Immigrant Gaps in job quality: Canadian immigrant women's resilience to automation *

Running title: Immigrant Gaps in Job Quality

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Abstract

Gaps in job quality between immigrant and domestic-born workers do not only concern pay but extend to other attributes. We consider r*esilience to technological change* as a measure of job quality and analyze job tasks most likely to describe a non-automatable job. We quantify the economic value of closing initial gaps in non-routine cognitive job tasks for university educated women as equivalent to a four to nine percent increase in their hourly wage. However, although immigrant resilience improves with time in Canada, most of the gains occur through routine cognitive tasks, generally believed to be subject to higher automation risk.

Key words: Immigrant women, job quality, job resilience, automation risk, non-routine cognitive tasks

1. Introduction

Immigrant women are known to have significantly worse labour market outcomes in host countries than similar native-born women, particularly during the initial years of settlement. While it is true that this group has experienced considerable gains in employment over the past fifteen years, these gains have been less significant than those of men. Married immigrant women are particularly prone to adverse labour market outcomes, given challenges and barriers to employment that exist for this group. Further, little is known, beyond employment and wages, about the quality of the jobs held by these women. We focus on an important aspect of job quality related to resilience to innovation and measured by job tasks less likely to be automated and look at differences in these attributes between Canadian and foreign-born women using the Labour Force Survey (LFS) and the O*NET data base.

The number of newcomers to Canada has been steadily increasing since 1981, from under four million, to eight million in 2021 and a projected ten million by 2026, of which approximately half are women.[1] Since the early 2000s, when employment statistics for immigrant women can be obtained consistently, employment levels of Canadian-born women have improved by 6 percentual points and those of recent immigrants (those arrived within ten years) also improved significantly (15 percentual points). The employment level of settled immigrant women (arrived more than ten years ago), on the other hand, has deteriorated relative to Canadian-born women since 2006. Regardless of these changes the relative employment of immigrant women remains below that of the Canadian born. This is in sharp contrast with that of immigrant men whose employment levels are very close to those of the Canadian born, even surpassing these in some instances (Figure 1).

Similarly, the average wage of immigrant women has deteriorated relative to Canadian-born women, which increased by 19% between 2006 and 2022 while that of immigrant women increased only by 15%. The earnings of men, which are larger than those of women, increased similarly for the Canadian born (13%) and the immigrants (14%). (Table A.1)

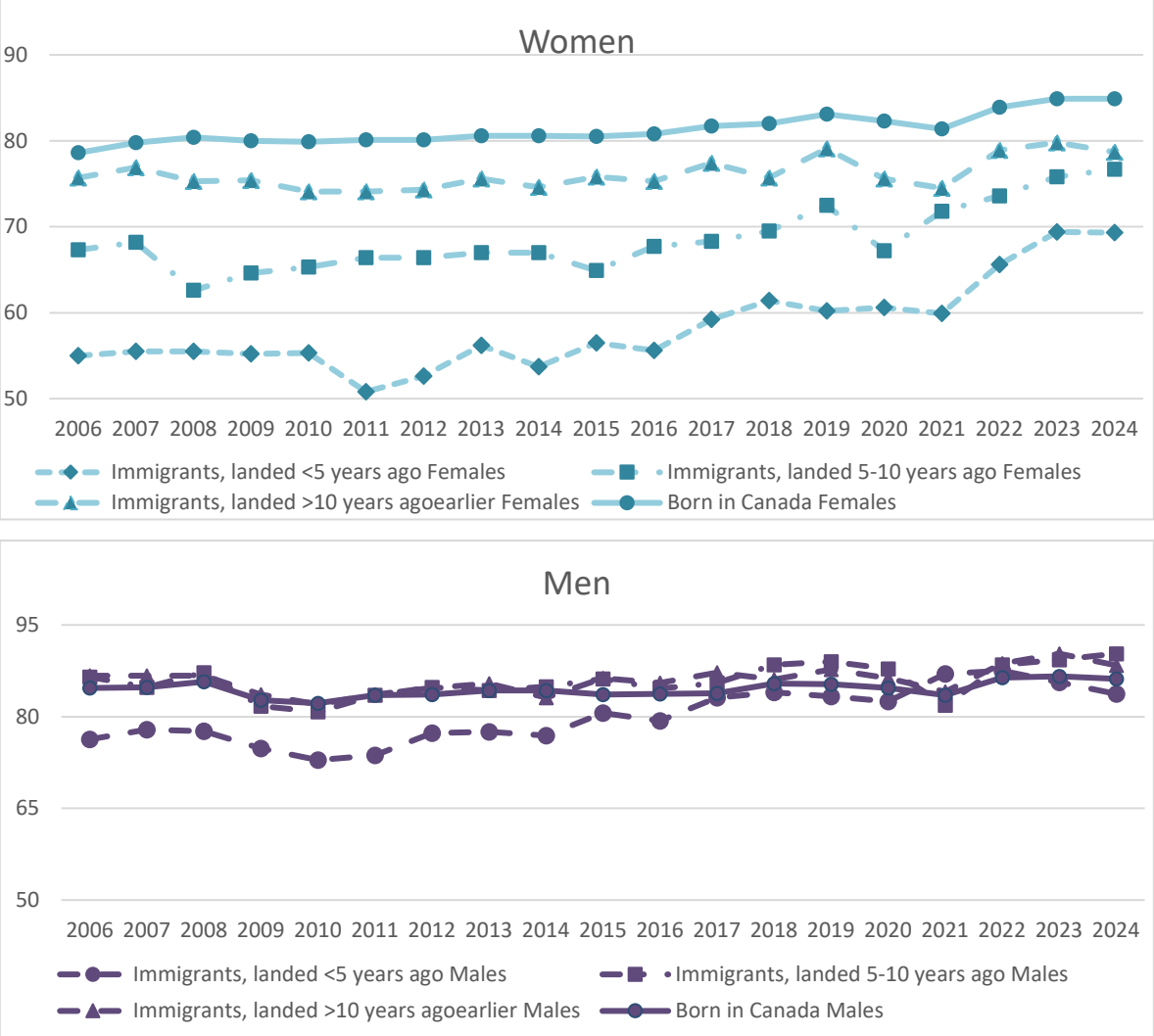
The immigration literature often focuses primarily on labour outcomes of immigrant men (and perfunctorily on those of women), with only limited attention paid to the unique barriers to participation faced by married women (Adserà and Ferrer, 2014 and 2016; Ng and Gagnon 2020). In Canada, recent research documents that historic gender gaps in employment and wages were improving for women in general (relative to men), and specifically for immigrant women (relative to Canadian-born women), during the years before the Pandemic (TRIEC, 2018). These gains were somewhat lost during the COVID19 years, which hit immigrant

[1] The Daily —https://www150.statcan.gc.ca/n1/daily-quotidien/221026/dq221026a-eng.htm)

women the hardest. The recovery, however, has been swift. Since then, progress in terms of participation has been unprecedented for women in Canada (LMCI Reports, March 2022; Crossman et al., 2021).

To us, the recovery prompts two further lines of inquiry: (1) Have recent gains in the labour market reached all women alike, specifically have they reached immigrant women? (2) What other dimensions could contribute to our understanding to job quality?

Figure 1. Employment Rate by immigrant status (Age 25-54).



Source: Authors calculations using Statistics Canada. Table 14-10-0086-01.

1.2 A brief discussion of job quality

In general, there has been little research about whether the jobs immigrants hold are (or were in the past) "good" or "bad". Job quality, broadly defined, was initially used in immigration economics to interpret the differences in substitutability between immigrant and native-born workers, a matter that remains at the hart of most academic debates over immigration. Seminal papers by Hamermesh (1998) or Olsen et al. (2010), argued that since immigrants have different preferences over the non-pecuniary aspects of a job (or "quality") - either because of different cultural preferences or by having different budget constraints - they are willing to take jobs the domestic born do not, which makes them "complement" rather than "substitute" labour to the locals.

Empirically, job quality has received considerable attention, specially in the context of Europe where numerous studies explore trends, causes and implications of differences in job quality across countries.[2] However, despite the appeal of investigating differences in job quality, it remains a scarcely researched area in economics, due to obvious difficulties in defining and measuring job quality (Clark, 2005). The main challenge is the multidimensionality of *quality.* To facilitate unified studies, the European Union developed a framework with seven features to characterize job quality: (1) Income and benefits; (2) Prospects; (3) Work intensity; (4) Working-time quality; (5) Skills and discretion; (6) Social environment; and (7) Physical health risks (Eurofound, 2016). It is difficult however to find survey data consistently covering all these aspects of jobs in large surveys.[3] It is also difficult to measure these dimensions in a consistent manner. While some measures are objective (income and benefits, skills and physical health risks), some (prospects or discretion) require workers to include a subjective perception of how the jobs align with various goals. Further, some dimensions that have objective measures (part-time) require a subjective assessment, as it could be interpreted either as high or low quality depending on the workers' conditions.[4] Objective measures, such as type of contract, hours of work, working schedules, coverage by collective bargain, etc.…are commonly found in recurrent official surveys gathering labour market information, such as country specific Labour Force Surveys (LFS). Other surveys allow to focus on dimensions of job quality often involving subjective assessment of working conditions (satisfaction).

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[2] See the special issue of the ILR Review - Volume 66, Number 4, Jul 01, 2013 - SAGE Journals and *The Oxford Handbook of Job Quality* (2022)

[3] In Canada Chen and Mehdi (2019), track job quality across six dimensions contained in the European Union framework (Eurofound, 2016) using the 2016 Canadian General Social Survey (GSS).

[4] Jones et al. (2023) explore this case when examining the association between job quality and parenthood

Specifically for the case of immigrant workers, Armenta and Gleeson (2022) highlight some of the most relevant job quality issues in the US. However, issues surrounding job quality of immigrant jobs is heavily dependent on the institutional set up of the host country. In Canada, Lamb and Banerjee (2024) examine the overrepresentation of Canadian immigrants in poor-quality employment using objective and subjective indicators of job quality drawn from the Canadian LFS and the GSS. They also show that although immigrants fare worse in objective measures of job quality, they do not see themselves as performing poor quality jobs. [5]

We contribute to the understanding of job quality by considering what we believe to be a dimension of highly current relevance. We examine whether jobs are resilient to recent trends in automation and Artificial Intelligence (AI) technologies predicted to change the landscape of work over the near future (Acemoglu and Restrepo, 2019). Empirical research investigating the likely impact of technology on employment was pioneered by Autor et al. (2003) who used the O*NET data base on job tasks to link changes in the use of routine and non-routine skills in the workplace to technological change over the previous decades. Nowadays, there exists a substantial literature examining the risks of automation on jobs, estimated in the range of 9% to 42%, with later studies converging towards estimates around 20% (Wyonch, 2020). [6] While some of these studies assess whether women or immigrants might be a higher risk of automation (Frenette and Frank, 2020; Oschinsky and Wyonch, 2017), none assesses the intersectionality of immigration and gender. From this literature we borrow the set of job tasks more likely to describe a non-automatable job (Acemoglu and Autor (2011), Frenette and Frank, 2020) and use these to measure an important dimension of job quality, which we call *resilience* for lack of a better word for "hard to replace by technology". The tasks identified with low risk of automation are non-routine cognitive analytical tasks, such as *analyzing data or information, thinking creatively, interpreting the meaning of information for others, and autonomy*; non-routine cognitive interpersonal tasks, such as *establishing and maintaining interpersonal relationships; guiding, directing and motivating subordinates; and coaching and developing others*; and non-routine manual/physical tasks, such as (*operating vehicles, mechanized devices or equipment; time spent using hands to handle, control or feed objects, tools or controls; spatial orientation; and manual dexterity*). On the other hand, routine cognitive tasks (*repeating the same tasks, being exact or accurate*) and routine manual/physical tasks (*pace determined by speed of equipment, controlling machines and processes, and time spent making repetitive motions*)

[5] Similarly to what was found by Zavodny (2015) in the US and by Diaz-Serrano (2013) in Spain.

[6] See Frey and Osborne (2013) for the US, Arntz, Gregory and Zierahn (2016) for the OECD and Oschinsky and Wyonch (2017) for Canada.

are considered to signal for easy to automate jobs, which we considered 'bad" quality jobs for the purposes of this work.

The multidimensionality of quality sometimes prompts researchers to construct quality indexes that better summarize the concept of job quality (Garcia-Serrano and Hernanz, 2023). In Canada, Tal (2013) created the ICBC job quality index summarizing the contributions of wages, part-time work and self employment to an objective measure of job quality. However, in other cases, individual measurement of each dimension of job quality is analyzed (Chen and Mehdi, 2019; Banerjee and Lamb, 2024; Frenette and Frank, 2020). This provides more detailed results, which seems indicated when exploring the fast-changing environment regarding resilience to automation. We follow this later approach and employ linear regressions or probit models to estimate the differences in individual attributes related to job quality between immigrants and Canadian-born men and women. Changes in the distribution of these attributes across domestic and foreign-born workers over time will contribute to answer questions regarding the breadth of labour market progress for immigrant women.

Our main contribution to the literature on job quality lies in providing estimates of how immigrant women might lag behind Canadian-born women in important job attributes related with the resilience (to automation) of their jobs. Further, we assess whether initial differences diminish or magnify over time spent in Canada. Within the literature of automation, we highlight the intersectionality of gender and immigration status in those attributes that define hard-to-automate jobs.

Our estimates of the assimilation of immigrant women in terms of job quality do not account for changes in the immigrant cohort composition over time. To the extent that Canadian-born and immigrant women move in and out of employment at different rates, our estimates might suffer from selection bias. We are unable to address the endogeneity of employment decisions for lack of adequate instruments. While bias from this problem is less important when comparing groups of women than when comparing men and women, we note that our interpretation of the estimates implicitly assumes that immigrant and Canadian-born women face similar probabilities of participating in the labour market. Descriptive work suggests that movements in and out of the labour force, particularly those out of employment, are on average different between immigrants and Canadian-born workers (Ferrer et al., 2023). The caveat is common in the empirical literature of immigration, where it is difficult to produce casual estimates and, in that regard, our results are comparable to others.

Our results indicate that only cognitive job attributes conform to desirable job characteristics for immigrant women. Newcomer women are less likely than the Canadian

born to work in good quality jobs, as defined by attributes associated with resilience to automation. Immigrant women also experience significant improvements along these dimensions over time spent in Canada. However, these gains are concentrated in routine tasks, considered to be more susceptible to automation in the near future. We quantify the economic value of closing initial gaps in *good attributes* for university educated women as equivalent to a four to nine percent increase in their hourly wage.

The following section explains our framework for interpretation and the data we use. Next, we discuss the results, and the last section concludes.

2. Methodology and Data

2.1. Framework of interpretation

To interpret estimates of the gaps in job attributes (at arrival and in subsequent years) between immigrant and Canadian-born women, we use the standard human capital theory applied to immigration, while recognizing that other factors such as cultural norms or discrimination might affect these patterns. When applied to immigration, the human capital model predicts that upon entry, immigrants experience a depreciation of the human capital specific to their previous labour market experience in their country of origin. This includes skills such as language fluency, knowledge of institutions and existence of established networks. Part of the economic assimilation process consists in acquiring these forms of country-specific human capital in the host country.[7]

As noted above, empirical economic research documents this process: immigrants experience worse labour market outcomes for immigrants than the native born upon arrival, but this is followed by a process of "catching-up" during the first ten years after migration. Whether complete parity to domestic levels is ever achieved is a matter of much controversy.[8] Moreover, subsequent work points towards substantial heterogeneity in this economic assimilation process across immigrants. See the work of Clark and Lindley (2009) for the UK; and Clarke et. al. (2019) for a comparison between Canada, Australia and the US.

The reasons behind the existence of these differences in labour market outcomes between immigrants and the Canadian born are numerous. Here we will only summarize the most common explanations, with an emphasis on those that specifically affect women immigrants.

(1) Low earnings of immigrants arriving to Canada have been linked to shifts in the most common source countries of immigrants, from Europe to Asia and the Middle East,

[7] See seminal papers by Borjas (1985); Duleep and Regets (1999).

[8] See among many others, Crossman et al. (2021), Donahue (2021); Hou (2024)

even though immigration policy has tended to favour more educated and skilled workers to facilitate their economic integration (Ferrer, Picott, and Riddell 2014). Empirical evidence shows that labour market assimilation can be difficult even for these highly skilled immigrants. Differences are attributed to lower levels of socio-economic affinity between Canada and the new source countries (Picot and Sweetman, 2004), increasing linguistic distance (Adsera and Ferrer, 2021) or difficulty with credential recognition (Banerjee et al., 2021). The field of Health, for instance is particularly prone to difficulties with credential recognition, which particularly affects immigrant women (Turcotte and Savage, 2020).[9]

(2) Even among those with strong language proficiency and credentials, the ability of highly skilled professionals to pursue reskilling, such as technical training necessary to enter the workforce, can be inhibited by the cost and length of the reskilling process. This aspect mostly affects immigrant women if they are mothers who need access to childcare. Although access to childcare is a common challenge for women more generally, immigrant women are most significantly affected because of reduced social and family support, particularly during the initial years in the country. In addition, cultural norms regarding gender roles deeply affect household bargaining regarding the balance between household and market activities for immigrant women to a larger extent than for the Canadian born. This often results in limited roles for immigrant women to engage in the labor market.

(3) One potential factor affecting the gaps for women is the fact that they are more likely to arrive in Canada as tied immigrants, which imposes additional restrictions on their ability to enter the labour marked. Even if the number of immigrant women entering Canada as principal applicants has increased over the years, entering as a spouse or dependent of a principal applicant is still the main category for women.[10] For women arriving as spouses, Bonikowska and Hou (2017) show how those married to spouses entering as economic immigrants tend to perform better than those entering within the family class. The heterogeneity in these outcomes likely comes from the fact that even though the educational attainment of spouses is likely to match that of their

[9] The fraction of nurse aides, care aides, or personal support care workers, with a bachelor's degree is 25% versus 5% among non-immigrants (Turcotte and Savage, 2020).

[10] In 2020 44% (37%) of immigrants admitted through Federal (Provincial) programs as principal applicants identified as female, up from 20% in 2013. However, 2020 was an exceptional year in terms of immigrants admitted due to the Pandemic, so caution should be exercised in inferring trends (Statistics Canada, https://www.canada.ca/en/immigration-refugees-citizenship/corporate/publications-manuals/departmental-performance-reports/2021/gender-based-analysis-plus.html) .

partners (and principal applicants) through assortative matching, other characteristics such as experience, language fluidity, or the ability to move may not, which renders dependents less "labour market ready" than principal applicants (Sweetman and Warman, 2010). Banerjee and Phan (2014) specifically look into the occupational integration of dependent immigrants and find that *professional* immigrant women face significantly worse labour prospects than nonprofessional immigrant women, regardless of their background.

(4) There is further evidence both from labour market data and from reports from racialized immigrant women themselves of the impact of racial and gender discrimination on their labour market outcomes. Even when immigrant women are fluent in English and/or French, they describe discrimination for having accents or for how they speak these languages in their search for work (Ferrer and Dhatt, 2024). The social experiment conducted by Oreopoulos (2011), where fake resumes of similarly qualified, but ethnically differentiated individuals were sent to job adds in Toronto, offers some evidence of discrimination in employment. The study found that applicants with English-sounding names (versus foreign-sounding names) were much more likely than others to receive a call from prospective employers.

Based on previous literature examining differences in labour market outcomes between immigrant and native-born women, and the literature connecting job tasks and the risk of automation (Frenette and Frank, 2020) we propose the following working hypothesis regarding whether job attributes of jobs held by immigrant women are expected to converge to those of jobs of native-born women in their first ten years in the destination country.

> H1. Immigrant women's lack of local human capital will result in negative initial gaps in attributes signaling "good jobs" (i.e. immigrants will have jobs showing less of these attributes than the Canadian born), such as high levels of non-routine job tasks. Alternatively, we expect smaller and possibly positive gaps in attributes that signal "bad jobs" (i.e. immigrants will have more of these attributes than the Canadian born), such as high levels of routine tasks, which may require less local human capital.
>
> H2. Through the acquisition of local human capital, we expect these differences to decrease over time.

2.2. The Labour Force Survey and the O*NET

For this analysis we use the confidential microdata from the Canadian Labour Force Survey (LFS), for the years 2006 to 2022. The LFS is a large-scale monthly survey used by Statistics Canada to ensure accurate estimates of unemployment in various regions across the country.

All members of the households in the LFS are followed for six months of the year and asked to provide basic demographic information and details of their labour force activity. The confidential files are made available by Statistics Canada through the Canadian Research Data Centers Network. These confidential files have the additional advantage of providing representative samples of the population that better inform our forecasts.

Each month there is a new rotation group entering the survey that is followed for 6 months, hence pooling all cross-sectional data together potentially introduces bias in the estimates. While clustering techniques could be employed to correct for it, we adopted the cleaner strategy of selecting respondents in the first month of their rotation for the analysis (and checked the robustness of our estimates to alternative months).

Starting in 2006, the LFS reports immigrant status (permanent or temporary residents), year and age of arrival. We further focus on women aged 25-59 (to circumvent complications regarding school and retirement choices), excluding temporary residents as we cannot differentiate those who are and are not on a path to permanent residency. We also focus women who are married or living common law at the time of the survey, given the significance that marital status typically has in determining the labour market outcomes of immigrant women. Unfortunately, the LFS does not include visa information (identifying the reason for migration) or visible minority status, and only limited information about immigrants' country of origin, which restricts our ability to obtain detailed estimates for racialized women.

The LFS reports on many labour outcomes, including hourly wages, hours of work, type of contract (permanent, contract work, other casual work) and full-time work, and define involuntary part-time work as "working part time for economic reasons".[11] Overall, these variables measure in large part the extent of compensation and job security, an important determinant of job quality, speaking to features (1) and (3) developed by Eurofound (2016). We also have information on the workers National Occupation Classification (NOC). From this classification we define an indicator for managerial occupations. We further use the NOC to match information on tasks used in the job coming from the O*NET. O*NET attributes could be used to measure the extent to which jobs have qualities such as those contemplated in the rest of the features developed in the Eurofound (2016). However, our focus here is on choosing attributes that will measure job resilience to automation as informed by the literature on the effect of automation in the labour market.

[11] Specifically, it excludes working part time due to illness, caring for family members, going to school or personal preference.

The O*NET provides detailed information about the tasks required to perform each job for the 700 different Standard Occupational Categories (SOC) coded by the US government. Economics has long made use of this information to measure the impact of technological change on work. Early studies investigated the precarity of jobs in view of technological change. Recently, the literature has moved to consider a more modern approach that focuses on task replacement, rather than job replacement, to account for the more commonly accepted possibility that technology will change the tasks needed in jobs rather than disposing with the job altogether (Acemoglu and Restrepo, 2019). The number of tasks surveyed by the O*NET and the highly systematic measurement process, provides us with a plausible way of measuring a dimension of job quality related to the probability of replacement by technology (Frenette and Frank, 2020).

We match data from sixteen tasks reported in the O*NET 2006, 2011 2016 and 2022 for SOC coded occupations with LFS occupations in the corresponding years. Mapping the O*NET characteristics, based on the SOC system used by the US, to the NOC system used by Statistics Canada is done through a series of cross walks and mapping exercises following changes in the O*NET taxonomy over time. See details in Appendix B.

Numerous studies use the O*NET combined with labour force survey data in Western economies. In Canada, Imai et al (2019) use the O*NET information to construct indexes for analytical and social skills to be merged with the Longitudinal Survey of Immigrants, and Adsera and Ferrer (2016) merge similar information with the Canadian Census of Population to look at social and analytical skills of immigrants. In Europe, Adsera et al. (2023) and D'Amuri, and Peri (2014) use the O*NET to construct other tasks skill indexes to merge with the occupations in the Economic Union Labour Force Survey (EU-LFS), Ortega and Polavieja (2012) construct indexes for manual and communication skills and merge these with the European Social Survey, and Amuedo-Dorantes and De la Rica (2011) merge the O*NET with Spanish Labour Force Survey data. The implicit assumption in all this work is that the task content of occupations in the US and Canada and other European countries is similar in relation to the skill dimensions being measured. This seems to be the case across all European countries, including CEE countries (see Hardy et al., 2018; Cedefop, 2013; Handle, 2012).

The O*NET contains information job characteristics encompassing 277 descriptors. Researchers often use Principal Component Analysis (PCA), a common statistical technique to reduce dimensionality while preserving as much of the occupational data variation as possible. We prefer to examine each of the O*NET tasks associated with different degrees of resilience to automation independently, rather than using a composite measure, to nest our results within those in Frank et al (2021) study of the changing nature of work in Canada. Given the rapid pace of technological change, the relevant tasks to be included in composite

indexes may change over long periods of time, making hard to interpret the indexes. Our strategy allows for a more granular analysis of the changes in tasks that could be masked if using aggregate task indexes. The tasks were selected to represent the five distinct task groups that the literature has identified: non-routine cognitive analytical, nonroutine cognitive interpersonal, routine cognitive, routine manual, and non-routine manual (Autor and Handel 2003). These major groups align well with the *a priori* expectation of being affected by automation, with non-routine tasks being harder to automate and routine tasks being easier. They also distinguish tasks that have *traditionally* being associated with women's jobs, such as non-routine interpersonal skills, and that might be considered harder to be the domain of immigrants, particularly those for whom English is a second language.

The actual tasks in each of the five groups are displayed in Box B.1. Most work tasks are measured on an importance scale ranging from 1 (not important) to 5 (extremely important), except for three tasks measuring the frequency that the task requires: s*tructured versus unstructured work*; *time spent making repetitive motions; and time spent using hands to handle, control or feed objects, tools, or controls.* The first one measures the extent to which a job is structured for the worker versus allowing the worker to determine their tasks, priorities and goals and is based on a scale of 1 (no freedom) to 5 (a lot of freedom) that represents a worker's degree of autonomy in their job. Because of the way it is recorded we

BOX B.1. THE O*NET TASKS

1. **Non-routine cognitive analytical tasks**: analyzing data or information, thinking creatively, interpreting the meaning of information for others, and autonomy
2. **Non-routine cognitive interpersonal tasks**: establishing and maintaining interpersonal relationships; guiding, directing and motivating subordinates; and coaching and developing others
3. **Routine cognitive tasks**: repeating the same tasks, being exact or accurate.
4. **Routine manual/physical tasks:** pace determined by speed of equipment, controlling machines and processes, and time spent making repetitive motions
5. **Non-routine manual/physical tasks:** operating vehicles, mechanized devices or equipment; time spent using hands to handle, control or feed objects, tools or controls; spatial orientation; and manual dexterity.

relabelled this task "*autonomy*" and consider it a non-routine task. [12] The latter two tasks are based on a frequency scale ranging from 1 (never) to 5 (continually or almost continually). (https://www.onetcenter.org/content.html).

3.2. Empirical Approach

To estimate the job assimilation process of immigrants into the labour market, we use a linear regressions specification to analyze differences in the level of tasks required for women's jobs for the years 2006 through 2022.

$$Y_{it} = X_{it}\,\beta_1 + \sum_I^4 \beta_I \;\; Coh_I \; + \sum_k^4 \beta_k \;\; ysm_k \; + \tau + m + Prov + \epsilon_{it} \qquad (1)$$

where the dependent variable (Y_{it}) is the measure of the tasks in women *i* 's job, observed at time *t.* The vector X_{it} contains standard demographic characteristics that are important in determining labour market outcomes of women. It includes a constant, age and age squared (to address life-cycle effects), education and presence of young children (to account for distinct productivity and opportunity costs of employment) and the prime-age male unemployment rate in the economic region to control for the business cycle as well as institutional features of the Employment Insurance (EI) system that might affect the probability to work.[13] Equation (1) also includes province fixed effects (*prov*) to control for geographical differences and time fixed effects accounting for time trends and seasonal effects - a series of indicators for survey's month and year - included in (τ) and (m). ϵ_{it} represents the error term. The Canadian born are the omitted category.

The independent variables of interest are ysm_k, denoting *k* indicators, one for each 5-year period of years since arriving in Canada, (0 to 5; 6 to 10; 11 to 15; 16 to 20). The coefficients β_k capture the effect of assimilation in job quality for immigrants, with k=1 denoting the effect of newcomers, and k=4 the effect of having been in Canada between 16 and 20 years. Note that this specification estimates assimilation profiles as a spline (or step) function, rather than forcing a quadratic profile for job quality assimilation, which would overestimate the assimilation rate of recent arrival cohorts.

Estimating the labour market assimilation of immigrants in the host country requires disentangling the economic progress of a given cohort with time in the country from entry

[12] Occupations with the lowest levels of *Autonomy* are Casino workers, Oil and Gas Drilling labourers, Railway and transport labourers, whereas those with the highest levels are Managers in Health Care, Chiropractors, Financial and Investment Analysts, Conference and Event Planners, Hairstylist and Barbers

[13] It is important to remove from labour outcomes confounding effects that have to do with the extent of economic activity. The standard measure of the business cycle is the prime-age male unemployment rate, which isolates the effect of mainstream economic activity.

effects intrinsic to the composition of immigrants arriving any given year, which changes depending on the international political and economic landscape at the time of migration and the host country's immigration policies. Having multiple cross sections allows to identify the average progress of an immigrant cohort distinctly from their entry effects. To address the impact of push/pull factors for immigration we introduce in the vector Coh indicators for four arrival cohorts: those arriving between 2001 and 2006, those arriving during the global financial crisis, between 2007 and 2013, those arriving during the economic bonanza of 2014 to 2019, and those arriving during and shortly after the Pandemic (2020 to 2022), relative to immigrants arriving before 2001.

Although our focus is on women, we conduct separate analysis using a similar sample of immigrant men to provide a comparison between assimilation patterns of immigrant men and women relative to their respective Canadian-born counterparts. We show the descriptives statistics for men to provide context, but we do not report regression results for this group. These can be made available upon request.

As mentioned above, we are aware that our estimates might be biased as we are unable to account for unobserved worker heterogeneity, which will require panel data. This is a common concern in the economics literature in immigration, and it has no obvious solution with current available data. However, in this regard we report that our estimates are similar to others in the literature.

2.4. LFS descriptive statistics

We report average values of our main dependent variables at the beginning and end of the period in Tables A1 and A2 in the appendix.[14] [15] Table A.1. covers O*NET measures of different routine tasks required by the jobs held and table A.2. covers O*NET measures of non-routine tasks. In the first three rows, the tables provide the weighted mean difference in each measure for each group at the beginning and end of our sample relative to that of the Canadian born in 2006. In rows 4 and 5, they display the Immigrant – Canadian-born gap for each measure each year. The first panel in each of these tables displays data for women and the second panel reports similar figures for men.

We look at the difference in average level of tasks – as collected by the O*NET - required in jobs performed by men and women over the period. The positive figures in the first and

[14] Trends in dependent variables have been substantially stable over the years and the averages in 2006 and 2022 are representative of slow-moving trends over the full period

[15] For additional context provided by standard quality measures found in the LFS (wages employment, managerial activity, type of contract, full time and part time for economic reason) see Ferrer and Dhatt (2024)

third row of Table A.2 show that jobs in 2022 require more of some routine tasks such as *being exact*, *conduct repetitive tasks*, *control machinery*, and *perform repeated motions*, than jobs in 2006 did. Jobs held by immigrant women increased these required tasks in 2022 by more than those held by the Canadian born, which resulted in positive Immigrant – Canadian-born gaps for these tasks in 2022. That is, for instance, in 2006 immigrants were required to perform less tasks that required being exact that the Canadian born (by 0.07 units) but in 2022 they were required to perform more of these tasks (by 0.02 units). Pacing the job to the speed of equipment is a requirement that has declined for all women.

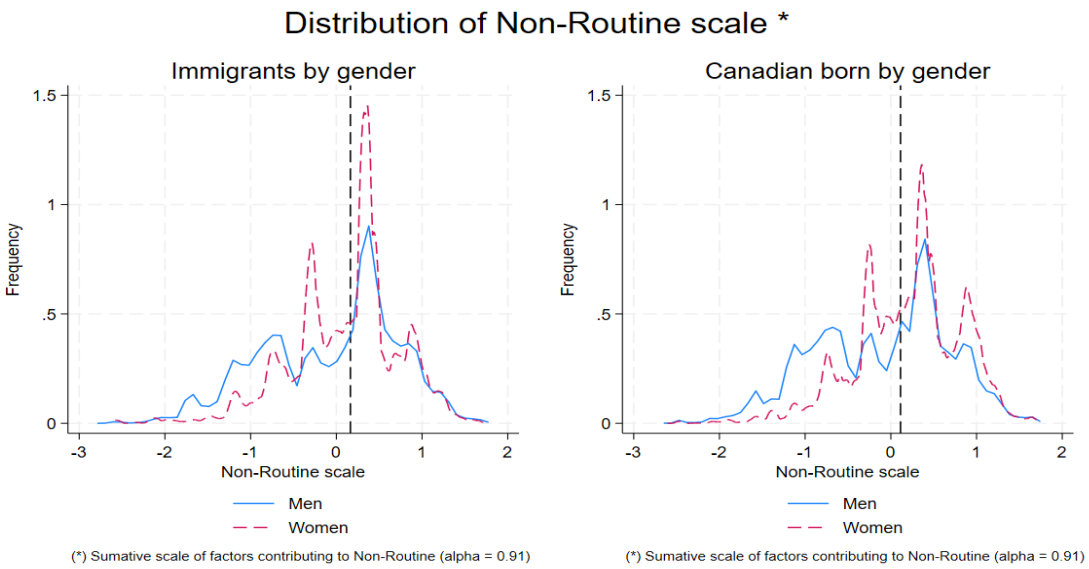
The extent to which jobs in 2022 show high degrees of *autonomy* (allowing the worker to determine their tasks) has declined for Canadian-born women, but even more so for immigrant women. Recall that this is considered a negative feature as the index ranges from 0 (no freedom) to 5 (lots of freedom). Therefore, a decline in the measure indicates a more mechanic and structured job, hence easy to automate. In this regard, immigrant women seem to have lost terrain as the gap in 2022 was larger than that in 2006. This is also the case for men, although to a lesser extent.

The corresponding changes for men in other characteristics were less dramatic. The biggest differences can be observed in routine physical measures, especially the task of *control machinery* and *pace determined by the speed of equipment*, which declined for immigrant men but increased for Canadian-born men.

It is worth noting that women's jobs are generally associated to higher amounts of non-routine cognitive tasks, the centerpiece of "good" jobs in this analysis. This is obvious for the Canadian born looking at averages in Table A.2. but less so for immigrants. To provide a better sense of differences in these tasks by gender, we show in Figure 2 the distribution of a "Non-routine cognitive index" by gender, for both immigrant and Canadian-born workers.[16] The figure shows how men are more concentrated at lower levels of the scale (relative to women) both among Canadian-born and immigrant workers.

[16] We estimate Cronbach's alpha of the non-routine, cognitive tasks by gender and immigration status. Cronbach's alpha quantifies the level of agreement of a set of survey items on a standardized 0 to 1 scale. Higher values indicate higher agreement between items.

Figure 2. Non-routine Scale, by gender



Source: Authors' calculations using the LFS 2006, 2011, 2016 and 2022

For non-routine tasks (Table A.2), immigrants typically held jobs with lower requirements for cognitive tasks (see the negative gaps in rows 4 and 5 of both panels). However, these gaps have declined over the years. For instance, the immigrant – Canadian-born gap in *inter-personal* and in *coaching others* tasks has declined by around 40% over the past fifteen years. Regarding physical non-routine tasks, immigrant women typically held jobs with higher (or similar) requirements than the native born in 2006. By 2022, these gaps have declined by as much as 40 percent (*manual dexterity, handling equipment*). This may show the effects of the most recent wave of automation affecting jobs that were thought difficult to automate 15 years ago (Oschinsky and Wyonch, 2017) but may not be so now.

There have been little changes in the non-routine gaps between immigrant and Canadian-born men over the duration of the sample.

2. Results

Here, we report findings regarding the job assimilation of immigrant women in Canada. Our focus is on the job quality of the jobs as measured by job tasks associated to resilience to innovation.

3.1. The Immigrant gap

We start by performing a series of Oaxaca-Binder decompositions to understand how the immigrant gap in non-routine cognitive tasks may have evolved since 2006 and show these in appendix table A.3. The positive numbers in the row *Immigrant Gap*, indicate that the Canadian born hold larger amounts (higher probability) of the outcome variable. Negative numbers indicate that immigrants do. The Oaxaca-Binder decomposition informs of the part of the adjusted gap (gaps that are net of the effects of covariates or *explained*) that is due to differences in the distribution of covariates between the groups, and differences in the value that these covariates have depending on the group that holds them (*unexplained*). [17]

The immigrant gap in *analyzing data* and *autonomy* has increased over time, whereas the gap in other non-routine cognitive tasks such as *interpersonal relations*, or *creative thinking* has diminished. As it is commonly found in the literature on the immigrant gap, most of these differences are *unexplained* by differences in the attributes of immigrant and Canadian-born women, which are typically favourable to immigrants. The changes are mostly associated to changes in the *unexplained* components, as it is the case with reported gender gaps. This means we still have a very fuzzy idea of what drives skill (or for that matter wage) gaps. Based on studies of the gender gap, a likely contributor to the immigrant gap among women are differences in the measurement of experience. Experience measurement is known to be responsible for a substantial fraction of the gender gap, since age is a better proxy for experience for men than women due to the distribution of childcare responsibilities across gender (Schirle et al., 2022). Although we abstract from those differences by comparing women to other women, in all likelihood the migration process makes age a poor measure of job market experience for immigrant women.

3.2. Assimilation in resilience to automation

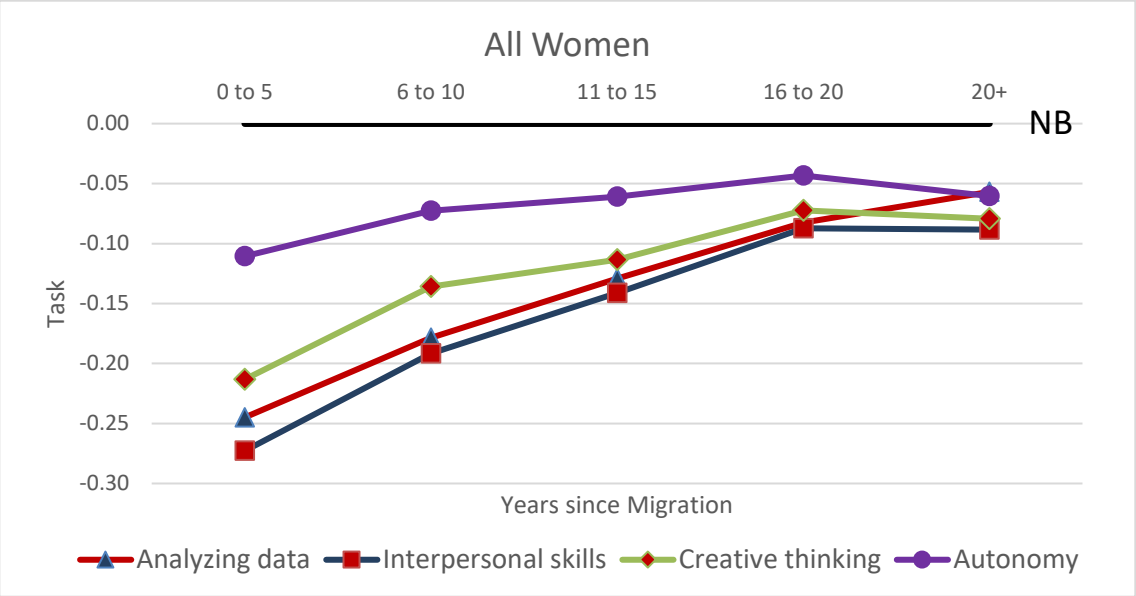
We estimate gaps in job quality measured by tasks indicating resilience to automation (non routine cognitive tasks) using equation (1) and report these estimates in Table A.4. We report estimates on some (not all) of the skill measures to conserve space. We base this selection on observed correlations between the tasks and chose to show those with the lowest correlation. The full set of results are available upon request.

Recent immigrant women hold jobs substantially less demanding in terms of non-routine cognitive tasks, falling behind those of the Canadian born by as much as 0.27 units (interpersonal skills). There is, however, a sustained increase in the requirement of non-routine cognitive tasks among employed immigrants over years in Canada. At 20 years, the

[17] For details about the technique see Fortin et al. (2011)

gap in *analyzing data* declines by around 75 percent, the gap in *interpersonal skills* and *creative thinking* by two thirds, and the gap in *autonomy* by 45 percent. Nevertheless, gaps in cognitive tasks still exist at more than 20 years since migration. (Figure 3)

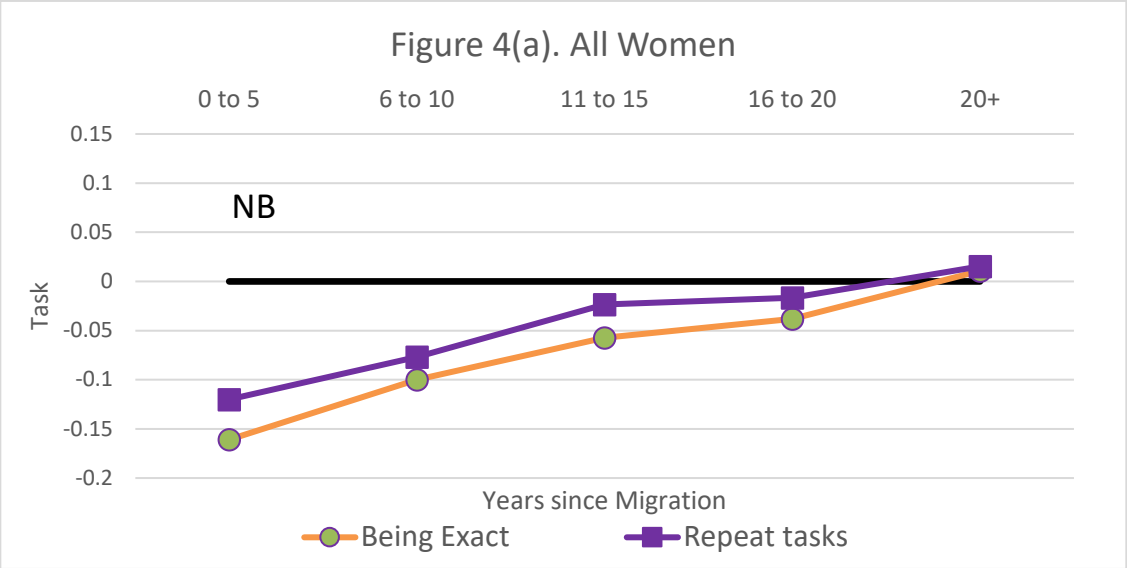
Figure 3. Relative amounts of non-routine cognitive tasks

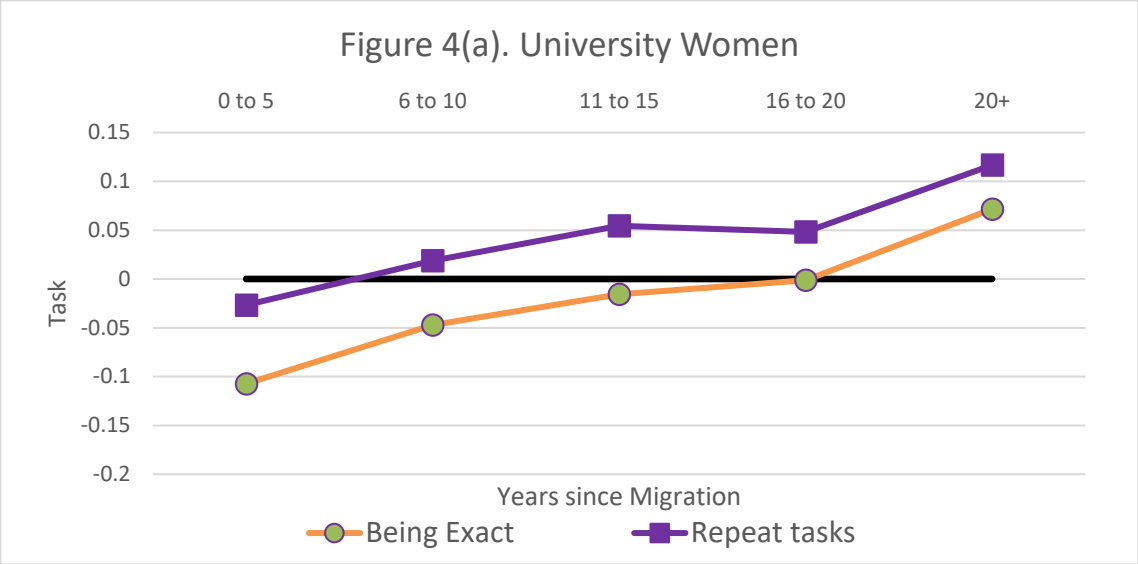


Source: LFS 2006-2022. Regression coefficients from table A.4.

Immigrant jobs are generally closer to those of non-immigrants in terms of routine cognitive tasks. These tasks also increase with time in Canada, with immigrant women generally performing more of these tasks in their occupations than Canadian-born women do. In this sense they show the trends that we expect from attributes of good jobs (H1 and H2). However, routine cognitive tasks have been classified as increasingly easier to automatize, particularly with the rapid change in AI technologies. To the extent that jobs with large amounts of routine cognitive tasks are more vulnerable to rapid technological change, immigrant women seem to be in more precarious position with time in the country. (Figure 4.a).

Figure 4. Relative amounts of routine-cognitive tasks





Source: LFS 2006-2022. Regression coefficients from table A.4 and A.5.

Requirements of physical non-routine tasks among employed immigrant women are typically higher than among the Canadian born (see the positive coefficients for these tasks in table A.4). These differences narrow as immigrants spend more years in Canada. Similarly, gaps in routine physical tasks are positive upon immigrant's arrival (immigrant women 's jobs require more of those tasks) and decline only somewhat with time spent in Canada, between 22% for tasks whose *pace is dictated by the speed of equipment*, to 40% for *making repeated*

motions or tasks *controlling machinery*. It is only after 15 years that a real decline in those tasks can be observed for these women.

While economic assimilation is a likely explanation for these increasing levels of good jobs attributes, we note that immigrants that have been in Canada for more than twenty years, might be highly selected from the population of immigrants. Estimates for this group might reflect selected withdrawal from the labour market, if either (a) immigrant women with "bad jobs" are more likely to leave their jobs after a few years in the labour market than the Canadian born with similar jobs are, or (b) immigrant women with "good" jobs are more likely to remain in the labour market than the Canadian born with similar jobs are. This bias might be more important the longer the immigrants are staying in the country. Since we do not have data to try to tease out this possibility, we prefer not to emphasize the longer-term results.

Because concerns about overqualification are more acute for educated immigrants, we conduct a similar analysis for the subsample of university educated women and present it in Table A.5. We remark that gaps in non-routine cognitive tasks for *recently arrived* university educated immigrant women are similar (or slightly larger) to those of the average immigrant. They also improve at a similar pace. Initial gaps diminish by more than 60 percent by the 20-year mark for university educated women. The final gaps among university educated settled immigrants (those with more than 20 years in the country) are somewhat smaller than those of the average immigrant woman, but not by much, except for *analyzing data* for which parity is reached by the 20-year mark. [18]

It is also worth mentioning that educated immigrant women are initially less required to *being exact* than similarly educated Canadian-born women (by 0.10 units) but similarly required to perform *repetitive tasks* (Figure 4.b). These skills are the ones along which much of the skill progression for educated immigrant women takes place. Final gaps end up being favourable to immigrants. However, given recent changes in technology, this might signal that university educated women are at a higher risk of automation, since they are more heavily concentrated in routine cognitive jobs. Educated immigrant women also perform jobs requiring similarly large amounts of routine manual tasks (Table A.5). However, the amount of these tasks over years in Canada declines at a faster pace that they do for the average immigrant.

Overall, our analysis of tasks suggests that immigrant women start initially in worse jobs than similar Canadian-born women. However, the task composition of their jobs improves

[18] Warman and Worswick (2015) look at the (aggregate) skills of immigrant women up to 2004. Their specification is different in that they assume a quadratic function. The estimates show little improvement in the non-routine cognitive skills of immigrant women with time in the country

over the years, reducing the amount of Physical tasks and increasing the amount of Cognitive tasks. University educated women show a similar trend, with initial large gaps, but also show a faster convergence toward the job tasks of similar Canadian-born women. For university educated women in particular, it is worth noting that they significantly increase the amount of *routine cognitive* tasks over the years, relative to the Canadian-born.

3.3. Closing the gap

We quantify the value of closing the task gap between immigrant and Canadian-born women to provide a sense of the economic value of these gaps. To do so, we estimate a model of wage determination, where each of the job tasks we are considering here are added to standard predictors of earnings, such as education and age. We take the estimated coefficients as measures of the price of tasks and use them to quantify the value of the skill gaps.

Using the gaps for educated women in Table A.5 - since the literature suggests that they are more likely to be overqualified or mismatched in their jobs - we report in table 1 the value of closing the gap in non-routine cognitive tasks at the point of entry (0 to 5 years since migration) and between 16 and 20 years after migration. The column labelled *Δ hourly wage* indicates the predicted increase in the educated immigrant's hourly wage if the gap in that job-required task was closed and immigrant and Canadian-born women performed similar levels of that task.

Closing the initial gaps in non-routine cognitive tasks would increase the hourly wages of educated immigrant women by $2.16 (*analyzing data*) or $0.89 (*autonomy*), that is between 9 and 4 percent of the 2022 wage. These are relatively large gains for immigrants. An added benefit of closing these gaps would be - to the extent that the relative importance of routine tasks diminishes in relation to non-routine tasks - the increment in the resilience of their jobs.

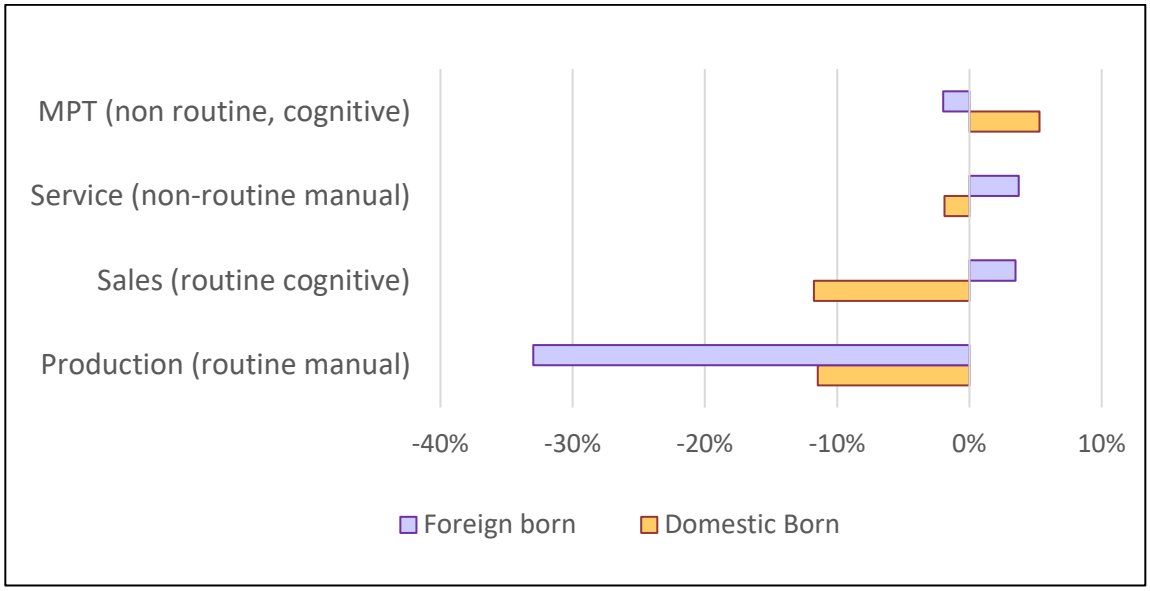
3.4 Automation risk

While it is out of the scope of this work to formally estimate the risk of automation (Oschinski and Wyonch, 2012; Wyonch, 2020), we would like to put this analysis into the context of the Canadian automation literature following the procedure in Frank et al. (2021). They group occupations into four categories based on those proposed by Acemoglu and Autor (2011): Managerial, Professional and Technical occupations, Service occupations, Sales, Clerical and Administrative Support occupations and Production, Craft and Operative occupations, each occupational group featuring predominantly one set of tasks. These are, respectively, non-routine cognitive, non-routine manual, routine cognitive and routine, manual. They then

compute the growth in employment shares across broad occupational groups using the LFS between 1987 and 2018.

We follow this process to provide a descriptive look at how representation in broadly aggregated occupations has evolved between 2006 and 2022 for foreign and Canadian-born women. Figure 5 shows the percentage change in employment by major occupation. The figure shows that since 2006, women's share of employment in Production occupations, involving mostly routine, manual tasks have continued to diminish significantly for immigrant and the Canadian born. In the other three occupational categories, however, the two groups of women follow different trends. While Canadian-born women are moving away from sales - and to a lesser extent service occupations - and into managerial occupations, immigrants are increasingly moving into sales and services occupations. According to Wyonch (2020) occupations under our groups of Sales, Service occupations and Trades, Crafts and Operative occupations have the highest risks of automation, which suggests that immigrant women are increasingly more represented in occupations susceptible to automation.

Figure 5. Percentage change in employment shares by major occupation group (2006-2022)



Note: **MPT** stands for "Managerial, Professional and Technical occupations (non-routine, cognitive tasks). **Service** includes "Service occupations" (non-routine, manual tasks). **Sales** stands for "Sales, Clerical and Administrative Support occupations" (routine, cognitive tasks). **Production** stands for "Production, Craft and Operative occupations" (routine, manual tasks).

Source: Labour Force Survey, 2006 and 2022.

Table 1. Value of closing the gap for university educated women at different times since migration (hourly wages)

2006 Immigrant women's average wage	20.7
2022 Immigrant women's average wage	24.09

				Non-routine Cognitive								
	Analyzing data			Interpersonal			Creative thinking			Autonomy		
	Task Gap	Task Price ($)	Δ hourly wage ($)	Task Gap	Task Price ($)	Δ hourly wage ($)	Task Gap	Task Price ($)	Δ hourly wage ($)	Task Gap	Task Price ($)	Δ hourly wage ($)
Years since migration												
0 to 5	-0.24	9.01	2.16	-0.25	4.01	1.00	-0.27	5.64	1.52	-0.09	9.92	0.89
16 to 20	-0.09		0.81	-0.08		0.32	-0.09		0.51	-0.06		0.60

Task gaps are those reported in table 3 for educated immigrant women.
Task prices are the estimated coefficients of an OLS hourly wage regression that includes the specific O*NET task. These estimated "task prices" are net of education and age, province, year and month. Wages are real wages (Dec. 2019 basis)

Δ hourly wage indicates the estimated average increase in hourly wages if the immigrant women held jobs requiring similar levels of tasks than comparable Canadian-born women (other things equal)

4. Discussion

When discussing immigrant gaps in economic integration, it is important to consider what barriers might be responsible for these gaps. Barriers related to individual characteristics (low levels of education or training) are intrinsically different from institutional barriers impeding career advancement and mobility (accessibility to jobs, discrimination) or cultural barriers (preferences over household and market work). Whether immigrant women are less likely to work in quality jobs involving high levels of cognitive tasks because of individual characteristics requires a different intervention from addressing discrimination or lack of access to these jobs. Policies designed to improve the labour market outcomes of immigrant women that focus on individual characteristics are likely to fail if significant institutional or cultural barriers to employment exist.

The LFS does not (cannot) inform comprehensively on the barriers behind the reported gaps in job quality. Given the generally high levels of education of immigrants, it is unlikely that individual characteristics is one of them, particularly for university educated women. In fact, detailed results from the Oaxaca-Binder decomposition suggest that a significant part of the gap is related not to differences in human capital (education and age) but differences in the valuation of these attributes. In other words, immigrant women with similar education and age than the native born should report occupations with higher levels of non-routine cognitive tasks. The unexplained component of the Oaxaca-Binder has sometimes been erroneously interpreted as discrimination. While discrimination can be part of the story, measurement error of the relevant variables is also a likely cause for differences in valuation. To the extent that age is a worse measure of actual experience for immigrant women than for the Canadian born, estimates of the value of age/experience would be biased (Drolet, 2022).

We use the results from a survey conducted by the *Women, Work and the Economy* group among Racialized Newcomer Women to Canada, to contextualize these results around the existence of barriers. According to the Survey, racialized newcomer women, do not think they need additional education, but identify lack of recognition of their foreign experience/lack of Canadian experience/lack of references as a major barrier to employment (81%). In contrast, discrimination is only cited as a barrier to employment by 17 percent of women. Hence, programs offering career advice and the opportunity to connect with peers and employers through networking or job fairs would be the most beneficial. The connection with employers has proven in the past to be doubly beneficial as it may also increase employer's information about foreign educational credentials and foreign labour market experience. (Ferrer and Dhatt, 2024)

A second barrier to employment and job search highlighted in the RNW survey concerns family responsibilities. Above one third of respondents who were looking for a job state that

they would not move to another city pursuing suitable employment. The main reason for this is being tied to a spouse who will not/cannot move, or other types of family responsibilities involving children. This agrees with substantial qualitative work in the area showcasing the issue of women as tied immigrants (Cookes, 2013; Banerjee and Phan, 2014; Sweetman and Warman, 2010). Also, one quarter of respondents identify childcare issues as a barrier to job searching or working, particularly among Latin American women and West Asian or Arab women (Ferrer and Dhatt, 2024). There is a significant branch of current research listing childcare issues as a barrier for work (Guo, 2013; Turcotte and Savage, 2020; Schirle et al. 2023).[19] Aside from government subsidized childcare, a potential solution to address this type of barrier could originate from employers identifying inclusive job search processes and creative forms of flexible employment that allow women to achieve the right work life balance.

We have purposedly not considered cultural barriers in this analysis. This is driven by the lack of adequate variables to measure cultural background. Some research uses labour force participation in the country of origin, or nationally aggregated responses from the World Values Survey (WVS) for questions regarding the role of women ("*When a mother works for pay, the children suffer*" or "*Being a housewife is just as fulfilling as working for pay*") to this effect. However, the samples in the LFS are not large enough to allow for individual country-of-origin controls. In our view, using the broad area of origin (seven indicators for different regions of the world) will likely confuse cultural background with other characteristics, most notably visible minority status.[20]

5. Conclusion

Using confidential data from the LFS and the O*NET data base we explore an important dimension of job quality – resilience to automation - along which the jobs of newcomer immigrant women lag behind those of the Canadian born. We show that immigrant women experience significant progress over time spent in Canada in the terms of the levels of cognitive tasks they perform in their jobs, particularly for university educated women. Large, negative gaps in non-routine cognitive job tasks diminish substantially over time, at least by 50% if not

[19] In results not presented here, we estimate the immigrant-Canadian-born difference in "good" job characteristics allowing for a differential effect of children between immigrants and native-born women. In general, the effect of children is relatively homogeneous for both groups of women. (Ferrer and Dhatt, 2024).

[20] In regressions not shown here, we added aggregate indicators for broad area of origin (seven). The results in these cases are very similar to those presented here, except for the long-term estimates (after 20 years in the country). Those coefficients require a more nuanced interpretation, and we opted for presenting results for the average immigrant.

more. However, immigrant women also see large increases in routine cognitive tasks levels over time.

While it is difficult to evaluate whether a given type of job task signals a job as "good", the general consensus is that non-routine tasks will be harder to replace by technology, making those tasks – and the jobs that require them - safer (Frenette and Frank, 2020) However, the fact that immigrant women do less physical tasks with time in the country, no matter whether routine or non-routine, suggest that these tasks reflect "bad quality" jobs. This may reflect the rapidly changing pace of technology which makes it easier to automate even the less routine physical tasks. All cognitive tasks, however, tend to increase with time in Canada, with levels of routine tasks performed by immigrants surpassing those of Canadian-born women. These results may reflect the job quality assimilation of immigrants, who typically struggle initially in the labour market but may recover equal footing with the Canadian born later in their careers. However, we add a caveat to this interpretation. While it likely reflects immigrant progress in terms of obtaining "good" jobs with time in Canada, an alternative explanation is the existence of selection bias. Since we lack panel data on the job trajectories of women, we use cross sectional data to estimate average trends for the cohort of immigrants that entered a given time in the country, rather than for individuals. As such, we cannot control for changes in the composition of cohorts. For instance, if immigrant women in bad jobs are disproportionally more likely to withdraw from the labour market after five or ten years of working than the Canadian born, our estimates for long term immigrant might be upward biased.

Considered together, our results warrant a word of caution regarding the apparent progress of immigrant women job tasks with time in the country. Even if they increase the amounts of non-routine cognitive tasks, the similar increase in routine cognitive tasks indicate that immigrant women might be at a higher risk of being displaced by automation than the Canadian born, since current technology developments point towards these tasks being subject to automation in the near future.

On this note, we also highlight the likely heterogeneity regarding the labour market experiences of immigrant women. Discrimination is likely to play a role in the barriers to employment of immigrants. Family situation and the ability to validate foreign experience and credentials during job search are also key factors affecting their labour market integration.

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Appendix A. Descriptive statistics

Table A.1. O*NET Measures – routine tasks. Weighted Mean differences by immigrant and year

		Cognitive		Manual		
		Being exact	Repeat Task	Control Machine	Speed Equipment	Repeat motion
WOMEN						
Canadian-Born	2006			-------- Reference --------		
	2022	0.131***	0.187***	0.121***	-0.065***	0.061***
Immigrant	2006	-0.073***	-0.064***	0.193***	0.137***	0.109***
	2022	0.155***	0.209***	0.194***	0.076***	0.178***
Immigrant-CB Gap	2006	-0.073***	-0.064***	0.193***	0.137***	0.109***
Immigrant-CB Gap	2022	0.024**	0.022**	0.073***	0.141***	0.117***
Observations		133,798	133,798	133,798	133,798	133,798
MEN						
Canadian-Born	2006			-------- Reference --------		
	2022	0.226***	0.356***	0.063***	0.048***	0.152***
Immigrant	2006	0.033***	0.026***	-0.038***	-0.007	0.083***
	2022	0.242***	0.401***	-0.085***	0.005	0.224***
Immigrant-CB Gap	2006	0.033***	0.026***	-0.038***	-0.007	0.083***
Immigrant-CB Gap	2022	0.016**	0.045***	0.148***	-0.043***	0.072***
Observations		146,177	146,177	146,177	146,177	146,177

Table A.2. O*NET Non-routine Measures. Weighted Mean differences by Immigrant and year

		Cognitive							Manual			
		Analyze Data	**Coach others**	**Inter-personal**	**Direct others**	**Interpret Info**	**Think Creatively**	**Autonomy**	**Manual dexterity**	**Operate vehicles**	**Spatial Orientation**	**Handle equipment**
WOMEN												
Canadian-Born	2006							Ref.				
	2022	0.44***	0.49***	0.27***	0.51***	0.43***	0.50***	-0.081***	-0.11***	0.30***	-0.08***	-0.08***
Immigrant	2006	-0.08***	-0.17***	-0.22***	-0.15***	-0.17***	-0.13***	-0.036***	0.17***	-0.01	0.06***	0.17***
	2022	0.35***	0.39***	0.14***	0.40***	0.31***	0.41***	-0.190***	0.01	0.31***	-0.08***	0.03***
Immigrant-CB Gap	2006	-0.08***	-0.17***	-0.22***	-0.15***	-0.17***	-0.13***	-0.036***	0.17***	-0.01	0.06***	0.17***
Immigrant-CB Gap	2022	-0.09***	-0.10***	-0.13***	-0.11***	-0.12***	-0.09**	-0.109***	0.10***	0.01	0.00	0.11***
Observations		133,798	133,798	133,798	133,798	133,798	133,798	123,318	133,798	133,798	133,798	133,798
MEN												
	2006							Ref.				
Canadian-Born	2022	0.36***	0.56***	0.35***	0.52***	0.41***	0.54***	-0.096***	-0.13***	0.39***	-0.09***	-0.08***
Immigrant	2006	-0.01	-0.08***	-0.05***	-0.13***	-0.02**	-0.01	0.009	-0.02	-0.21***	-0.11***	0.03**
	2022	0.39***	0.49***	0.31***	0.38***	0.39***	0.53***	-0.159***	-0.19***	0.11***	-0.23***	-0.09***
Immigrant-CB Gap	2006	-0.01	-0.08***	-0.05***	-0.13***	-0.02**	-0.01	0.009	-0.02	-0.21***	-0.11***	0.03**
Immigrant-CB Gap	2022	0.03*	-0.07***	-0.04***	-0.14***	-0.02**	-0.01	-0.063***	-0.06**	-0.18***	-0.14***	-0.01
Observations		146,177	146,177	146,177	146,177	146,177	146,177	129,236	146,177	146,177	146,177	146,177

Table A. 3. Women immigrant gap estimates of job characteristics (2006 and 2022)

	Analyzing data		Interpersonal skills		Creative thinking		Autonomy	
Panel A. 2006								
Canadian-Born	2.999	**	3.722	**	2.921	**	4.195	**
	(0.005)		(0.004)		(0.005)		(0.003)	
Immigrants	2.919	**	3.504	**	2.789	**	4.159	**
	(0.019)		(0.021)		(0.020)		(0.012)	
Immigrant Gap	0.081	**	0.217	**	0.132	**	0.036	**
	(0.020)		(0.021)		(0.021)		(0.013)	
Explained	-0.074	**	-0.039	**	-0.048	**	-0.021	**
	(0.006)		(0.004)		(0.005)		(0.002)	
Unexplained	0.155	**	0.256	**	0.180	**	0.057	**
	(0.020)		(0.021)		(0.021)		(0.013)	
Panel B. 2022								
Canadian-Born	3.435	**	3.987	**	3.418	**	4.115	**
	(0.005)		(0.003)		(0.005)		(0.003)	
Immigrants	3.350	**	3.865	**	3.328	**	4.006	**
	(0.010)		(0.006)		(0.009)		(0.006)	
Immigrant Gap	0.085	**	0.123	**	0.090	**	0.109	**
	(0.011)		(0.007)		(0.010)		(0.007)	
Explained	-0.081	**	-0.038	**	-0.046	**	-0.032	**
	(0.004)		(0.002)		(0.003)		(0.002)	
Unexplained	0.166	**	0.161	**	0.136	**	0.141	**
	(0.011)		(0.007)		(0.010)		(0.007)	

Table shows the results from an Oaxaca-Binder Decomposition. Rows 1 and 2 show the mean of the characteristic for Canadian-born and Immigrant women respectively and *Immigrant Gap* denotes the difference. The fourth row shows the explained component of the difference. A negative number indicates that the difference should be greater if immigrants had the same values of explanatory variables (education, family composition, age) than the Canadian Born.

Table A.4. Task differences by time in Canada - Coefficients from OLS regressions (Women)

	Non-routine Cognitive				Non-routine Physical	
	Analyzing data	Interpersonal skills	Creative thinking	Autonomy	Manual Dexterity	Spatial Orientation
Years s. migration	*Relative to the Canadian born*					
0 to 5	-0.245 **	-0.273 **	-0.213 **	-0.111 **	0.237 **	0.089 **
	(0.008)	(0.006)	(0.008)	(0.006)	(0.010)	(0.005)
6 to 10	-0.178 **	-0.192 **	-0.136 **	-0.073 **	0.204 **	0.068 **
	(0.007)	(0.005)	(0.007)	(0.005)	(0.008)	(0.004)
11 to 15	-0.129 **	-0.141 **	-0.113 **	-0.061 **	0.172 **	0.049 **
	(0.006)	(0.004)	(0.006)	(0.004)	(0.007)	(0.004)
16 to 20	-0.083 **	-0.087 **	-0.072 **	-0.043 **	0.102 **	0.032 **
	(0.005)	(0.004)	(0.005)	(0.003)	(0.006)	(0.003)
20+	-0.057 **	-0.088 **	-0.079 **	-0.060 **	0.118 **	0.009 **
	(0.003)	(0.002)	(0.003)	(0.002)	(0.003)	(0.002)
Observations	547,921	547,921	547,921	547,921	547,921	547,921

	Routine Cognitive		Routine Physical		
	Being exact	Repeat task	Machine set speed	Control Machinery	Repeat motion
0 to 5	-0.161 **	-0.120 **	0.150 **	0.198 **	0.164 **
	(0.006)	(0.009)	(0.007)	(0.008)	(0.008)
6 to 10	-0.100 **	-0.077 **	0.109 **	0.163 **	0.130 **
	(0.005)	(0.007)	(0.006)	(0.007)	(0.007)
11 to 15	-0.057 **	-0.023 **	0.100 **	0.140 **	0.118 **
	(0.005)	(0.006)	(0.005)	(0.006)	(0.006)
16 to 20	-0.038 **	-0.017 **	0.055 **	0.072 **	0.062 **
	(0.004)	(0.006)	(0.005)	(0.005)	(0.005)
20+	0.011 **	0.015 **	0.118 **	0.116 **	0.098 **
	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)
Observations	547,921	547,921	547,921	547,921	547,921

Author's calculations using the LFS 2006-2022. Married women 25 to 59 years old. The OLS regression includes controls for education (non-university post-secondary and university), age and age square, number of children in the household (under 6, and between 6 and 17), period of arrival in Canada (2001-06, 2007-13, 2014-19, and 2020-22) and the prime-age, male unemployment rate in the area, in addition to province, year and month fixed effects.

Table A.5. Task differences by time in Canada - Coefficients from OLS regressions (University Educated Women)

	Non-routine Cognitive				Non-routine Physical	
	Analyzing data	Interpersonal skills	Creative thinking	Autonomy	Manual Dexterity	Spatial Orientation
Years s. migration	*Relative to the Canadian born*					
0 to 5	-0.291 **	-0.257 **	-0.266 **	-0.111 **	0.265 **	0.091 **
	(0.012)	(0.008)	(0.012)	(0.007)	(0.014)	(0.006)
6 to 10	-0.214 **	-0.190 **	-0.195 **	-0.084 **	0.237 **	0.075 **
	(0.011)	(0.007)	(0.010)	(0.006)	(0.012)	(0.005)
11 to 15	-0.148 **	-0.127 **	-0.136 **	-0.072 **	0.186 **	0.042 **
	(0.009)	(0.006)	(0.009)	(0.005)	(0.011)	(0.005)
16 to 20	-0.082 **	-0.073 **	-0.088 **	-0.051 **	0.102 **	0.020 **
	(0.009)	(0.005)	(0.008)	(0.005)	(0.010)	(0.004)
20+	-0.004	-0.071 **	-0.099 **	-0.039 **	0.079 **	0.004
	(0.005)	(0.003)	(0.005)	(0.003)	(0.006)	(0.003)
Observations	182,737	182,737	182,737	182,737	182,737	182,737

	Routine Cognitive		Routine Physical		
	Being exact	Repeat task	Machine set speed	Control Machinery	Repeat motion
0 to 5	-0.107 **	-0.027 *	0.154 **	0.156 **	0.214 **
	(0.009)	(0.013)	(0.009)	(0.011)	(0.012)
6 to 10	-0.047 **	0.019	0.125 **	0.146 **	0.183 **
	(0.008)	(0.011)	(0.008)	(0.010)	(0.011)
11 to 15	-0.016 *	0.055 **	0.101 **	0.124 **	0.154 **
	(0.007)	(0.010)	(0.007)	(0.009)	(0.009)
16 to 20	-0.001	0.048 **	0.052 **	0.057 **	0.095 **
	(0.006)	(0.009)	(0.006)	(0.008)	(0.009)
20+	0.072 **	0.117 **	0.069 **	0.055 **	0.116 **
	(0.004)	(0.005)	(0.004)	(0.005)	(0.005)
Observations	182,737	182,737	182,737	182,737	182,737

Author's calculations using the LFS 2006-2022. University educated married women 25 to 59 years old. The OLS regression includes controls for age and age square, number of children in the household (under 6, and 6 to 17), period of arrival in Canada (2001-06, 2007-13, 2014-19, and 2020-22) and the prime-age, male unemployment rate in the area, in addition to province, year and month fixed effects.

Appendix B

The O*NET

During the time framework we are considering, there have been several taxonomy changes in the O*NET classification: in 2009, 2010, and 2019. The main goal of a revision to the taxonomy is to reflect changes occurring in the world of work because of new technologies, innovative business practices, and the organization of work. As a result, new occupations emerge, and others are split or merged in the revisions. To use O*NET data across taxonomy changes, one needs to rewrite the classification codes so that the occupations are comparable. We first constructed a longitudinal file containing the selected sixteen O*NET tasks for the required years for all Standard Occupation Classification (SOC) codes used by O*NET in each year. We used the (O*NET provided) 2010-2019 crosswalk to make the 2022 O*NET data compatible with 2010 SOC codes. 2011 and 2016 data need no conversion since they used the same 2010 taxonomy. The ONET does not provide a direct crosswalk from 2006 to 2010 but does provide one between 2006 and 2009. We manually tracked changes between 2009 and 2010, effectively creating a 2006-2010 crosswalk, which we used to rewrite the 2006 occupation codes to be compatible with 2010 SOC codes. When a SOC code is split into multiple SOC 2010 codes, they all get the same index. If several codes merged into a single SOC code, we take a simple average across the indices corresponding to the (single) 2010 SOC code.

The revised O*NET-SOC 2006 taxonomy, outlined here, will include 949 occupational titles, 812 of which represent O*NET data-level occupations. Data-level occupations are those occupations for which the O*NET Program collects data. Data and occupational information are collected on a wide variety of variables and scales, such as occupational characteristics and worker requirements drawn from the O*NET Content Model

The revised O*NET-SOC 2009 taxonomy will include the addition of 153 new and emerging (N&E) occupations identified within 17 in-demand industry clusters. N&E occupations are defined as occupations that involve significantly different work from that performed by job incumbents of other occupations, and occupations that are not adequately reflected by the existing O*NET-SOC structure (National Center for O*NET Development, 2006). There are a total of 159 N&E occupations; 6 of which were included in the O*NET-SOC 2006 taxonomy. N&E occupations are detailed O*NET-SOC level occupations. Fifty-two of the 153 N&E occupations being added to the 2009 taxonomy are breakouts of SOC occupations, while 101 N&E occupations are classified under SOC residual “All Other” categories.

The scheduled February 2011 release of O*NET 15.1 will represent the sixteenth update of the O*NET database since its initial release in 1998 and the fourth taxonomy modification. The first modification was the conversion from an Occupational Employment Statistics-based (OESbased) classification, O*NET OU 1998, to a SOC-based classification, O*NET-SOC 2000. O*NET-SOC 2006 represented the second taxonomy modification, where the main goal was to ensure that O*NET data were, and

continue to be, collected at the appropriate level of specificity (National Center for O*NET Development, 2006b). **The third taxonomy modification, O*NETSOC 2009, reflected the addition of 153 N&E occupations**. The current, fourth modification will represent the conversion of the O*NET-SOC taxonomy to the 2010 SOC.

The O*NET-SOC 2010 taxonomy includes the addition of 4 new N&E occupations, bringing the total to 152 for this release. Fifty-four of the 152 N&E occupations are breakouts of SOC occupations, and the remaining 98 are classified under SOC residual "All Other" categories.

The Center revised the O*NET-SOC 2010 taxonomy to adopt the 2018 SOC structure's codes, titles, and definitions. Additionally, the Center added and removed detailed occupations to reflect the current US economy. The Center's technical report provides a detailed description of those revisions (see Gregory et al., 2019). In short, 157 occupations were removed (37 SOC level occupations, 120 detailed O*NET-SOC occupations) and 63 occupations were added (51 SOC-level occupation, 12 detailed occupations) to the taxonomy.

A further step is needed stablishing a correspondence between the SOC classification and the NOC (National Occupational Classification) - Canada's national system, for describing occupations. The NOC system comprises more than 40,000 job titles gathered into 500 unit groups. We match occupations from the US and Canada by name and manually paired when the exact name is not a match. 203 NOC codes had just one match in the O*NET and 295 NOC codes were matched with more than one SOC code, and for these we take the average of the SOC occupations indexes. 2 NOC codes did not correspond to any ONET SOC.[21]

https://www.onetcenter.org/research.html?c=Taxonomy

https://www.onetcenter.org/dl_files/UpdatingTaxonomy2009_Summary.pdf

[21] At the start of this project the LFS used NOC4 classification index. After the 2023 Rebase of the LFS files, it provided only NOC5 occupational classifications. We used the NOC4-NOC5 correspondence to update our tasks file to the new NOC5 classification (Correspondence Table: National Occupational Classification (NOC) 2016 V1.3 to National Occupational Classification (NOC) 2021 V1.0 based on GSIM (statcan.gc.ca)). NOC5 has 516 unit groups, of which 400 have a one-to-one correspondence with NOC4

Description of O*NET variables

Element ID	Element Name	Description	
1.A.1.f	Spatial Abilities	Abilities related to the manipulation and organization of spatial information	
1.A.2.a.2	Manual Dexterity	The ability to quickly move your hand, your hand together with your arm, or your two hands to grasp, manipulate, or assemble objects.	Additional Q Importance scale 1-5
4.A.2.a.4	Analyzing Data or Information	Identifying the underlying principles, reasons, or facts of information by breaking down information or data into separate parts.	Background Q Importance scale 1-5
4.A.2.b.2	Thinking Creatively	Developing, designing, or creating new applications, ideas, relationships, systems, or products, including artistic contributions.	Background Q Importance scale 1-5
4.A.3.a.3	Controlling Machines and Processes	Using either control mechanisms or direct physical activity to operate machines or processes (not including computers or vehicles).	Background Q Importance scale 1-5
4.A.3.a.4	Operating Vehicles, Mechanized Devices, or Equipment	Running, maneuvering, navigating, or driving vehicles or mechanized equipment, such as forklifts, passenger vehicles, aircraft, or watercraft.	Background Q Importance scale 1-5
4.A.4.a.1	Interpreting the Meaning of Information for Others	Translating or explaining what information means and how it can be used.	Background Q Importance scale 1-5
4.A.4.a.4	Establishing and Maintaining Interpersonal Relationships	Developing constructive and cooperative working relationships with others, and maintaining them over time.	Background Q Importance scale 1-5
4.A.4.b.4	Guiding, Directing, and Motivating Subordinates	Providing guidance and direction to subordinates, including setting performance standards and monitoring performance.	Background Q Importance scale 1-5
4.A.4.b.5	Coaching and Developing Others	Identifying the developmental needs of others and coaching, mentoring, or otherwise helping others to improve their knowledge or skills.	Background Q Importance scale 1-5

4.C.1.a.2.l	Face-to-Face Discussions	How often do you have to have face-to-face discussions with individuals or teams in this job?	Work context Q Time scale 1-5
4.C.2.a.3	Physical Proximity	To what extent does this job require the worker to perform job tasks in close physical proximity to other people?	Work context Q Importance scale 1-5
4.C.2.d.1.g	Spend Time Using Your Hands to Handle, Control, or Feel Objects, Tools, or Controls	How much does this job require using your hands to handle, control, or feel objects, tools or controls?	Work context Q Importance scale 1-5
4.C.2.d.1.i	Spend Time Making Repetitive Motions	How much does this job require making repetitive motions?	Work context Q Importance scale 1-5
4.C.3.b.4	Importance of Being Exact or Accurate	How important is being very exact or highly accurate in performing this job?	Work context Q Importance scale 1-5
4.C.3.b.7	Importance of Repeating Same Tasks	How important is repeating the same physical activities (e.g., key entry) or mental activities (e.g., checking entries in a ledger) over and over, without stopping, to performing this job?	Work context Q Importance scale 1-5
4.C.3.b.8	Structured versus Unstructured Work	To what extent is this job structured for the worker, rather than allowing the worker to determine tasks, priorities, and goals?	Renamed Autonomy
4.C.3.d.3	Pace Determined by Speed of Equipment	How important is it to this job that the pace is determined by the speed of equipment or machinery? (This does not refer to keeping busy at all times on this job.)	Work context Q Importance scale 1-5