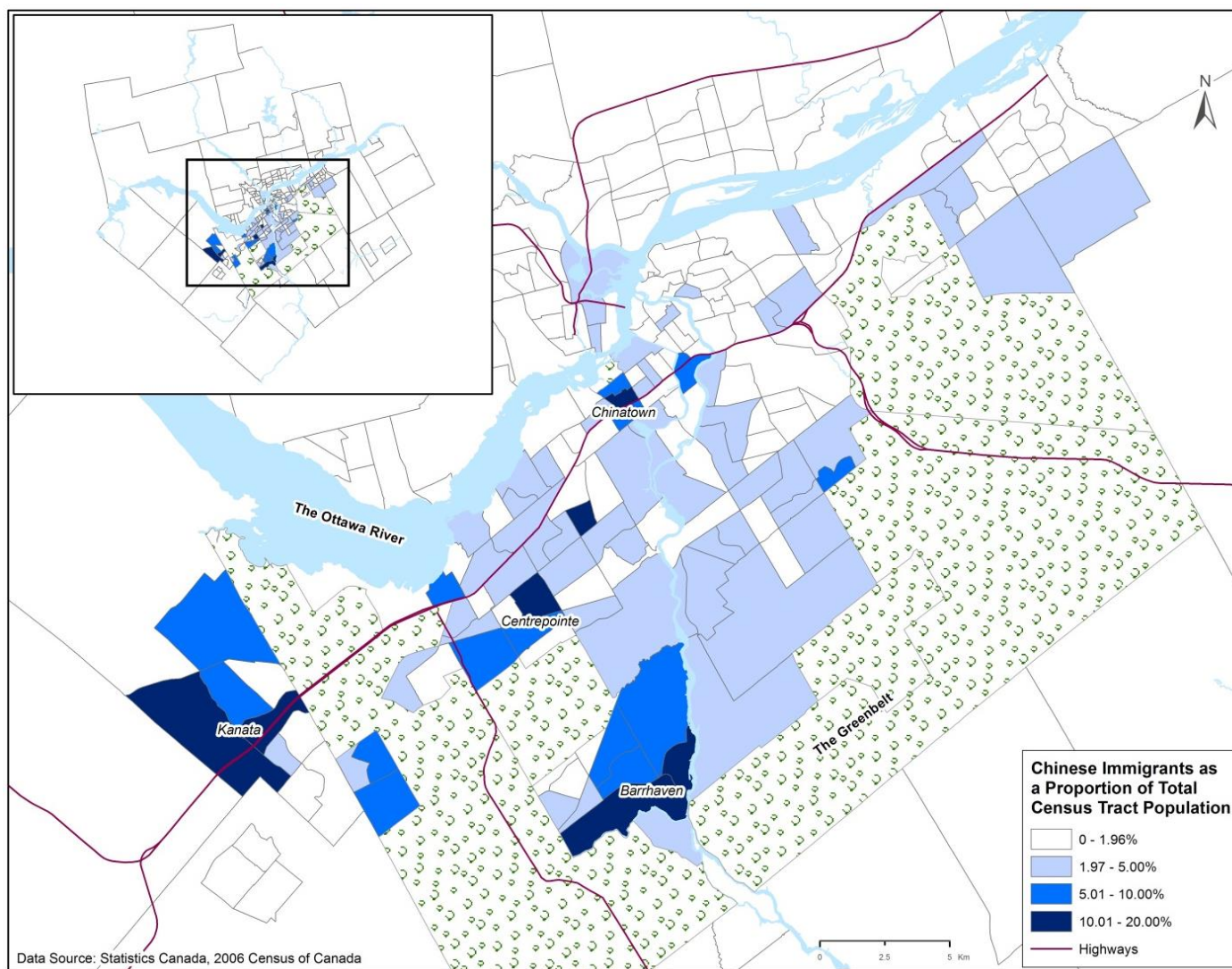


Figure 3.2 Relative Concentration of Chinese Immigrants in Ottawa-Gatineau CMA, 2006

(63 percent held at least a Bachelor's degree). Many of recently arrived Chinese immigrants work in Ottawa-Gatineau's high-tech sector (see Chapter 2). The group also has a distinct geography, especially relative to most other immigrant groups, in that it is overwhelmingly located in Ottawa. In fact, less than 1,000 Chinese lived in Gatineau in 2006 and constituted less than 5.5 percent of the total Chinese population (Gilbert, Veronis, Brosseau & Ray, 2014). Moreover, the Chinese population living in Ottawa is strongly biased toward the city's western suburbs, which is also where a large proportion of the region's high-tech industry is located (Figure 3.1 and Figure 3.2).

3.4 Data and Methodology

To examine how Chinese immigrants' residential location influences their employment in the high-tech sector in Ottawa-Gatineau, this study draws on the full 2006 Census. The census microdata file¹ is rich in information about individuals' socio-economic characteristics (e.g., place of birth, ethnicity, education, occupation, industry of work, and income). In addition, it provides geographic information about the population at the census tract level (i.e., approximates a neighbourhood scale), including the locations where people reside and work. This enables analysis of the geographies of employment at a fine geographic scale. Data from the 2006 census are used primarily because they capture the situation with regard to high-tech employment in Ottawa-Gatineau after the high-tech bubble crisis at the beginning of 2000s, and provide a picture of more typical high-tech activities in the sector. The data from the 2006 census also have several advantages over the 2011 census/ National Household Survey (NHS) data because many of the variables useful for this study were collected as part of the NHS, which has several data quality issues.

The NHS departs significantly from earlier census methodologies, most notably in terms of relying on voluntary respondents, which has led to a much higher non-response rate. The non-response rate is especially significant for groups that are numerically small and/or whose first language is neither English nor French (e.g., unemployed, low-income groups and immigrants).² Due to issues related to the reliability of 2011 census/NHS, this analysis uses the 2006 census to investigate Chinese immigrants' employment status and to investigate the effects of residential location on recently-arrived Chinese immigrants' likelihood of employment in the high-tech sector.

The analysis is restricted to individuals who are between 23 to 70 years old. This age range is considered to be the “working age population” in the research literature as it includes people who have completed most, if not all of their formal education, and relatively few individuals older than 70 are active in today's labour force (Frank, 2013; Li P. , 2008). Second, only those who are in the labour force – people who are employed or unemployed and actively looking for work – are included in this study. Lastly, this study focuses on Chinese immigrants who were born in mainland China (People's Republic of China), Hong Kong, and Taiwan³. Although their pre-migration political and social values and economic behaviors may be different, these recently arrived immigrants are broadly similar in education levels, as well as employment rates and incomes after arrival (Lien, 2010; Lin, 2013). The important cultural and linguistic differences that exist between these groups are also largely ignored by the Canadian-born population of European origins.

The high-tech sector is organized around knowledge-based activities and use modern technologies and information. There are various ways to define the high-tech sector, each relating to different understandings of high-tech activities as well as different

research contexts and purposes (Chapple, Markusen, Schrock, Yamamoto, & Yu, 2004; Hall & Khan, 2008; Hall & Sadouzai, 2010). This study adopts a broad definition of the high-tech sector that includes individuals who either hold high-tech occupations or work in high-tech industries. More specifically, this definition of high-tech sector captures those performing work that requires high-tech related skills and experience, regardless of where they fall in an industrial classification scheme (e.g. a computer technician who works in the public service sector). At the same time, this definition includes all individuals who work in high-tech industries, primarily because an understanding of the industry is required regardless of the types of occupation (e.g. an executive assistant who works at IBM). Accordingly, an individual who is either employed in a high-tech occupation or works in a high-tech industry is considered to be working in the high-tech sector.

3.5 Methodological Considerations: The Relationship between Residential Location and Employment

This study has two highly related parts. The first component is focused on classifying census tracts (i.e., a proxy for neighbourhoods) in terms of Chinese ethnic composition and whether individuals work in the neighbourhood in which they reside. The second part is somewhat broader in scope and examines the social, demographic and employment characteristics of all adult residents in census tracts to examine whether the characteristics of *where* Chinese newcomers live influence their likelihood of employment in the high-tech sector. The two components together evaluate the relative influence of several different aspects of local residential conditions on the probability of employment in the high-tech sector among Chinese women and men.

The first component of the study seeks to identify locations in Ottawa-Gatineau where Chinese immigrants are: residentially concentrated; work concentrated; both residentially and work concentrated; and under-represented in both respects. The literature on geographies of employment suggests residential location has important implications for where immigrants work and the kind of employment that they find (Kelly, 2012; Wright, et al., 2010). In the context of the present study, it is anticipated that well-educated and professional Chinese immigrants have a stronger likelihood of working in the high-tech sector if they both live and work in areas where the Chinese population is spatially concentrated. The degree to which Chinese men and women benefit equally from specific types of residential/work configurations is also evaluated.

To establish the configurations of home and work concentrations, residential and employment location odds ratios are calculated to construct an index. The residential odds ratio (RO) indicates the degree to which Chinese immigrants are residentially over- or under- represented in a census tract compared to the non-Chinese population. Similarly, the workplace odds ratio (WO) indicates the over- or under- representation of where Chinese immigrants work, again in relation to the non-Chinese population.

$$\text{Residential Odds: } RO_i = (R_i/R_{t-i}) / (OR_i/OR_{t-i})$$

$$\text{Workplace Odds: } WO_i = (W_i/W_{t-i}) / (OW_i/OW_{t-i})$$

R_i is the number of Chinese immigrants residing in census tract i ; R_{t-i} is the number Chinese immigrants residing in census tracts other than i ; OR_i is the number of non-Chinese population residing in census tract i ; OR_{t-i} is the number non-Chinese population residing

in census tracts other than i. The calculation is same for measuring Chinese workplace configuration.

To be consistent with previous studies that use a similar methodology to identify ethnic neighbourhoods (Logan & Zhang, 2004; Wang Q. , 2010), a Chinese residential concentration is one in which the odds (RO) are equal to or greater than 5.0. Research about ethnic segregation at work also suggests that locations of work are considerably less segregated than residential areas (Ellis, et al., 2004). As a consequence, a Chinese employment concentration is one where the workplace odds (WO) are equal to or exceeds 2.0 (Wang Q. , 2010). Accordingly, census tracts in Ottawa-Gatineau have been classified into four types of residential/work configurations using this index: 1. *Chinese Community* (residential concentration strong), 2. *Chinese Enclave* (employment concentration strong), 3. *Chinese Home and Work Enclave* (strong residential and employment node), and 4. *Host/Non-Chinese Community* (Chinese under-represented both residentially and in employment) (Table 3.1). By far, the majority of census tracts in Ottawa-Gatineau metropolitan area are classified as Host/Non-Chinese Community, and a small number of tracts fall into one of the three types of Chinese concentration. Chinese individuals living in Ottawa-Gatineau are then associated with one of the four types of neighbourhood configurations. This typology indicates where in the metropolitan area Chinese immigrants either live with co-ethnics and/or work with co-ethnics.

Table 3.1 Typology of Residential and Work Configurations among Chinese Immigrants in Ottawa-Gatineau CMA, 2006

Types of Residential/Work Configurations	Residential Odds	Workplace Odds
<i>Chinese Community</i>	≥ 5	< 2
<i>Chinese Enclave</i>	< 5	≥ 2
<i>Chinese Home and Work Enclave</i>	≥ 5	≥ 2
<i>Host/non-Chinese Community</i>	< 5	< 2

The second part of the analysis investigates neighbourhood-level social, employment, and demographic characteristics with respect to the likelihood that Chinese immigrants will work in the high-tech sector. Most studies examining individuals' employment outcomes focus on their human capital characteristics and the physical distance between home and work locations, but few examine the relative significance of the characteristics of where people live on the probability of working in a particular occupation or industrial sector. Examining neighbourhood characteristics acknowledges the importance of social contacts and information ties in finding employment, especially among individuals belonging to minority communities whose social networks may be more restricted than those of people who belong to the social majority or 'host' society (Hagan, 1998; Sassen, 2012).

In this component of the study, it is hypothesized that living in areas where a large proportion of workers are employed in the high-tech sector will have a positive influence on the likelihood that Chinese immigrants will also work in this sector. Previous empirical studies show that geographic proximity facilitates information flows, which can provide valuable information about job opportunities to people who live nearby (Bayer, et al., 2008;

Damm, 2014). Bayer, et al. (2008) argue that neighbourhood-based job referrals can be especially important for women and immigrants, primarily because responsibilities for social reproduction and/or limited language skills respectively often restrict individuals' social and spatial networks to neighbourhoods rather than an entire metropolitan area. It has also been argued that living in neighbourhoods where co-ethnics are a large component of the population allows immigrants, especially new arrivals, to find employment in similar workplaces and to work in broadly comparable occupations (Damm, 2014; Wang Q. , 2010). Specifically, Park (2012) demonstrates that living in an immigrant neighbourhood has a significant influence on newcomers' industrial segregation and labour market outcomes. In order to frame neighbourhood diversity in a broader context, the proportional representation of several other immigrant groups (i.e., South Asians, whites, and all other foreign-born groups) are included in this component of the analysis. Immigrants from South Asia are deliberately included in the analysis because, like Chinese immigrants, they are a large and important segment of high-tech workers in Canada (Li & Lo, 2012).

In addition to shared demographic characteristics, the social characteristics of the neighbourhoods where people reside may influence employment options. First, research suggests that people are more likely to interact with others who share a broadly similar socio-economic status. For example, Haurin, et al. (2005) find that as home ownership rates rise in a neighbourhood, so does social interaction among residents. They suggest that the link between home ownership and social interaction is reinforced by homeowners' locational stability relative to renters, which over time tends to build and strengthen neighbours' social networks. Therefore, it is anticipated that Chinese individuals will have

stronger local ties if they live in neighbourhoods where home ownership rates are high and the proportion of homes without a mortgage is also high. Second, living in neighbourhoods where many people live in married or common-law household types may also encourage contacts because of the stability associated with raising children and the possibilities of developing social interaction with neighbours simply through daily activities associated with child rearing (e.g. school activities, recreation) (Manley & Ham, 2012). Third, the educational characteristics of neighbours may also influence both the likelihood of information exchange and the relative value of information about employment options and opportunities (Granovetter, 1973). Given the importance of advanced education for employment in many high-tech and 'creative' occupations (Florida, 2012), it is anticipated that living in neighbourhood with a strong proportion of highly-educated residents may lead to greater information sharing about jobs that demand similar educational qualifications. Finally, whether a neighbourhood has a large proportion of recently arrived immigrants or more long-established households may also influence the quality of information that is shared. It is anticipated that neighbourhoods where the immigrant population is long-established will be a better source of information about employment opportunities simply because people have had a longer period of time to establish networks, especially in with respect to occupations that demand high levels of education and work experience (Keene, Bader, & Ailshire, 2013).

To examine the relative importance of ethnic neighbourhood residential/work configurations and neighbourhood socio-demographic characteristics on the likelihood that Chinese women and men will work in the high-tech sector, a series of regression analyses were undertaken. The first two standard logistic models separately examine the

effect of residential location and neighbourhood-level socio-demographic characteristics on Chinese immigrant men and women's high-tech employment probability. The first model only includes the four types of residential/work configurations (Host/Non-Chinese community is the reference category) at the individual level. The second model includes neighbourhood social characteristics measured at the census tract level. The dependent variable (working/not working) is dichotomous, but the independent variables are continuous and presented as percentage values. Hence, the odds ratios for Model 2 indicate the degree to which the likelihood of employment in the high-tech sector changes as the proportion of individuals with particular social and demographic characteristic changes within census tracts. The results are presented as odds ratios, which indicate the constant effect of each independent variable on the probability of high-tech employment while controlling for the effects of all other determinants. A greater odds ratio indicates a stronger effect of one category of an independent variable relative to a comparison or reference category on the dependent variable, which in this study is whether an individual works in the high-tech sector (1) or not (0).

It has been argued that it is important to carefully evaluate the relative significance of the ethnic composition and the socio-demographic characteristics of neighbourhoods primarily because they have been found to be highly inter-related. However, examining each dimension independently appears to overestimate the influence of each set of factors on an individual's labour market outcomes (Xu, 2014). Therefore, to avoid this problem and provide a strong estimation of the relative significance of residential/work configurations *and* neighbourhood-level socio-demographic characteristics on Chinese immigrants' likelihood of working in the high-tech sector, the results of a multi-level

regression model are presented to conclude the analysis section. The multi-level regression model uses both residential/work configurations and the neighbourhood-level socio-demographic characteristics in the calculations of odds likelihood. This two-level model enables a joint consideration of the effects of these variables in predicting the likelihood of high-tech employment. Again, odds ratios are used to interpret the influence of the predictors.

3.6 Living and Working with Co-ethnics: The Influence of Residential/Employment Configurations

As cities are made up of clusters of residential and employment nodes, as well as where both home and work activities exist side-by-side (Glasmeier & Farrigan, 2007), Ottawa-Gatineau's neighbourhoods have been classified according to four types of residential/work configurations based on the relative presence (or absence) of the Chinese immigrant population (Table 3.1). The only area where Chinese are both residential and employment concentrated is Kanata Lakes – Marchwood, which here is classified as a *Chinese Home and Work Enclave* (Figure 3.3). This suburban neighbourhood is distinguished from the rest of the city in a number of ways: most adults (72.8%) have at least a Bachelor's-level education, nearly half of the residents are employed in the high-tech sector, and average employment and household incomes are much higher than the average for all residents in Ottawa-Gatineau. In addition, half of the residents in this area are immigrants and nearly one-fourth of them are recent arrivals who immigrated to Canada between 1996 and 2006 (Table 3.2). Furthermore, this area is distinguished by the large

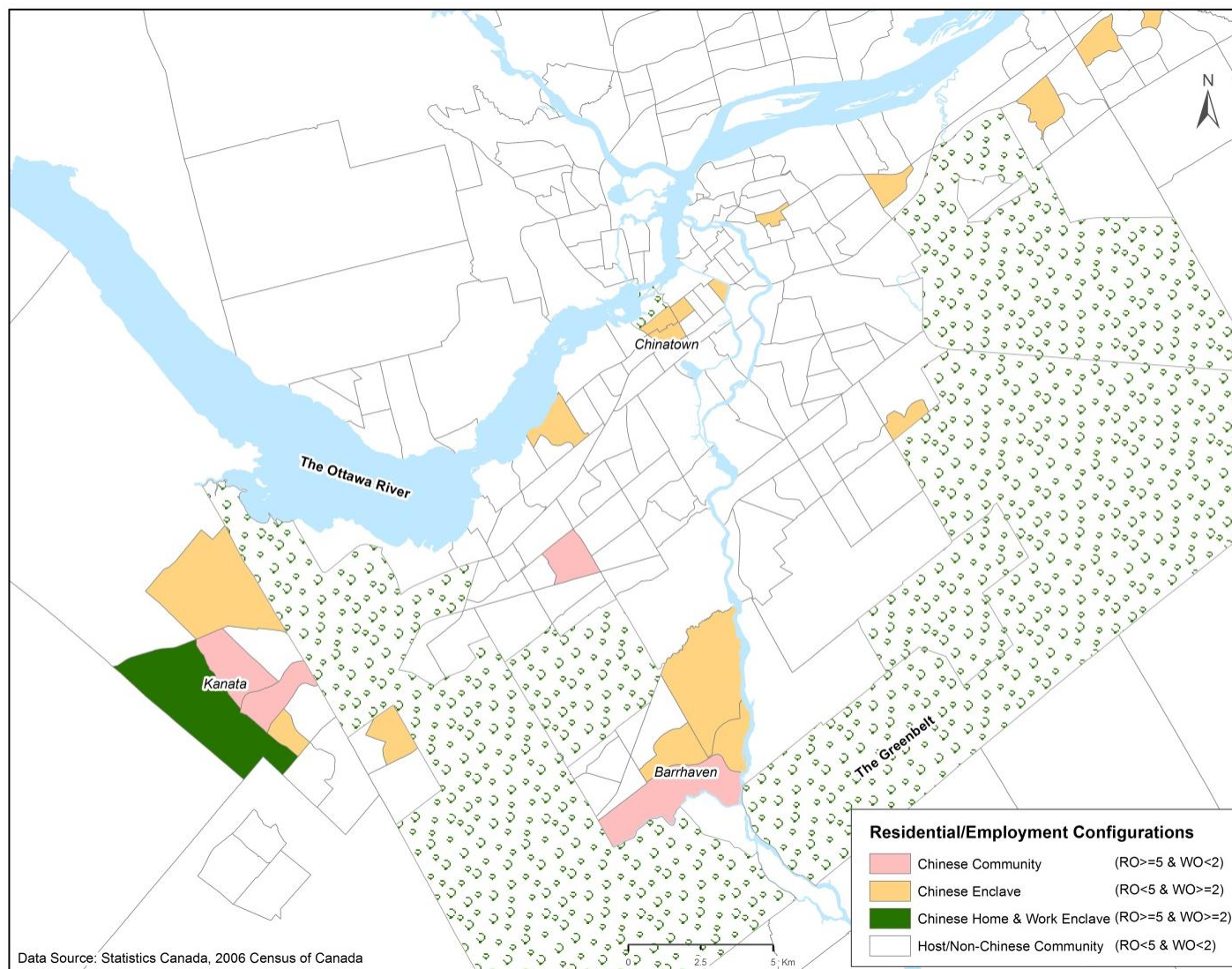


Figure 3.3 Geographic Distribution of Residential and Work Concentrations for Chinese Immigrants, Ottawa-Gatineau CMA, 2006

number of Chinese men who have at least a Bachelor degree and the majority of them (88.6%) hold high-tech related jobs with an average annual employment income of almost \$100,000 (Table 3.3). In contrast, only 43.1% of Chinese women in this area work in the high-tech sector and their average annual employment income is only \$36,000. Most Chinese women, however, have attained a Bachelor's degree (78.1%).

Table 3.2 Socio-economic Characteristics of Residents in Residential/Work Concentrations in Ottawa-Gatineau CMA, 2006

Characteristics	All Ottawa- Gatineau Residents	Residents in Chinese Home and Work Enclave	Residents in Chinese Community (home)	Residents in Chinese Enclave (work)	Residents in Host/Non- Chinese Community
N (weighted)	555,050	1,575	11,745	46,820	498,060
	%	%	%	%	%
High-tech Workers	33.2	47.3	46.4	38.9	32.4
Bachelor Degree (& higher education)	37.4	72.8	60.5	47.8	36.0
Average Employment Income (in \$1,000)	47.6	77.3	63.2	51.5	46.8
Average Household Income (in \$1,000)	101.4	159.6	133.9	109.0	99.8
Couple Households	72.3	89.5	82.3	76.0	71.8
Total Immigrant Population	21.6	50.1	42.9	31.4	20.3
Chinese Immigrants	2.0	18.8	12.3	5.2	1.5
South Asian Immigrants	2.0	6.0	6.7	4.6	1.7
White Immigrants	9.3	18.0	13.4	10.1	9.1
All Other Immigrants	8.0	7.2	9.5	10.3	7.7
Home Ownership	74.3	97.8	93.0	79.0	73.5
Home without Mortgage	20.5	22.8	26.9	18.0	20.6
Canadian Citizenship	95.9	93.6	94.4	95.1	96.0
Immigrated 1996-2006	5.9	24.8	16.4	9.6	5.3
Immigrated 1981-1995	7.8	17.7	16.5	11.9	7.3
Immigrated before 1980	7.9	7.6	10.1	9.9	7.6

N = Total population, who are in the labour force, between age 23 and 70, in Ottawa-Gatineau.
Data Source: calculated by the author of the 2006 Census of Canada.

Chinese immigrants also live in a few suburban residential neighbourhoods, namely Kanata- March Road, Centrepont, and Barrhaven that fall into the *Chinese Community* category (Figure 3.3). With proximity to the Kanata North Business Park and the former Nortel Research Center in Ottawa's western suburbs (Nepean area), these areas have attracted a large number of high-tech workers (46.4%). Many residents in these areas are highly educated and have high employment incomes. Slightly over 40% of residents are foreign-born (Table 3.2). Chinese immigrants, in particular, make up about one-third of the total immigrant population living in neighbourhoods that fall into the *Chinese Community* category.

Using the neighbourhood typology, there are several *Chinese Enclave* neighbourhoods in Ottawa-Gatineau, where Chinese immigrants are under-represented residentially but over-represented in the local workforce (Figure 3.3). Chinese immigrants work in numerous locations, but occupational concentrations include the traditional enclave in Chinatown adjacent to the downtown core, and the concentration of high-tech work in the western suburbs of Kanata. Other smaller *Chinese Enclave* areas are closer to downtown in the central area, near the airport in Hunt Club, and next to industrial parks in Barrhaven. Chinese immigrants in these areas have slightly lower education levels and are less likely to be employed in the high-tech sector compared to those who live in the other two types of residential/employment configurations (Table 3.3). Finally, the neighbourhood typology highlights that there are many areas of the city where Chinese immigrants' presence as residents and/or workers is at best modest (*Host/Non-Chinese Community*) (Figure 3.3).

Table 3.3 Characteristics of Chinese Immigrant Men and Women in Residential/Work Concentrations in Ottawa-Gatineau CMA, 2006

Characteristics	All Chinese Residents		Chinese Home and Work Enclave		Chinese Community (home)		Chinese Enclave (work)		Host/Non-Chinese Community	
	<i>F</i>	<i>M</i>	<i>F</i>	<i>M</i>	<i>F</i>	<i>M</i>	<i>F</i>	<i>M</i>	<i>F</i>	<i>M</i>
N (weighted)	5294	5547	156	140	712	736	1148	1283	3590	3668
	%		%		%		%		%	
High-tech Workers	40.2	58.4	43.6	88.6	52.1	72.8	40.6	66.4	37.9	53.9
Bachelor Degree (& higher education)	64.2	73.4	78.1	100.0	76.3	85.2	63.9	76.6	62.6	71.0
Educated in Canada	39.8	46.0	38.5	43.2	41.9	45.7	34.0	48.7	41.2	45.0
Average Employment Income (in \$1,000)	34.2	53.2	35.9	96.1	43.0	65.0	32.2	56.3	33.3	48.6
Commute Distant $\geq 20\text{km}^4$	27.0	27.7	59.0	21.4	31.7	26.2	38.7	26.1	23.8	28.3
Commute by Private Car	42.3	66.6	39.1	75.7	50.4	73.0	33.7	69.4	43.3	64.7
Commute by Public Transit	51.6	26.2	58.7	15.7	47.5	23.1	60.9	22.0	49.8	27.9
Commute by Walking/Cycling	6.0	7.2	2.6	8.6	2.0	3.9	5.4	8.6	6.9	7.4
Couple Households	81.1	84.4	79.4	85.7	86.7	90.2	90.5	87.9	76.9	82.1
Presence of Kids	45.3	46.6	73.5	71.4	53.9	54.9	60.7	57.7	39.8	42.0
Immigrated 1996-2006	51.7	47.1	55.8	59.3	52.5	55.2	60.1	55.3	49.1	43.0
Immigrated 1981-1995	31.6	33.7	41.7	35.7	37.9	31.4	30.4	32.8	31.1	34.6
Immigrated before 1980	16.7	19.2	2.6	5.0	9.6	13.5	9.5	11.9	19.8	22.4

N = Chinese immigrants, who are in the labour force, between 23 and 70 years old, in Ottawa-Gatineau.

Data Source: calculated by the author of the 2006 Census of Canada.

In summary, Chinese immigrants in Ottawa-Gatineau are residentially concentrated in only a few areas, but are over-represented in terms of work in several different locations, including a large employment concentration in Kanata. However, these descriptive results provide little insight into how Chinese newcomers' residential location and neighbourhood characteristics influence their likelihood of high-tech employment, or whether specific types of residential/work configurations are associated with employment in the high-tech sector. To respond to these questions, the next section investigates the degree to which

different residential/work configurations are associated with the likelihood of employment in Ottawa-Gatineau's high-tech sector.

3.7 Evaluating the Influence of Residential/Employment Configurations

The regression results appear to suggest that the configurations of residence and work, as well as the socio-demographic composition of neighbourhoods, can have a significant influence on the likelihood that Chinese immigrants will work in the high-tech sector. The degree to which these factors affect the likelihood of employment in the high-tech sector, however, differs substantially for men and women (Table 3.4). The findings presented here are organized in three sections: 1) residential/work configurations (Model 1); 2) neighbourhood-level socio-demographic characteristics (Model 2); and 3) the combined effect of both residential/work configurations *and* neighbourhood-level socio-demographic characteristics (Model 3). Separate models are run for women and men, and the results pertain to only individuals participating in the labour force.

The first model reveals the importance of where Chinese immigrants live in terms of residential/work configurations (Table 3.4, Model 1). The odds ratios underscore that Chinese men who live in the *Home and Work Enclave* are over two times more likely to work in the high-tech sector (odds ratio = 2.644) compared to those who live in the *Host/Non-Chinese Community* neighbourhoods. In fact, men are more likely to work in high-tech in any neighbourhood/work configuration other than Chinese men living in *Host/Non-Chinese Community* neighbourhoods. However, Chinese women living in the *Home and Work Enclave* configuration area are much less likely to hold high-tech related jobs (odds ratio = 0.625). Instead, Chinese women who live in a *Chinese Community* neighbourhood

configuration have a strong likelihood of working in the high-tech sector (odds ratio = 2.379) compared to those who live in the *Host/Non-Chinese Community* configuration.

Table 3.4 Effects of Residential Location on High-tech Employment among Chinese Men and Women in Ottawa-Gatineau CMA, 2006

Variables	Chinese Women			Chinese Men		
	Model1	Model2	Model3	Model1	Model2	Model3
<i>Residential/Work Configurations</i>						
Chinese Home & Work Enclave	0.625*		0.408**	2.644**		1.278
Chinese Community (home)	2.379***		1.484*	2.492***		0.539**
Chinese Enclave (work)	1.272**		1.129*	1.778***		0.945
<i>Neighbourhood-level Socio-demographic Characteristics</i>						
High-tech Workers (%)		1.080***	1.079***		1.081***	1.083***
Chinese Immigrants (%)		1.280***	1.368***		1.003	1.039
South Asian Immigrants (%)		1.428***	1.500***		1.087	1.105
White Immigrants (%)		1.429***	1.551***		1.108*	1.113
All other Immigrants (%)		1.329***	1.431***		1.042	1.048
Home Ownership (%)		1.013**	1.015**		0.997	0.998
Home without Mortgage (%)		1.026***	1.022***		1.003	1.010
Canadian Citizen (%)		0.948	0.946		1.003	1.018
Couple Household (%)		0.977***	0.975***		1.015*	1.010
Educational Attainment (%) (Bachelor Degree & higher education)		0.976***	0.974***		0.994	0.994
Period of Migration 1996-2006 (%)		0.728***	0.682***		0.984	0.985
Period of Migration 1981-1995 (%)		0.781***	0.726***		0.951	0.946
Period of Migration before 1980 (%)		0.680***	0.635***		0.847	0.917
N (weighted)	5300			5550		
LR Chi ² (df)	26.532 (3)***	321.744 (13)***	339.170 (16)***	52.471 (3)***	642.925 (13)***	655.824 (16)***

N = Chinese immigrant men & women, who are in the labour force, between 23 & 70 years old, in Ottawa-Gatineau.

Data Source: calculated by the author of the 2006 Census of Canada.

Similarly, living in a *Chinese Enclave* configuration moderately increases both Chinese immigrant men and women's likelihood of working in the high-tech sector (odds ratio = 1.778 and 1.272 respectively, both statistically significant). These findings suggest that the ethnic composition of the residential/work configuration has a different effect for Chinese

men and women. Overall, however, it is clear that living in areas where contacts can be made with other Chinese co-ethnics, whether in residential or employment contexts, is quite important.

Moving on to consider the influence of social, demographic and employment characteristics of census tracts on the likelihood of high-tech employment, a number of factors stand out (Table 3.4, Model 2). The results indicate that living with neighbours who work in the high-tech sector does increase both Chinese men and women's likelihood of high-tech employment, and while statistically significant, the magnitude of the odds ratios departs little from even odds (men, odds ratio = 1.081; women, odds ratio = 1.080). Other variables seem to be much more influential. The analyses indicate that as the percentage of Chinese, South Asian, White and All Other immigrants in a neighbourhood grows, the likelihood of high-tech employment among Chinese women increase (odds ratio = 1.280, 1.428, 1.429 and 1.329 respectively). In contrast, the only ethnic minority variable that is statistically significant for Chinese men is the proportion of White immigrants in a neighbourhood (odd ratios=1.108). As other research suggests, women, especially immigrant women, are more likely than men to rely on personal contacts within neighbourhoods or ethnic communities for job information (Phan, et al., 2015; Ellis, et al., 2007). In fact, no other neighbourhood social characteristics are significant for Chinese men. Another neighbourhood factor that has a statistically significant relationship to high-tech employment among Chinese women is the home ownership. As an indicator of the role of residential stability in helping to develop meaningful contacts, living in a neighbourhood with more home owners increases the likelihood of their high-tech employment possibility slightly among women (odds ratio=1.013). Contrary to expectations, the educational

attainment characteristics of a neighbourhood are not a significant predictor of high-tech employment. Finally, the composition of a neighbourhood in terms of the period of immigration of foreign-born residents has a very minor influence on Chinese men and women's likelihood of employment in the high-tech sector. Overall, this regression model indicates that the neighbourhood-level social characteristics are frequently statistically significant for women, but as indicated by the odds ratios, the magnitude of most neighbourhood socio-demographic effects are modest.

The third model includes both residential locations in different residential/work configurations and neighbourhood-level social characteristics. After controlling for the combined effects of these characteristics, living in a *Chinese Community* configuration (odds ratio=1.484) and *Chinese Enclave* (odds ratio=1.129) is still significantly related to the likelihood that Chinese immigrant women will work in high-tech employment. However, living in any residential/work configuration is no longer a significant predictor of Chinese men's employment in high-tech and, actually, living in the *Chinese Community* configuration lower men's likelihood of employment in the high-tech sector (odds ratio= 0.539 compared) relative to those in the *Host Community* (Table 3.4, Model 3). The changes in the degree to which living in a particular residential/work configuration affects Chinese men and women's high-tech employment compared to Model 1 suggest that neighbourhood-level socio-demographic characteristics should not be discounted, although their effects are modest.

Model 3 indicates that some neighbourhood-level socio-demographic characteristics continue to play an important role in explaining Chinese immigrants' high-tech

employment, although they are statistically more influential for women than men (Table 3.4). In the mixed model, living in a neighbourhood with neighbours who work in the high-tech sector turns out to be the only statistically significant factor that is positively associated with Chinese men's employment in the same sector (odds ratio=1.083). In addition to the importance of residential/work configurations, Chinese women's likelihood high-tech employment is slightly increased by living with others who work in the high-tech sector (odds ratio=1.079). The immigrant composition of the neighbourhood, however, is a much stronger predictor. Specifically, the effects of the proportion of Chinese, South Asian, White, and All Other immigrants are moderately strong (odds ratio = 1.368, 1.500, 1.551 and 1.431 respectively). In general, by controlling for the residential/work configuration, the importance of neighbourhood-level socio-demographic characteristics for predicting Chinese women's likelihood of high-tech employment is more evident.

Interpreting these results is far from straightforward, and it is important to recognize that they should be treated as provisional given relatively small sample sizes, especially when Chinese women and men are disaggregated. Nevertheless, the findings do suggest that the ethnic composition of neighbourhoods, not just in terms of who lives in a location, but also who works there, cannot be discounted in terms of influencing the likelihood of employment in particular niches, such as high-tech. Obviously, research that examines *how* people find employment in particular sectors is required in order to better interpret how such outcomes are produced as these results provide only modest insight into employment search processes. In this respect, any analysis must consider the very different factors that seem to be important in shaping the likelihood of employment in high-tech for women and men.

3.8 Summary and Conclusion

This study examines the geographies of employment among well-educated and professional Chinese immigrants who live in Ottawa-Gatineau, the 'Silicon Valley North' of Canada. The importance of the high-tech industries in Ottawa-Gatineau's economy and a growing number of resident foreign-born workers make the city an exceptional case study for investigating the geographical influence of ethnically organized residential/work configurations and neighbourhood-level socio-demographic characteristics. In Ottawa-Gatineau, the Chinese community in 2006 was largely composed of recent arrivals and the high-tech sector was a major employment niche. Simply mapping the distribution of Chinese immigrants in Ottawa-Gatineau emphasizes the importance of many middle- and upper-middle class suburban neighbourhoods, and the relative proximity of these locations to several high-tech employment nodes is inescapable. While high-tech innovation and manufacturing nodes, such as Kanata North cannot be discounted, it is important to bear in mind that Ottawa-Gatineau's economy is largely based on services, and the demand for high-tech workers characterizes many different industrial sectors.

Human capital characteristics, such as education, skills, work experience and language, of course are influential in shaping employment trajectories. However, this study suggests that where people live and work can also be important primarily because people may be exposed to networks of information at a local scale. Where to live is often a family rather than individual decision, and beyond the proximity to work, it can implicate a range of social factors including schools for children, reputation, and proximity to co-ethnic families and institutions (Foner, 1997; Ray & Preston, 2009). To the extent that where people live and work is organized ethnically, the influence of place-based relationships

should not be discounted. The empirical analyses conducted here reveal that locational attributes can be especially important for Chinese women. The distinctly different results for women and men highlight the importance of a gendered analysis when interpreting labour market outcomes, and that such an analysis must extend beyond just evaluating wage differentials. It may well be that human capital characteristics have an overwhelming influence on the employment achievement of men, thereby minimizing the significance of residential location or ethnic ties, especially among the well-educated (see Hagen 1998 for a different interpretation with respect to low-skilled and non-English speaking immigrant men).

These results fundamentally do not indicate why the social and demographic composition of neighbourhoods appears to function differently for women and men. Most certainly further research is warranted, especially projects that adopt a qualitative methodology to evaluate the meaning and significance of local social networks, information sharing, and home-work relationships. As suggested by social network theory, informal information about job opportunities, which often nests within residential locations, can be influential for immigrants, especially immigrant women whose social reproduction responsibilities often bring them into contact with neighbourhood and/or ethnic community social networks (Avenarius, 2009; Granovetter, 1973).

Endnotes

1. Access the full 20% census microdata file is governed by strict confidentiality and disclosure rules at The Carleton, Ottawa, Outaouais Local Research Data Centre (COOL RDC).
2. See http://www12.statcan.gc.ca/NHS-ENM/2011/ref/about-apropos/nhs-enm_r005-eng.cfm and <http://www.statcan.gc.ca/eng/blog-blogue/cs-sc/2011NHSstory> for a discussion of Statistics Canada's analysis of data quality issues in relation to the National Household Survey.
3. According to the 2006 census, the approximate percentages, of the total foreign-born Chinese, by birthplace of Mainland China, Hong Kong, and Taiwan, are: 75, 22, and 3 percent for the Ottawa-Gatineau CMA respectively.
4. This study uses 20 kilometers as a cut-off for long commute distance, because the straight-line distance between Kanata and the downtown core is about 22 kilometers.

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CHAPTER 4

Highly Skilled Immigrants and Employment: A Summary of Research Findings for Chinese Newcomers and High-tech Employment in Ottawa-Gatineau

4.1 Introduction

Since the late 1960s, Canada has steadily moved toward building an immigration system that emphasizes the human capital characteristics of potential newcomers, regardless of place of birth. Well-educated and skilled individuals now constitute a large portion of the Chinese newcomer population that has settled in Canada over the last 25 years, and they are (re)shaping the residential, work and commercial landscapes of cities across Canada (Li P. , 2010; Li & Lo, 2012; Ray, Halseth, & Johnson, 1997; Wang & Wang, 2012). This thesis examines the degree to which highly trained and experienced Chinese immigrants are able to access high-tech employment in Canadian cities. With a focus on Ottawa-Gatineau – a city that is frequently recognized as a leading location of high-tech enterprises – this project examines the differentiated experiences of women and men with respect to high-tech employment. The study also considers the degree to which employment in the high-tech sector is related to social and demographic characteristics of neighbourhoods where Chinese immigrants live, as well as qualities of co-ethnic residential concentration that can be found among Chinese newcomers. In this latter respect, attention is drawn to the differential influence of local conditions on the employment status of women and men.

Based on an analysis of 2006 census data, the project finds that Chinese immigrants in Ottawa-Gatineau are more likely to be working in Ottawa's high-tech sector than their

counterparts in Vancouver and Toronto. They are also more likely to be working in this sector in Ottawa-Gatineau than other immigrant groups and the Canadian-born population. This relationship, however, is considerably stronger for men than for women – when other factors are held constant, Chinese women in all three cities are much less likely to work in the high-tech sector relative to men. When the scale of analysis shifts to Ottawa-Gatineau and considers the composition of residential and work geographies among Chinese women and men, the social characteristics of locations also appear to exert an influence on the likelihood of high-tech employment. There are distinct pockets of Chinese residential concentration in Ottawa-Gatineau, and a few places where individuals both live and work in high-tech employment, and many of these residential locations are proximate to concentrations of high-tech industries (e.g., Kanata and suburbs of western Ottawa within the Greenbelt). The research suggests that living in particular kinds of co-ethnic concentrations can influence the likelihood of high-tech employment. Building in consideration of the social and demographic characteristics of the neighbourhoods where Chinese immigrants live also underlines the influence of local conditions. These effects, however, appear not to be experienced by women and men in the same way. Local conditions are much more strongly related to the probability that men will work in the high-tech sector. Most certainly, the city in which a newcomer lives can have an influence on employment status. In turn, local conditions, namely configurations of residential concentration among co-ethnics, cannot be ignored and suggest an important role being played by locally-based social networks in shaping employment outcomes. Equally important, however, is the need to recognize that these factors exert a very different

influence on the employment status of women and men, and underline the need to consider gender relations in any analysis about employment.

4.2 Summary of Key Findings

To conclude the thesis, it is valuable to reiterate and briefly elaborate on the significance of several findings. First, the probability that Chinese immigrants find work in the high-tech sector does vary significantly across Canada (Chapter 2). Certainly Chinese are more likely to work in this sector than their counterparts in Toronto and Vancouver, which may simply reflect the greater availability of such forms of employment in Ottawa-Gatineau, one of Canada's pre-eminent post-industrial economies (Andrew, Ray, & Chiasson, 2011). However, it is important not to lose sight of the fact that Chinese immigrants in Ottawa-Gatineau are also more likely to work in this sector than individuals who belong to other immigrant groups or are themselves Canadian-born. Factors that may be contributing to this stronger likelihood include qualities of settlement and the social and demographic characteristics of neighbourhoods in which they reside. As previous research suggests, many social and human capital characteristics, such as country of origin, gender, period of migration, and educational attainment, are strongly correlated with working in the high-tech sector (Adamuti-Trache, Anisef, & Sweet, 2013; Nohl, Karin, Schmidtke, & Weib, 2014). This project, however, draws attention to the influence of local labour market conditions and configurations of residential concentration for understanding well-educated and professional Chinese immigrants' economic integration.

Immigrants confront particular labour market structures and opportunities in the cities where they reside, and this has an influence on the kinds of jobs they can obtain and

ultimately their employment outcomes. Specifically in Ottawa-Gatineau, national-level immigration policy objectives that target highly skilled applicants for permanent residence intersect with employment opportunities at the local level, and in turn shape very distinct residential and work geographies among Chinese immigrants (Chapter 3). The relationship between neighbourhood-level social and demographic characteristics, as well as co-ethnic residential and work configurations, and high-tech employment does play out differently for women and men. To simply state that highly skilled Chinese newcomers are highly likely to work in the high-tech sector effectively erases the much more tenuous qualities of this relationship among Chinese women.

Chinese women are less likely to hold high-tech jobs in general than their male counterparts, but their likelihood of employment in the sector is stronger in Ottawa-Gatineau than in Toronto and Vancouver. Pointing to the role of co-ethnic networks in leading to particular kinds of employment opportunities, in Ottawa-Gatineau, Chinese women's likelihood of high-tech employment increases significantly among those who live in co-ethnic neighbourhoods or areas where there is a strong immigrant concentration. On the other hand, Chinese men's likelihood of employment in the high-tech sector is relatively uninfluenced by particular configurations of co-ethnic residential concentration or local neighbourhood characteristics, thereby suggesting that human capital characteristics are of primary importance. The distinctly different results for women and men highlighted the importance of a gendered analysis when interpreting employment outcomes, and that consideration of gender should extend beyond simply examining wage differentials. Human capital may have an overwhelming influence on the employment status of men, thereby

minimizing the significance of residential location or ethnic ties, especially among the well-educated.

4.3 Limitations and Directions for Future Research

The Canadian census is an unparalleled source of data for evaluating differences in employment outcomes across geographic space and between any number of different social groups and social aggregates. Few sources match the flexibility of the census in terms of defining groups, comparing geographic areas, or examining the social and demographic characteristics of the places where individuals live. Anecdotal evidence has long suggested that a large segment of the Chinese immigrant population works in the high-tech sector, and even casual examination of a map of Chinese residential location (see Figure 3.3) suggests a relationship with the traditional centre of this industry in the western suburbs of Ottawa. The analysis conducted for this project certainly lends credence to such assumptions. More importantly, however, the study underlines that analyses of social and employment status need to scale down from the nation to consider the particularities of urban labour markets where most immigrants build their careers. Overwhelmingly, immigrants and especially visible minorities live in Canada's largest metropolitan areas, which means that national level analyses tend to camouflage many place-specific qualities of their employment and socio-economic status. This is especially true if newcomers, such as the Chinese, are compared to the Canadian-born population as a whole, who are more likely to live in smaller cities and towns, and to be less well educated (Reitz & Zhang, 2011). Given its large and comprehensive sample size, the census also enables detailed analysis of the ways in which ethno-racial status intersects with other identity markers, such as

gender, when evaluating employment outcomes in a social group. As rich as these data and analyses are in establishing patterns and relationships, they can only hint at the processes that underpin particular outcomes.

The strong presence of Chinese immigrants working in Ottawa-Gatineau's high-tech sector suggests that further research should consider the role of social ties within families and the Chinese immigrant community in influencing employment outcomes among women and men, especially in terms of sharing information about high-tech job opportunities. As Sassen (1998) has argued with regard to employment search in labour markets, the ways in which information is shared within ethnic groups may be influential in directing immigrants to certain employment niches. In addition, although much of the research concerns low-wage and low-skill employment, researchers studying ethnic employment enclaves have long emphasized the role of social ties in leading newcomers to find employment outside of the mainstream labour market (Greve & Salaff, 2005; Li P. , 2004; Ooka & Wellman, 2006; Sanders, Nee, & Sernau, 2002). Moreover, as this research clearly demonstrates, the employment status of women departs from that of men in important ways, particularly with regard to the high-tech sector, and it would be tremendously valuable to investigate the ways in which gender roles and family responsibilities influence employment choices for Chinese women and men. The fact the co-ethnic neighbourhood configurations have an influence on the likelihood that Chinese women will work in high-tech, but not men, further emphasizes the need to examine gender roles, as well as how expectations around employment in particular sectors are gendered. This finding also raises questions about precisely how local co-ethnic concentrations and social status influence employment outcomes among women. A

qualitative approach would shed considerable light on the ways in which social networks, information sharing, home-work relationships, and gender discrimination in particular employment sectors influence outcomes. Given that social actors are embedded in structures that determine their opportunities and barriers (Schweizer, 1997), the analysis of immigrants' social network structures (e.g., network extensiveness, heterogeneity, and density) and how social networks are built within and/or outside the ethnic community, could provide considerable insight into employment search and advancement strategies within any employment sector, including high-tech (Avenarius, 2009).

In-depth interviews with Chinese women and men in Ottawa-Gatineau would be valuable in understanding the relationship between home and work for individuals employed in the high-tech sector. Although the quantitative analysis presented here only hints at a possible relationship, it is difficult to believe that the spatial coincidence in the proximity of home and work among Chinese newcomers is only coincidental. Where to live is often a family rather than individual decision, and implicates a range of factors beyond simply proximity to work, including the quality of schools, neighbourhood reputation (e.g., safety), and proximity to co-ethnic families and institutions (Foner, 1997; Ray & Preston, 2009). It would be interesting to know more about why middle-class Chinese households choose to locate in Ottawa's west end suburbs generally and Kanata in particular. Equally, understanding the ways in which such residential location decisions shape employment searches and ultimately choices for women and men would strongly complement the findings from this project.

Key informant interviews with local community leaders and officials could also reveal the ways in which institutions help Chinese newcomers identify employment

opportunities. For example, community settlement services frequently do mount employment support programs to help internationally-educated professionals find jobs that match their skills and experience. In this regard, the role of immigrant community service centres with respect to matching small- and medium-size high-tech businesses to skilled newcomers merits investigation. Finally, the trajectories of well-educated and professional Chinese immigrants who decide to become entrepreneurs in high-tech also merits research attention, particularly in light of local policies intent on encouraging entrepreneurship in the National Capital Region (Spigel, 2011).

For many years, Canadian immigration policy has deliberately privileged the selection of applicants who have strong human capital characteristics, and this policy has certainly contributed to shaping the very strong educational and skill characteristics of the Chinese population living in Canada today. This project has examined the degree to which Chinese newcomers find employment in the high-tech sector – a sector that places a strong premium on educational attainment and skills in innovation and problem solving. It also considers the role of *where* immigrants live in shaping outcomes by focusing on Ottawa-Gatineau, a city well-known for having both a highly educated workforce and a significant concentration of high-tech industries. The study indicates that living in Ottawa-Gatineau is important for working in high-tech and suggests that social relationships made in local space may play a role in finding employment in this sector, especially for women. However, it also emphasizes that the experiences of Chinese immigrants with respect to employment in high-tech are multiple, and in this respect gender is a fundamental factor to be considered. Research findings have consistently pointed to immigrants having difficulty finding jobs that are commensurate with their educational attainment, experience, and

skills (e.g., Frank, 2013), but underlying these outcomes are social relations that influence outcomes for women and men in very different ways.

The research presented is indicative of the need for research that examines the intricacies of relationships between where people live and work. In this respect, it is necessary to consider home and work as more than just points in space and instead investigate the complex webs of social relationships, mediated by ideas and structures about class, ethnicity, culture and gender, which influence opportunities for women and men in labour markets. A seminal statement on this point was made in a US context by Hanson and Pratt (1995), although with relatively weak attention paid to immigrant communities that are complex in terms of socio-economic status and live in the suburbs of large cities. To understand the employment status of newcomers, whether they are highly skilled or not, clearly demands much stronger consideration of the social relationships that construct home and work locations in urban and suburban environments. Women and men are enmeshed in complicated gendered norms about their roles and responsibilities within ethnic communities, families and workplaces, as well as in notions and prejudices about competencies and equity in particular industries. However, they are also actors in urban environments in which ethnic communities continue to cluster spatially, co-ethnic and local social ties influence knowledge of opportunities, and simply the ability to move across space is highly variable. As this research project suggests, the social, demographic and economic barriers and opportunities encountered in particular types of city and suburban environments merit much greater attention in research efforts to understand employment status and social mobility among immigrants.

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