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Gender, International Training and Ethnic Visibility: An Intersectional Approach to Studying Engineers in Canada.

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Gender, International Training and Ethnic Visibility: An Intersectional Approach to Studying Engineers in Canada.

by

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ABSTRACT

Engineering in Canada has a large proportion of internationally-trained professionals. This reflects the rapid globalization of many professional fields in nations that have migration policies designed to attract the "best and brightest". Engineering is also a highly male-dominated field where women are tokens (below 15%) who may face a "chilly climate" as a result of their numeric underrepresentation and perceived occupational "inappropriateness". Empirical research that examines the transferability of immigrants' skills often highlights the risk of occupational mismatch or underemployment. Research on immigrant engineers' careers is usually restricted to studying men, and the career prospects of immigrant women engineers are understudied. This dissertation aims to address this gap by using intersectionality as a framework to examine immigrant women's combined vulnerabilities as internationally-trained professionals re-establishing their careers in a new country and as female tokens in a male-dominated field. Drawing on the nationally-representative 2006 Canadian census data, a series of multinomial logistic regressions are carried out to predict the likelihood of individuals with engineering training being successful in gaining entrance to: (1) the Canadian labour market; (2) the field of engineering; and (3) advanced positions within the engineering field. The intersection of gender, origin of training and ethnic visibility is examined by modeling the combined interacting effects of these three status variables. The results demonstrate that gender and, immigration and visible minority statuses work as independent and intersecting forces. Women, immigrants and visible minorities, each, are at a disadvantage in obtaining these different career outcomes. The intersections between the statuses create complex and diverse trajectories of disadvantage showing that the experiences of immigrant women engineers cannot be understood by studying immigrant men or women as a homogeneous group. Specifically, immigrant women are at a

cumulative disadvantage in their chances of obtaining any employment, employment in engineering, and securing advanced positions within the field. Moreover, the analysis suggests that the cumulative disadvantage of immigrant and visible minority female engineers is produced by different forces. The results of this study highlight the relevance of the intersectionality framework in studying immigrant women professionals and offers important methodological considerations in studying occupational match versus mismatch.

PREFACE

This thesis is original, unpublished, independent work by the author, Alla Konnikov.

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This success is as much yours as it is mine!

DEDICATION

To my grandparents whose unconditional love has been an endless source of strength in my life.

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Chapter 1

INTRODUCTION

"*'I didn't come here to live this kind of life': Skilled immigrants on desperate hunt for jobs in Quebec*[1]". This title of an article published online in CBC News on September 25, 2018 illustrates the problem of skilled immigrants' employment prospects in Canada. Evidence from the media, documentary and empirical studies indicate that skilled immigrants entering Canada in various occupations struggle to find employment commensurate with their skills, the same set of skills that allowed them to gain admission to the country. As a result, skilled immigrants are at high risk of settling in unskilled jobs. This phenomenon is referred to as an "occupational mismatch" or "underemployment" in the academic literature concerned with immigrants' economic integration (Chiswick & Miller, 2009; 2012; Reitz, 2001; 2005; 2007). The stories of skilled immigrants occupying menial jobs are common and the image of an engineer working as a taxi driver is the ultimate illustration of this problem. Immigrants' underemployment is a universal phenomenon that persists across different nations and in a variety of occupations (Batalova, Fix & Bachmeier, 2016; Beckhusen et al, 2014; Galarneau & Morissette, 2008; Wald & Fang, 2008). It resonates especially with the migration policy of Canada that is oriented to bringing "the best and the brightest" to contribute to the local and global economy.

In 1967, Canada launched the "point-system" migration policy that was developed to attract highly-skilled immigrants to participate in building a knowledge-based economy, and filling in long-term labour shortages. Different aspects of individuals' human capital were evaluated and graded, producing a score that serves as the basis for their admission (Green & Green, 1995; Li, 2001; Reitz, 2007; Shachar, 2006). This approach singled out highly-skilled

[1] The full article is available through this link: https://www.cbc.ca/news/canada/montreal/quebec-immigration-skilled-workers-election-1.4833739

immigrants from the general migration flow as having high potential to contribute to the receiving country's wealth and competition in globalized labour markets. In an age of rapid technological development, Science, Technology, Engineering and Math (STEM) professionals formed one of the most desirable set of occupations under this stream (Boyd, 2013; Hunt & Gauthier-Loiselle, 2010). STEM professionals stand out for the large proportion of immigrants in North America in general and Canada in particular (Beckstead & Gellatly, 2006; Boyd, 2013; Boyd & Tian, 2018; Council of Canadian Academies, 2015; Hango, 2013; National Science Foundation, 2014; Varma, 2007). A substantial proportion of admitted immigrants has contributed to the large ethnic diversity in the STEM markets (Boyd & Schellenberg, 2007; Boyd & Thomas, 2001;Tang, 2000; Teelucksingh & Galabuzi, 2005).

Among different STEM occupations, the engineering field stands out for several unique characteristics. First, engineering training is considered highly transferable due to the perceived universality of its science, math and technology-based knowledge. This characteristic promises immigrant engineers a relatively smooth transition into the labour markets of the host nations, as compared to their counterparts, such as lawyers and teachers, whose education and skills are deeply embedded within local linguistic and cultural contexts (Remennick, 2012). In Canada, however, engineering is a regulated profession, and its practitioners are subject to a licensing process (Boyd & Thomas, 2001). This fact constitutes a second unique characteristic of engineering, differentiating the field from other STEM occupations that are not regulated in Canada. This regulation is a substantial barrier for skills recognition of internationally-trained engineers entering Canada. Entrance to the field is restricted unless the licensing process, which can be especially difficult for newcomers, is successfully completed (Boyd & Thomas, 2001; Friesen, 2016; Girard & Bauder, 2007). This barrier adds another layer of difficulty to the

challenges newcomers usually face, such as adjustment to a new country and their lack of social networks. This situation creates a paradox in which engineering skills have high transferability potential but at the same time are not necessarily recognized within the Canadian labour market.

The unique characteristics of engineering for immigrants has sparked substantial empirical interest among Canadian scholars of immigration (Boyd & Thomas, 2001; Boyd & Tian, 2018; George et al, 2012a, b; Shan, 2013a, b). Empirical studies suggest that internationally trained engineers in Canada are behind their Canadian counterparts in rates of employment in general, occupational match and their ability to advance their professional careers (Boyd & Thomas, 2001; Boyd & Tian, 2018; George et al, 2012b). They are perceived to be less hirable in general and during economic downturns in particular (Shan, 2013a), and their earnings are significantly lower (Aydemir & Skuterud, 2005; Clarke & Skuterud, 2014). Among immigrants, however, the experience of occupational attainment is not homogeneous and has especially pronounced barriers for those who are coming from non-European countries and are visible as ethnic minorities.

Since a large proportion of post-1967 immigrants to Canada are coming from regions other than Europe (Li, 2001; Simmons, 2010), their ethnic visibility provides a marker of foreignness that may intensify difficulties in terms of informal recognition for their skills (Reitz , 2001; Reitz & Somerville, 2004). Empirical studies show that barriers to professional integration are more pronounced for immigrants who are associated with a visible minority group (Boyd, 2000; Boyd & Schellenberg, 2007; Boyd & Thomas, 2001; Hiebert, 1999; Man, 2004; Reitz et al, 2009; Wong & Wong, 2006). These individuals meet the socially constructed image of "immigrant" (Guo, 2009; Man, 2004) as someone who is not of European descent, has limited

command of English and has different communication styles from what is perceived appropriate in the Canadian work culture (Friesen, 2012; Shan, 2013).

Empirical inquiry on immigrant engineers offers two main explanations for their occupational mismatch: (1) the difficulty in formal skills recognition, specifically in the process of re-accreditation and obtaining an engineering license; and (2) the difficulty in the informal skills recognition as a result of Canadian employers' misconceptions about foreign skills and work experience. These perceptions tend to be largely stereotypical and are attached to markers of ethnic visibility. Despite the substantial contributions of this research, these insights are limited in their focus to men, while the experiences of immigrant women engineers are understudied.

Thus, women are rarely the focus when studying skilled and professional migration (Kofman, 2000; Kofman & Raghuram, 2006; Raghuram, 2008; Ramos & Bosch, 2014). They are usually seen as dependents who immigrate to support their husband's careers, who are primarily responsible for household work and childcare, and who are not concerned with pursuing their own professional careers (Dlamini et al, 2012; Kofman, 2000; Raghuram, 2008). Thus, most studies that are concerned specifically with skills transferability of internationally-trained engineers have focused on men (Boyd & Thomas, 2001; Boyd & Tian, 2018; Girard & Bauder, 2007), or included gender among the other predictors (Tang, 1997a, b; 2000; Wong & Wong, 2006). Women engineers are often dropped from the analysis due to methodological concerns such as an insufficient sample size (Boyd & Thomas, 2001). Likewise, immigrant women have been overlooked in the literature concerned with women's professional careers in general, and within male-dominated fields and engineering in particular (Hatmaker, 2013; Miller, 2002, 2004; Powell, Bagilhole & Dainty, 2009). These latter studies focus on gendered dynamics in

organizational settings and tend to see women as a homogeneous group in comparison to men in the field. As a result, the career experiences and outcomes of immigrant women in engineering are largely unknown. Their invisibility is contextualized within the fact that engineering is the most male-dominated profession in many post industrialized societies, including Canada (Engineers Canada, 2014; Isaacs, 2001).

The empirical evidence from Canada, the United States, Australia and the United Kingdom, show that historically, the proportions of practicing female engineers has been extremely low (Engineers Australia, 2015; Engineers Canada, 2014; Hatmaker, 2013; Hersh, 2000; Hill, Corbett & St. Rose, 2010; IET, 2013; Isaacs, 2001). During the 1960s, the representation of women in the US engineering market constituted less than 1%. This number reached 5.8% in 1983; 9.5% in 1994 (Isaacs, 2001), and 11% in 2013 (Hatmaker, 2013). In Canada, the percentage of women engineers has been constantly growing since 2009 across all provinces, with the highest proportion in Alberta (13.9%) and the lowest in Yukon (7%), reaching an average of 12.3% across Canada in 2013 (Engineers Canada, 2014).

The underrepresentation of women in engineering places them in a position of "tokens", a group whose relative representation is below 15% (Kanter, 1977). According to Kanter's model, skewed representation situates individuals in a vulnerable position in relation to the dominant group. This vulnerability is framed by three perceptual tendencies, (1) visibility, (2) polarization, and (3) assimilation. These mechanisms imply that (1) tokens are highly visible to the dominant group, (2) tokens' differences are exaggerated by the dominant group, and (3) tokens are assumed to have specific attributes and act in specific ways based on stereotypes held by the dominant group. Combined, these processes create pressures on tokens within the group dynamics and jeopardize their ability to perform.

Despite the general underrepresentation of women in engineering, immigrant women are highly present within the token group of female engineers. The proportion of women among internationally-trained engineers is one to five, which is twice as high as Canadian-trained female engineers (Boyd & Schellenberg, 2007; Mishagina, 2012). The number of immigrant women with STEM degrees reached its peak in 2001 and has declined since then. However, immigrant women with STEM degrees still outnumber their Canadian-trained female counterparts (NSERC, 2017).

In this study I focus on immigrant women engineers in Canada who may be subject to multiple and unique barriers to occupational attainment. They may simultaneously struggle with skills recognition, stereotyped assumptions and institutional discrimination similar to their male counterparts. However, within the male-dominated field of engineering, their experience as tokens is situated within the intersecting vulnerabilities of their immigration status, ethnic visibility and gender. In male-dominated fields that offer high economic returns and prestige, sustaining a professional career for women who possess additional statuses, such as ethnic visibility and/or being an immigrant, intensifies the negative effects of tokenism (Charleston et al, 2014; McGee & Bentley, 2017; Ong et al, 2011; Roth, 2004; West & Fenstermaker, 1995; Yoder, 2002).

The phenomenon of women's cumulative vulnerability has received close attention in the theoretical approach of intersectionality (Crenshaw, 1989). The intersectionality perspective emerged from Black Feminism scholarship to capture how the intersection of gender and race creates a unique social experience and leads to multiple marginalities (Crenshaw, 1989). According to this approach, the intersection of several categories, such as gender, race and class, creates a non-separable mechanism that underlies the everyday social experience contextualized

within specific power relations (Crenshaw, 1989; Jordan-Zachery, 2007; Shields, 2008). Even though the intersection of multiple categories may result in either oppression or opportunity (Baca Zinn & Dill, 1996), special attention is given to how multiple forms of oppression converge. In this study I focus on immigrant women engineers for whom the multiple forms of oppression, such as a de-valuation of international training in combination with institutional discrimination and gendered discrimination in male-dominated fields may occur simultaneously.

I elaborate on the intersectionality perspective to bridge the context of international skills transferability and the context of women professionals in male-dominated fields. This approach helps to highlight the unique situation of internationally-trained women engineers in Canada who have so far remained understudied. Drawing on nationally representative census data (Canadian Census 2006), the purpose of this dissertation is to examine the ways in which international training, gender and ethnic visibility intersect to shape the career attainment of engineers in Canada. In doing so, the analysis is organized around three key outcomes that reflect important aspects of establishing a professional career in a new country marked by: (1) entering the labour market; (2) entering the professional field; and (3) securing an advanced position within the professional field. These outcomes correspond with the following three questions: considering the intersection between origin of training, sex and ethnic visibility, are engineers able to find any employment? Once employed, do they secure employment commensurate with their skills? Once employed in the engineering field, do they secure advanced positions?

1.1 Empirical Considerations

The findings in the literature suggest three important empirical considerations in studying the transferability of international engineering skills and training. First, most empirical inquiries have relied on immigration status or place of birth to differentiate between immigrants and non-

immigrants (Boyd & Thomas, 2001; Tang, 2000). In the case of immigrant engineers who require re-accreditation, the use of immigration status and place of birth is not sufficient (Boyd & Thomas, 2001). Boyd and Thomas's (2001) study on engineers in Canada was the first to recognize this limitation. Instead of immigration status they used the cutoff age of twenty-nine upon arrival to Canada as a proxy for having completed a higher education abroad. In the most recent study, Boyd and Tian (2018) used a dataset that contained information on the location of higher education. They found significant differences in outcomes between internationally and locally-trained engineers, as well as within international training between different countries of origin. The current study relies on the 2006 Canadian Census that contains information regarding respondents' location of training. The advantage of using a measure of the location of training is that it provides a more accurate way of singling out internationally-trained immigrants who are required to undergo re-accreditation in Canada.

The second important consideration is related to the operationalization of occupational match versus mismatch. Most empirical evidence relies on four occupational outcome categories. These include engineering managerial occupations, engineering professional occupations, engineering technical occupations and all other occupations (Boyd & Thomas, 2001; Fernandez, 1998; Lim et al., 1998; Tang, 1997). The problem with this approach is that the category of "all other occupations" may be quite diverse with different fields and different occupational locations included. For instance, individuals with engineering training may find themselves in skilled managerial, professional and technical positions that are not part of the engineering labour market. Although these positions are not in engineering, they should not be paired with jobs in the unskilled labour market. As an example, knowledge-based occupations, such as computer programmers and architects, were part of the "other" category in Boyd and Thomas's study

(2001). These jobs are quite different from unskilled jobs, such as retail workers and food service providers, which are also included in the category of "all other occupations". It should be noted, however that in their recent study, Boyd and Tian (2018) addressed this limitation by differentiating between occupations that require college degrees and ones that do not, in order to better measure occupational mismatch.

In this study, I propose a new categorization to differentiate between occupational match and mismatch. Specifically, I have developed a measure that includes the following seven categories: (1) senior and/or engineering managerial occupations; (2) other managerial occupations; (3) engineering professional occupations; (4) other professional occupations; (5) engineering semi-professional (technical) occupations; (6) other semi-professional (technical) occupations; and (7) all other (unskilled) occupations. I suggest this seven-category measure is more sensitive in assessing occupational match versus mismatch because it considers managerial, professional and technical occupations in fields other than engineering. In this case, the reference category "all other occupations" contains only unskilled jobs that can be viewed as the ultimate occupational mismatch. More details concerning this measure are provided in the methods section.

Part of the ability to obtain employment commensurate with the skill level is related to the structure of opportunities to secure advanced employment within the field. Therefore, the final consideration refers to the attempt to learn about the potential to career advancement while using cross-sectional data. The cross-sectional data is limited in the ability to examine career mobility as it provides a snapshot of the current career locations of the participants, while former and future locations are unknown. Nevertheless, prior research has relied on cross-sectional data to learn about immigrant' and women engineers' chances to occupy advanced career locations in

comparison to their non-immigrant and male counterparts (Boyd & Thomas, 2001; Goldberg et al, 2004; Servon & Visser, 2011). These studies have employed models that helped to predict the chances of obtaining advanced and managerial positions in engineering, and have examined whether these chances have been different for immigrant and non-immigrant engineers (Boyd & Thomas, 2001; Lim et al. 1998; Tang 1997) and for men and women (Goldberg et al, 2004; Servon & Visser, 2011). These studies interpreted the underrepresentation of the minority groups in the managerial and advanced positions as potential blocked mobility to upper echelons in the professional career ladder, using the terminology of the "glass ceiling" and the "leaky pipeline".

Following these studies, I think it is important to examine the way the intersection between the origin of training, sex and ethnic visibility shapes the opportunities to hold an advanced position within the field of engineering, while recognizing the limitation of cross-sectional data. To do so, in the final step of my analysis I focus on the engineers who were able to obtain employment in the engineering field and are located across the following occupational categories: (1) senior and/or managerial; (2) professional; and (3) semi-professional positions in engineering. I suggest that the examination of this outcome, which is limited to engineers who were successful in obtaining access to the engineering field, helps to expand this inquiry on the career attainment beyond the access to the labour market in general and engineering employment in particular. The way individuals are distributed across these engineering positions may shed light on the way the intersection between the origin of training, sex and visible minority statuses shape the potential structure of opportunities within the field.

1.2 Contributions

This study aims to contribute to the existing literature in three important ways. First, it focuses on the employment and occupational outcomes of immigrant female engineers who have

been consistently overlooked in the literature both on immigration and gender. These women possess a desirable set of skills, but in addition to the barriers documented for men, may be penalized further for their gender in the male-dominated field of engineering. Second, this study is informed by the intersectionality perspective to shed more light on the interplay between immigration status, ethnic visibility and gender in shaping the structure of opportunities for professional integration. Framed by the intersectionality approach, this study aims to clarify the way immigrant women engineers' career outcomes may differ from the career outcomes of their male immigrant and female non-immigrant counterparts. Third, this study puts forward two important methodological considerations, namely: (1) the use of the location of training instead of immigration status to identify internationally-trained engineers who may be subject to structural barriers of re-accreditation; and (2) the introduction of the new measure of occupational match versus mismatch that is more sensitive to identifying the ultimate occupational mismatch outcome of working in unskilled positions. The next chapter is devoted to providing an overview of the relevant theoretical and empirical literature that clarifies the rationale for this study.

Chapter 2

CONCEPTUAL FRAMEWORK

Theory and research on engineers' professional integration as seen through the prism of immigration, gender and ethnic visibility.

This chapter consists of four major sections. Drawing on the intersectionality perspective, the first section provides a theoretical framework to contextualize the inquiry on immigrant women engineers in Canada from the combined perspective of immigration, gender and ethnic visibility. The second and the third sections present theoretical and empirical evidence concerning different dimensions of the intersection of immigrant status and gender. The second section presents literature on highly skilled immigrants' modes of incorporation and skills transferability and discusses the variety of factors that shape immigrants' structure of opportunities in general, and within the regulated engineering market in Canada in particular. The third section presents literature concerned with women's professional careers in general, and their careers within male-dominated fields and engineering in particular. This section highlights the disadvantages that follow women's numerical scarcity and "occupational inappropriateness" in the field. The fourth and the final section presents a summary of the conceptual model and the hypotheses tested in this study.

2.1 The Intersectional Approach to Studying Immigrant Female Engineers

In 1984, Boyd suggested that the study of women immigrants requires a special conceptual approach, due to their simultaneous vulnerability as women in societies dominated by men and as immigrants in new countries. The way gender and immigration status intersect to produce additional barriers that female immigrants encounter in their labour market integration has been identified using different terms, including "a double negative effect" and "a double disadvantage" (Boyd, 1984; Donato et al, 2014; Raijman & Semyonov, 1997; Rebhun, 2008,

2010). The empirical evidence suggests that immigrant women in general, and ethnic minorities in particular, obtain the lowest employment outcomes, receive the lowest payoff for their human capital, have the least authority in the work place and are concentrated in the least rewarded jobs (Aldridge, 1999; Browne, 1999; Browne et al., 2001; Donato et al, 2014; Goyette & Xie, 1999; Maume, 1999; Reitz, 2007; Semyonov, Raijman & Maskileyson, 2014; Spalter-Roth & Deitch, 1999; Tang, 1997; Wong & Wong, 2006). Similar terminology of "double negative" has been used to describe the multiple vulnerabilities of women of colour in labour markets (Beal, 1970; Segura, 1989). Other sources refer to holding several disadvantaged categories in a particular social setting as "double/multiple jeopardy/penalty" (Beal, 1970; Browne & Misra, 2003; Ransford, 1980; Simien, 2007).

As a result of multiple vulnerabilities, certain groups may suffer from a "cumulative disadvantage". The roots of the concept extend to multiple academic fields while two major uses of this term are distinguished in the literature (DiPrete & Eirich, 2005). The first is rooted in Merton's (1973) work on cumulative advantage, which highlighted how a favorable beginning of scientific careers benefitted later career stages. This concept refers to the idea that group differences, whether positive or negative, tend to accumulate over time producing cumulative advantages or disadvantages over the course of one's life or career. The methodological focus of this conceptualization is longitudinal and it centers on growing differences over time (Bielby & Bielby, 1992; DiPrete & Soule, 1988; Fernandez-Mateo, 2009). The second way this concept is used is rooted in Blau and Duncan's (1967) notion of cumulative effects produced by group differences that, when interacting with other factors, tend to result in multiple disadvantages or "cumulative discrimination" (Blank, Dabady, & Citro 2004). Other studies use the concept of cumulative disadvantage to highlight women's multiple vulnerabilities based on the intersection

of their gender with other statuses, such as race, immigration status, and/or family responsibilities (Ferree & Purkayastha, 2000; Purkayastha, 2005).

Due to the diversity of terms used to describe women's multiple disadvantages, it is important to clarify the use of such terminology. In this dissertation, "cumulative disadvantage" is used within the context of the intersectionality framework (Crenshaw, 1989) to conceptualize the location of immigrant women engineers in Canada at the intersection of multiple sources of vulnerability. Their simultaneous positions as foreign-trained professionals, female tokens and possibly visible minorities, may result in cumulative (i.e. intersectional) negative effects on their career outcomes in engineering. Being at the intersection of these potentially disadvantageous statuses, these women may experience independent and cumulative disadvantages from each direction separately and combined. The study of immigrant women professionals requires a multidimensional approach that considers the potential intersections of gender, immigration status, ethnic visibility, and the status of women professionals in male-dominated work environments. Methodologically, I focus on a *cumulative* effect produced by the interaction between these categories on career outcomes, above and beyond the main effects that each category produces independently. Specifically, the cumulative disadvantage is assessed by considering the statistical significance of the estimated moderating effects. The next section discusses intersectionality as a framework that explains the way these multiple forms of disadvantage may converge.

2.1.1 Intersectionality

The concept of intersectionality emerged from Black feminist scholarship to suggest that multiple forms of oppression are related to characteristics such as gender, race and class that converge to shape an individual's social life (Collins, 1990; Crenshaw, 1989; 1991; McCall,

2005). The term was coined by Kimberlé Crenshaw (1989), while the idea of intersectionality had emerged much earlier (Collins, 1990; Garry, 2011). To illustrate how intersectionality works, Crenshaw (1989) uses the analogy of an individual standing in the middle of an intersection. Being at a traffic intersection, the individual is at risk of being affected by movement from any direction, individually and combined. Garry (2011) proposes to add a roundabout to this intersection to visualize how the directions can be mixed and magnified to harm the individual in a variety of ways.

Usually, the epistemological focus of intersectionality is on the marginalized and oppressed (Collins, 1990). This study, however, seeks to shed light on the career outcomes of women who are considered privileged in terms of their human capital, but may be cumulatively disadvantaged in their careers as a result of the intersection of their ethnic visibility, immigration status and token status within the male dominated context of the engineering profession. To use the intersection analogy, immigrant women engineers may be negatively affected by at least two simultaneous processes: as immigrant professionals trying to rebuild their careers in a new country and as women in a male dominated field. In addition, ethnically-visible immigrants and women, as well as immigrant women in particular, may face stereotypes and institutional barriers from each of the aforementioned directions.

The product of intersection reflects the existing relations of power in a particular society and may result in both unique forms of oppression and unique forms of opportunity (Baca Zinn & Dill, 1996; Shields, 2008). Therefore, the context in which the experience takes place becomes especially relevant to the intersectionality framework since social meanings attached to identity categories vary according to different geographic, social, cultural, political and organizational settings (Baca Zinn & Dill, 1996). Gender, however, is the most pervasive, visible and stable

identity category that defines individuals' lives across the globe (Epstein, 2007; Shields, 2008). All women are at potential risk of multiple forms of disadvantage since their social position as women is already subordinated (Epstein, 2007; Nash, 2008). Moreover, it has the potential to be further complicated by their marital and parental status, immigrant status, race, ethnicity and class.

2.1.2 Approaches to Studying Intersectionality

Recently, more studies have embraced the terminology of intersectionality to study different aspects of immigrants' lives, such as health (Bowleg, 2012; Brown, 2018; Evans & Erickson, 2019), entrepreneurship (Banerjee, 2018; Wang, 2018) and political discourse around migration and refugees (Carastathis, Spathopoulou, &Tsilimpounidi, 2018). The intersectionality framework has been also applied to studying various forms of inequality and discrimination (Bowleg, 2008, 2012; Harnois & Ifatunji, 2010; Klocker& Tindale, 2019; Kwon, 2015; Reisen et al, 2013; Seaton et al, 2010). These studies have used diverse methodologies and different variations of intersections. For example, Banerjee (2018) employed the intersectionality framework to explore the way gender, class, and visa regulations in the United States intersect to shape the choices and experiences of entrepreneurship among dependent spouses of highly skilled workers (Banerjee, 2018). Another recent study explored how the experiences of second-generation youth in the United States engage in translating and brokering practices for their non-English speaking parents. This study reveals the ways in which these children navigate through the intersection of gender, race, class, and age, thus making connections between their parents and the host society (Kwon, 2015).

The complexity involved in operationalizing the concept of intersectionality has sparked substantial scholarly discussion on the methodological challenges involved in using

intersectionality as a framework for empirical research (Choo & Ferree, 2010; Jordan-Zachery, 2007; McCall, 2005; Nash, 2008; Shields, 2008; Simien, 2007; Yuval-Davis, 2006). Two analytical elements have been widely proposed for consideration. The first is related to the inseparability of identity categories. Intersectionality scholars have argued that the intersection of gender, race and class creates a unique inseparable mechanism that cannot be examined simply by summating the categories (Collins, 1990; Crenshaw, 1989; Jordan-Zachery, 2007) and may create diverse intersectional experiences for similar identity combinations (Garry, 2011). Jordan-Zachery (2007) illustrates the inseparability as a "marble cake" in which she describes herself in terms of her "blackness" being mixed with her "womanness" and these statuses cannot be separated in an attempt to understand her experiences as a Black woman. The second consideration refers to the "non-additive" way of understanding the effects of intersectionality. Crenshaw (1989) argues that the experiences of Black women cannot be traced by summarizing the amount of sexism and racism, as Black women are not simply subject to more oppression. Rather, their experiences are qualitatively different from the experiences of White women and Black men (Crenshaw, 1989; Shields, 2008).

Given the complexity of the concept that implies multiple and multidimensional comparisons, the use of the intersectionality framework in empirical research is a methodological challenge (Simien, 2007). In a thorough review of the most highly regarded research studying multi-dimensional inequality, Choo and Ferree (2010) conclude that even widely-accepted, prize-winning research struggles to fully explore intersectionality as a multidimensional experience of oppression. Their discussion highlights that both quantitative and qualitative analyses face challenges due to the complexity of conceptualizing intersectionality, which implies the inseparability of categories and intersectional, rather than additive, experiences.

Thus, in her reflection on a series of studies conducted on the experiences of Black lesbian women in the United States, Bowleg (2008) highlights multiple elements in both their qualitative and quantitative parts that have failed to measure and capture the intersectional experiences of the respondents.

While qualitative designs have been more welcomed by intersectionality scholars and are seen as more suitable for revealing the complexity of lived experiences, the challenges of using the framework in a quantitative design have been widely discussed (Bowleg, 2008; Choo & Ferree, 2010; McCall, 2005). The complexity involved in the inseparability of different categories is a major challenge for quantitative research, in which the categories are specified and separated from each other in order to be operationalized. The complexity involved in a non-additive understanding of intersectionality is another challenge for quantitative analysis, since most statistical analysis concentrates on the cumulative, i.e. additive, effects of multiple disadvantages.

Very few studies have produced practical suggestions on how to deal with the complexity of the concept (Choo & Ferree, 2010; McCall, 2005) or how to develop a quantitative research approach that elaborates on intersectionality (Harnois & Ifatunji, 2010; Bright, Malinsky & Thompson, 2016). Claims have been made that intersectionality is incompatible with positivist ideas of quantitative research (Bowleg, 2008), and attempts have been made to develop measures and analytical approaches unique to intersectionality (Bauer & Scheim, 2018; Evans & Erickson, 2019; Bright, Malinsky & Thompson, 2016). However, even in cases where specific examples and techniques were discussed, practical suggestions that could be applied to a large variety of empirical inquiries are limited (Bright, Malinsky & Thompson, 2016).

Estimating multiplicative interaction terms while studying intersectionality has been proposed as one way to explore intersectionality in quantitative research (Choo & Ferree, 2010; Evans & Erickson, 2019; McCall, 2005; Seaton et al, 2010). Interaction terms allow researchers to examine whether there is an additional effect of being a woman and immigrant and/or ethnically-visible, beyond the independent main effects that each category produces. In other words, interaction terms can help to examine the "racial variation within gender and the gendered variation within race" (Nash, 2008:2).

The use of interaction terms, however, is not free of methodological limitations (Bowleg, 2008). One concern is that non-significant interaction terms may misleadingly suggest the lack of an intersectional effect. The strong main effects of each category may overpower the effects of interaction terms, leading to misinterpretations (Bowleg, 2008). Also, the significance of the moderating effects only suggests the existence of the intersectional experience, i.e., descriptive intersectionality, but is unable to test the causal effects of this experience, i.e., analytical intersectionality (Bauer & Scheim, 2018). In other words, the statistical estimations of interactions are unable to go beyond the quantitative understanding of intersectionality, as they cannot test whether the experience of disadvantage is not only larger or smaller, but, inherently qualitatively different, as intersectionality scholars emphasize.

Currently, there appears to be no ideal approach to using intersectionality as a framework in quantitative research. These challenges and uncertainties prevent quantitative studies of immigration from embracing the term. Instead, studies use the terms "multiple/double jeopardy", "double negative" and "double disadvantage" (Boyd, 1984; Donato et al, 2014; Raijman & Semyonov, 1997; Rebhun, 2008, 2010) to describe the experiences of women who carry an additional social category that disadvantages them in everyday life in general and in the labour

market in particular. Although these studies do not use intersectionality as a framework and may not reveal the way multiple forms of oppression converge, they provide important empirical support for adopting the intersectional approach. I argue that these studies are intersectional in their inquiry since they reveal the existence of cumulative disadvantages that immigrant women and/or ethnically-visible women encounter in different aspects of their social life.

Since this project attempts to draw on intersectionality as a theoretical framework, it is important to discuss my methodological position. In her discussion of the methodological complexity involved in studying intersectionality, McCall (2005) offered three approaches to apply the master/identity categories as analytical tools for studying intersectionality. These are (1) the anti-categorical approach, which denies the use of preexisting categories as analytical tools; (2) the intra-categorical approach, which focuses on the complexity of lived experience within a particular group (category); and (3) the inter-categorical approach, which adopts the existing social categories as analytical tools and focuses on the relations between them (McCall, 2005). McCall recommends the inter-categorical approach for quantitative research, which strategically uses preexisting social categories.

Following McCall (2005), I adopt the inter-categorical approach, relying on the preexisting social categories of gender, immigration status and ethnic visibility, and the way these were measured in the Canadian Census of Population (2006). I test the interactions between the categories to explore variation in employment status and occupational attainment by sex and ethnic visibility for immigrant engineers in Canada, and variation by immigration status and ethnic visibility for women in engineering. Despite the limitations of this approach noted above, I believe this study proposes a way to gain insight into the intersectional experiences of immigrant female engineers in Canada by looking at their occupational outcomes. Drawing on

nationally representative data provides me with the advantage of accessing a wide range of participants and their occupational locations (Bauer, 2014).

My approach to the operationalization of intersectionality is to put the examined social phenomenon in its particular context, to conduct multiple comparisons, and to unpack the interactional effects (Choo & Ferree, 2010; McCall, 2005; Nash, 2008). Garry (2011) argues that intersectionality is neither a theory nor a method, it is a framework that highlights the direction for research, the type of questions to ask and the way to contextualize the results. Therefore, the use of the intersectionality framework forces nuanced and careful interpretations. An example is provided in a study on racial discrimination conducted by Harnois and Ifatunji (2010), which found that a larger percentage of Black men experience racial discrimination in comparison to Black women. The authors argued that without the intersectionality framework, they would have concluded that Black men are subject to more discrimination than Black women. Instead, they noticed that the measures of racial discrimination were capturing types of racial discrimination usually faced by men. Further examination of the instrument measuring racial discrimination through factor analysis supported this argument, showing that the set of measures suited the experiences of men more accurately than the experiences of women. If more quantitative research embraces the complexity of the intersectionality perspective, considers its limitations and states explicitly the assumptions behind the inquiry, it may contribute to a better understanding of the phenomena of intersectionality in multiple contexts. Using the terminology of intersectionality in different fields of study will help to accumulate empirical evidence of intersectional experiences involving different categories, locations, historical contexts and methodology. All together, it will help to illustrate that intersectionality has the capacity to serve

as a general theory of cumulative and intersectional mechanisms of exclusion, or inclusion, with different identity categories and different contexts involved.

In this study, I embrace the concept of intersectionality to examine the occupational career outcomes of immigrant female engineers in Canada. In doing so, I consider two main processes that simultaneously occur for immigrant women engineers: (1) the process of skills transferability for internationally-trained professionals; and (2) the process of establishing a professional career by women in a male-dominated field. These processes have received considerable attention in two distinct bodies of literature that reflect the barriers that immigrant engineers and women engineers may face in their journey of pursuing their professional careers. These bodies of literature focus on a single core dimension in the chain of intersectional barriers that women immigrant engineers may face, as immigrants and as women, with only some attention to the heterogeneity that exists within these groups. The theoretical and empirical findings in both bodies of literature will be discussed in the sections that follow.

2.2 Immigrant Professionals: Theoretical and Empirical Evidence

2.2.1 Economic Assimilation and Skilled Immigrants

Historically, scholars have assessed the successful integration of immigrants by looking at economic outcomes, specifically earnings, and comparing them with similar outcomes among the native-born population. The occupational and economic integration of skilled immigrants has received substantial empirical attention in the United States (Bloom & Gunderson 1991; Borjas, 1994; Chiswick, 1979; Chiswick & Miller, 2009; 2012), Canada (Boyd and Thomas, 2001; Reitz, 2001, 2007), Australia, Germany (Kogan, 2003; Licht & Steiner, 1993), the United Kingdom (Clark & Lindley, 2005**)** and other immigrant receiving nations (Green, 1999; Raijman & Semyonov, 1995, 1997; Remennick, 2012). It has been widely established that despite the

high level of their human capital, immigrants tend to experience downward mobility upon arrival (see, e.g., Borjas, 1990, 1994; Chiswick, 1978, 1979; Lofstrom, 2000). It has been found, however, that they have some ability to improve their positions over time once they accumulate locally-relevant resources and overcome the barriers related to initial adjustment in the host country (Borjas, 1994; Gorodzeisky & Semyonov, 2011; Kogan, 2003; Raijman, & Semyonov, 1995, 1997; Reitz, 2007; Semyonov et al., 2014).

The paradigm known as the "hypothesis of labour market assimilation", or the U-shape integration pattern, suggests a temporary reduction in economic attainment that is primarily related to adjustment to a new country. This paradigm promises improvement once immigrants accumulate more of the local resources, including polishing their language skills, acquiring a local social network, and learning the local ways of "doing the job". Specifically, the Chicago school economist Barry Chiswick proposed that immigrants' "positive self-selection", such as higher level of skills, motivation and aspiration, is what facilitates their rapid economic improvement (Chiswick, 1978; 2000). This idea centers on the human capital approach that sees skills, talent and motivation as the main determinants of successful integration.

2.2.2 Occupational Match versus Mismatch

To a large extent, the ability of skilled immigrants to integrate into a new country depends on their ability to find employment commensurate with their skills. The terms "educational or occupational match" versus "mismatch" were embraced to conceptualize the ability of immigrants to find employment below, equal or above their skill level (Chiswick & Miller, 2009; 2012). Immigrants' occupational mismatch or underemployment is defined as the inconsistency between the educational level obtained and the position occupied. This became a special concern due to the high economic costs involved in the underutilization of immigrant

skills (Batalova, Fix & Bachmeier, 2016; Reitz, 2001; 2007; Reitz, Curtis & Elrick, 2014) and the personal costs for the immigrants when they experience persisting downward mobility (Borjas, 2009; Boyd & Tian, 2018; Wald & Fang, 2008; Yuen, 2010). Occupational mismatch is indeed a barrier to economic assimilation, but the costs are beyond economic. Several studies have suggested that occupational mismatch is associated with high volumes of personal stress that negatively affect individual well-being (Dunlavy, Garcy & Rostila, 2016; Painter, 2014) and life satisfaction (George et al, 2012b). In the case of skilled immigrants whose training required prolonged investments and who were expected to join the labour market in their field of training, the assessment of the ability of immigrants to obtain employment commensurate with their skills is key to understanding their economic assimilation.

2.2.3 Skills Transferability

A growing body of literature from multiple immigration countries highlights the difficulty immigrants face in the process of finding employment commensurate with their skill level (Borjas, 1989, 1994, 2000; Chiswick, 1978, 1979; Colic-Peisker, 2011; Gorodzeisky & Semyonov, 2011; Raijman & Semyonov, 1998; Tienda & Mitchell, 2006). The main explanation for the widespread phenomenon of immigrants' underemployment is related to the fact that international human capital is not entirely transferable across different nations. "Less-than-perfect" skills transferability was proposed as one of the most important factors that hinders highly-skilled immigrants integration prospects (Chiswick & Miller, 2009; 2012). The transferability of skills varies for different occupations, where skills that are deeply embedded within local linguistic, cultural and legal contexts are less transferable than skills that have low dependency on the specific local context (Remennick, 2012).

The career prospects of immigrants may differ according to the complex interplay between immigrants' individual traits (Reitz, 2007), employers' perceptions of immigrants (Li, 2002; Reitz, 2001; Shan, 2013a) and certain contextual characteristics of the context of reception (Girard & Bauder, 2007; Portes & Rumabut, 1996, 2014; Shan, 2013a; Reitz, 2007). Individual traits include both identity characteristics, such as gender, ethnicity, and age, and human capital characteristics, such as the level of education, language proficiency, and other skills. Contextual factors include the migration policy regarding the selection and integration of immigrants, the labour market situation and characteristics of the ethnic community (Portes & Rumbaut, 1996).

Certain labour market characteristics may affect immigrants' career potential in a new country (Portes & Rumbaut, 1996). For instance, the challenges of career attainment for immigrants are magnified within saturated labour markets and during recessions. Alternatively, they are positively affected by a booming economy and rapidly developing labour markets (Konnikov & Raijman, 2015; Raijman & Semyonov, 1998; Shan, 2013a; Weinberg, 2001). In an ethnographic study on Chinese engineers in Edmonton and Toronto, Shan (2013) found that the differences in the engineering markets between these two cities interacted with the ways engineers' skills were evaluated by potential employers. Thus, in Toronto's more saturated labour market, engineers reported an overemphasized need for Canadian experience and the so-called "soft skills", whereas in Edmonton emphasis on the requirements for "hard skills" was more prevalent. In a comparative study on Former Soviet Union (FSU) engineers in Israel and Germany, Konnikov and Raijman (2015) found that differences in the labour market situations between these countries (a shortage in Germany versus a surplus in Israel) produced diverse paths of integration for immigrant engineers. Specifically, the rapidly developing Information Technology (IT) market in Israel created a dual labour market trajectory. As a result, engineers

entering the IT field found themselves "in the right place at the right time" and engineers entering traditional engineering fields faced a rigid, saturated and highly competitive labour market that compromised their career potential.

Within the context of a specific occupation and location, several factors may be responsible for the poor transferability of skills across nations and into Canada. First, the educational training and work experience may not contain all the elements needed to be fully transferable to the Canadian context and meet Canadian standards as they are defined by the local regulatory bodies (Friesen, 2012; Reitz, 2005). As well, potential employers may lack effective tools and knowledge to evaluate internationally acquired skills and may rely on stereotypes regarding the immigrant's country of origin (Li, 2000; Reitz, 2001; 2005; 2007; Shan, 2013). In this work, I consider the regulated nature of the engineering labour market in Canada as a key factor that shapes the structure of opportunities for internationally-trained engineers who come to Canada and, based on their human capital and training expect to continue their professional careers.

2.2.4 The Engineering Labour Market in Canada

Engineering is one of the most desirable occupations in Canada as it provides its practitioners with high returns to human capital and high levels of occupational prestige (Engineers Canada, 2014). The engineering labour market is a part of the global economy and attracts many internationally-trained professionals from across the globe (Boyd & Thomas, 2001; Zietsma, 2010). Engineering skills are also considered to be highly transferable across different nations, due to the relative universality of engineering knowledge and the low dependency on local cultural and linguistic contexts (Remennick, 2012). Despite this positive picture, many immigrant engineers face considerable hardship in rebuilding their professional careers in

Canada. The first barrier is related to difficulties in gaining formal recognition of their skills, which is regulated by the provincial professional associations (Bauder, 2003; Friesen, 2012; Girard & Bauder, 2007; Kustec, Thompson & Xue, 2007; Reitz, 2001). The second barrier is related to difficulties in receiving informal recognition of skills from potential employers (Guo, 2009; Reitz, 2001; Schellenberg & Maheux, 2007; Shan, 2013a). The third refers to difficulties in securing employment in the engineering field and obtaining advanced and managerial positions (Boyd & Thomas, 2001; Wong & Wong, 2006).

2.2.4.1 The Process of Re-accreditation

Research suggests that international skills in general, and engineering ones in particular, are undervalued in Canada and are rarely granted full recognition, especially in the case of regulated occupations (Girard & Bauder, 2007; Guo, 2009; Reitz, 2001, 2005, 2007). Several studies indicate that the process of re-accreditation is demanding and difficult to complete (Bauder, 2003; Girard & Bauder, 2007; Guo, 2009; Kustec, Thompson & Xue, 2007; Man, 2004; Reitz, 2001, 2005, 2007). To reach equivalency with Canadian engineering standards needed to practice engineering in Canada, applicants are required to complete the Professional Practice Examination for engineers (Boyd & Thomas, 2001; Friesen, 2012; 2016; Girard & Bauder, 2007). Although the process of licensing is regulated, the assessment of training and experience differs from one case to another, depending on the country of origin, program of study and previous work experience. Following the individual process of re-accreditation, immigrants may be required to undergo multiple exams in addition to the Professional Practice Examination. While multiple scholars define the accreditation process as difficult, confusing and complex (Bauder, 2003; Girard & Bauder, 2007; Guo, 2009), little is known regarding the particular barriers that may hinder the process at different stages. Immigrants coming from countries whose

bureaucratic systems differ from those in Canada may face substantial challenges in acquiring the necessary documentation, which hinders the process of skill recognition from the very beginning (Reitz, 2001; 2007).

There is no centralized system in Canada to assess foreign skills in general and engineering licensing in particular (Andersson & Guo, 2009; Friesen, 2012; 2016; Guo, 2009). The applicant must coordinate between multiple agencies, both in the country of origin and in Canada (Guo, 2009), and each province is responsible for its own regulation process (Friesen, 2012). The scope of requirements is summarized in the following example from the Professional Engineers of Ontario (PEO) association, the province with the highest proportion of immigrants in Canada. To become a licensed professional engineer one must meet the following requirements: "…be at least 18 years old; be of good character; meet PEO's academic requirements for licensure (hold an undergraduate engineering degree from a Canadian Engineering Accreditation board (CEAB) - accredited program, or possess equivalent qualifications); fulfill the engineering work experience requirements (demonstrate at least 48 months of verifiable, acceptable engineering experience, at least 12 months of which must be acquired in a Canadian jurisdiction under a licensed professional engineer); and successfully complete PEO's Professional Practice Examination (PPE)"[2] (PEO, n.y.).

2.2.4.2 Entering the Engineering Field

Part of the licensing process is related to obtaining several years of engineering work experience, of which at least one must be acquired in North America (Boyd & Thomas, 2001; Friesen, 2016; PEO, n.y.) Therefore, immigrant engineers face a second substantial barrier in the accreditation process and their professional integration in Canada, one stemming from the

[2] The information is obtained from the official website of the Association of Professional Engineers in Ontario http://www.peo.on.ca/index.php?ci_id=2061&la_id=1

difficulty in receiving Canadian experience in their field of training. Since potential employers tend to undervalue foreign skills (Guo, 2009; Reitz, 2001; Reitz, 2005; Schellenberg & Maheux, 2007; Shan, 2013), immigrants find themselves in a Catch-22: they are not hired due to their lack of local experience and they cannot obtain local experience since they are not hired (Foster, 2006; Girard and Bauder, 2007; Sakamoto, Chin & Young, 2010; Somerville & Walsworth, 2010). In the case of immigrant engineers, the inability to find and sustain a job in the engineering field for twelve months further hinders the process of accreditation.

Different studies have indicated the barrier of first employment in the field of training as a crucial step towards rebuilding a professional career (Foster, 2006; Grenier & Xue, 2011; Konnikov & Raijman, 2016; Reitz, 2007; Somerville & Walsworth, 2010). In addition to being a mere formality in the process of obtaining an engineering license, the first employment in the field of study provides immigrants with essential knowledge regarding Canadian work culture. First employment provides an opportunity to eliminate the gaps between the international and local work content, communication styles and obtain connections with other professionals in the field (Friesen, 2016). It is a fundamental first step to establishing and advancing a professional career. Once familiar with the Canadian ways of "doing the job", immigrants are more equipped to compete with their Canadian-trained counterparts.

Reitz (2001, 2005, 2007) emphasizes that the barrier to first employment partially results from potential employers' lack of tools to evaluate international human capital. Because they lack adequate knowledge to assess the value of international skills, they tend to overemphasize Canadian education and experience as a guarantee for meeting their employment standards. Reitz (2001) suggests that one solution can be training potential employers in how to evaluate foreign education and experience. One practical way to deal with this uncertainty is through bridging

programs. These represent a variety of educational-occupational training programs that have been developed to provide immigrants with theoretical and practical knowledge of the local labour market, and usually combine the elements of some training with internship at local companies for a "safe" period of time. These programs are designed to help immigrants gain useful knowledge regarding the local labour market and offer opportunities to access it, but they also, allow potential employers a "safe" period to evaluate immigrants' human capital. Many of these bridging programs put a special focus on "soft" skills, by training immigrants to adopt communicational styles expected in Canadian jobs (McCoy & Masuch, 2007). The growing popularity and effective results of these programs in helping immigrants overcome the barriers of first employment are documented in Canada and elsewhere (Guo, 2009; Kogan, 2016; Konnikov & Raijman, 2016; McCoy & Masuch, 2007; Reitz, 2005; Stier & Lebanon; 2003).

Without these programs, potential employers' uncertainty around the value of foreign skills may activate stereotypical assumptions attached to immigrants' country of origin. Stereotyping is a cognitive strategy used to process large quantities of information that exist in any social encounter (Allport, 1954; Fiske & Taylor, 1991; Ridgeway, 1997). Research suggests that stereotypical assumptions are commonly involved in the hiring processes to determine the value and suitability of potential applicants and usually involve highlighting categories of social visibility such as ethnicity, race and gender (Guo, 2009; Reitz, 2001, 2005; Shan, 2013). In the case of immigrants, their possible visibility as ethnic minorities may activate stereotypes attached to their particular country of origin, ethnicity and/or race. The possible negative consequences of ethnic visibility are discussed in the next section.

2.2.5 The Role of Ethnic Visibility

Research shows that the extent to which immigrant engineers' skills are devalued varies by their country of origin, while the patterns of exclusion are especially evident for engineers who were born in Southeast Asia (Boyd, 2000; Boyd & Schellenberg, 2007; Boyd & Thomas, 2001; Wong & Wong, 2006). The ethnic visibility of the country of origin activates social meanings that may be associated with that particular origin. Depending on the nature of these meanings, they can facilitate or hinder employment opportunities. Ethnographic research that has explored the experiences of Chinese engineers in Canada highlights that employers tend to perceive them as having weaker communication skills and lower levels of assertiveness compared to North American-trained engineers (Shan, 2013a). At the same time, employers in the United States tend to perceive Chinese as a "model minority" whose hard-working individuals are preferable for hiring (Tang, 1997b; 2000; Wong & Wong, 2006).

Numerous scholars indicate that the notion of "immigrant" is socially constructed (Guo, 2009; Li, 2002; Ng, 1990; Shan, 2013b). This means that markers of "foreignness", rather than actual immigration status, may determine the way an individual is perceived and evaluated. The markers of being an immigrant usually refer to one's visibility in the eyes of the dominant society, which in Canada primarily consists of individuals of European origin, and includes physical and linguistic characteristics, including skin colour and accent (Li, 2001; Man, 2004). These perceived differences reinforce the idea that an individual does not belong to the dominant group and is therefore foreign. Thus, in the hiring process, the mere perception of the individual as foreign is more important than their actual immigration status (Guo, 2009).

The cumulative disadvantage of immigrants who belong to an ethnic minority group is not unique to Canada. Due to the persisting historic subordination of ethnic minorities in North

America and elsewhere, visible ethnicity and race have been found to be factors that prevent immigrants from integrating into the mainstream societies of predominantly European origin. Evidence from the United States (Borjas & Tienda, 1985; Catanzarite & Trimble, 2008; Tienda and Mitchell, 2006), Europe (Aleksynka & Algan, 2010; Constant & Massey, 2003; Licht & Steiner, 1993; Shields & Price; 1998; Chiswick, 1980; Clark & Lindley, 2009) and Canada (Boyd, 1985; Reitz, 2001; 2007; Shan, 2013; Zong, 2004) largely supports this trend.

Overall, multiple factors may shape the prospects of internationally-trained engineers in Canada's engineering labour market. Difficulties may arise from the process of re-accreditation, as international skills may not be entirely transferable to Canadian standards, and immigrants may have to meet multiple criteria in the process of obtaining a license. Other difficulties may result from stereotyped perceptions on the part of potential employers, in addition to the limited language and communicational skills of the applicants, and institutional discrimination that is related to their ethnic visibility. All these factors contextualize the experiences of immigrant engineers regardless of their gender. However, for women, among internationally-trained engineers, the male-dominance of the engineering field constitutes another barrier to sustaining a professional career. The next section will explore the way professional labour markets in general, and male-dominated fields in particular, are inherently gendered and provide another contextual characteristic of the engineering field to frame the prospects of female immigrant engineers.

2.3 Women Professionals: Theoretical and Empirical Evidence

Despite the changes that have occurred in women's participation in the labour force in general, and in male-dominated occupations in particular, women are still behind men in many aspects of professional career outcomes. One major explanation for that is related to the fact that men and women have historically occupied different types of work (Bielby & Baron, 1986;

Reskin, 1993; Reskin & Bielby, 2005; Reskin & Padavic, 1994; Reskin & Roos, 1990), and traditional professions, such as law, medicine and engineering have been historically dominated by men. In their theoretical overview of gender differences in work settings, Reskin (1993) and later Reskin and Bielby (2005) highlight that occupational sex segregation cannot be reduced to a matter of personal preference and reflects power relations of the larger social setting. Occupational fields that are considered female-dominated are characterized by inferior economic outcomes, such as earnings and occupational prestige (Padavic & Reskin, 2002). Male-dominated fields assume a high level of competence and skills and are associated with greater economic rewards, prestige and opportunities for career advancement. At the same time, female-dominated fields, even the professional ones, such as teaching and social work, are not subject to similar perceptions and rewards. Furthermore, once male-dominated occupations absorb massive numbers of female "newcomers," economic and other rewards decline.

Occupational sex segregation is partly responsible for the gendered wage gap. Women earn less than men since they work in occupations with lower economic rewards. Research focusing on economic and occupational outcomes suggests that women receive lower economic returns to their human capital (Blau & Kahn, 2007; Morgan, 1998; Prokos & Padavic, 2005; Weisman & Teitelbaum, 1987) and are less likely to be promoted to managerial and senior positions (Gill et al, 2008; Servon & Visser, 2011), while men usually dominate the upper levels in the organizational hierarchy (Burt, 1998; Fernandez & Fernandez-Mateo, 2006; Mouw, 2003; Reskin & McBrier, 2000). Reskin and Bielby (2005) state that this pattern is persistent over time and across different nations; although gender stratification has changed over the years, "comparative historical research indicates that no societies accord advantage to women over men" (p.73). Research concerned with the reasons behind this inequality reveals that women are

perceived as less productive and less committed to their professional careers than men because of their family obligations (Becker, 1985; Correll, Benard, & Paik, 2007; Wallace, 2008; Wallace & Young, 2008).

The common perception is that a work-family conflict occurs for most women and prevents them from devoting themselves to their professional careers (Becker, 1985). This perception has economic consequences and has been conceptualized as a "motherhood penalty" (Budig & England, 2001). This penalty can take different forms resulting in lower salaries (Budig & England, 2001), limited career opportunities (Roth, 2004), and negative attitudes towards women's career potential (Correll, Benard, & Paik, 2007). In an experimental study conducted by Correll, Benard, and Paik (2007), women whose curriculum vitae contained markers of motherhood were assigned the lowest scores for their employment potential. Specifically, they were rated as less hirable, less suitable for promotion and management training, and deserving of lower salaries because they were believed to be less competent and less committed than fathers, non-fathers and non-mothers. In another study conducted in the United Kingdom, women engineers reported feeling penalized for the possibility of becoming mothers, regardless of their actual family situation (Hersh, 2000). In male-dominated fields, such as engineering, perceptions of women's incompatibility with the work tasks may be even more pronounced forcing women to constantly negotiate their right for professional existence. The next section will present theoretical observations regarding women's scarcity in certain work settings and the ways in which this scarcity may shape their career experiences and outcomes.

2.3.1 Women in Male-dominated Fields

In 1977, Rosabeth Moss Kanter conceptualized a model that explains gendered inequality at work by considering the relative proportions of different individuals within groups with a

focus on skewed group dynamics. Kanter defined skewed groups as groups with a "large preponderance of one type over another, up to a ratio of perhaps 85:15" (Kanter, 1977: 966). The numerically dominant groups were named "dominants" and the numerically scarce individuals (less than 15 %) as "tokens". The unique characteristic of tokens is that they are identified by a master category and are forced to represent this category in the organizational setting. This combination situates them in a vulnerable position in relation to members of the dominant group.

According to Kanter, the status of tokens defines social interaction following three perceptual tendencies associated with skewed groups: "visibility", "polarization" and "assimilation". The high visibility of tokens generates performance pressures, such as the tendency to outperform since every imperfection becomes highly visible. Polarization implies that the dominant group becomes highly aware of tokens and as a result exaggerate group differences, which in turn results in solidifying in-group versus out-group boundaries. The third process, which is assimilation, refers to a set of stereotypical assumptions held by the dominant group with regard to the personalities and behaviours of the tokens. Finally, the tokens experience "role encapsulation" that is embodied by reacting according to stereotypical scripts held by the dominant group. Combined, visibility, polarization and assimilation create and facilitate exclusionary practices towards tokens in their social encounters with the dominant group.

The performance of women in male-dominated fields is situated within this context of skewed group dynamics. High visibility creates a pressure to outperform in professional tasks. However, if female tokens perform better than their male counterparts they generate a sense of threat, which may result in further exclusion by the dominant group. At the same time, if they are not exceptional in their performance, it re-affirms the dominant group's stereotype regarding

their inferior abilities and skills. Overall, Kanter's model indicates that the tokens' reactions, whether conservative or resistant, will re-affirm the dominant group's beliefs and assumptions rather than challenge them.

A large body of literature has explored the consequences of tokenism suggesting that female tokens suffer from the exclusionary mechanisms described by Kanter with a variety of negative consequences to their careers (e.g., Cohen & Swim, 1995; Floge & Merrill, 1986; Kanter, 1977; Roth, 2004, Wallace & Kay, 2012; Yoder, Adams & Prince, 1983). At the same time, empirical evidence from female-dominated fields did not offer similar support for the male tokens' vulnerability (Cohen & Swim, 1995; Floge & Merrill, 1986; Shreiber, 1979). In most cases, the high visibility provides men with better career opportunities in female-dominated settings, which has been referred to as the "glass escalator" (Williams, 1992; Yoder, 2002).

Although Kanter proposed her theory as gender neutral, focusing on the negative consequences of proportional rareness, later research highlighted that the disadvantage it carries reflects the power distribution in the larger social setting (Yoder, 1991, 1994, 2002, 2005). In other words, proportional rarity interacts with token status, resulting in negative consequences for groups who are considered to be of lower status compared to dominants (e.g., female tokens and men dominants) and in positive consequences for groups considered to be of a higher status compared to dominants (e.g., male tokens and female dominants). Members of lower racial, ethnic, and educational status may also experience the negative consequences of tokenism, while tokens of higher status groups experience positive consequences and may be elevated in the social setting (Yoder, 1991; 1994; 2005).

Some approaches highlight the possible benefits involved in women's token situation. Since male-oriented tasks are scored higher on job prestige and are subject to higher economic

returns, in comparison with the female-oriented tasks (Reskin & Bielby, 2005), female tokens apparently gain access to the benefits of male-dominated fields (Laws, 1975). Laws (1975) indicates that the positive aspects of tokenism are sustained under the following condition: "the flow of outsiders into the dominant group must be restricted numerically, and they must not change the system they enter..." (p.51). Blalock (1967), in his conceptualization of minority-group relations, emphasized that once a minority's numerical proportion increases, the majority is threatened and responds in a harsher way than when the proportion of the minority is small. Indeed, female tokens may at times attain benefits by having access to better economic and prestige outcomes associated with male-dominated fields. Yet, the fact that individuals with similar education and training experience different career outcomes based on their gender, the skew of their gendered representation and negative consequences associated with the latter, creates a serious concern. The situation reveals inequality involved in women's career experiences within male-dominated fields.

Underrepresentation alone seems to be insufficient in explaining women's vulnerability in male-dominated fields. The negative effects of tokenism are not only produced by proportional rarity itself but also by the stereotypes that the dominant group holds towards the token group (Duguid, 2011; Yoder, 2002; Yoder & Sinnett, 1985). It is also evident that proportional rareness and stereotyping are correlated, while gendered stereotyping is reinforced in male-dominated settings as indicated by the tendency of polarization and assimilation (Comer & Drollinger, 1997). Yoder (1991; 2002) suggests that "occupational inappropriateness" is one of the factors responsible for the negative consequences of tokenism. Occupational inappropriateness contains two main aspects - numerical and normative (Yoder, 1991). The numerical aspect includes the relative proportion of each gender. Occupations where men prevail numerically over women are

considered male-dominated. The normative aspect includes the norms that define the appropriateness of certain tasks for men and women. This perception delineates which occupations are gender appropriate for women and which for men (Schachter, 1951). Yoder (1991) states: "hence tokenism effects the result of being a woman, being numerically scarce, and working in an occupation normatively defined as men's work" (p. 188). Engineering in Canada is consistent with this statement. It is one of the most male-dominated fields numerically that was historically constructed as masculine in its work tasks.

2.3.2 Women in Engineering

Women's experiences in engineering are defined by patterns that place in doubt the legitimacy of their presence. Studies that explore women engineers' career patterns report several forms of exclusion that women encounter in their employment settings. First, their ability to express their opinions during professional meetings and informal interactions with their colleagues is limited (Du, 2006; Gill et al, 2008; Hatmaker, 2013). Second, their gendered identity is emphasized over their professional identity as they are expected to perform "feminine" tasks, such as making coffee, taking notes, or buying presents (Dryburgh, 1999; Hatmaker, 2013; Miller, 2004). Third, they experience paternalism from their male colleagues, which takes the form of distinctive attention, special treatment and "protection" (Powell, Bagilhole & Dainty, 2009). Fourth, they face a hostile anti-female environment from supervisors, co-workers and clients (Hatmaker, 2013; Servon & Visser, 2011). Lastly, skeptical attitudes towards their technical abilities are a common experience of women engineers (Miller, 2002, 2004; Powell, Bagilhole & Dainty, 2009). All together, these patterns reveal that women are perceived to be out of the ordinary in the field of engineering, in need of assistance, and their presence requires special accommodation. These experiences may contribute to the "chilly climate" associated with

women working in male-dominated fields such as engineering (Flam, 1991; Logel et al., 2009; Moss-Racusin et al, 2012).

These experiences make survival in the masculine culture of engineering a challenging task for women (Evetts, 1998). As a response, they adopt a variety of tactics to cope with the dominant masculinity (Dryburgh, 1999). Specifically, women in engineering engage in the following practices: (1) to "prove" themselves in response to the perceived doubt in their technical skills (Evetts, 1998; Hatmaker, 2013; Miller, 2002, 2004; Powell, Bagilhole & Dainty, 2009); (2) to undermine their gender (Powell, Bagilhole & Dainty, 2009); and/or (3) to negotiate the paternalistic behaviour of their male co-workers (Gherardi, 1994; Powell, Bagilhole & Dainty, 2009).

With regard to technical abilities, women face constant doubt related to the competency of their skills. They respond with a chain of actions to build their reputation within the team and in front of clients. Being partly or fully excluded from informal interactions, they focus on the professional aspects of work in order to excel in engineering tasks (Servon & Visser, 2011). Once they "prove" themselves, they sometimes receive excited responses by surprised coworkers (Evetts, 1998). These chains of actions and responses verify that initially women's competency is not perceived in the same way as men's, and women need to work not only on their engineering tasks but also to negotiate gendered expectations.

In addition of proving competency, women also engage in various identity strategies as a response to the masculine image of the field (Hatmaker, 2013; Miller, 2004; Powell, Bagilhole & Dainty, 2009). These strategies include turning on an "engineering mind" and developing a set of behavioural and embodied practices of acting like "one of the boys". The latter includes a more unisex appearance, an attempt to hide and suppress their emotions, and to engage in what would

be perceived as masculine behaviour. These accommodations were summarized by women as "thinking/acting like a man" (Chinn, 1999).

Resisting and negotiating paternalism is another practice that engineer women engage in. Gherardi (1994) shows that in situations where women resist male coworkers' gallantry, it results in a negative label and is followed by even more pronounced exclusion from group interactions. Extra attention and help may reinforce the image of female engineers needing more assistance and being less capable than their male counterparts (Powell, Bagilhole & Dainty, 2009). Paternalism may provide an illusion of mentorship. Mentorship is an important resource in any work environment, but can be especially critical for female tokens who often experience a sense of isolation. Genuine mentorship is an important vehicle in sustaining a professional career in general and in engineering in particular (Ingram, 2005; Ingram & Mikawoz, 2006; Wallace & Haines, 2004). Evidence from male-dominated fields suggests that women may have limited access to mentoring relationships, but even if they do, their ability to make use of mentoring is obscured compared to that of their male counterparts (Kay & Wallace, 2009).

The gender of mentors is an important factor to consider. Female mentors in male-dominated fields may serve as role models, as well as sources of gender-specific information with regard to building a professional career as a woman in a male-dominated field (Wallace, 2006). However, women's successful careers in male-dominated fields do not always facilitate the entry and success of other women into the field (Wallace, 2006; Yoder, 2002). Some empirical evidence even suggests that female mentorship benefits male protégés more than female protégés (Maume, 2011). While in senior positions, female mentors are unable to assist other women since their own place within the field is not naturally stable and safe. Given that men are in more powerful positions in a male-dominated field, having a male mentor can be

particularly beneficial as they are able to provide their protégés with accessibility to dominant group resources (Ingram & Mikawoz, 2006). These resources, in turn, can be less applicable to women because of the dual-role expectations that are placed on them that include both family and work demands.

Studies that explore women's experiences in engineering provide a solid illustration of the ways gender shapes career experiences in environments of male dominancy and female scarcity. This literature highlights the stories of women's vulnerability from the perspective of gender relations, which involves doubt in women's competence, gendered expectations, and exclusion from formal and informal interactions. According to the intersectionality approach, women who are racially and ethnically different from the dominant majority are subject to different everyday experiences. In particular, women of racial and ethnic visibility experience a intersectional disadvantage in their employment settings that is derived from the simultaneous vulnerabilities based on gender and race (Crenshaw, 1989). In male-dominated fields where women are already in the vulnerable position of tokens, possessing other characteristics, such as being immigrants or ethnically visible may intensify the disadvantage.

Several studies have employed the intersectionality perspective to examine the experiences of African American female tokens in STEM occupations in the United States (Charleston et al, 2014; McGee & Bentley, 2017; Ong et al, 2011). The results of these studies strongly indicate that the experiences of African American women are different from their White counterparts. For example, African American women earn 25% less than ethnic majority women (NSF, 2013) and face the barriers of racism (Johnson, Brown, Carlone, & Cuevas, 2011) and gender discrimination in their fields (Brown, 1997; Jackson & Charleston, 2012; Johnson et al., 2011; Malcom, 1996; Margolis, Goode, & Bernier, 2011). Empirical evidence reveals a strong

sense of isolation, and participants have struggled to identify whether the roots of this hostility lies in their race or gender or both (Charleston et al, 2014). As women in general, African American women face stereotypical assumptions regarding their competence and behaviour (Aronson, Fried & Good, 2002; Charleston et al, 2014). It is clear that the stereotypical response of the dominant group is magnified by the intersections of race and gender.

Following this empirical evidence, immigrant women may have to navigate multiple expectations held by their potential employers. They must convince potential employers that, as immigrants, their engineering training and communicational skills are of the same quality as that of their Canadian counterparts. They also must convince them that they are as competent as men in performing engineering work. Overall, these women may face several patterns of exclusion simultaneously, dealing with the fact that being a woman and an immigrant create too many undesirable traits held in the eyes of potential employers. Inquiry into this situation requires a special frame of reference. The intersectionality framework is helpful in combining these perspectives to better contextualize the career outcomes of women engineers who are immigrants and who may also belong to a visible minority group.

2.4 The Perspective of This Study

In this study, the examination of immigrant women in engineering is contextualized in two different ways. The first is related to a broader understanding of skilled immigrants' professional integration, with a focus on the process of skills transferability in the regulated labour market of engineering in Canada. The literature from immigration scholarship presented earlier, highlights several major barriers for internationally-trained engineers in Canada. These barriers may include difficulty in the process of credential recognition, language and communicational barriers, stereotypes and the devaluation of international skills. These barriers

have been found to be especially pronounced for immigrants who come from non-European countries and who are visible as ethnic minorities. This is one part of the story of immigrant female engineers that frames their struggles as internationally-trained professionals who seek skills recognition and a continuation of their careers.

The second way is related to the broader understanding of the experiences of women in professional male-dominated fields, with a specific focus on female tokens in engineering who are extremely scarce and who perform work that continues to be perceived as masculine. The negative consequences of tokenism and occupational inappropriateness include performance pressures, gender stereotyping, a devaluation of women's performance, isolation and a lack of support. This is another part of the story of immigrant female engineers that frames their struggles as female tokens in highly masculine and male-dominated fields where even the locally-born and trained women face considerable challenges. The concept of intersectionality helps to combine these points of view together and highlights the multiple barriers that may simultaneously converge to shape the career attainment of women carrying multiple disadvantaged statuses, along with their gender.

The most common approach to studying the incorporation of immigrants into labour markets, especially in the knowledge-based sector, has been comparing immigrant men with non-immigrant men. In the literature concerned with women's professional careers in male-dominated fields, women are compared to men, and tend to be treated as homogeneous groups. The overlooked comparison between immigrant men and immigrant women on the one hand, and immigrant women and non-immigrant women on the other, is the central focus of this study. Following the intersectionality perspective, I put a special focus on the differences that may exist among women considering their immigration status and ethnic visibility. This study places

immigrant women engineers in the middle of the intersection between gender, immigration status and ethnic visibility, locating their unique situations compared to immigrant men, to non-immigrant women, and visible minorities compared to ethnic majorities.

Two main barriers are discussed in the literature on immigrant professionals: the difficulty in skills recognition and discrimination due to ethnic visibility. I operationalize the two barriers that immigrants can face by including the origin of training (i.e., the need for skills recognition) and visible minority status as two different measures that each may lead to a disadvantage in professional settings. The main barrier highlighted in the literature on tokenism is that of being a woman in a gender-inappropriate field and therefore numerically scarce. I operationalize these barriers by including the variable sex in the analysis. Also, the tokenism literature provides a rationale and a framework for focusing on women in engineering as the most male-dominated profession in North America. Following the intersectionality perspective, the main focus of this work is on the interactions between sex, international training and visible minority status. The next section summarizes the set of hypotheses derived from the combined perspectives of immigration, gender and ethnic visibility on engineers' occupational outcomes.

2.5 The Conceptual Model

Following the theoretical insights and empirical evidence summarized in the previous sections, this section presents the hypotheses that will be tested in the current analysis. The conceptual model is presented in Figure 1. The first set of hypotheses is related to the effect of **origin of training** on the likelihood of obtaining any employment, obtaining occupational match versus mismatch and securing an advanced position within the engineering field. The literature suggests that skilled immigrants are not subject to a single barrier of employment but face

numerous barriers to obtaining employment commensurate with their skills and career advancement. The first set of hypotheses are as follows:

> Hypothesis 1a: Immigrant (internationally-trained) engineers will be less likely to obtain any employment compared to their non-immigrant (Canadian-trained) counterparts.
>
> Hypothesis 1b: Immigrant (internationally-trained) engineers will be less likely to occupy positions matching their skill level (professional and managerial) and will be more likely to occupy positions that do not match their skill level (unskilled and semi-professional) in comparison to their non-immigrant (Canadian-trained) counterparts.
>
> Hypothesis 1c: Immigrant (internationally-trained) engineers will be less likely to occupy advanced positions within the engineering field in comparison to their non-immigrant (Canadian-trained) counterparts.

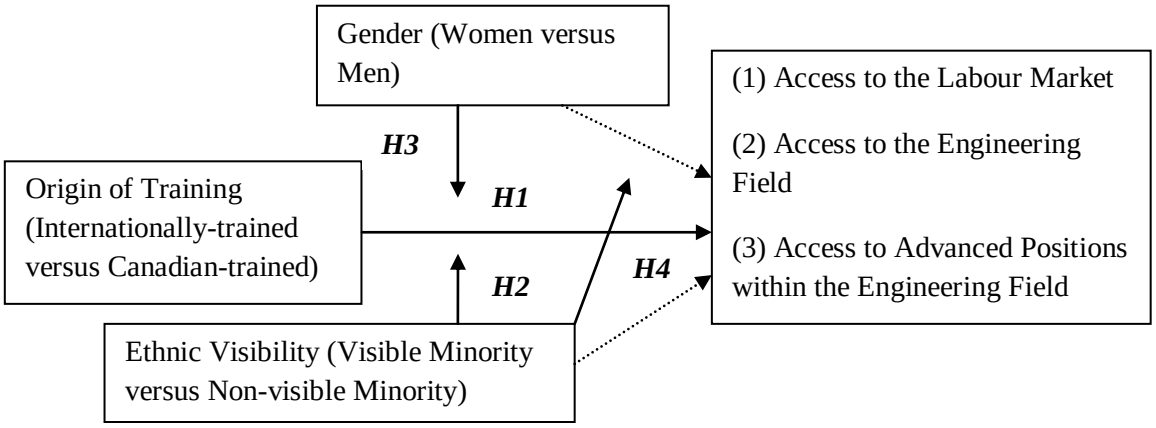
The literature clearly indicates that individuals who are ethnically-visible face greater disadvantages in their economic and occupational integration in general, and further barriers that all immigrants face regardless of their ethnic visibility. Therefore, the second set of hypotheses is related to the moderating effects of **visible minority status** on the relationship between origin of training and the likelihood of obtaining any employment, employment commensurate with the skill level and securing an advanced position within the engineering field:

> Hypothesis 2a: Visible minority immigrant engineers will be less likely to obtain any employment in comparison to immigrants who are not visible minorities.
>
> Hypothesis 2b: Visible minority immigrant engineers will be less likely to occupy positions matching their skill level (professional and managerial positions) and more likely to occupy positions that do not match their skill level (unskilled and semi-professional) in comparison to immigrants who are not visible minorities.
>
> Hypothesis 2c: Visible minority immigrant engineers will be less likely to occupy advanced positions within the engineering field in comparison to immigrants who are not visible minorities.

The last set of hypotheses follows from the literature that suggests women's general vulnerability in male-dominated fields and women's cumulative vulnerability as a result of the intersection of their gender, immigration status and ethnic visibility. Therefore, the third and the fourth hypotheses refer to the moderating effects of **sex** with international training and visible minority status.

> Hypothesis 3a: Female immigrant engineers will be less likely to obtain any employment in comparison to male immigrant engineers and female non-immigrant engineers.
>
> Hypothesis 3b: Female immigrant engineers will be less likely to occupy positions matching their skill level (professional and managerial positions) and more likely to occupy positions that do not match their skill level (unskilled and semi-professional) in comparison to male immigrant engineers and female non-immigrant engineers.
>
> Hypothesis 3c: Female immigrant engineers will be less likely to occupy advanced positions within the engineering field in comparison to male immigrants and female non-immigrant engineers.
>
> Hypothesis 4a: Visible minority female engineers will be less likely to obtain any employment in comparison to female engineers who are not visible minorities.
>
> Hypothesis 4b: Visible minority female engineers will be less likely to occupy positions matching their skill level (professional and managerial positions) and more likely to occupy positions that do not match their skill level (unskilled and semi-professional) in comparison to female engineers who are not visible minorities.
>
> Hypothesis 4c: Visible minority female engineers will be less likely to occupy advanced positions within the engineering field in comparison to female engineers who are not visible minorities.

Figure 1: The Conceptual Model



Chapter 3

RESEARCH METHODOLOGY

This chapter outlines the methodology for this research. The first section provides information regarding the dataset and the sample. The second section discusses the way engineers' occupational integration is operationalized and highlights the challenges involved in this operationalization. The third section describes the measures of the focal and control variables, and the last section describes the analytical approaches, including the statistical analyses used in this study.

3.1 Data Source and Sample

This study was conducted using data from the 2006 Census of Canada (Census of Population and Census of Agriculture) distributed on May 16, 2006. In the 2006 census, two questionnaires were distributed among the population. The short one (Form 2A), containing questions regarding demographic characteristics such as place of birth, immigration status, marital status, and year of arrival, was distributed to 80% of all households. The long questionnaire (Form 2B), with questions regarding education (e.g., level of education, years of schooling, major field of study, etc.) and labour market outcomes, was distributed to 20% of all households in Canada. The total population enumerated by the 2006 census was 31,612,897. In 2013, when I started planning this study, I chose the 2006 census data over the more recent 2011 one due to changes in the way the data was collected in the 2011 census. The long version of the 2006 survey was no longer mandatory in 2011, leading to a lower response rate. Since the variables that are the focus of this study (such as the labour market outcomes and education) are derived from the long questionnaire, I decided to use the 2006 census, as it has a higher response rate.

Individuals with post-secondary training in engineering were selected using the item that measures field of study based on the Classification of Instructional Programs (CIP) (Canada 2000). This item asks: *What was the major field of study of the highest degree, certificate or diploma that this person completed?* In this measure, engineering training is presented by two codes: "14" refers to individuals with post-secondary engineering training with a university degree and higher, and "15" refers to individuals with post-secondary engineering training below a university degree. Using code 14, I located individuals with engineering post-secondary education with a university degree[3] and higher and excluded individuals with post-secondary education below a university degree (code 15). The more detailed information regarding the specific fields of training included in the sample are summarized in Appendix 1.

Since the main focus of this study is to examine occupational attainment (i.e. occupational match versus mismatch), I decided to focus on individuals with a university degree in engineering or higher since their training is expected to lead to professional engineering employment. Individuals with a university degree and higher are trained to occupy professional and managerial positions upon completing all the educational requirements and obtaining a license to practice engineering. For these individuals, working in semi-professional positions may be considered as a slight occupational mismatch since they are overqualified for this job; and working in non-professional unskilled positions is considered the ultimate mismatch. I restricted the sample to the age range of 25 to 64, which represents a core working population. Overall, the sample includes 110,505 individuals with post-secondary engineering training.

[3] The individuals with the University diploma or degree below the Bachelor's are included in the sample.

3.2 Measures

3.2.1 Dependent Variables

Three outcome variables were constructed to measure key aspects in immigrants' occupational integration in the field of engineering. The outcome variables are labeled (1) employment status, (2) occupational category, and (3) occupational location within engineering. The outcomes reflect the opportunities for immigrant engineers to (1) enter the labour market in general, (2) to enter the engineering field in particular, and (3) to establish their occupational location within the engineering field.

3.2.1.1 Employment Status

Employment status was created using the item that refers to the respondents' labour market activities in the week prior to the census day. The original variable includes individuals 15 years of age and older, and consists of ten categories: (1) employed – absent in reference week - armed forces; (2) employed – absent in reference week – civilian; (3) employed – unpaid family worker[4]; (4) employed – paid – armed forces; (5) employed – paid – civilian; (6) not in labour force – excluding institutional residents; (7) not in labour force – institutional residents; (8) unemployed – looked for work – experienced; (9) unemployed – looked for work – inexperienced; and (10) unemployed of temporary layoff. More detailed information regarding the measure of labour force participation is presented in Appendix 2.

I recoded the categories that refer to activities of being *employed* (1-5), being *out of the labour force* (6-7) and being *unemployed* (8-10), and created a new measure of **employment status**. The status "unemployed" refers to the individuals who are currently not employed but are

[4] This category refers to persons who worked without pay in a family business, farm or professional practice owned or operated by a related household member. Work without pay in a family business does not include unpaid housework, unpaid childcare, unpaid care for seniors and volunteer work (Census 2006 Codebook).

actively seeking employment. The status "out of the labour force" refers to the individuals who are currently not employed and are not seeking a job. The status "employed" refers to the individuals who are currently working and serves as a reference category. According to Boyd and Thomas (2001), the categories of "employed", "unemployed" and "out of the labour force" efficiently capture the recent labour market activities of individuals.

3.2.1.2 Occupational Category

While measuring employment status is relatively straightforward, the operationalization of occupational match and mismatch using an occupational category requires a more nuanced approach. As indicated above, most empirical evidence relies on four occupational categories, such as engineering managerial occupations, engineering professional occupations, engineering technical occupations and "all other occupations" (reference category) to capture the main occupational outcomes for individuals with engineering training (Boyd & Thomas, 2001; Fernandez, 1998; Lim et al. 1998; Tang, 1997). However, this approach leaves the category of "all other occupations" quite heterogeneous. In the study of immigrant engineers conducted by Boyd and Thomas (2001), the category of "all other occupations" included a variety of highly-skilled occupations such as architects and urban planners, along with a variety of unskilled occupations, such as food providers and retail sellers. Although the skilled occupations found in this category are not purely engineering ones (Boyd & Thomas, 2001), they represent knowledge-based occupations that require a university degree and skills. These occupations are also associated with a high level of occupational prestige and status compared to non-professional occupations.

The diverse category of "all other occupations" poses conceptual and methodological concerns. At the conceptual level, the main question is whether all the positions included in the

reference category indeed indicate an ultimate mismatch for individuals with engineering training. For example, working in a food service industry is a conceptually different labour market experience in comparison with employment in a knowledge-based sector. From one point of view, both situations refer to non-engineering jobs that can be considered an occupational mismatch since these positions are not commensurate with engineering skills. However, these employment outcomes differ in terms of their occupational prestige and economic rewards, creating qualitatively different work experiences outside the field of engineering.

Methodologically, the reference category needs to be homogeneously meaningful to provide a valid baseline for comparison. The heterogeneous nature of the category that contains all other non-engineering occupations does not meet this standard due to the conceptual considerations discussed above. One way to deal with this concern is to allow "engineering professional occupations" to be the reference category. In this case, the ultimate occupational match of working as a professional engineer provides a valid baseline for comparison, while all other categories are being assessed in reference to engineering professional employment. This approach provides a methodological solution but does not eliminate the main conceptual concerns regarding the diverse experiences that the category of "all other occupations" contains. I argue that part of this diversity can be accounted for and controlled methodologically.

To address these concerns in my work, I constructed a measure that differentiates between managerial engineering and managerial non-engineering occupations; professional engineering and professional non-engineering occupations; semi-professional engineering and semi-professional non-engineering occupations; and all other occupations that are mostly unskilled. This approach offers a more detailed operationalization of the possible career outcomes for individuals with engineering training compared to the four categories presented

above. The main logic behind this differentiation is that working in a skilled non-engineering job and an unskilled non-engineering job represent different types and degrees of occupational mismatch that should not be combined. Similar concerns were raised in a recent study of STEM professionals in Canada conducted by Boyd and Tian (2018). The authors found a partial solution by differentiating between non-STEM occupations that do and do not require a college degree. This approach helps to control for different occupational levels in measuring occupational mismatch.

Following these considerations, I created the measure of **occupational category** derived from the question: *What is this person's work or occupation?* The original variable in the 2006 Census refers to occupation minor groups according to the National Occupational Classification for Statistics 2006 (NOC-S 2006). The measure of minor groups consists of 140 occupational groups derived from 520 occupational unit groups. Following the classification of NOC minor groups I created seven occupational categories that include: (1) *senior and/or managerial engineering occupations*; (2) *other (non-engineering) managerial occupations*; (3) *engineering professional occupations*; (4) *other (non-engineering) professional occupations*; (5) *engineering semi-professional (technical) occupations*; (6) *other (non-engineering) semi-professional (technical) occupations*; and (7) *non-engineering (unskilled) occupations* (reference category). The more detailed explanation regarding the classification of occupational groups is presented in Appendix 3.

Since post-secondary education in engineering normally leads to a professional career, obtaining a *senior and/or engineering managerial* or *engineering professional occupation* (coded 1 and 3, respectively) is considered the best occupational match. Working in an *engineering semi-professional technical occupation* (coded 5) indicates a slight mismatch as it represents an

entry-level position in engineering. Lastly, working in a *non-engineering (unskilled) occupation* (coded 7) constitutes the ultimate mismatch. *Other managerial, professional and semi-professional (technical) non-engineering occupations* (coded 2, 4 and 6) are coded separately to allow for the empirical homogeneity of the reference category representing non-engineering occupations that are also unskilled. Occupations coded as 2, 4, and 6 serve as control categories and are not being analyzed in this dissertation. The more detailed explanation regarding the way occupational match and mismatch were classified is presented in Appendix 4.

3.2.1.3 Occupational Location Within Engineering

The final outcome examined in this study is related to the distribution of engineers across occupational locations within the field of engineering. I focus on individuals who work in some kind of engineering jobs following the categorization offered in the measure **occupational category**. Based on the latter, I created a measure of **occupational location within engineering** to include the following categories: (1) *senior and/or managerial engineering occupations*; (2) *engineering professional occupations* (the reference category); and (3) *engineering semi-professional (technical) occupations*. The use of managerial, professional and technical positions to capture basic career outcomes of engineers is common in the empirical research (Boyd & Thomas, 2001; Fernandez, 1998; Lim et al. 1998; Tang, 1997a,b; Servon & Visser, 2011). These categories reflect the basic hierarchy of a traditional engineering career ladder, ranging from technical positions that represent the lowest rank to senior, managerial positions that represent the highest rank (Badawy, 1988, 1995; Jagacinski, 1987; Lannes, 2001; Layton, 1986; Mignonac & Herrbach, 2003; Servon & Visser, 2011; Tremblay, Wils, & Proulx, 2002; Youst, 1990).

It is important to recognize, however, that engineering career paths are diverse and can hardly be reduced to three simple categories. This basic categorization is limited in capturing the

complexity and variety of all possible career trajectories in engineering. The literature suggests that engineers may follow multiple career paths, including, but not limited to, the managerial ladder examined in this study (Igbaria et al, 1999). The location of engineers on particular career paths is related to multiple factors, including personal preferences conceptualized in the literature as "career anchors"[5] (Schein, 1985; 1996) in combination with the structure of opportunities within the organization and general economic situation in the field (Lannes, 2001; Giles, Ski and Vrdoljak, 2009; Martínez-León et al, 2018; Mignonac & Herrbach, 2003). Schein (1996) defines the "career anchors" as "a self-concept consisting of 1) self-perceived talents and abilities, 2) basic values, and, most important, 3) the evolved sense of motives and needs as they pertain to the career" (page 2). Individuals with different career anchors may have different preferences for entering the managerial career ladder (Hsu et al, 2003; Kim & Cha, 2000; Tremblay, Wils, & Proulx, 2002).

For example, scientist engineers with advanced graduate degrees may prefer the technical career ladder, with increased autonomy and opportunities to engage in research activity, over the managerial career ladder that is loaded with supervisory responsibilities (Allen & Katz, 1992; Kim & Cha, 2000). Canadian scholars Tremblay, Wils, & Proulx (2002) summarize that "perhaps engineers who choose management place more emphasis on managerial rewards, which are often expressed in terms of salary increase, fringe benefits, perks and decision making, and that engineers who opt for the technical path tend to value and seek other types of recognition (e.g. recognition of technical expertise)" (page 17). Also, considerable diversity may exist within the aggregated managerial and professional categories as technological markets are becoming fluid and complex. First, the shift to a more project-based approach has flattened the

[5] Measures of individual career preferences are not included in the 2006 Census data, and are therefore beyond the scope of this study.

organizational structure in engineering firms, creating fewer managerial positions for engineers and technical workers (Martínez-León et al, 2018). Second, some managerial titles may have become inflated and do not necessarily represent a more senior career step above the professional ranks (Tang, 1997). As a result, the hierarchical differentiation between managerial and professional positions is unclear, forcing cautious conceptual and methodological[6] interpretations in evaluating the desirability and prestige of these two career outcomes.

Despite the limitations of this measure of occupational location, it provides the opportunity to examine the distribution of engineers across engineering locations that approximate a hierarchical career ladder. Since the career preferences of participants are unknown, it is argued that if the distribution across these engineering locations is unequal based on international training, sex and ethnic visibility, it may offer evidence of an unequal structure of opportunities for career advancement for these groups. This inquiry is especially relevant since women and minorities have been consistently found disproportionally underrepresented in advanced and managerial positions in science and technology fields (Boyd & Thomas, 2001; Etzkowitz, et al., 2000; Fountain, 2000; Servon & Visser, 2011; Tang, 1997a,b).

3.2.2 Focal Independent Variables

In this study, three focal predictors are examined as primary factors related to the structure of opportunities of being employed, of finding employment commensurate with skill level and of advancing employment within the engineering field. These predictors are: (1) sex; (2) origin of engineering training; and (3) visible minority status.

Sex is a dummy variable with women coded 1 and men coded 0.

[6] Methodologically, the unknown ranking between the categories is not a concern when using multinomial logistic regression. This type of regression analysis yields an estimation of the likelihood of being found in one particular category as opposed to another category, with no assumption of a hierarchy between the categories.

Origin of engineering training is derived from the question: *In what province, territory or country did this person complete his/her highest degree, certificate or diploma?* Based on this question, I created a categorical variable that differentiates between the following locations of training: (1) Canada (reference category); (2) the United States; and (3) International. Two dummy variables were obtained from the created variable: "International training" and "United States training". Due to the United States' linguistic, educational and cultural proximity to Canada, it is not combined with the category of "International training"; and it is not combined with Canadian training since these individuals did not obtain their education in Canada. The comparison of interest is *International training* (coded 1) versus *Canadian training* (coded 0), and *United States training* is added to the model as a control variable.

Visible minority status was created based on the question regarding individuals' self-reported "visible minority" status. The original variable consists of 15 categories including Chinese, South Asian, Black, Filipino, Latin American, Southeast Asian, Arab, West Asian, Korean, Japanese, Other, Multiple visible minority, Not a visible minority, Not applicable (Institutional resident) and Aboriginal[7]. Based on this measure, I created a dichotomous dummy variable to differentiate between individuals who self-identify with any *visible minority group* (coded 1) and *individuals who do not* (coded 0).

3.2.3 Control Variables

To test the net effects of the focal independent variables, I control for human capital and demographic characteristics that previous research has found relevant in predicting immigrants' and women's career attainment in male-dominated fields. These variables are related to human

[7] Self-reported aboriginals were excluded from the analysis because they represent a distinct minority group in Canada. The unique characteristics of this and the way these may shape occupational integration into engineering require a distinct focus and are beyond the scope of group this project.

capital, such as level of education and linguistic proficiency (i.e., English/French being a mother tongue versus not) and demographic characteristics, such as age, age at migration, status and time spent in Canada, and number of children. The measures for the control variables are described in greater detail below.

The variable **level of education** is created based on the measure of the highest degree obtained: *Has this person completed a university degree, certificate or diploma?* and *Has this person completed a college, CEGEP, or other non-university certificate or diploma?*, which consists of 14 categories. The categories are: (1) none; (2) high school graduation certificate or equivalency certificate; (3) other trades certificate or diploma; (4) registered apprenticeship certificate; (5) college, CEGEP or other non-university certificate or diploma from a program of 3 months to less than 1 year; (6) college, CEGEP or other non-university certificate or diploma from a program of 1 year to 2 years; (7) college, CEGEP or other non-university certificate or diploma from a program of more than 2 years; (8) university certificate or diploma below Bachelor's degree; (9) Bachelor's degree; (10) university certificate or diploma above Bachelor's degree; (11) degree in medicine, dentistry, veterinary medicine or optometry; (12) master's degree; (13) earned doctorate degree; and (14) not applicable (institutional residents). I created a set of dummy variables that include the following categories: (1) *Bachelor's degree*, (2) *Master's degree*, (3) *Doctoral degree* and (4) *below a Bachelor's degree* (reference category). While the importance of human capital in general and education in particular, has been discussed in detail in the conceptual framework; the importance of other control variables requires further clarification.

The ability to successfully transfer educational capital to the labour market realm is strongly correlated with language proficiency (Espenshade & Fu, 1997; Espinosa & Massey,

1997; Chiswick, 1998, 2007; Chiswick & Miller 1998; Raijman, 2013; Reitz, 2007; Remennick, 2012; Van Tubergen & Kalmijn, 2009; Van Tubergen & Wierenga, 2011). Since the census does not include measures of official language proficiency, to account for some language related variability, I am using a measure that refers to the respondents' mother tongue. Without the ability to assess official language proficiency, this measure allows me to differentiate between individuals whose mother tongue is English or French (official languages in Canada) and whose mother tongue in neither English nor French. I assume having one of the official languages (English or French) as a mother tongue provides engineers with an advantage in entering the Canadian labour market in comparison to individuals for whom these are second languages. This variable is not ideal to control for language proficiency, since individuals whose first language is neither English nor French may still have a good command of either official language. The dummy variable **language proficiency** employed in the analysis is dichotomous with *the official language (English, French or both) is a mother tongue* coded 1 versus *a non-official language is a mother tongue* is coded 0.

For immigrants, **age at migration** is an important factor to consider since it is correlated with the ability to acquire a new language and skills. Individuals who arrive at a young age and attend local educational institutions are more likely to have similar labour market experiences with native-born and locally-trained counterparts. Newcomers who arrive at an older age, having acquired most of their education and job experience abroad, may face more challenges due to the differences, real or perceived, from their locally-trained and raised counterparts (Haberfeld, Semyonov & Cohen, 2000; Myers, Gao & Emeka, 2009; Pichler, 2011; Raijman & Semyonov, 1995; Rumbaut, 2004). In this analysis, **age at migration** is a continuous variable and was derived from the question *In what year did this person first become a landed immigrant?* Using

this measure, I calculated the age at migration by subtracting it from the census year. The non-immigrant respondents were coded "0" in order to include them in the analysis; the individuals who were not permanent residents at the time of the census were assigned their current age for the age at migration to be included in the analysis.

Time spent in Canada enhances immigrants' integration through socialization into the host society. Following assimilation assumptions, over time, immigrants familiarize themselves with the local language and norms, acquire social and economic resources and, therefore, are perceived to have become more similar to the native born population (Bloom & Gunderson, 1991; Borjas, 1994; Chiswick, 1978, 1979; Gorodzeisky & Semyonov, 2011; Jasso, 2009; Kogan, 2003; LaLonde & Topel, 1990; Logan & Rivera Drew, 2011; Raijman & Semyonov, 1995, 1997; Reitz, 2007; Semyonov, 1997). However, some empirical evidence shows that the role of tenure in the country may have different consequences. For skilled immigrants, the initial years in the country are crucial for the process of rebuilding their professional career (Grenier & Xue, 2011; Stier & Lebanon, 2003). Immigrants who struggle to gain access to their professional field in the first years upon arrival often find it extremely difficult to catch up due to the large investments needed to re-initiate a professional career. These investments include language acquisition, development of social networks and formal assessments of foreign credentials. Once the need to provide for the family becomes urgent and leads an immigrant to turn to underemployment, the ability to allocate time and finances to the process of skills recognition diminishes.

The original variables in census 2006 referred to the "*the year landed immigrant status was first obtained in Canada; includes immigrants who landed in Canada prior to Census Day, May 16, 2006*". Based on this measure I created a categorical variable of **immigration status**

and time spent in Canada that differentiates between the following categories: (1) *non-permanent residents*; (2) *immigrants of less than 5 years in Canada*; (3) *immigrants of 6-15 years in Canada*; (4) *immigrants of 15 and more years in Canada*; and (5) *non-immigrants*. Following this categorization, I created 4 dummy variables with non-immigrants as the reference category. This allows me to control simultaneously for individuals' immigration status and time spent in Canada.

Regardless of immigration status, age is an important factor to consider while studying careers and labour market integration (Goldberg et al, 2004). For immigrants who need to start over in a new country, age is a crucial factor since it may take time to gain skills recognition and rebuild their professional career. In this analysis, **age** is a continuous variable that is derived from the question *Date of Birth* which was subtracted from the year of the census.

Since gender is one of the focal independent variables in this analysis, the presence and number of children are important variables to consider in predicting women's employment in general and in professional careers in particular. In addition to the common perception that women hold the major responsibility for childrearing, women are also found to suffer a career penalty because of their motherhood (Budig & England, 2001; Correll, Benard, & Paik, 2007; Hersh, 2000; Roth, 2004). **Number of children** is a continuous variable that ranges from 0 to 5, with "*no children*" (coded 0) and "*5 or more children*" (coded 5).

3.3 Analytical Approach

The analysis consists of two parts. The first step in the analysis includes calculating the descriptive statistics of the outcome variables. Descriptive cross tabulations provide a snapshot of the distribution of individuals with engineering training across different categories in two of the three outcomes (employment status and occupational category) by sex, origin of training and

visible minority status. The outcome of occupational location is not presented in the descriptive statistics since it is a reduced version of the occupational category. The designed-based F tests[8] indicate whether there are statistically significant relationships between the occupational outcomes and the focal independent variables (Table 4).

The next step is the multivariate analysis. Multinomial logistic regression models are employed to predict the likelihood of getting access to the labour market in general; getting access to matched employment in the engineering field; and advancing occupational location within the engineering field[9]. That is, I model the outcomes of employment status, occupational category and occupational location within engineering using the independent variables of sex, origin of training and visible minority status, controlling for human capital and demographic characteristics (Tables 5 to 10). Multinomial logistic regression is used to model polytomous categorical outcome variables that have more than two categories (Hoffman, 2004). The coefficients indicate the independent effects of the predictor variables on the relative probability of being in each occupational category as opposed to the reference category, such as the probability of working in engineering, managerial, professional, or technical positions versus working in non-professional unskilled positions.

In this study, the exponentiated version of the coefficients is presented – Relative Risk Ratios (RRR), which indicate the change in the odds of being found in a particular category of the outcome variable versus the reference category created by the particular independent variable. The example would be the effect of being a woman versus a man on the odds of being

[8] Pearson's chi squared statistic is corrected for the survey design with the second-order correction of Rao & Scott (1984) and is automatically converted into a designed-based F statistic. For more information contact STATA Manual for survey data analysis (page 5): https://www.stata.com/manuals13/svysvytabulatetwoway.pdf

[9] The same correction of Rao & Scott (1984) is applied in estimations of the model fit for the multinomial logistic regressions. The design-based F statistic is reported for the goodness-of-fit (Archer & Lemeshow, 2006)

unemployed versus employed. The coefficients that are lower than 1 represent a negative effect, and the coefficients that are higher than 1 represent a positive effect. To make the interpretation of the effects of each predictor on the odds ratios more explicit, I converted the odds to percentages in the following way: if 1 indicates the baseline or 0 change, the RRR of 1.265 indicates a 26.5% increase (1.265-1=26.5); the RRR of 0.810 indicates a 19% decrease (0.810-1=-0.19); and the RRR of 2.562 indicates a 156.2% increase (2.562-1=1.562).

To test the intersectionality hypothesis, three two-way cross-products were created between: international training and visible minority status; international training and sex; and sex and visible minority status[10] (Tables 5 to 10). These interaction terms allow me to test the cumulative effects of the intersections between the categories, over and above the main independent effects of each. Specifically, they test whether visible immigrants, immigrant women and visible minority women accumulate multiple disadvantages in finding employment in general, within the engineering field in particular, and securing advanced positions once they gain access to the engineering field. The three-way interaction product that included sex, origin of training and visible minority status was tested and was found non-significant.

The results presented in this study are weighted using the probability weights, and rounded in accordance with Statistics Canada vetting rules. Probability weights help to account for the census's sampling strategy and refer to the number of subjects in the population that each observation represents when computing estimates such as proportions, means, and regression parameters. Using the probability weights prevents the standard errors from being inaccurately small and statistic parameters from being inflated, thus making it more difficult to reject the null hypothesis.

[10] Also, the same interactions were produced with US training. These interactions are not of empirical interest to this study and therefore serve as control variables.

Chapter 4

RESULTS

This chapter summarizes the descriptive and multivariate results in predicting occupational outcomes through the prism of international training, sex and ethnic visibility. The chapter is organized around the following sections. The first section provides a descriptive portrait of engineers while considering their origin of training, sex and ethnic visibility. The second section provides a descriptive overview of engineers' career outcomes, including their employment status and occupational category for those employed. This section helps to map the trend of labour market integration and the types of jobs engineers occupy based on their origin of training, sex and visible minority status. The third section provides the descriptive employment and occupational profiles of engineers, using the intersection of their sex, origin of training, and ethnic visibility. This analysis allows me to trace the ways occupational integration differs for different groups as a result of the intersection of statuses. The final sections present the results of the multivariate analysis that allows me to test the main and moderating effects of origin of training, sex and visible minority status on the labour market and occupational outcomes, controlling for human capital and demographic characteristics. The multivariate results are organized around the three outcomes, which represent major career opportunities for engineers' occupational integration: (1) access to the labour market (employment status), (2) access to the engineering field (occupational category), and (3) access to advanced positions within the engineering field (occupational location within engineering). The key patterns of results for the control variables are also presented in this chapter.

4.1 Individuals With Engineering Training - A Descriptive Portrait

Table 1 summarizes the descriptive statistics of individuals with engineering training based on their origin of training, sex and visible minority status. Among all individuals with engineering training, 43% are internationally-trained, 54% are trained in Canada and 3% are trained in the United States. Nearly 42% of engineers self-identified with a visible minority group and only 16% percent of engineers are women.

Table 1: Engineers by Sex, Origin of Training and Visible Minority Status

Sex	Women	Men	Total (N=110,505)
Origin of Training			
Internationally-trained	57%	40%	43%
Canadian-trained	41%	57%	54%
US-trained	2%	3%	3%
Visible Minority Status			
Visible Minority	47.5%	40.8%	41.9%
Not a Visible Minority	52.5%	59.2%	58.1%
Total	16%	84%	100%

Comparing women and men reveals a substantial diversity by their origin of training and visible minority status. Table 1 shows that this diversity is especially prevalent among women, with 57% being internationally-trained, 41% trained in Canada and around 2% trained in the United States. This distribution indicates that more than half of female engineers in Canada are immigrants. In addition to the different origin of training, female engineers vary based on their visible minority status, with the split between visible minority and non-visible minority being almost half and half. Visible minority status adds another level of variation within the categories of origin of training (Table 2), showing that immigrant and non-immigrant groups vary based on their ethnic visibility. For example, among the Canadian-trained female engineers, nearly 30% self-identified with at least one visible minority category, and around 60% of ethnically-visible women are found within the internationally-trained group.

Table 2: Male and Female Engineers by Origin of Training and Visible Minority Status

Women	Canadian-trained	Internationally-trained	US-trained	Total (N=110,505)
Not a Visible Minority	70%	40%	51%	52.5%
Visible Minority	30%	60%	49%	47.5%
Total	41%	57%	2%	100%
Men				
Not a Visible Minority	77%	35%	50%	59.2%
Visible Minority	23%	65%	50%	40.8%
Total	57%	40%	3%	100%

These descriptive characteristics of engineers in Canada reveal a highly diverse group that varies by their origin of training, ethnic visibility and sex in complex ways that require an intersectional approach. The next table highlights that the gendered representation in engineering is even more complex when the origin of training and visible minority status are considered. While the overall pattern supports a highly skewed gendered representation, women's highest representation in engineering is found within the internationally-trained group (21.3%), and especially among the internationally-trained who do not self-identify with a visible minority group (23.9%). The lowest relative representation, correspondingly, is found among the Canadian-trained engineers (12.1%) and specifically among the representatives of non-visible minorities among them (11.1%). These results highlight that the origin of training and ethnic visibility shape women's representation in engineering in Canada. The next section explores the ways in which this heterogeneity may produce differences in engineers' labour market and occupational integration profiles.

Table 3: Proportions of Male and Female Engineers by the Combination of the Origin of Training and Visible Minority Status

	Women (N=17,655)	Men (N=92,850)	Total (N=110,505)
Overall	16.0%	84.0%	110,505
Internationally-trained	21.3%	78.7%	47,205
Canadian-trained	12.1%	87.9%	59,890
Visible Minority	18.1%	81.9%	46,305
Not a Visible Minority	14.4%	85.6%	64,195
Internationally-trained Visible Minority	19.9%	80.1%	30,260
Internationally-trained not a Visible Minority	23.9%	76.1%	16,940
Canadian-trained Visible Minority	15.4%	84.6%	14,350
Canadian-trained not a Visible Minority	11.1%	88.9%	45,545

4.2 Engineers' Employment Situation and Occupational Integration: A Descriptive Overview

Table 4 summarizes the distribution of individuals with engineering training across the categories of employment status and occupational category overall and by sex, origin of training and visible minority status. Overall, 83.6% of individuals with engineering training are employed, 5.8% are unemployed and 10.6% are out of the labour force. Among the individuals who are currently employed, 37.5% are working in professional engineering positions, around 6.3% are working in senior and managerial engineering positions, 8.4% are in semi-professional (technical) positions and 16.7% occupy the unskilled non-professional positions that represent the ultimate occupational mismatch. There are also 9.9% of individuals occupying a non-engineering managerial position, 7.4% occupying a non-engineering professional position and 8% occupying a non-engineering semi-professional position. The non-engineering occupational outcomes are not part of the current analysis and are therefore omitted from the discussion.

Table 4: Percentages of Engineers Across the Categories of Employment Situation and Occupational Category, by Sex, Origin of Training and Visible Minority Status

Employment Status (N=110,505)	Overall	Women	Men	Internationally-trained	Canadian-trained	Visible Minority	Not a Visible Minority
Employed	83.6%	74.6%	85.3%	79.2%	87.2%	79.9%	86.3%
Unemployed	5.8%	8.5%	5.3%	8.5%	3.7%	8.4%	4%
Out of the Labour Force	10.6%	16.9%	9.4%	12.4%	9.1%	11.7%	9.7%
Design-based F-test		F = 180.2261***		F = 531.3965***		F = 589.1204***	
Occupational Category (N=92,395)	Overall	Women	Men	Internationally-trained	Canadian-trained	Visible Minority	Not a Visible Minority
Engineering Managerial Occupations	6.3%	3%	6.8%	3.8%	7.8%	3.5%	8.1%
Other Managerial Occupations	9.9%	7%	10.4%	8.7%	10.7%	8.0%	11.2%
Engineering Professional Occupations	37.5%	34%	38.1%	26.7%	45.2%	31.2%	41.7%
Other Professional Occupations	7.4%	12%	6.7%	6.1%	8.1%	7.4%	7.5%
Engineering Semi-Professional Occupations	8.4%	8%	8.4%	10.2%	7.1%	9.9%	7.4%
Other Semi-Professional Occupations	13.8%	12%	14.1%	16.5%	10%	14.6%	13.3%
All Other (Unskilled) Occupations	16.7%	24%	15.5%	28%	8.8%	25.4%	10.9%
Design-based F-test		304.9349***		611.8618***		688.6862***	

The results highlight substantial disparities in engineers' employment and occupational outcomes by sex, origin of training and visible minority status. Women are less represented than men in the category of being employed (74.6% versus 85.3%) and are overrepresented in the categories of being unemployed (8.5% versus 5.3%) and being out of the labour force (16.9% versus 9.4%). For the employed, the distribution across the occupational categories shows

another pattern of women's disadvantage. Specifically, they are underrepresented in the managerial category (3% versus 6.8%) and are overrepresented in the unskilled category (24% versus 15.5%), while their representation in the professional and semi-professional categories are almost the same. A similar trend of disadvantage is found for internationally-trained and visible minority engineers. While the labour market integration patterns mirror that of women, the occupational integration patterns show several nuances. Internationally-trained engineers are underrepresented in managerial (3.8% versus 7.8%) and professional occupations, with a significantly large disparity in the latter (26.7% versus 45.2%). In contrast, they are overrepresented in semi-professional (10.2% versus 7.1%) and unskilled (28% versus 8.8%) occupations. The same pattern is evident for visible minorities.

Overall, the descriptive results highlight the relative disadvantages that being a woman, a representative of a visible minority and an internationally-trained produces in engineering careers. However, the binary presentation of the categories is unable to reveal the ways in which the career outcomes may be shaped differently for different intersections of the categories, such as for the internationally-trained and visible minority women, or Canadian-trained and non-visible minority men. The next section explores the variations for men and women by their origin of training and ethnic visibility by looking at the descriptive profiles created for different intersections of the categories.

4.3 Engineers' Employment Situation and Occupational Integration: Intersectional Descriptive Profiles

Figures 2 and 3 provide descriptive analyses of employment status and occupational category by sex and its intersection with origin of training and visible minority status. The hierarchical structure of these descriptive employment profiles allows to explore the variation

between and within the groups, with each step adding another status to the analysis, such as sex, sex and international training, and then, sex, international training and visible minority (VM) status.

Figure 2: Descriptive Employment Profiles for Male and Female Engineers by the Origin of Training and Visible Minority Status

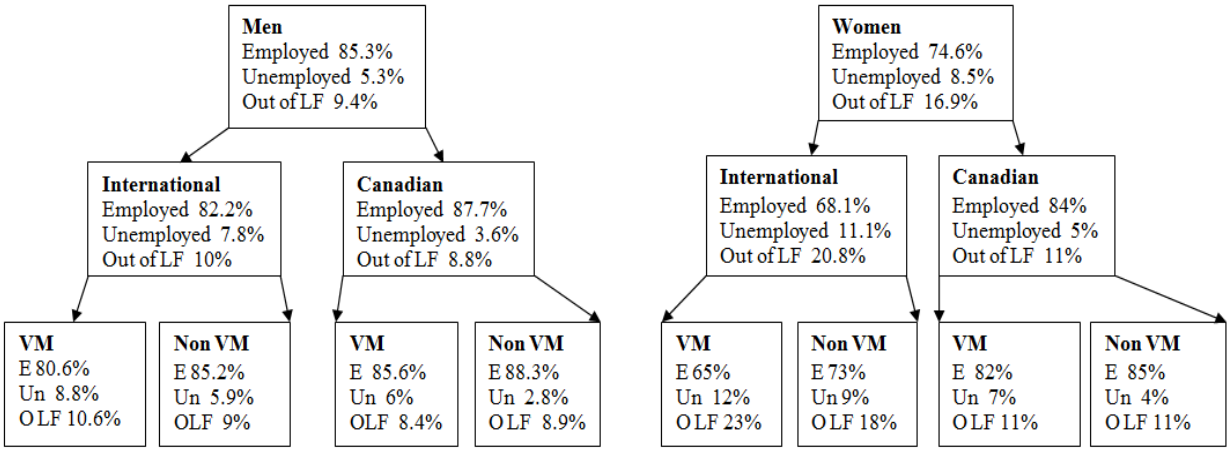


Figure 2 highlights the heterogeneous employment outcomes for men and women, once the origin of training is considered, and shows further heterogeneity for both men and women, internationally- and Canadian-trained, once ethnic visibility is taken into consideration. While previous descriptive results (Table 4) suggest immigrants' underrepresentation in the category of being employed, this analysis shows that the disparity is especially pronounced for women (68.1% versus 84%), and to a lesser extent for men (82.2% versus 87.7%). Also, internationally-trained women are twice as likely to stay out of the labour force in comparison to the Canadian-trained women (20.8% versus 11%), while the difference for men is quite modest (10% versus 8.8%). Both men and women who are internationally-trained are twice as likely to be unemployed in comparison to their Canadian-trained counterparts, but the proportions are higher for women.

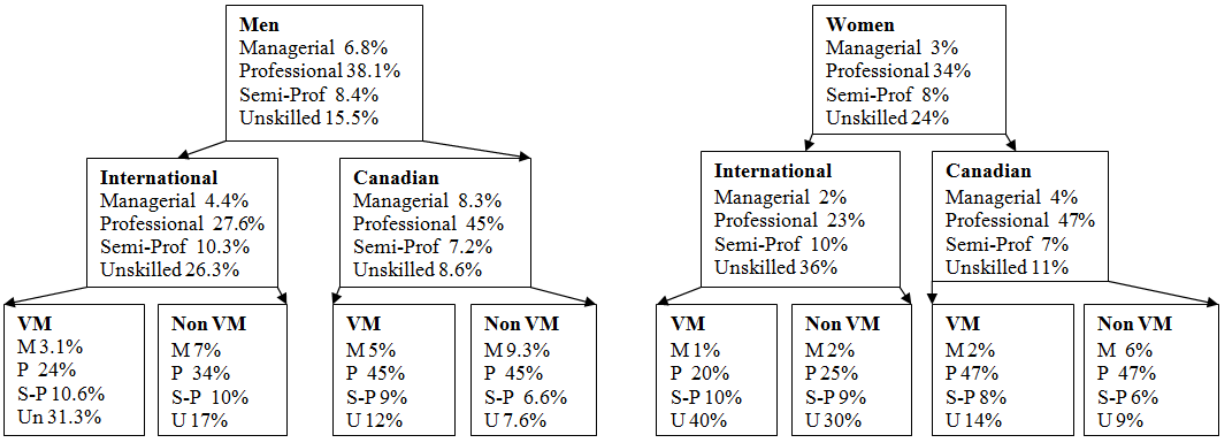
Another layer of variation is created by considering visible minority status for both internationally- and Canadian-trained men and women. The disadvantage of the visible minority group that was revealed previously in Table 4 seems to have an impact on the employment situation independent from the origin of training. Visible minority engineers of both sexes and origins of training have lower levels of employment and higher levels of unemployment and being out of the labour force. However, for the Canadian-trained, the differences in the category of being employed are relatively small. Internationally-trained women who belong to a visible minority group appear to be the most disadvantaged group in all parameters, with the highest rates of unemployment (12%) and being out of the labour force (23%), and the lowest rate of being employed (65%). The internationally-trained women who do not belong to a visible minority group show a slightly better outcome, but are still largely behind their Canadian-trained counterparts, women and men, as well as internationally-trained men. In turn, Canadian-trained and non-visible minority men are the group that has the best employment profile among all groups, with the lowest percentage of unemployment (2.8%) and being out of the labour force (8.9%) and the highest proportion of being employed (88.3%).

The next figure explores the variation within occupational categories using the same approach. Table 4 suggests persistent disadvantage for immigrants versus non-immigrants across all engineering categories, and an overrepresentation in the unskilled category. Figure 3 indicates that the trend is similar for both men and women, where internationally-trained women are at a disadvantage in comparison to both internationally-trained men and Canadian-trained women. For example, internationally-trained women are represented in the managerial category by 2%, half as much compared to Canadian-trained women (4%) and internationally-trained men (4.4%). The underrepresentation of the internationally-trained in the professional category is

consistent for both sexes, being half the rate of their Canadian-trained counterparts. The category of unskilled employment reveals another element of double disadvantage for internationally-trained women, with the highest percentage (36%) in comparison to both other women (11%) and internationally-trained men (26.3%).

For both men and women, ethnic visibility produces a further disadvantage for immigrants, in all but semi-professional, engineering positions. Also, striking differences by ethnic visibility are found for Canadian-trained men and women in their representation in the managerial positions, with non-visible minority Canadian-trained women being three times more represented in comparison to the visible Canadian-trained minority women (6% versus 2%). For men, the differences are 9.3% versus 5%, accordingly. Also, visible minority Canadian-trained men and women are overrepresented in the category of being in an unskilled occupation. Similar to their overall employment situation, internationally-trained visible minority women obtained the highest representation rate in the unskilled positions (40%) and the lowest representation rate in all engineering categories, compared with all the other groups, with only 1% employed in managerial positions. Similarly, the group with the highest representation rate in engineering and the lowest proportion in the unskilled market (7.6%) includes the Canadian-trained non-visible minority men. Among men, internationally-trained visible minority engineers have the highest proportion in the category of unskilled occupations (31.3%) and the lowest proportion in the managerial (3.1%) and professional (24%) occupations.

Figure 3: Descriptive Occupational Profiles for Male and Female Engineers by the Origin of Training and Visible Minority Status



Overall, these descriptive employment profiles suggest the following patterns. First, the results support the male-dominancy of the engineering field, where women in general and as a diverse group are underrepresented in employment and across all engineering occupational categories. Second, the results highlight that engineers' employment and career patterns are deeply intersectional, showing that the binary comparisons by sex, origin of training and visible minority status are unable to provide an accurate picture of the variety of differences that exist between and within the groups. Finally, ethnic visibility appears to play a substantial role in shaping some of the employment and career outcomes for both internationally- and Canadian-trained engineers, men and women. The next section will investigate these patterns further in the multivariate analysis that controls for a variety of demographic and human capital factors that are important in predicting employment and occupational integration.

4.4 Multivariate Analysis

As indicated in the conceptual framework, female engineers are often excluded from analyses of the experiences of immigrant engineers and treated as a homogenous group in studies

that focus on female tokens in general, and women in engineering in particular. To better locate the situation of immigrant female engineers from an intersectionality perspective, and to account for differences between men's and women's groups sizes, the multivariate analysis was conducted on two different samples: (1) one that includes women and men with engineering training and, a separate analysis that includes (2) only women with engineering training. The analysis conducted on the sample that includes female and male engineers helps to highlight the diverse outcomes for immigrant engineers while considering their sex and ethnic visibility. The analysis restricted to women only helps to disentangle the heterogeneous outcomes of female tokens in engineering. It highlights the intersectional nature of their professional careers, focusing on the differences found among women based on their origin of training and ethnic visibility.

The multivariate analysis is conducted by modeling occupational outcomes that represent key indicators of different degrees of career attainment. The first model estimates the likelihood of being unemployed and being out of the labour force in reference to being employed. This model helps to explore the pattern of general accessibility to the labour market regardless of specific occupational location. The second model predicts the likelihood of obtaining a specific occupational category within the labour market. This model snapshots the accessibility of a matched engineering position at various levels (managerial, professional and semi-professional) in comparison to the unskilled non-professional occupations that represent the ultimate occupational mismatch. The third and last model explores accessibility to specific positions within the engineering career ladder by modeling occupational location in engineering. This model predicts the likelihood of obtaining semi-professional versus professional employment and managerial versus professional employment. These models may help to learn about the

structure of opportunities that exist within the engineering field, including the potential for career advancement. To test for intersectionality, each model was conducted in hierarchical steps. The first step estimated only the main effects and the second step estimated the main effects with the addition of the interaction coefficients. The main effects presented in the tables are derived from the first models, and the moderating effects are derived from the second models. In order to better capture intersectionality for women, each set of models was estimated on two different samples: the one that includes all individuals with engineering training and the one that includes only women with engineering training. The coefficients presented in the tables are differences in the odds ratios (Relative Risk Ratios - RRR) of the examined category versus the category of reference (i.e. unemployed versus employed) created by the independent variables and interactions.

4.4.1 Access to Employment

Table 5 summarizes the main and moderating effects of the independent variables on the predicted probabilities of being unemployed and out of the labour force versus being employed for all engineers. The main effects reveal that engineers who fall into the categories of being internationally-trained, a representative of visible minority or female, independently of each other, are more likely to be out of the labour force. The odds of being out of the labour force versus employed are 156.2% higher for women in comparison to men (RRR=2.562). The odds for immigrants are 23.3% higher than for non-immigrants (RRR=1.233). The odds for visible minorities are 43.4% higher in comparison with their non-visible minority counterparts (RRR=1.434). For women (RRR=1.533) and visible minority (RRR=1.336) engineers the pattern of predicting unemployment versus employment is the same. However, internationally-trained engineers are less likely to be unemployed versus employed by 19% (RRR=0.810) in

comparison with their Canadian-trained counterparts. The interaction coefficients suggest that for immigrant women engineers, the risk of being unemployed increases by 26.5% (RRR=1.265), and the risk of being out of the labour force increases by 40.1% (RRR=1.401).The remaining moderating effects are not statistically significant, which means no other groups are found to accumulate a cumulative disadvantage in entering the labour market.

Table 5: Coefficients (Odds Ratios) of Multinomial Logistic Regression Predicting Employment Status for all Engineers

Main Effects N=110,505	Out of the Labour Force (Employed=0) RRR (SE)	Unemployed (Employed=0) RRR (SE)
Women (Men=0)	2.562*** (0.074)	1.533*** (0.057)
Visible Minority (Not a Visible Minority=0)	1.434*** (0.044)	1.336*** (0.050)
Internationally-trained (Canadian-trained=0)	1.233*** (0.052)	0.810*** (0.042)
US-trained (Canadian-trained=0)	1.292*** (0.086)	0.833 (0.080)
Bachelor's Degree (Lower than Bachelor's=0)	0.851*** (0.025)	0.840*** (0.034)
Master's Degree (Lower than Bachelor's=0)	0.754*** (0.029)	0.768*** (0.039)
Doctoral Degree (Lower than Bachelor's=0)	0.556*** (0.040)	0.687*** (0.062)
Age at Migration	0.972*** (0.002)	1.027*** (0.003)
Age	1.071*** (0.002)	0.996 (0.003)
Mother Tongue is an Official Language (Non-official Language=0)	0.951 (0.035)	0.828*** (0.041)
Number of Children	0.766*** (0.010)	0.834*** (0.013)
Non-Permanent Residents (Non-immigrant=0)	10.572*** (1.145)	1.042 (0.161)
Less than 5 years in Canada (Non-immigrant=0)	4.199*** (0.384)	1.757*** (0.214)
6 to 15 years in Canada (Non-immigrant=0)	1.912*** (0.162)	0.825 (0.091)
More than 16 years in Canada (Non-immigrant=0)	1.326*** (0.076)	0.653*** (0.056)
Moderating Effects	Design-based F-test = 193.98***	
Internationally-trained X Women	1.401*** (0.089)	1.265** (0.107)
Internationally-trained X Visible Minority	1.106 (0.073)	1.045 (0.090)
Women X Visible Minority	0.955 (0.058)	0.917 (0.071)
	Design-based F-test = 147.95***	

RRR=Relative Risk Ratio; SE=Standard Error; *p<0.05; **p<0.01;***p<0.001

The analysis conducted on women only provides further evidence of women's diverse employment outcomes. The results presented in Table 6 indicate that internationally-trained women are more likely to be out of the labour force than their Canadian-trained counterparts, but the difference is not significant for being unemployed. Controlling for origin of training, visible minority women are more likely to be both unemployed and out of the labour force than their non-ethnically visible counterparts. Specifically, being an internationally-trained woman increases the odds of being out of the labour force by 52.3% (RRR=1.523). Visible minority women's odds are 24.1% higher (RRR=1.241) for being out of the labour force and 18.7% higher for being unemployed (RRR=1.187) than the odds for non-ethnically visible women. Also, the moderating effects indicate that immigrant visible minority women are at increased risk of being out of the labour force by 35.3% (RRR=1.353). No similar moderating effect is found to be significant for predicting unemployment versus employment.

Overall, the results indicate that women and internationally-trained and visible minorities may experience some barriers to entering the labour market, but the patterns differ between the groups and across the intersections of categories. Overall, women are more likely to be out of the labour force and unemployed than men. This outcome is intensified for the internationally-trained and visible minority women (Hypotheses 3a and 4a are fully supported). However, for immigrants in general the results are mixed. They are more likely than their Canadian-trained counterparts to be out of the labour force but are less likely to be unemployed (Hypothesis 1a is partially supported). For internationally-trained women, the scenario is different as they are more likely to be out of the labour force and unemployed compared to internationally-trained men; and are more likely to be out of the labour force than Canadian-trained women. Another pattern of disadvantage is related to ethnic visibility. Ethnically-visible individuals are more likely to be

unemployed and out of the labour force, and this pattern is evident for women only. From the women only analysis, the results highlight a cumulative disadvantage of being an immigrant and visible minority (above and beyond the main effect of each) in being out of the labour force versus employed. No similar effect is found for men (Hypothesis 2a is not supported).

Table 6: Coefficients (Odds Ratios) of Multinomial Logistic Regression Predicting Employment Status for Female Engineers

Main Effects N=17,655	Out of the Labour Force (Employed=0) RRR (SE)	Unemployed (Employed=0) RRR (SE)
Visible Minority (Not a Visible Minority =0)	1.241*** (0.070)	1.187* (0.087)
Internationally-trained (Canadian-trained=0)	1.523*** (0.146)	1.037 (0.121)
US-trained (Canadian-trained=0)	1.738** (0.305)	0.624 (0.206)
Bachelor's Degree (Lower than Bachelor's=0)	0.825** (0.057)	0.712*** (0.066)
Master's Degree (Lower than Bachelor's=0)	0.665*** (0.056)	0.693** (0.076)
Doctoral Degree (Lower than Bachelor's=0)	0.445*** (0.084)	0.645* (0.139)
Age at Migration	0.992 (0.006)	1.022* (0.010)
Age	1.020*** (0.005)	0.975** (0.009)
Mother Tongue is an Official Language (Non-official Language=0)	0.885 (0.081)	0.864 (0.111)
Number of Children	1.200*** (0.031)	1.010** (0.003)
Non-Permanent Resident (Non-immigrant=0)	4.551*** (1.149)	1.640 (0.612)
Less than 5 years in Canada (Non-immigrant=0)	2.132** (0.475)	2.092* (0.652)
5 to 15 years in Canada (Non-immigrant=0)	0.952 (0.192)	0.969 (0.265)
More than 16 years in Canada (Non-immigrant=0)	0.999 (0.147)	0.756 (0.167)
	Design-based F-test = 32.65***	
Moderating Effects		
Internationally-trained X Visible Minority	1.353* (0.196)	0.952 (0.179)
	Design-based F-test = 28.79***	

RRR=Relative Risk Ratio; SE=Standard Error; *p<0.05; **p<0.01;***p<0.001

4.4.2 Access to the Engineering Field

Table 7 summarizes the results that estimate the probabilities of securing an engineering job at various levels, including managerial and professional (occupational match) and semi-professional positions (entry-level/slight mismatch) and unskilled positions (ultimate mismatch). The results suggest that being a woman, internationally-trained and a visible minority, independent of each other, reduces the odds of obtaining engineering employment at all levels. The odds of internationally-trained engineers of obtaining a managerial and a professional position are lower by 56.7% (RRR=0.433) and 64.1% (RRR=0.359), respectively, than the odds of their Canadian-trained counterparts. The odds of immigrants holding a semi-professional position are lower by 37.3% compared to non-immigrants (RRR=0.627). The odds of women of obtaining a managerial position are lower by 62.7% than men's (RRR=0.373). A similar disadvantage for women compared to men is evident in obtaining professional (lower by 43%; RRR=0.570) and semi-professional (lower by 35.9%; RRR=0.641) engineering employment. Being part of a visible minority group reduces the odds of obtaining a managerial position by 55.9% (RRR=0.441), a professional position by 39.6% (RRR=0.604) and a semi-professional position by 29.3% (RRR=0.707), in comparison with individuals who do not identify with a visible minority group.

To test the hypotheses of intersectionality, the three two-way interaction terms were included in the models. The results suggest that for women and visible minorities the negative effect of international training on the probability of obtaining engineering employment is intensified. According to Table 7, the odds of obtaining managerial positions for immigrant engineers who are ethnically-visible are reduced by an additional 33.1% (RRR=0.669); the odds of obtaining professional employment are reduced by an additional 37.3% (RRR=0.627); and the

odds of obtaining semi-professional employment are reduced by an additional 25.9% (RRR=0.741). For internationally-trained women, the odds of holding a managerial position are reduced by an additional 46.5% (RRR=0.535) and the odds of holding a professional position are reduced by an additional 28.5% (RRR=0.715). The combination of being a woman and ethnically-visible has an opposite effect with the double advantage of obtaining some engineering positions versus the ultimate mismatch: an additional increase of 37% is evident for their odds of holding professional employment (RRR=1.370), and an additional 24.3% is evident for semi-professional employment (RRR=1.243). The moderating effect is not significant for the odds of obtaining a managerial versus an unskilled position.

Table 8 summarizes the results of the multinomial logistic regression analyses predicting the likelihood of obtaining some kind of engineering position (managerial, professional or semi-professional) versus an unskilled one, for women only. The results indicate that being an internationally-trained woman decreases the odds of obtaining any kind of engineering position in comparison with Canadian-trained women. Specifically, immigrant women's odds of finding managerial employment are reduced by 58.9% (RRR=0.411) and their odds of professional employment are reduced by 68.4% (RRR=0.316). Being ethnically-visible reduces the odds of obtaining managerial employment by 58.5% (RRR=0.415) and by 28.9% (RRR=0.711) for professional employment. International training and ethnic visibility do not seem to differentiate the odds of obtaining semi-professional employment for women. Also, the moderating effect combining ethnic visibility with the origin of training was not statistically significant.

Table 7: Coefficients (Odds Ratios) of Multinomial Logistic Regression Predicting Occupational Category (Match versus Mismatch) for all Engineers, Currently Employed

Main Effects N=92,395	Managerial Engineering Occupations (Unskilled=0) RRR (SE)	Professional Engineering Occupations (Unskilled=0) RRR (SE)	Semi-Professional Engineering Occupations (Unskilled=0) RRR (SE)
Women (Men=0)	0.373*** (0.025)	0.570*** (0.019)	0.641*** (0.029)
Visible Minority (Not a Visible Minority=0)	0.441*** (0.023)	0.604*** (0.018)	0.707*** (0.028)
Internationally-trained (Canadian-trained=0)	0.433*** (0.031)	0.359*** (0.016)	0.627*** (0.035)
US-trained (Canadian-trained=0)	0.844 (0.093)	0.624*** (0.053)	0.859 (0.095)
Bachelor's Degree (Lower than Bachelor's=0)	5.469*** (0.314)	8.178*** (0.294)	1.250*** (0.046)
Master's Degree (Lower than Bachelor's=0)	12.548*** (0.889)	17.991*** (0.845)	1.599*** (0.089)
Doctoral Degree (Lower than Bachelor's=0)	27.181*** (3.784)	35.893*** (4.146)	2.070*** (0.323)
Age at Migration	0.970*** (0.004)	0.981*** (0.003)	0.993 (0.003)
Age	1.031*** (0.003)	0.982*** (0.002)	0.982*** (0.003)
Mother Tongue is an Official Language (Non-official Language=0)	1.709*** (0.104)	1.338*** (0.051)	1.140** (0.056)
Number of Children	1.232*** (0.021)	1.039** (0.012)	1.008 (0.016)
Non-Permanent Residents (Non-immigrant=0)	4.289*** (0.798)	1.527** (0.199)	0.772 (0.143)
Less than 5 years in Canada (Non-immigrant=0)	0.711* (0.107)	0.751** (0.074)	1.014 (0.128)
6 to 15 years in Canada (Non-immigrant=0)	1.640*** (0.218)	1.462*** (0.130)	1.322 (0.150)
More than 16 years in Canada (Non-immigrant=0)	2.095*** (0.196)	1.689*** (0.112)	1.500*** (0.125)
	Design-based F-test = 197.57***		
Moderating Effects			
Internationally-trained X Women	0.535*** (0.080)	0.715*** (0.052)	0.860 (0.085)
Internationally-trained X Visible Minority	0.669*** (0.073)	0.627*** (0.042)	0.741** (0.065)
Women X Visible Minority	0.891 (0.145)	1.370*** (0.093)	1.243* (0.115)
	Design-based F-test = 149.39***		

RRR=Relative Risk Ratio; SE=Standard Error; *p<0.05; **p<0.01;***p<0.001

Table 8: Coefficients (Odds Ratios) of Multinomial Logistic Regression Predicting Occupational Category (Match versus Mismatch) for Female Engineers, Currently Employed

Main Effects N=13,175	Managerial Engineering Occupations (Unskilled=0) RRR (SE)	Professional Engineering Occupations (Unskilled=0) RRR (SE)	Semi-Professional Engineering Occupations (Unskilled=0) RRR (SE)
Visible Minority (Not a Visible Minority=0)	0.415*** (0.073)	0.711*** (0.049)	0.892 (0.084)
Internationally-trained (Canadian-trained=0)	0.411** (0.107)	0.316*** (0.035)	0.788 (0.119)
US-trained (Canadian-trained=0)	0.727 (0.355)	0.761 (0.209)	1.072 (0.404)
Bachelor's Degree (Lower than Bachelor's=0)	5.187*** (1.177)	7.798*** (0.856)	1.558*** (0.171)
Master's Degree (Lower than Bachelor's=0)	14.429*** (3.648)	17.286*** (2.178)	2.717*** (0.380)
Doctoral Degree (Lower than Bachelor's=0)	46.606*** (22.782)	37.310*** (13.670)	4.580** (2.112)
Age at Migration	0.938*** (0.013)	0.970*** (0.007)	0.974* (0.010)
Age	1.038*** (0.010)	0.969*** (0.006)	0.982* (0.00)
Mother Tongue is an Official Language (Non-official language=0)	3.041*** (0.782)	1.310* (0.145)	1.041 (0.147)
Number of Children	1.048 (0.062)	0.944 (0.031)	0.945 (0.041)
Non-Permanent Resident (Non-immigrant=0)	10.357*** (6.607)	0.943 (0.313)	0.477 (0.236)
Less than 5 years in Canada (Non-immigrant=0)	1.805 (0.930)	1.025 (0.274)	1.112 (0.396)
5 to 15 years in Canada (Non-immigrant=0)	5.584** (2.770)	2.160** (0.517)	1.447 (0.463)
More than 16 years in Canada (Non-immigrant=0)	3.659*** (1.206)	1.933*** (0.359)	1.376 (0.326)
	Design-based F-test = 28.29***		
Moderating Effects			
Internationally-trained X Visible Minority	1.371 (0.501)	1.042 (0.165)	0.826 (0.180)
	Design-based F-test = 25.09***		

RRR=Relative Risk Ratio; SE=Standard Error; *p<0.05; **p<0.01;***p<0.001

The multivariate analysis of access to the engineering field provides strong evidence of an increased risk of occupational mismatch for internationally-trained engineers (Hypothesis 1b is fully supported). This risk is intensified for the internationally-trained women and ethnically-visible minorities (Hypotheses 2b and 3b are fully supported). The analysis conducted on women

only demonstrates women's heterogeneous experience, showing that internationally-trained and ethnically-visible women are less likely to gain access to the engineering field compared to their female counterparts who are not immigrants and not ethnically-visible (Hypotheses 3b and 4b are fully supported). Overall, internationally-trained, women and ethnically-visible minorities are less likely to obtain occupational match in comparison to Canadian-trained, men and ethnic majority engineers.

4.4.3 Occupational Location Within the Engineering Field

To explore the distribution of engineers across different occupational locations in the field of engineering, I performed analysis restricting the sample to individuals with engineering training who work in some sort of engineering job. Table 9 summarizes the main and moderating effects of the likelihood of obtaining semi-professional and senior/managerial employment in engineering with professional employment serving as the reference category. The analysis of occupational location within engineering provides mixed results. Women, internationally-trained and visible minority engineers are more likely to hold a semi-professional than a professional position in engineering. Specifically, women are more likely by 13.3% (RRR=1.133), immigrants are more likely by 73.6% (RRR=1.736) and ethnically-visible minorities are more likely by 20% (RRR=1.200) to be found in a semi-professional employment. The odds of obtaining managerial versus professional employment shows a different pattern. The analysis of working in senior/managerial positions versus professional ones provides mixed results. Women (RRR=0.677) and visible minority engineers (RRR=0.743) are less likely to obtain a managerial position by 32.3% and 24.7%, respectively, in comparison with men and ethnic majority engineers. However, the odds of obtaining managerial employment for immigrants are in fact higher by 18.4% (RRR=1.184*) than for their non-immigrant counterparts.

Looking at the moderating effects, women (by 25.7%; RRR=1.257) and visible minority immigrants (by 22.1%; RRR=1.222) are more likely to work in semi-professional rather than professional positions, but no cumulative effects are found for obtaining managerial versus professional employment. The only group that appears to be cumulatively less likely to obtain managerial (versus professional) employment in engineering is ethnically-visible women whose odds are lower by an additional 34.3% (RRR=0.657).

Table 10 summarizes the results for women who work in some sort of engineering occupation and highlights that a distribution across engineering positions differs for women based on their origin of training and visible minority status. Internationally-trained women are more likely than Canadian-trained women to work in semi-professional (versus professional) occupations by 155.4% (RRR=2.554). Similar to the results obtained from the whole sample, for women, international training does not have a significant negative effect on their likelihood of obtaining a managerial position versus a professional position. For visible minority women, the pattern of disadvantage persists. Regardless of their immigration status, visible minority female engineers are more likely to work in semi-professional occupations by 25.6% (RRR=1.256) and are less likely to work in managerial occupations by 39.3% than non-visible minority women are (RRR=0.607). The moderating effect combining ethnic visibility with the origin of training was not statistically significant.

Table 9: Coefficients (Odds Ratios) of Multinomial Logistic Regression Predicting Occupational Location in Engineering for all Engineers, Currently Employed in the Engineering Field

Main Effects N=48,155	Managerial Engineering Occupations (Professional=0) RRR (SE)	Semi-Professional Engineering Occupations (Professional=0) RRR (SE)
Women (Men=0)	0.677*** (0.043)	1.133** (0.051)
Visible Minority (Not a Visible Minority=0)	0.743*** (0.037)	1.200*** (0.047)
Internationally-trained (Canadian-trained=0)	1.184* (0.079)	1.736*** (0.097)
US-trained (Canadian-trained=0)	1.390*** (0.127)	1.336** (0.136)
Bachelor's Degree (Lower than Bachelor's=0)	0.675*** (0.039)	0.156*** (0.007)
Master's degree (Lower than Bachelor's=0)	0.711*** (0.047)	0.088*** (0.005)
Doctoral Degree (Lower than Bachelor's=0)	0.785* (0.078)	0.054*** (0.007)
Age at Migration	0.987*** (0.003)	1.013*** (0.003)
Age	1.050*** (0.002)	1.000 (0.002)
Mother Tongue is an Official Language (Non-official Language=0)	1.258*** (0.070)	0.826*** (0.039)
Number of Children	1.181*** (0.017)	0.976 (0.015)
Non-Permanent Resident (Non-immigrant=0)	2.632*** (0.439)	0.467*** (0.084)
Less than 5 years in Canada (Non-immigrant=0)	0.982 (0.131)	1.292* (0.148)
5 to 15 years in Canada (Non-immigrant=0)	1.157 (0.136)	0.872 (0.090)
More than 16 years in Canada (Non-immigrant=0)	1.230* (0.099)	0.833* (0.062)
	Design-based F-test=165.78***	
Moderating Effects		
Internationally-trained X Women	0.771 (0.110)	1.257* (0.120)
Internationally-trained X Visible Minority	1.127 (0.111)	1.222* (0.097)
Women X Visible Minority	0.657** (0.104)	0.874 (0.083)
	Design-based F-test=124.23***	

RRR=Relative Risk Ratio; SE=Standard Error; *p<0.05; **p<0.01;***p<0.001

Table 10: Coefficients (Odds Ratios) of Multinomial Logistic Regression Predicting Occupational Location in Engineering for Female engineers, Currently Employed in the Engineering Field

Main Effects N=5,940	Managerial Engineering Occupations (Professional =0) RRR (SE)	Semi-Professional Engineering Occupations (Professional =0) RRR (SE)
Visible Minority (Not a Visible Minority=0)	0.607** (0.109)	1.256* (0.121)
Internationally-trained (Canadian-trained=0)	1.354 (0.356)	2.554*** (0.382)
US-trained (Canadian-trained=0)	1.085 (0.527)	1.501 (0.515)
Bachelor's Degree (Lower than Bachelor's=0)	0.658 (0.154)	0.204*** (0.029)
Master's Degree (Lower than Bachelor's=0)	0.859 (0.220)	0.157*** (0.026)
Doctoral Degree (Lower than Bachelor's=0)	1.333 (0.495)	0.101*** (0.035)
Age at Migration	0.960** (0.014)	1.007 (0.010)
Age	1.076*** (0.009)	1.012 (0.008)
Mother Tongue is an Official Language (Non official language=0)	2.244***(0.626)	0.761* (0.098)
Number of Children	1.109 (0.068)	1.004 (0.046)
Non-Permanent Resident (Non-immigrant=0)	10.830*** (7.033)	0.535 (0.269)
Less than 5 years in Canada (Non-immigrant=0)	2.086 (1.025)	0.930 (0.320)
5 to 15 years in Canada (Non-immigrant=0)	2.954* (1.416)	0.585 (0.181)
More than 16 years in Canada (Non-immigrant=0)	2.021* (0.646)	0.649 (0.144)
	Design-based F-test = 18.25***	
Moderating Effects		
Internationally-trained X Visible Minority	1.420 (0.519)	0.784 (0.159)
	Design-based F-test = 16.20***	

RRR=Relative Risk Ratio; SE=Standard Error; *p<0.05; **p<0.01;***p<0.001

The results highlight that engineers are unequally represented across engineering locations based on their origin of training, sex and visible minority status, controlling for human capital characteristics. Internationally-trained engineers are overrepresented in the lower ranks (semi-professional positions) of engineers, but are more likely to occupy managerial (versus professional) positions (Hypothesis 1c is partially supported). The same pattern is evident for

internationally-trained women and visible minority engineers. Their increased risk of semi-professional employment is intensified but no similar disadvantage is found in obtaining managerial (versus professional) employment (Hypotheses 2c and 3c are partially supported). For ethnically-visible engineers the pattern is different. Ethnically-visible minorities in general are less likely to hold a managerial position and the effect is most pronounced for ethnically-visible women, both, compared to visible minority men and non-visible minority women (Hypothesis 4c is fully supported).

Overall, the results suggest that immigrant engineers face a different structure of opportunities for professional integration, depending on their sex and ethnic visibility. Immigrant female engineers are in the most disadvantaged position in comparison to the other groups. They face multiple cumulative disadvantages at several thresholds examined in this study. Immigrant women engineers are less likely to be employed, to obtain engineering employment and to obtain professional positions (versus semi-professional) within the engineering field. Ethnically-visible immigrant engineers have cumulative disadvantages at some stages of occupational integration, such as finding employment in engineering and securing professional employment (versus semi-professional) within the field. However, for men, once a professional position is obtained, there seems to be no barriers to obtaining a managerial position in engineering. A complex pattern is evident for women who are ethnically-visible regardless of their origin of training. Ethnically-visible women seem to face an accumulation of disadvantages in some aspects of their careers, and these disadvantages are independent from the effects of origin of training. Overall, the findings reveal that women face the most substantial disadvantages at each stage of the development of their careers. The intersectionality hypotheses are supported, suggesting that

immigrant and visible minority women experience cumulative disadvantages at each stage of developing their careers.

4.5 Control Variables

As indicated above, in addition to the focal variables of origin of training, sex and ethnic visibility, the analyses also included control variables for human capital and demographic characteristics which previous research has found relevant in predicting immigrants' and women's career attainment in engineering. These variables are related to human capital, such as level of education, linguistic proficiency (i.e., English/French being a mother tongue versus not) and demographic characteristics, such as age, age at migration, immigration status and time spent in Canada and number of children. The descriptive statistics for the control variables are presented in Appendix 5. While not the focus of this study, it is important to highlight some major patterns of findings among the control variables that may help to better understand the results of this study as well as the directions for future research. Below, I summarize the main patterns related to the way the control variables appear to shape the structure of opportunities for each potential employment outcome examined in this study.

4.5.1 Access to Employment

The results suggest that higher levels of education and having children produce a positive effect on access to employment in general, while the effects of age at migration, being a native speaker, and immigration status and tenure are mixed. Specifically, individuals with more advanced degrees are more likely to be employed. The number of children is another factor that seems to benefit access to employment in general. However, for women the pattern is the opposite. With each additional child, they are in fact more likely to be unemployed and out of the labour force. Age at migration produces diverse effects on the chances of being employed. For

instance, immigrants who were older at migration are more likely to find themselves unemployed but less likely to be out of the labour force. Having English or French as a mother tongue benefits the odds of being employed for the entire sample but is not significant for women. All groups of immigrants are more likely to be out of the labour force and the odds are especially high for the non-permanent residents and those who have resided in Canada for less than five years. However, more senior immigrants are in fact more likely to find themselves employed (versus unemployed) than non-immigrants. Women exhibit a similar pattern to newer immigrants who are also less likely to be employed.

4.5.2 Access to the Engineering Field

Having a higher level of education and an official language as a mother tongue are especially beneficial in securing an occupational match in engineering. Across all categories of engineering employment (managerial, professional and semi-professional), more advanced degrees produce the largest effects. The largest positive effect is found for PhD holders (versus those whose degree is below Bachelor's). Native speakers are also more likely to be found in positions of occupational match. In addition, having more children seems to be beneficial when the entire sample is examined. However, the effect of the number of children is not significant when predicting occupational match for women only. Immigrants who were older at the time of arrival are less likely to obtain employment of occupational match. The effects of immigration status and tenure in Canada are mixed. Newcomers who have spent less than five years in Canada are at a disadvantage in obtaining managerial and professional positions in engineering, but the pattern shifts for those who have lived in Canada for six years or more. Also, being a non-permanent resident is positively associated with occupying both managerial and professional positions in engineering.

4.5.3 Occupational Location Within the Engineering Field

Being a native speaker is the most important factor in predicting the likelihood of obtaining advanced positions within the field of engineering, especially with regard to managerial versus professional positions. Also, similar to previous occupational outcomes, advanced levels of education are positively associated with securing professional employment, but are negatively associated with securing managerial employment (as opposed to professional) for the entire sample. The effect for women is not significant. Similar to the previous model, the number of children is beneficial in obtaining advanced positions in engineering when the entire sample is examined. The effect, however, is not significant for women. Non-permanent residents are significantly more likely to occupy advanced locations in engineering. However, newcomers who have spent less than five years in Canada are more likely to work in semi-professional positions within the field. The pattern switches entirely for immigrants who have spent more than sixteen years in Canada. They are more likely to secure advanced positions compared to non-immigrants. Immigrant women seem to accumulate this advantage after being in Canada for six years, being more likely to occupy managerial positions.

Overall, the results suggest that the effects of some of the control variables differ when examining the entire sample compared to women only. These patterns highlight the ways in which engineering careers are gendered are complex. For example, the effect of the number of children is contradictory when comparing the results for the entire sample to the results for women only. Having more children seems to benefit each career outcome for engineers in general. However, for women, the effect of the number of children is either non-significant or negative. These results clearly indicate that having children may benefit male engineers in terms of employment status and occupational attainment, which is not the case for women. These

results support the existence of the "motherhood" penalty that is widely discussed in the literature concerned with the impact of having children on women's careers (Budig & England, 2001; Correll, Benard, & Paik, 2007; Hersh, 2000). Within the intersectionality framework, an interesting question for future studies is whether the effect of this penalty is different for immigrant and ethnically-visible women.

Another important finding is related to the positive role of higher degrees in increasing the likelihood of being employed and obtaining an occupational match. This finding is consistent for both the entire sample and for women only. However, the effects of levels of education on securing advanced degrees in engineering is ambiguous. It has a positive impact on securing professional versus semi-professional positions for the entire sample and women only. But, it produces a negative effect on securing managerial versus professional positions for the entire sample, while it is not significant for women. These complex results regarding education support the previously made claims that the hierarchical differentiation between managerial and professional locations in engineering is unclear. Several explanations are possible.

First, since a Bachelor's degree is considered adequate for obtaining an engineering license, having a degree above the Bachelor's may not affect the likelihood of obtaining senior and managerial positions in engineering. Other human capital attributes, such as communication and organizational skills, as well as leadership skills, may be more relevant in determining suitability for advanced positions in engineering. The strong positive effect of being a native speaker on the likelihood of obtaining a managerial degree is evidence for that. Second, the NOC code titles may contain many heterogeneous categories of professional and managerial locations. Part of this diversity may be related to the growing prevalence of the technical career ladder in engineering (Igbaria et al, 1999) and a shrinking managerial ladder (Martínez-León et al, 2018).

Also, the relationship between the level of education and occupational outcomes may differ by gender, origin of training and ethnic visibility. The contrasting results for the entire sample and women only supports this possibility. Similarly, Boyd and Thomas's (2001) study shows that the effects of level of education differs for immigrant and non-immigrant engineers. The current study, however, is unable to provide empirical support for this interpretation, as moderating effects between the examined categories and the levels of education are beyond the scope of this project.

4.6 Summary of Results

The results of this study provide empirical evidence of the complex disadvantages that are tied to origin of training, sex and visible minority status underlying the outcomes of professional integration for immigrant engineers. The results suggest diverse employment outcomes for immigrants based on their sex and ethnic visibility, and diverse employment outcomes for women based on their origin of training and ethnic visibility. These findings help to shed light on the ways that career attainment of internationally-trained female engineers may differ from both internationally-trained engineers who are men and Canadian-trained engineers who are women. An additional factor that intensifies the disadvantages for immigrants in general and immigrant women in particular is ethnic visibility.

Table 11 summarizes the results in relation to the hypotheses tested in this study. The first set of hypotheses predicted that internationally-trained engineers will be less likely to obtain any employment (Hypothesis 1a); less likely to obtain employment commensurate with their skill level (occupational match) (Hypothesis 1b); and less likely to obtain advanced employment within the engineering field (Hypothesis 1c). The results reveal the following scenario for internationally-trained engineers: they do not face barriers to entering the labour market in

general, but they are at a higher risk for an occupational mismatch where they are underemployed and working in non-engineering unskilled positions. Within the engineering field, immigrants tend to occupy semi-professional as opposed to professional positions, no disadvantage is evident in securing managerial as opposed to professional employment. Thus, Hypothesis 1a is not supported, Hypothesis 1b is fully supported and Hypothesis 1c is partially supported.

The second set of hypotheses predicted that origin of training interacts with ethnic visibility to shape the occupational outcomes of engineers. Specifically, I hypothesized that ethnically-visible immigrants will be even less likely to obtain any employment (Hypothesis 2a); less likely to obtain employment commensurate with their skill level (Hypothesis 2b); and less likely to obtain advanced employment within the engineering field (Hypothesis 2c). The results suggest that ethnic visibility does intensify the negative effect of origin of training for some occupational outcomes. Thus, immigrants who belong to a visible minority group, regardless of sex, do not face cumulative barriers to entering the labour market in general. However, the risks observed for all internationally-trained engineers, such as lower chances of obtaining an occupational match and lower chances of obtaining a professional (versus semi-professional) position in engineering are intensified. Similar to the main effect of international training, no moderating effect is found to reduce the chances of obtaining senior and managerial positions (versus professional ones) within the field. Thus, Hypothesis 2a is not supported, Hypothesis 2b is fully supported and Hypothesis 2c is partially supported.

The third set of hypotheses predicted immigrant women's cumulative disadvantage to enter the labour market (Hypothesis 3a) and the engineering field (Hypothesis 3b), and to obtain advanced employment within the engineering field (Hypothesis 3c). The results suggest that

women engineers who are internationally-trained experience more disadvantages at each stage of their professional careers, both in comparison to men and to Canadian-trained women. Compared to men, they are at greater risk of unemployment, being out of the labour force and experiencing an occupational mismatch. In addition, immigrant women have lower chances for advanced positions within the field, such as being less likely to obtain professional (versus semi-professional) employment. Like immigrant men, immigrant women are not at a disadvantage in their odds of obtaining managerial as opposed to professional employment in engineering. Based on these results, Hypotheses 3a and 3b are fully supported and Hypothesis 3c is partially supported.

The fourth and last set of hypotheses proposed women's cumulative disadvantage based on the intersection of their gender and ethnic visibility. Specifically, I hypothesized that women who self-identify with a visible minority group will be less likely to enter the labour market (Hypothesis 4a), to enter the engineering field (Hypothesis 4b) and to obtain advanced employment within the engineering field (Hypothesis 4c). The initial analyses that included all engineers suggested that ethnically-visible women do not seem to be at a disadvantage to access the labour market in general and the engineering field in particular. However, when the analyses are restricted to only women, the findings reveal that ethnically-visible women are more likely to be out of labour force, unemployed and underemployed in comparison to women who are not ethnically-visible. Also, ethnically-visible women are the least likely to obtain senior and managerial positions within the engineering field. In comparison to immigrant women, whose barriers seem to disappear once a professional position in the field is secured, the disadvantages for ethnically-visible women seem to persist. This finding may indicate that different factors are responsible for the disadvantage faced by immigrant and ethnically-visible women in

engineering, and their cumulative vulnerability may be produced by different forces. Overall, the results fully support Hypotheses 4a, 4b and 4c.

Table 11: Summary of Findings and Hypotheses

Origin of Training Hypotheses	**Results**
Hypothesis 1a: Immigrant (internationally-trained) engineers will be less likely to obtain any employment compared to their non-immigrant (Canadian-trained) counterparts.	Not supported (Table 5)
Hypothesis 1b: Immigrant (internationally-trained) engineers will be less likely to occupy positions matching their skill level (professional and managerial) and more likely to occupy positions that do not match their skill level (unskilled and semi-professional) in comparison to their non-immigrant (Canadian-trained) counterparts.	Fully supported (Table 7)
Hypothesis 1c: Immigrant (internationally-trained) engineers will be will be less likely to occupy advanced positions within the engineering field in comparison to their non-immigrant (Canadian-trained) counterparts.	Partially supported (Table 9)
Intersection of Origin of Training with Visible Minority Status Hypotheses	**Results**
Hypothesis 2a: Visible minority immigrant engineers will be less likely to obtain any employment in comparison to immigrants who are not visible minorities.	Not supported (Table 5)
Hypothesis 2b: Visible minority immigrant engineers will be less likely to occupy positions matching their skill level (professional and managerial positions) and more likely to occupy positions that do not match their skill level (unskilled and semi-professional) in comparison to immigrants who are not visible minorities.	Fully supported (Table 7)
Hypothesis 2c: Visible minority immigrant engineers will be less likely to occupy advanced positions within the engineering field in comparison to immigrants who are not visible minorities.	Partially supported (Table 9)

**This table continues on the next page*

Table 11 (continued): Summary of Findings and Hypotheses

Intersection of Gender with Origin of Training Hypotheses	**Results**
Hypothesis 3a: Female immigrant engineers will be less likely to obtain any employment in comparison to male immigrant engineers and female non-immigrant engineers.	Fully supported (Tables 5 and 6)
Hypothesis 3b: Female immigrant engineers will be less likely to occupy positions matching their skill level (professional and managerial positions) and more likely to occupy positions that do not match their skill level (unskilled and semi-professional) in comparison to male immigrant engineers and female non-immigrant engineers.	Fully supported (Tables 7 and 8)
Hypothesis 3c: Female immigrant engineers will be less likely to obtain advanced employment within the engineering field in comparison to male immigrants and female non-immigrant engineers.	Partially supported (Tables 9 and 10)
Intersection of Gender with Visible Minority Status Hypotheses	**Results**
Hypothesis 4a: Visible minority female engineers will be less likely to obtain any employment in comparison to female engineers who are not visible minorities.	Fully supported (Tables 5 and 6)
Hypothesis 4b: Visible minority female engineers will be less likely to occupy positions matching their skill level (professional and managerial positions) and more likely to occupy positions that do not match their skill level (unskilled and semi-professional) in comparison to female engineers who are not visible minorities.	Fully supported (Tables 7 and 8)
Hypothesis 4c: Visible minority female engineers will be less likely to obtain advanced employment within the engineering field in comparison to female engineers who are not visible minorities.	Fully supported (Tables 9 and 10)

Chapter 5

DISCUSSION AND CONCLUSIONS

This dissertation examines the ways in which international training, gender and ethnic visibility intersect to shape the career attainment of engineers in Canada. This study is grounded in two distinct bodies of literature: (1) research on immigrants' skills transferability with a focus on skilled immigrants' occupational attainment; and (2) research on women's careers in male-dominated fields in which women are tokens and are perceived to perform gender-inappropriate tasks. I bridge these two perspectives under the intersectionality framework to shed light on the employment outcomes of immigrant female engineers in Canada, whose realities are not captured by studying only immigrant men or by studying non-immigrant women in male-dominated fields.

To focus on women engineers who may simultaneously be immigrants and ethnically-visible, I conducted the analysis in the following way. I examined occupational outcomes of engineers while considering their gender and ethnic visibility and examined occupational outcomes of women while considering their ethnic visibility and origin of training. This strategy helps to explore the heterogeneity of the outcomes of immigrant engineers and the heterogeneity of the outcomes of women engineers from the combined perspectives of gender, origin of training and visible minority status. The cross-sectional nature of the data and the quantitative analysis pursued in this study document inequalities produced by membership in the examined groups but are unable to shed light on the mechanisms and processes that create this disadvantage. In this section, I engage in a dialog with the literature that frames this inquiry to contextualize the interpretation of the results of this study. I look into the possible explanations for the findings and suggest directions for future research. To navigate through the complexity of

findings derived from examining several career aspects and multiple intersections of identity categories, this discussion is organized as follows. First, I focus on the most significant findings concerning immigrant engineers in general and contextualize the results within the literature on skills transferability. I discuss the ways in which these outcomes differ by ethnic visibility and gender. Next, I focus on the findings specific to women engineers and discuss how the concepts of tokenism and intersectionality help to better understand the results obtained from the combined perspective of gender, origin of training and visible minority status. I conclude by discussing the implications of this research, its contributions and its limitations, as well as directions for future research.

5.1 Immigrant Engineers

5.1.1 The Role of International Training

Three major patterns of findings regarding immigrants' ability to rebuild their professional careers in engineering in Canada stand out: (1) internationally-trained engineers are not at a disadvantage in gaining access to the labour market in general, as they are more likely to be employed compared to their Canadian-trained counterparts; (2) yet, while employed, they are at a higher risk for occupational mismatch, being more likely to find themselves in unskilled non-professional employment than any employment within the engineering field; and (3) while employed within the engineering field, they are more likely to occupy semi-professional positions, but also more likely to occupy managerial than professional positions; and (4) some of these effects are intensified for ethnically-visible and female immigrant engineers, with the latter being in the most disadvantaged position.

The finding that immigrant engineers are at a disadvantage in accessing the engineering field, but not the labour market in general, supports previous studies that stress immigrant skills'

underutilization resulting from occupational mismatch (Reitz, 2001; 2007; Reitz, Curtis & Elrick, 2014). Two explanations are offered in the literature to clarify immigrant engineers' occupational mismatch in Canada. One explanation stresses the process of formal skills recognition that is regulated by provincial regulatory bodies, which can be long, costly and difficult to navigate (Bauder, 2003; Girard & Bauder, 2007; Guo, 2009; Kustec, Thompson & Xue, 2007; Li, 2001; Schellenberg & Maheux, 2007; Reitz, 2001). The second explanation stresses the process of informal skills recognition from potential employers who may be biased against foreign education and training (Guo, 2009; Reitz, 2001; Shan, 2013).

Formal skills recognition is a mandatory process required in obtaining the title of Professional Engineer (P.Eng) and is grounded in the value of public safety (Friesen, 2016). The purpose of professional regulation in engineering is to ensure foreign credentials meet Canadian standards (Friesen 2012; 2016). Yet some scholars argue that the process of credentials recognition is politicized and influenced by the perception that foreign education is inferior to Canadian education (Guo, 2009; Shan, 2013b), and that it can only meet, but never exceed Canadian standards. These assumptions are especially relevant for immigrants coming from developing nations, as over the last few decades more source countries have been represented by non-European nations. Without full skills recognition, the wasted human capital results in both personal and economic costs, and contradicts Canada's migration policy, which puts a special emphasis on human capital.

Prior research has emphasized that potential employers do not have the tools to efficiently evaluate the quality of international training and experience prior to hiring (Li, 2001; Reitz, 2001; Reitz, 2005; Shan, 2013). As a result, employers tend to undervalue international skills and prefer to hire individuals with local experience and training. Canadian sociologist

Jeffrey Reitz suggests that providing employers with knowledge to evaluate international skills can partially address the problem of skills underutilization (Reitz, 2001; 2005). However, the effectiveness of this solution is unclear. Empirical evidence suggests that efforts to reduce managerial bias through diversity training have very modest effects (Kalev, Dobbin & Kelly, 2006). The process of hiring is complex and activates the most commonly shared social beliefs with regards to the social categories that job applicants are perceived to possess, regardless of being immigrants or not: "when employers are looking for the most 'appropriate' worker, suitability is largely defined categorically, heavily influenced by the sex of the person who typically fills the job. Much of the same holds for ethnicity" (Waldinger & Lichter, 2003:8).

In regulated occupations, such as engineering, employers may be less concerned with the skills' evaluation process because they tend to rely simply on the engineering license as a quality standard. Considering the challenges internationally-trained professionals face in obtaining this license, immigrant engineers may be trapped in a vicious circle. They need at least twelve months of Canadian engineering work experience to qualify for an engineering license (Boyd & Thomas, 2001). However, they are unable to find employment in engineering without the license as it is the main indicator of the quality of their skills (Girard & Bauder, 2007). As such, the inability to find employment in the field of engineering is another factor that may contribute to immigrants' underemployment in the context of high employment rates.

Research suggests that obtaining first employment in the field of training is the most difficult task for immigrant professionals (Grenier & Xue, 2010; Konnikov & Raijman, 2016; McCoy & Masuch, 2007). Immigrants' skills potential appear as a "black box" for Canadian employers, who may then activate basic stereotypes to navigate this uncertainly, placing immigrants at the bottom of the hiring hierarchy. Therefore, bridging programs that provide

immigrants with initial employment opportunities by connecting them directly with potential employers, advocating on their behalf, and funding their internships in some cases, have been found effective in facilitating immigrants' professional integration (Kogan, 2016; Konnikov & Raijman, 2016; McCoy & Masuch, 2007; Reitz, 2005; Stier & Lebanon; 2003). Bridging programs have the capacity to deal with biased perceptions towards international human capital, since they allow a "safe" period during which employers can evaluate the skills of internationally-trained professionals. In Canada, however, the bridging programs that exist are highly selective due to limited quotas, lack of a centralized system and the irregular nature of provincial and federal funding (Guo, 2009; McCoy & Masuch, 2007). Despite their positive impact, these programs only effectively assist a very small and select portion of skilled immigrants.

This challenge is not unique to the engineering field or to Canada. Immigrants from other regulated occupations, such as medicine, face substantial challenges to entering their fields of work in Canada and elsewhere (Banerjee & Phan, 2014; Girard & Smith, 2013; Remennick, 2012; Shuval, 1997; Zietsma, 2010). The less than perfect transferability of skills highlights the complexity around the notion of skill. Bourdieu, in his definition of cultural capital, differentiated between the embodied state, the actual skill possessed by the individual, and the institutionalized state, which is the legal and social confirmation of this knowledge. The latter includes formal verification, such as a certificate, diploma or degree that certifies the knowledge possessed by the individual (Bourdieu, 1986). In regulated fields, such as engineering in Canada, the ability to license these skills appears more important in influencing the process of career attainment than the actual set of skills possessed by the individual (Bauder, 2003; Girard & Bauder, 2007; Guo, 2009).

Another finding of this study reveals that immigrants who obtain a job in the engineering field are more likely to occupy semi-professional rather than professional jobs. These results suggest that within the engineering field immigrants continue to face the risk of occupational mismatch. This finding corresponds with the previous results of the study of Boyd and Thomas (2001) according to which immigrant engineers who were assumed to be trained abroad were more likely to hold technical positions in engineering. The higher concentration of internationally-trained engineers in semi-professional jobs may be due to the fact that they do not require the engineering license. Therefore, engineers who do not complete the process of re-accreditation or are currently engaged in the process may find working in semi-professional positions as the best available option as opposed to working in the unskilled labour market.

The fact that immigrants are more likely to occupy technical positions in engineering may jeopardize their ability to advance their careers. In many knowledge-based and professional fields, managers are selected from professional ranks (Beck, Reitz, & Weiner 2002; Reitz, 2005). Groups who have limited access to professional employment within the field are simultaneously excluded from opportunities for further career advancement. Townsend (1996) uses the concept of "glass walls" to define positions that are connected to the hierarchical career ladder. Women and minorities are at a greater risk of being trapped outside the "glass walls", or in positions that prevent them from getting access to the types of jobs that allow them to rise to upper management positions (McCoy & Masush, 2007; Townsend, 1996). These results offer partial support for the existence of blocked mobility for immigrants, conceptualized as the "glass ceiling effect" in previous studies (Reitz, 2003; Tang, 1997b; Wong & Wong, 2006).

However, the results of this study suggest that when the probability of obtaining managerial as opposed to professional employment is examined, immigrants' odds are slightly

higher compared to their Canadian-trained counterparts. The fact that internationally-trained individuals do not appear to be underrepresented in the managerial versus professional positions suggests several possible explanations. First, it is possible that access to professional employment is the main milestone in rebuilding a professional career for internationally-trained engineers in Canada. The effect of tenure in the country supports this claim by showing that immigrants who have spent more than 16 years in Canada are more likely to obtain managerial positions in engineering. Another possible explanation is that some of the managerial titles do not require an engineering license, thus providing an alternative access to an engineering career, without the need to carry a title of P. Eng (Professional Engineer). These job titles may include a growing number of Project Managers in engineering and technology labour markets.

Together, these results suggest that the following scenario is possible: immigrant engineers may struggle with the process of re-accreditation and finding employment within the engineering field. As a result, they tend to compromise their career development and accept employment below their skill level, which results in occupational mismatch. Those who find employment in engineering tend to be over-represented in the technical positions. However, for those who are successful in securing a professional position, there appears to be no further barriers for promotion to managerial employment. Still, since immigrants start over, rather than continue, their professional careers, the time they spend in gaining access to professional employment may jeopardize their opportunities to rebuild their professional careers. It takes time to move up the career ladder within a professional field. Long interruptions, such as the ones immigrants face during the re-accreditation and licensing processes, put them behind their locally-trained counterparts.

5.1.2 The Intersection of International Training and Ethnic Visibility

The results of this study are consistent with previous research that suggests that immigrants who belong to a visible minority group face greater disadvantages in the labour market (Anisef, Sweet & Frempong, 2003; Boyd, 2000; Boyd & Thomas, 2001; Boyd & Tian, 2018; Pendakur & Pendakur, 2000; Reitz, 2003; Reitz et al, 2009). Being a visible minority intensifies the negative effects associated with international training, and places immigrant minorities at even higher risk of occupational mismatch. The results of this study suggest that ethnically-visible immigrant engineers are cumulatively disadvantaged in obtaining any position in engineering, including managerial, professional or semi-professional ones. Also, immigrants' overrepresentation in semi-professional rather than professional employment in engineering is even more pronounced for those who belong to a visible minority group.

The greater disadvantages for visible minority immigrant engineers are grounded in the social construction of the concept of "immigrant" as someone who is visibly "foreign", that is, of a non-European decent, and who has a limited command of English and/or a foreign accent (Guo, 2009; Man, 2004; Shan, 2013a). In the context of the Canadian migration policy, immigrants' ethnic visibility correlates with coming from a non-European country. These nations are often perceived by the Canadian mainstream as underdeveloped economically, which may influence the ways in which potential employers understand and evaluate international educational and professional backgrounds (Guo, 2009; Shan, 2013b). For example, Boyd and Tian (2018) in their recent study on STEM professionals found that immigrants from non-European nations were subject to a greater disadvantage than their counterparts from European nations. Shan (2013a), in her institutional ethnography study of career practices in engineering, reveals that a set of stereotypical assumptions is attached to visible ethnic origin. These

assumptions result in poorer evaluations of the candidates' skills. Her comparison of two cities with different labour market situations in engineering highlighted how the emphasis on "soft skills" in Toronto's saturated engineering market discriminated against immigrant engineers, while in the booming economy of Edmonton the notion of "soft skills" became less important (Shan, 2013a).

Despite its official policy of multiculturalism, Canadian society appears deeply divided by race (Li, 2001; Pendakur & Pendakur, 2002; Reitz, 2007; Reitz et al, 2009; Reitz & Banerjee, 2007). Thus, across all models estimated in this study, the main effect of ethnic visibility remains a significant predictor that produces a negative effect on all occupational outcomes, including entry into the labour market, engineering field and occupational location within the field. Although, this study utilizes visible minority status as a moderator of the relationship between international training and occupational attainment, it is hard to ignore the consistency in which ethnic visibility alone, while controlling for immigration status, produces negative effects on different aspects of engineers' careers. This finding is not unique to the Canadian engineering field, as ethnically-visible immigrant engineers in the United States have also been found more likely to be working in semi-professional employment and less likely to occupy managerial positions within the field (Alarcon, 1999; Fernandez, 1998; Lim et al. 1998; Tang, 1993; 1995; 1997; 2000).

5.1.3 The Intersection of International Training and Gender

The results highlight that internationally-trained women are subject to cumulative negative disadvantages in their chances of obtaining any employment, employment within the engineering field and securing advanced employment within the field. While the main barrier for internationally-trained engineers seems to be related to accessing the field in general and

professional employment in particular, the barriers for immigrant women seem to be more pronounced and different. These results support claims made in previous literature about immigrant women's double disadvantage in multiple aspects of economic integration (Dlamini et al, 2012; Man, 2004; Salaff & Greve, 2003; Wong & Wong, 2006). However, to the best of my knowledge, this study for the first time provides empirical evidence on immigrant women's cumulative (i.e. intersectional) disadvantages in the male-dominated field of engineering. The analyses conducted in this study indicate that immigrant female engineers are at a greater disadvantage compared to immigrant men and non-immigrant women in pursuing their engineering careers in Canada. I discuss this finding in more detail in the next section, which focuses on female engineers' occupational attainment from the intersectionality perspective.

To conclude, this study reveals that internationally-trained engineers are behind Canadian-trained counterparts in their chances to establish an engineering career. Immigrants' high employment rate, together with high underemployment, highlight the underutilization of human capital resulting from occupational mismatch that has already been voiced as a concern in previous studies (Reitz, 2001; 2007; Reitz, Curtis & Elrick, 2014). Following the finding of immigrant engineers' occupational mismatch, I join other immigration scholars in arguing that additional efforts should be made to improve immigrant professionals' potential for occupational integration. These efforts are especially needed in regulated fields, such as engineering. Canadian migration policy prioritizes human capital and the ability to contribute to the local economy and Canada's position in a globalized technology industry. Hence, the inability of immigrant engineers to enter professional employment and contribute at their full capacity is an urgent concern. The engineering field in Canada, being highly globalized and a regulated

occupation at the same time, sustains a paradox in which international engineering skills are highly scored in the policy, but undervalued in the labour market.

5.2 Female Engineers

In turning the focus to women, the results of this study suggest several important patterns. First, women in general, compared to men, are disadvantaged across all dimensions of career attainment examined in this study. They are more likely to be unemployed and out of the labour force, less likely to obtain employment within the field of engineering and are less likely to occupy advanced positions within the field. Second, women's disadvantage is intensified for those who are immigrants and for those who belong to a visible minority group. And third, the cumulative disadvantages for immigrant and visible minority women seem to have different trajectories. Overall, the results highlight the intersectional nature of women's outcomes in engineering where disadvantage is intensified by being an immigrant and a visible minority.

In line with the tokenism hypothesis, the results of this study highlight women's general vulnerability in engineering compared to men at each outcome of their career attainment. The main effect of gender remains significant, showing women's disadvantage in entering the labour market, entering the engineering field, and advancing their position within it. These results provide further empirical support to disadvantages that women face in male-dominated fields where they are highly visible as tokens and perform tasks which are perceived to suit men (Budig & England, 2001; Hatmaker, 2013; Kanter, 1977; Miller, 2002, 2004; Powell, Bagilhole & Dainty, 2009; Roth, 2004a; 2004b; Yoder, 1991; 2002; Yoder, Adams & Prince, 1983; Yoder & Sinnett, 1985; Zimmer, 1988).

In 2001, Boyd highlighted that the proportion of immigrants among women engineers in Canada is substantial and requires empirical attention. The descriptive analysis of this study

supports these claims and reveals a diversity among women engineers in terms of their origin of training and ethnic visibility. More than half of female engineers in Canada are internationally-trained and half of female engineers in Canada are self-identified with a visible minority group. These results reveal the heterogeneous composition of women in the Canadian engineering labour market. This heterogeneity supports the relevance of the intersectionality framework in studying this group. According to the results, the diversity among women in engineering leads to diverse occupational outcomes.

The examination of women in engineering from the intersectionality perspective reveals that the general disadvantage that women face is intensified for immigrant and ethnic minority women for all outcomes examined in this study. However, the trajectories of disadvantage vary. Immigrant women are cumulatively more likely, in comparison to immigrant men and non-immigrant women, to find themselves in positions of occupational mismatch (versus non-immigrant women) but are not at a disadvantage in obtaining managerial positions. It suggests that the process of formal and informal skills' recognition is the main milestone for internationally-trained immigrants in Canada regardless of gender. In addition to the increased risk of occupational mismatch, immigrant women are at a cumulative disadvantage in obtaining any employment as they are more likely to find themselves unemployed and out of the labour force compared to immigrant men and non-immigrant women.

For ethnically-visible women, the results indicate a different pattern of cumulative disadvantage. While they are more likely to be unemployed and out of the labour force, they are not at a disadvantage of obtaining matched employment, and are more likely to occupy professional positions in engineering versus unskilled positions when the entire sample is examined. However, when the analysis is restricted to women only, their multiple disadvantages

become more evident. In comparison to women who belong to the ethnic majority, ethnically-visible women are less likely to be employed in engineering, independent of their immigrant status. Moreover, ethnically-visible women are the only group to be at a disadvantage in obtaining managerial positions in engineering. Overall, the results suggest that the disadvantage of ethnically-visible women is more apparent when compared with other women rather than with visible minority men.

There was no significant interaction between the immigrant and visible minority statuses for women. Interactions are robust methodological tools used to examine evidence for intersectionality (Choo & Ferree, 2010; Evans & Erickson, 2019; McCall, 2005; Seaton et al, 2010), so one way to interpret this result is to deny any intersectional disadvantage for women who happen to be both immigrants and ethnically-visible. However, the intersectionality experience can hardly be reduced to the significance of an interaction coefficient. Bowleg (2008) suggests that the lack of significant moderating effects is not necessarily an indication of the lack of an intersectional experience. Rather, the strength of the main effects may overpower the interaction among the variables. McCall (2001) highlights that gender and race stratification systems are neither completely independent nor completely interacting. She indicates that multiple studies that examined differences in wages did not find interactions between gender and race statistically significant. So, one way to understand the lack of moderating effect between ethnic visibility and origin of training for women is to suggest that immigrant and visible minority women are subject to challenges of a different kind. These challenges may intersect to create more barriers but are essentially produced by different forces.

For immigrant women, the following scenario is possible: they struggle to obtain professional employment in engineering following the hardship involved in the process of skills

recognition. Consequently, they may experience an occupational mismatch as they find themselves unemployed, underemployed or occupying technical positions within the field. Once they are successful in completing the accreditation process and obtaining professional employment in engineering, the barrier of skills recognition is removed. For ethnically-visible female engineers, a different scenario is possible. In the case of visible minority women, the disadvantage is related to factors other than the lack of skills recognition. If these negative effects are independent of origin of training, they may be related to the greater visibility of these women as ethnic minorities and the meanings attached to their origin. Ethnic or racial visibility may be interpreted as markers of foreignness regardless of the actual immigrant status of the individual (Guo, 2009). Considering the consistent negative effect of ethnic visibility across all models examined in this analysis, it may be that ethnically-visible female engineers suffer from hidden discriminatory practices since visibility is not a barrier they can remove. These struggles are magnified by their numerical scarcity as tokens within a male-dominated field.

The descriptive analysis of occupation profiles suggests that the most disadvantaged group across all employment outcomes are the ethnically-visible immigrant women, since they have the highest unemployment and underemployment rates and the lowest representation in advanced positions in engineering. In contrast, the most advantageous group is the ethnic majority Canadian-trained men. Despite the limitation that the descriptive profiles do not control for human capital and demographic characteristics, they provide a rough map of the unequal representations of engineers across occupational locations based on their gender, origin of training and ethnic visibility. It is possible that immigrant female engineers who are ethnically-visible may struggle simultaneously with the barriers of skills recognition, lack of experience in the Canadian labour market, poor language skills and their increased visibility of "foreignness"

in addition to being female tokens in a highly male-dominated field. But, if the disadvantaged position of internationally-trained female engineers, both ethnically-visible and not, can be explained by objective factors (e.g., the difficulty in skills transferability, poorer linguistic and communicational skills), the disadvantaged position of ethnically-visible women (who are not immigrants) is likely a consequence of stereotypes and discriminatory practices.

Empirical evidence from both immigration and gender studies highlight the prevalence of stereotypes in hiring processes. Shan (2013), in her institutional ethnography study, revealed that potential employers hold stereotyped assumptions regarding immigrant engineers' abilities. For example, they assume that Asian engineers possess lower levels of assertiveness and have weaker communicational skills. Experimental studies reveal that women scored lower on their competence, commitment and potential to hold managerial jobs (Heilman et al, 1995) especially when they are assumed to be mothers (Correll, Benard, & Paik, 2007). In male-dominated fields where women are tokens, the visibility of women generally exaggerates differences and stereotypical assumptions (Kanter, 1977; Roth, 2004a; 2004b; Yoder, 1991; 2002).

While stereotyping is known as a cognitive tool applied by individuals to reduce complexity in social encounters and processes (Allport, 1954; Fiske & Taylor, 1991; Ridgeway, 1997), few studies focus on the intersection of the stereotypes attached to those holding several identity statuses simultaneously. Specifically, being a woman and a visible minority, regardless of their actual immigration status, magnifies one's visibility and may create "too much" perceived incompatibility in a field that is historically and socially constructed as white men's domain (Miller, 2002; 2004). In a study of undergraduate female students in STEM occupations, one of the participants accounts for this perceived intersectional incompatibility: she describes

that not many women are expected to be in the field of computer science, and black women are not expected at all (Varma, Prasad & Kapur, 2006: 310).

The stereotypes attached to immigrants, ethnic minorities and female tokens in engineering may intersect to form entirely different meanings attached to the combination of these categories. These intersecting images are conceptualized by Crenshaw (1991) in her discussion of representational intersectionality. Specifically, she emphasizes that images attached to "blackness" and "womanness" intersect to create entirely different images from those attached to either Black men or White women. Therefore, the socially constructed stereotypes of Black women cannot be understood by studying social construction of women in general (Kennelly, 1999). This dissertation highlights the complex cumulative disadvantage that the intersecting statuses of being a woman, an immigrant and an ethnically-visible minority produce in affecting occupational outcomes in engineering. This complex disadvantage may be a consequence of the ways negative assumptions attached to female tokens, foreign human capital and ethnic visibility intersect and magnify in a variety of ways.

Nowadays, more women pursue careers in fields that were historically male-dominated and more research and policies are oriented towards maintaining gender equity (Kalev, Dobbin, & Kelly, 2006; Miller, Kerr & Reid, 1999; Turcotte, 2011). These trends suggest an improvement in women's occupational situations overall and may suggest that theories such as tokenism may be no longer relevant. The results of this study highlight that women overall are still at a disadvantage in the male-dominated field of engineering, while currently other factors, such as origin of training and ethnic visibility, further complicate this disadvantage. The findings of this study demonstrate that immigration and visible minority statuses work as both independent and intersecting forces. Ethnic visibility seems to be the factor that has the capacity

to intensify barriers for immigrants and women, but also acts independently from immigration status and gender. It appears that the examination of women in engineering requires an intersectional approach that considers heterogeneity within this group, and the way this heterogeneity may lead to different career outcomes and consequences.

5.3 Conclusions

The results of this study suggest several important conclusions regarding the use of the intersectionality framework in studying immigrant women professionals, immigrant professionals' skills transferability and important methodological considerations in studying occupational match versus mismatch. Focusing on different aspects of occupational attainment, such as general employment, occupational match and advanced employment in engineering, this study shows that internationally-trained women and visible minorities are disadvantaged in their career attainments. The internationally-trained are at increased risk of occupational mismatch, and this disadvantage is intensified for visible minorities and women. Immigrant women are at a increased risk of unemployment, of being out of the labour force and finding themselves in occupational mismatch. Ethnically-visible women are disadvantaged in each aspect of career attainment and are the only group to be at a cumulative disadvantage of obtaining the managerial engineering employment. Overall, the results highlight the complex interplay between these statuses that take both intersectional and independent forms and create different combinations of occupational outcomes for different groups. These findings provide support for several assumptions raised independently in the different bodies of literature focusing on immigrant professionals' integration and on women in male-dominated fields, and which are bridged together under the intersectionality framework. As such, this study contributes to the existing literature in a number of ways.

First, this study joins a small but growing number of quantitative inquiries informed by the intersectionality perspective (e.g., Bauer & Scheim, 2018; Bowleg, 2008; Evans & Erickson, 2019; Harnois & Ifatunji, 2010; Kofi Bright, Malinsky, & Thompson, 2016). It employs intersectionality as a framework to combine the perspectives of immigrants' skills transferability and women's careers in male-dominated fields. Acknowledging the challenge of using intersectionality in a quantitative design, this study examines the moderating effects of the statuses of being internationally-trained, a visible minority and a woman on different aspects of career attainment. The interactions employed in this analysis provided strong evidence for the diversity in occupational outcomes for immigrants and for women, when the intersection of origin of training, gender and ethnic visibility are considered.

Second, this study puts emphasis on the outcomes of immigrant women engineers who remain understudied in the literature concerned with immigrant professionals and in the literature concerned with women in male-dominated fields. The results suggest that the occupational attainment of immigrant women in engineering cannot be fully understood by studying immigrant men and non-immigrant women engineers. Women engineers in Canada appear as a diverse and unique group. Their different trajectories of disadvantage, complicated by the additional factor of ethnic visibility, reveal a complex interplay between these statuses that may take both intersectional and independent forms and create different combinations of occupational outcomes for women engineers when their immigration and visible minority statuses are considered.

Lastly, this study puts forward new methodological considerations. These considerations included (1) the use of "location of training" instead of immigration status to identify internationally-trained engineers who may be subject to the structural barriers of re-accreditation

and (2) the development of a new measure of occupational match versus mismatch that is more sensitive to identifying the ultimate occupational mismatch outcome of working in unskilled positions. Both methodological initiatives proved to be useful. The effect of international training remains significant after controlling for immigrant status and tenure in the country, highlighting that skills transferability is a distinct barrier to professional employment. The use of the new measure of seven occupational categories helped to differentiate between different forms of non-engineering employment, helping to single out the ultimate mismatch of non-professional and unskilled employment in non-engineering occupations.

5.3.1 Limitations

There are several key limitations to this study. First, the quantitative data and analysis pursued in it allow for a documentation of the pattern of disadvantages derived from origin of training, gender and visible minority status, separately and combined. Yet, this analysis is unable to explain *how* the documented inequalities are produced. Although the analysis controls for the measures of human capital and demographic characteristics, other factors may shape the process of career attainment in a variety of ways. Quantitative analysis relies on the ways the social factors and phenomena were measured and quantified and is limited in its ability to capture the complexity of lived experience. The lived experiences of occupational match and mismatch, as well as career advancement, can be diverse and individuals may attach different meanings to these experiences. The cross-sectional nature of the data intensifies this limitation as it is only capable of providing one snapshot of the reality that is flexible, fluid and complex. Finally, the dataset used in this study is from 2006. The employment patterns of immigrants and women in Canada may have undergone substantial transformations over the last thirteen years. It should be noted, however, that the results of a recent study by Boyd and Tian (2018), which used the 2011

Census data to study immigrants in Canadian STEM fields largely correspond to those of the current study.

The second key limitation is related to the ability of the current analysis to reveal the intersectional experience behind the occupational outcomes for immigrant women engineers. The use of intersectionality as a framework in a quantitative study is a challenge. The concept of intersectionality implies a non-additive "intersectional" rather than cumulative (i.e. additive) disadvantage, which is incompatible with the restrictions of a quantitative design. The estimation of the interaction terms allows me to test the existence of the additional cumulative effects of the two categories combined, above and beyond the main effect of each. The significance of this effect provides evidence for the existence of intersectional forces behind the scenes but is unable to unpack the meaning in terms of the lived experience. Moreover, the coefficients indicate an averaged approximation of the cumulative disadvantage, independent of the human capital and demographic characteristics. In day-to-day situations, the experiences of intersectionality may take diverse forms in responding to tiny differences in individual and contextual characteristics.

5.3.2 Directions for Future Research

There are several directions in which future research can contribute to a better understanding of the phenomena of immigrants' occupational attainments, and the intersectional forces related to career attainment. First, the use of exploratory research informed by the intersectionality framework may help to explore the complexity of lived experiences. As such, this can be beneficial in exploring the ways in which this experience may be similar or different for engineers who are women, immigrants, ethnically-visible, or who belong to several of these groups simultaneously. Also, the examination of other occupational fields, such as non male-dominated or non-regulated ones, can help to clarify how the trajectories of disadvantage may

differ according to the particular occupational context. I argue that a comparison of female immigrant engineers to information technology (IT) professionals can sustain an interesting case, since both occupations are highly male-dominated but differ in their degree of regulation (i.e., the IT professionals are not regulated in Canada).

Second, more quantitative studies that employ the intersectionality framework are needed to unpack the moderating effects in a more detailed way. For example, a more nuanced approach to ethnic visibility can be especially beneficial. In this study, ethnic visibility was operationalized by self-identified visible minority status. However, visible minority status contains many diverse identities that may shape the experiences of individuals in ways that are both similar and different. Taking the diversity of this category into consideration may provide a more accurate and nuanced view into the ways in which intersectionality can be manifested. Also, the intersection between international training, sex and ethnic visibility may affect the ways in which other factors shape career attainments. For example, the relationship between the level of education and career outcomes may be different for men and women, immigrants and non-immigrants, and is complicated further by visible minority status. Testing the moderating effects between level of education and identity categories for men and women, immigrants and non immigrants may help to add to a further understanding of multiple, cumulative, disadvantages using the intersectionality framework.

Third, longitudinal designs will benefit future research in a number of ways. They will allow a dynamic investigation of the occupational outcomes of individuals over periods of time throughout their career. Quantitative longitudinal designs may help to document a trajectory of career mobility, while qualitative longitudinal designs may help to explore the way professional careers unfold. For instance, it is unclear why internationally-trained engineers are more likely to

obtain managerial versus professional employment in engineering. Does it suggest that blocked mobility is removed after reaching professional positions? Alternatively, does it indicate an inflation of the managerial titles? A combination of personal accounts and more complex data is needed to unpack this ambiguity. These designs, however, are especially challenging to sustain due to multiple complexities in gathering and analyzing such data.

Fourth, the use of the newly developed measure of seven occupational categories appears to be helpful in differentiating between different forms of non-engineering employment. This measure included non-engineering categories at the managerial, professional and semi-professional levels along with non-engineering unskilled jobs in order to single out the ultimate mismatch of unskilled employment in non-engineering occupations. More research is needed to test the robustness of this measure in other professional settings and to shed more light on the way this detailed approach to occupational match versus mismatch better facilitates assessment of immigrants' occupational integration.

Finally, this study focused on occupational aspects of careers, addressing the following questions: Are engineers able to find any employment? Once employed, do they secure employment commensurate with their skills? Once employed in the engineering field, do they secure advanced positions? At the same time, this study did not examine income, which is another important aspect of occupational integration, corresponding with the following question: Once employed in the field of training, do engineers receive similar or a different earnings, as far as immigration, gender and ethnic visibility are considered? Multiple sources of empirical evidence exist on wage disparities (Wald & Fang, 2008; Pendakur & Pendakur, 2000; Stewart & Dixon, 2010) but most studies usually focus on a single level of comparison (i.e. men vs. women, immigrants vs. non-immigrants). Future research that employs the intersectionality

perspective in studying income disparities could provide another important piece to a better understanding of how economic outcomes may unfold when the diversity of groups and intersection of multiple categories are considered simultaneously.

5.3.3 Policy Implications

The results of this study strongly suggest that the process of skills recognition is key to a better understanding of immigrants' occupational attainment. In the context of Canadian immigration policy that is actively recruiting new immigrants based on their human capital characteristics, immigrant engineers' occupational mismatch is a serious concern that needs to spark discussion around its policy implications. There are three major players involved in the process of skills recognition: migration policy itself, regulatory bodies that are in charge of re-accreditation, and potential employers (Girard & Bauder, 2007; Reitz, 2001; 2005). The three operate within different sets of goals and interests. Migration policy defines and modifies the means through which the human capital of potential Canadians is organized and assessed. The main goal of this policy is to expand competitive human capital and to contribute to Canada's economic situation locally and globally (Shachar, 2006). The goal of the regulatory bodies is to ensure that international human capital is assessed against Canadian standards, and to define what re-accreditation is needed to grant individuals full recognition (Friesen, 2016). The goal of potential employers is to hire the most effective candidate among the ones competing, one who would be an asset to the organization with the lowest risks and lowest investments possible. Since these bureaucratic bodies are grounded within a separate set of goals, more empirical inquiry is needed to provide practical suggestions for the ways in which the collaboration between these bodies needs to improve. For example, future research might combine frontline workers' and immigrants' perspectives of the accreditation process using the ethnographic

approach. Interviews with service providers in charge of immigrants' re-accreditation may help to shed light on the ways in which this process is understood, performed and organized. Interviews with immigrant professionals who engage in the process of re-accreditation may help to shed light on the specific barriers and struggles they face as well as the strategies they develop to overcome them.

In closing, the results of this study highlight the persisting disadvantages faced by women in the field of engineering, which are further intensified for immigrants and visible minorities. It seems too early to assume that women's disadvantages in male-dominated fields have disappeared. Tokenism is still a relevant concept despite women's growing numbers in traditionally male-dominated professionals. However, in the Canadian context, this perspective is not complete since women engineers are a diverse group that includes many immigrants, and many are visible ethnic minorities. Therefore, an intersectional approach is needed to combine the possible directions of disadvantage that these women may face as internationally-trained professionals struggling with skills recognition; as ethnic minorities struggling with visibility, stereotypes and discrimination; and as female tokens in a male-dominated work environment. Overall, the findings of this study help to open a window to better understand the complexity involved in the multidimensional experience of immigrant women engineers in Canada, who may be privileged in terms of their skills but are at a high risk of being penalized for their gender, origin of skills and ethnic visibility, alone and combined.

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APPENDIX 1

The Sample

The selected sample consists of the following training titles: Engineering, general; Aerospace, Aeronautical and Astronautical Engineering; Agricultural/Biological Engineering and Bioengineering; Architectural Engineering; Biomedical/Medical Engineering; Ceramic Sciences and Engineering; Chemical Engineering; Civil Engineering, General; Geotechnical Engineering; Structural Engineering; Transportation and Highway Engineering; Water Resources Engineering; Civil Engineering, Other; Computer Engineering, General; Computer Hardware Engineering; Computer Software Engineering; Computer Engineering, Other; Electrical, Electronics and Communications Engineering; Engineering Mechanics; Engineering Physics; Engineering Science; Environmental/Environmental Health Engineering; Materials Engineering; Mechanical Engineering; Metallurgical Engineering; Mining and Mineral Engineering; Naval Architecture and Marine Engineering; Nuclear Engineering; Ocean Engineering; Petroleum Engineering; Systems Engineering; Textile Sciences and Engineering; Materials Science; Polymer/Plastics Engineering; Construction Engineering; Forest Engineering; Industrial Engineering; Manufacturing Engineering; Operations Research; Surveying Engineering; Geological/Geophysical Engineering; and Engineering, Other.

APPENDIX 2

Labour Force Participation

To model labour force participation, I used the variable (LF71) that refers to"*The historical labour force activity variable [that] classifies persons 15 years of age and over, including institutional residents, in the week (Sunday to Saturday) prior to Census Day (May 16, 2006), as employed, unemployed or not in the labour force according to the labour force activity concepts used in the 1971 Census*." The labour force activity measures have remained fairly consistent since 1971. However, some changes in the questions and how they are processed, as well as some minor conceptual changes, have been introduced throughout the past seven censuses. This derived variable which considers as many of these differences as possible should be used in doing historical tabulations that include 1971 or 1976 Census data. When doing historical tabulations that include 1981 to 2006 Census data, the regular labour force activity variable- LFTag - Labour Market Activities: Labour Force Activity (in Reference Week) can be used.

Another variable to measure labour market participation is COWD-*Labour Market Activities: Class of Worker (Derived).*This variable classifies persons who reported a job in one of the following categories: (a) persons who worked mainly for wages, salaries, commissions, tips, piece-rates, or payments 'in kind' (payments in goods or services rather than money); (b) persons who worked mainly for themselves, with or without paid help, operating a business, farm or professional practice, alone or in partnership; (c) persons who worked without pay in a family business, farm or professional practice owned or operated by a related household member. Note that work without pay in a family business does not include unpaid housework, unpaid childcare, unpaid care to seniors or volunteer work.

To make sure the variable LF71 is robust I cross tabulated the variables LF71 with LFTag**.** The focus is on the category Employed - Unpaid family worker (a part of the general category of "employed"), since the meaning attached to this category could be historically modified. The category 3 in LF71 (Employed - Unpaid family worker) corresponds with the category 2 in LFTag (Employed - Worked in reference week – Civilian). While cross tabulating LF71 with COWD, the category 3 corresponds with the category 1 in COWD (Unpaid family workers - Worked without pay for a relative in a family business or farm). Therefore, it seems that the meaning attached to the category is the same.

APPENDIX 3

Classification of Occupational Groups

The 2006 Census occupation data are classified according to the National Occupational Classification for Statistics 2006 (NOC-S2006). This classification is composed of four levels of aggregation. There are 10 broad occupational categories containing 47 major groups that are further subdivided into 140 minor groups. Major occupational groups are classified by the first two digits of the NOC code, minor groups refer to the classification according to first three digits and unit group is classified by the four digits. At the most detailed level, there are 520 occupation unit groups. Occupation unit groups are formed based on education, training, or skill level required to enter the job, as well as the kind of work performed that is determined by the tasks, duties and responsibilities of the occupation (Census 2006 Codebook).

The NOC code consists of the two major parameters: skill type and skill level. Skill type refers to the actual task performed, and reflects the field of work and training usually required to enter the field. The first digit of the NOC code indicates the skill type, including: (0) Management occupations; (1) Business, Finance and Administration Occupations; (2) Natural and Applied Sciences – the focus of this project. This category contains professional and semi-professional occupations in sciences, including physical and life science, engineering, architecture and information technology; (3) Health Occupations; (4) Occupations in Social Sciences, Education, Government Service and Religion; (5) Occupations in Art, Culture, Recreation and Sport; (6) Sales and Service occupations; (7) Trades, Transport and Equipment Operators and Related occupations; (8) Occupations Unique to Primary Industry; and (9) Occupations Unique to Processing, Manufacturing and Utilities.

Skill level indicates the amount of training typically required to work in the particular occupation. This also reflects the complexity of the tasks performed in comparison to other occupations. Four skill levels are found in the National Occupational Classification that are identified by the letters from A to D. For example, skill level A, represented by the digit 1, refers to the occupations that usually require a University degree. Engineers and other STEM professionals fall under this category. Skill level B, represented by the digit 2, refers to the variety of semi-professional occupations that usually require some sort of post-secondary training, normally less than a University degree. The skill level C requires secondary school and skill level D refers to the occupation that only requires the on-job training. Management occupations are not assigned a skill level category and are represented by the digit 0. According to NOC logic, skills other than a formal level of education may determine the suitability of the person to occupy a managerial position in a given field. These skills include but are not limited to the scope of previous experience, intellectual property and organizational capabilities. Therefore, the level and scope of the skills required for a managerial occupation can be better understood by looking at the first two digits of the NOC code that represent skill level and skill type. This way, 00 refers to senior management occupations and 02 refers to management occupations in the Natural and Applied sciences, and in this study represents managerial engineering and other science-based positions.

APPENDIX 4

Classification of Occupational Match versus Mismatch

To classify minor occupational groups, I relied on the National Occupational Classification (NOC) skill level codes. Occupations with the skill level of 0 were grouped in both Managerial categories, to include (1) Senior Managers and Legislators, and Managers in engineering, architecture science and information systems. I combined these two groups together since they both refer to a very advanced occupational niche in the labour market and can be both considered as the highest occupational location for individuals with engineering training. The second category (2) includes all other Managerial positions. To create a category of Professional Engineering positions (3) I combined the NOC codes of skill type 2 (Natural and Applied Science) and skill level 1 (Occupations that usually require a University degree). To create the category of Other Professional occupations (4), I combined groups with skill level 1 from the different skilled types. Category 5 includes all individuals with skill type 2 (Natural and Applied Science) and skill level of 2 (occupations that usually require college or vocational training). Category 6 includes individuals with the same skill level from different skill types. The last category (7) includes unskilled occupational titles. A more detailed description of the NOC codes that form each of the categories is presented below.

Now, I expand on skill type 2 – Natural and Applied Sciences – and provide a rational for using this category to define the occupational match for individuals with engineering training. In this section I raise and address two major questions: (1) what are the occupations covered under the skill type 2? and (2) why do I consider these occupations to be the closest measure of engineers' occupational match? Relying on the 2-digit level classification, I examined the occupations listed under major group 21 that refers to professional occupations in Natural and

Applied science. The following minor groups summarize the professional positions: 211 Physical Science Professionals; 212 Life Science Professionals; 213 Civil, Mechanical, Electrical and Chemical Engineers; 214 Other Engineers; 215 Architects, Urban Planners and Land Surveyors; 216 Mathematicians, Statisticians and Actuaries; and 217 Computer and Information Systems Professionals. To identify the semi-professional technical positions, I followed the major group 22 that summarized Technical occupations related to Natural and Applied Sciences, including: 221 Technical Occupations in Physical Sciences; 222 Technical Occupations in Life Sciences; 223 Technical Occupations in Civil, Mechanical and Industrial Engineering; 224 Technical Occupations in Electronics and Electrical Engineering; 225 Technical Occupations in Architecture, Drafting, Surveying and Mapping; 226 Other Technical Inspectors and Regulatory Officers; 227 Transportation Officers and Controllers; and 228 Technical occupations in Computer and Information Systems. I decided to use these occupations to measure the occupational match for individuals with engineering training. Specifically, I did not limit engineers' occupational match to engineering positions only such as 213 Civil, Mechanical, Electrical and Chemical Engineers and 214 Other engineers, and followed a similar decision for the semi-professional category. Conceptually, occupational match can be defined as occupying a position commensurate with skill level and content, a kind of position that will adequately match an amount of human capital for which the person cannot be considered over-qualified or under-qualified (Chiswick and Miller, 2009; 2012).

Previously I discussed the complexity involved in the classification of occupational match versus mismatch and the need to single out the managerial, professional and semi-professional positions that are not related to engineering but represent a variety of knowledge-based occupations. These occupations cannot be seen as an ultimate mismatch as

underemployment is, but neither can they be seen as an occupational match. For example, an engineer who works as a professional psychologist is working in an occupation substantially different from his/her engineering skill set, but they still occupy a skilled position that requires a University degree in that field. Now, what if a person with engineering training occupies a science-based position, such as Chemist or Architect, which is not considered a purely engineering occupation in NOC. This scenario is different from the previous one since these occupations are grouped under the same code in NOC and represent a set of positions found within similar fields, which require more similar education and training than the one of the engineer and psychologist. Engineers obtaining a position within the general field of the Natural and Applied Sciences is a qualitatively different experience from obtaining a position within a substantially different field, or totally unskilled position. Singling out another form of non-engineering professional employment could complicate the operationalization of the term much further, to the extent of becoming inefficient. Qualitative research that focuses on the perceptions of engineers to occupational match versus mismatch could shed more light on the better way to operationalize the concept. Inexistence of such empirical evidence means that the aggregations used in NOC are the best available indicators to rely on in operationalizing occupational matches for engineers. Following this logic, I treat any professional position obtained within the Natural and Applied Sciences fields as a potential occupational match for individuals with engineering training.

APPENDIX 5

Control Variables' Descriptive Statistics

Table 12: Percentages, Means and Standard Deviations for the Control Variables

Control Variables	Percentage Total (N=110,505)
The Level of Education	
Lower than Bachelor's degree	19%
Bachelor's degree	61%
Master's degree	17%
Doctoral degree	3%
Number of Children	
0 and not applicable	41%
1	23%
2	26%
3	8%
4	2%
5 or more children	1%
Immigration status and tenure	
Non-Permanent residents	2%
Landed Immigrants less than 5 years in Canada	19%
Landed Immigrants 6-15 years in Canada	21%
Landed Immigrants 15 and more years in Canada	18%
Non-Immigrants	40%
Mother Tongue	
English or French	47.4%
Neither English nor French	52.6%
	Mean (STD)
Age	42.4 (0.03)
Age at Migration	18.4 (0.06)
Number of Children	1.1 (0.004)