

Revisiting Gender Occupational Segregation Trends in Canada: 1991–2016

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Abstract

Despite continued interest in gender (in)equality at work, Canadian research on gender occupational segregation stopped in the early 2000s. We revisit gender occupational segregation trends using newly developed harmonized occupational categories which resolve temporal changes in occupational classifications. Our analysis of the 1991-2016 Canadian Census Masterfiles finds gender occupational segregation, whether measured by the index of dissimilarity or Gini index, has steadily decreased since the 1990s. Yet the pace of its decline has slowed since 2000. This can be explained by the diminishing changes in vertical segregation, measured by inequality in earnings across occupations. Our results contribute to an ongoing debate about a stalled gender revolution. We also suggest new topics for future study.

RÉSUMÉ

INTRODUCTION

The second half of the twentieth century was transformative for Canada's women and men. Declining fertility rates and smaller family sizes followed the end of the "baby boom" years (1946-1963). Legal grounds for divorce expanded with 1969 legislation, increasing the percentages of single-headed families to levels similar to those of the 1920s and 1930s, although the latter levels reflect spousal mortality rather than marital dissolution (Boyd, 1988). Ongoing growth in the service economy stimulated the growing labour force participation of women, particularly married women (Crompton & Vickers, 2000; Phillips & Phillips, 1993). The percentage of women aged 25-54 in the paid labour force grew from 24 percent in 1953 to 43 percent in 1971 and to 79 percent in 2001, while comparable rates for men remained relatively steady at 96 percent (1953), 95 percent (1971), and 92 percent (2001) (Statistics Canada, 2015b).

These changes in female labour force participation during the second half of the twentieth century were significant in two ways. First, the high rates signaled that women's participation in Canada's monetarized economy was permanent. Second, following recognition that women were likely to stay in paid work, attention shifted to gender inequalities within the labour force.

Scholars in both Canada and the United States noted that the higher levels of occupational segregation between women and men marked the first half of the twentieth century but declined throughout the 1950s and into the 1990s (Beller, 1984; Blau & Hendricks, 1979; Brooks, Jarman & Blackburn, 2003; Fox & Fox, 1987; Moore, 1985). However, Canadian research on gender

segregation virtually stopped after the mid-1990s, leaving unanswered questions on whether gender dissimilarities have continued to decline into the twenty-first century, and if so, at what rate and with what implications.

Our chronological based review of the history of gender occupational segregation in North America and the definitions, concepts, explanations and measurements generate four questions that update past understandings of gender segregation in occupations. In what follows, we articulate these questions and then address them by analyzing harmonized Canadian census data for the past 25 years, 1991 to 2016. Three measures, the index of dissimilarity, the Gini index and the horizontal index, demonstrate small declines in gender occupational segregation continue during this 25-year period. These temporal changes largely reflect the movement of women out of female-dominated low-paid occupations into more gender integrated highly-paid professional/managerial occupations. A fourth index measuring vertical segregation of women and men according to the earnings rankings of occupations also shows temporal declines in gender inequalities.

A HERSTORY OF WORK AND GENDERED OCCUPATIONAL DISTRIBUTIONS

Feminists and labour market analysts alike note two features of women's work. First, many occupations held by women commodify work previously performed in the home. Second, women and men often concentrate in different occupations, seen in the predominance of men in agricultural and manufacturing occupations and the location of women in teaching, clerical and domestic service work. These observations rest on historical analyses of women's and men's

work that precede the gender revolution of the 1970s (Brandt, Black, Bourne & Fahrni, 2011; Hartmann, 1976; Kessler-Harris, 1982; Phillips & Phillips, 1993). The early gendered workplace practices were foundational for establishing where women worked as their labour force participation rates increased. Although some were employed in male-dominated industries and occupations during the Great Depression and World War II (Crompton & Vickers, 2000; Pierson, 1977; Phillips & Phillips, 1993), many women entering Canada's paid workforce from the 1970s on were employed in female-dominated occupations, such as elementary school teachers or caregivers (including nurses). Clerical work was feminized early in the century, and it was a major site of female employment by the late 1960s as the growth of the service sector drove new demands for record keeping (Boyd, 1992; Fortin & Huberman, 2002; Lowe, 1982). By 1971, over one-third of women in Canada's paid workforce was in a clerical occupation (England & Boyder, 2009, Table 1).

In sum, rising female labour force participation in Canada did not mean women and men worked in the same occupations. This dissimilarity directed attention to the gender concentration and the gendered segregation of occupations. Concentration refers to the representation of women (or men) in an occupation, usually measuring as the percentage of women (or men) in a specific occupation (for examples, see Armstrong & Armstrong, 1978; Moore, 1985). Gender occupational concentration is related to, but different from, gender segregation (Brooks et al., 2003; Siltanen, Jarman & Blackburn, 1995). In most studies, the term "gender segregation" (and its cognate "sex segregation") refers to the different distributions of women and men across occupational titles. There exist different ways to measure gender differences in occupational distributions, sometimes producing debates described by one contributor as "index wars"

(Bridges, 2003). One frequently used index compares differences in distributions by calculating the index of dissimilarity (Duncan & Duncan, 1955). This technique is often called the segregation index, reflecting its origins and extensive use in American studies of residential segregation of whites and blacks. The index scores go from zero, indicating no differences between groups, to 100 (or 1), indicating complete differences (total segregation). A commonly used interpretation of the index is that it represents the percentages (or proportions) of women (or men) who would have to change their occupations for the distribution to be identical to that of men (or women).

When two or more time periods are studied, changes in the dissimilarity indices can be decomposed into two or more components (Blau & Hendricks, 1979; Das Gupta, 1987). One component measures the changes in the indices associated with temporal shifts in the occupational structure of the economy (for example, temporal declines in employment in agricultural occupations and/or employment increases in health care occupations). The second component measures changes in the indices associated with temporal alternations in the gender composition of occupations (for example, growing percentages of women over time among medical doctors). A third component can be calculated as representing the interaction, or combined effects of both the occupational mix and the gender composition of occupations. This decomposition technique helps address a methodological concern that occupational desegregation, when measured in DI, can happen even when the gender composition within a specific occupation remains unchanged, if the occupational structure of the economy is changing substantially. For example, gender desegregation in professional occupations in the United States in the 1960s was mainly driven by a secular decline in employment of women in female-

dominated occupations such as registered nurses and elementary school teachers (Fuchs, 1975). Meanwhile, the proportions of women in these occupations only marginally changed, and the shares of men in emerging occupations like computer specialists increased. In such circumstances, gender occupational desegregation does not necessarily equate with improved gender economic and social equality. It is therefore important to understand what drives gender occupational desegregation over time (Cotter, Defiore, Hermsen, Kowalewski & Vanneman, 1995).

Past Canadian studies show that gender segregation indices declined over the last half of the twentieth century. In their seminal study, Fox and Fox (1987) calculate that the index of dissimilarity hovered between 71 and 72 for 1931-1951, meaning that 71-72 percent of women (or men) would have to change occupations for their occupational distribution to be identical to that of men (or women) in the labour force. The index then stabilized, remaining at 70 in 1961 and 1971 before declining to 61 in 1981 (Fox & Fox, 1987, Table 1: column D_t). Slightly different values are reported in research by Fortin and Huberman (2002), but the trend lines are remarkably similar. Fox and Fox (1987, Table 1) conclude the period 1961-1981 saw the most dramatic declines in the segregation index, with the largest decrease between 1971 and 1981. Their analysis ends with 1981, but other scholars find further declines during the 1980s and into the 1990s (Boyd, 1992; Brooks et al., 2003; Fortin & Huberman, 2002; Gunderson, 1998). Similar patterns are observed in the United States (Blau & Hendricks, 1979; Blau, Brummund & Liu, 2013; Cotter et al., 1995; Jacobs, 1989). Overall, the slowdown in occupational desegregation of women and men became part of the narrative of the “stalled gender revolution”

between 2010 and 2020 in both Canada and the United States (England, 2010; England, Levine & Mishel, 2020; Guppy & Luongo, 2015).

As we noted previously, after the early to mid-1990s, gender occupational segregation received little attention in Canada. Three studies indicate small declines from the 1980s into the 1990s (Brooks et al., 2003; Fortin & Huberman, 2002; Gunderson, 1998).¹ Although trends are consistent, the studies differ in the number of occupational titles used in calculating index values, and all deal with a time span that incorporates two different occupational classifications. The Canadian Classification and Dictionary of Occupations (CCDO) used in the 1961-1986 censuses was replaced in 1991 by the National Occupational Classification (NOC). Our study takes advantage of 25 years of the NOC data by returning to the issue of temporal trends in gender segregation in Canadian occupations.² We ask two related questions found in earlier research:

Question 1: Does the magnitude of the occupational segregation between women and men, noted almost 25 years ago in Canada, continue to decline from 1991 to 2016?

Question 2: To what extent do changes in the index of dissimilarity between 1991 and 2016 reflect alterations in the gender composition of occupations, compared to occupational restructuring in the economy?

DIFFERENCES VERSUS INEQUALITIES: GENDERED HIERARCHIES AT WORK

Observing the contemporary levels of gender segregation and assessing temporal trends are important for three main reasons. First, gender differences in occupations have impacts on other labour market inequalities, and these impacts spill over into other domains of life, including the

well-being of families and seniors. Generally, occupations refer to the kinds of work performed in a job and include the tasks, duties, responsibilities and skills required (Statistics Canada, 2018). As part of the larger work setting, occupations are associated with social and economic networks and with mobility opportunities or barriers. They are sources of status, prestige and earnings which, in turn, influence consumption (including access to health and shelter), savings, wealth accumulation and pensions. Occupations also are linked to work stress, risk of injuries and precarious/non-standard employment conditions.

Second, gender differences in occupational locations help explain why women's aggregate wages were, and continue to be, lower than men's. Estimates of the relationship between gender, occupations and earnings vary according to data analytic techniques, time periods and number of occupational categories (Brown, Moon & Zoloth, 1980). However, both occupation-specific studies (Prentice, 1977) and trend analyses of censuses (Fortin & Huberman, 2002; Fox & Fox, 1983; Pelletier, Patterson & Moyser, 2019) point to the gender segregation of occupations as one correlate of the gender wage gap in Canada.³

Third, gender segregation stimulates research into its causes and manifestations. Between the 1970s and today, North American and European explanations of gender segregation have emphasized socio-demographic transformations (Blackburn & Jarman, 2006) along with various proximal causes, such as supply and demand factors, including worker traits and preferences, employer preferences and statistical discrimination (e.g., Cortes & Pan, 2017; England, 1984; Reskin, 1993), with more attention paid to micro-level factors (Charles, 2003). These explanations of occupational segregation are usually embedded in broader analytical perspectives

that deal with gender inequalities more generally, such as the neoclassical human capital model, institutional and labour market segmentation approaches and feminist/gender perspectives (Anker, 1997).

Feminist approaches speak to empirical findings that many occupations held by women are similar to work performed in the home in earlier times, and women are frequently absent from higher status, higher paying occupations. Writing in the 1970s, Hartmann (1976) argues male domination in the sexual division of labour and the attendant power imbalances in the home were carried into the paid workplace throughout the development of capitalism. Through their exclusionary actions, male workers were able to keep women out of male-dominated sectors of employment, restricting women to lower status and less well-paying occupations. These gender inequalities continued with the growth in services. Similarly, early Canadian studies often combined a feminist lens with structural explanations that stressed the role of the economy and/or state in creating occupational segregation at work. For example, early research by Fox & Fox (1987) emphasized the combination of male power and capitalism as creating the setting for the gendered segregation of occupations while Armstrong and Armstrong (1978) stress the intersections of the division of labour and the economy as key to understanding the existence of female occupational “ghettos,” using concentration measures.

Starting in the 1990s, new explanatory frameworks began to stress culture as supporting powerful gender essentialist ideologies; these frameworks emphasized innate gender differences as the basis of occupational segregation specifically and gender inequality generally (Charles & Bradley, 2009; Charles & Grusky, 2004; Ridgeway, 2011). In the United States, the emerging

“egalitarian essentialism” framework for occupational segregation incorporated beliefs about innate female-male differences but also emphasized gender equality as the right of individual women to choose what they perceived to be best for them (Charles & Grusky, 2004; Wharton, 2015). The combination of gender essentialism and the strong cultural emphasis in the United States and other countries on individual self-expression also is used to explain gender segregation in other areas, including fields of study, career choices and occupational decisions (Charles & Bradley, 2009).

Specifically, scholars argue that as a result of reproduction, child raising and family roles, cultural ideologies have developed which portray women as having specific innate qualities particularly useful for caring, serving, household-related work and social interaction tasks. Through socialization, cultural belief systems, the media and everyday interactions, these attributes have become accepted as the essential and innate properties of women (Anker, 1997; Charles, 2003; Joyce & Walker, 2015; Levanon & Grusky, 2016). These qualities characterize the occupational tasks of nurses, social workers, maids, housekeepers, cleaners and countless other occupations (Charles, 2003). Women predominate in these occupations (and are absent in others) either because of interests and preferences (England, 2010; Hakim, 2000) or because they are viewed by employers as innately skilled to perform the required tasks. Essentialism also exists for men, where essential qualities include physical strength and leadership traits (Levanon & Grusky, 2016). Such traits map onto many diverse occupations, including blue-collar jobs, policing and firefighting and executive management positions.

Although gendered ideologies underlie the persistence of occupational segregation, essentialism as an explanation of occupational segregation does invite criticism. Blackburn and Jarman (2006, p. 251) argue that a conceptual reliance on essentialism over-estimates male agency, under-estimates female ability to resist, ignores female acquiescence to some aspects of inequality, overlooks the intersection of gender and class (and we would add race and nativity) and ignores temporal expansions and contractions in the economy that influence labour demand.

Additionally, to date only two investigations directly study the relationship between essentialized female and male traits and the structure of gender segregation in the labour market. These U.S. studies used occupational trait data provided in O*Net (Charles, 2003; Levanon & Grusky, 2016; USDOL/ETA, no date). Gender differences are represented by logged (ln) odds of the numbers of women in highly aggregated groups of occupations compared to the numbers of men. The two main conclusions of the log-linear analyses are that different and unequal occupational locations of women and men reflect two dimensions of inequality. Differences in job traits associated with occupations correspond to select essentialist traits; for example, fine motor skills characterize occupations that are prototypically regarded as female, while manual labour characterizes occupations regarded as male (Charles, 2003; Levanon & Grusky, 2016). The second dimension of inequality is the principle of male primacy, defined as male advantages in pay and prestige.

Comparable studies do not exist in Canada, partly because a Canadian equivalent to O*Net does not exist.⁴ Yet the emphasis on two dimensions of gender segregation resonates with earlier Canadian and British research distinguishing between horizontal and vertical gender segregation (Brooks et al., 2003; Fortin & Huberman, 2002; Hakim, 1979; Moore, 1985). The most general

definition of horizontal segregation refers to the pattern whereby women and men are not working in the same occupations; more specifically, women cluster in some occupations while men cluster in others (Moore, 1985). In addition to this general definition, there are two slightly more nuanced ones. In the first and more commonly accepted version, horizontal segregation refers to the distributions of men and women workers across the entire occupational scale (Blackburn, Brooks & Jarman, 2001; Fortin & Huberman, 2002). In the second, horizontal segregation is defined as the segregation of women and men across the non-manual/manual divide. This definition is found in U.S. scholarship where several researchers emphasize that men are more likely than women to hold manufacturing or blue-collar occupations while women concentrate in white-collar positions, particularly in service, care or clerical occupations (Charles, 2003; England et al., 2020). Here, analyses are conducted separately for white- and blue-collar occupations (Charles & Grusky, 2004; England, 2010).

Regardless of its specific definition, horizontal gender segregation is “durable,” long-lasting and resistant to change. At first, some formerly male-dominated occupations may be easy for women to enter (England, 2010; Fox & Fox, 1987). This can occur for a variety of reasons such as women meet accreditation requirements in select professions, labour scarcities exist, or the employment conditions change. Occupations such as insurance adjuster, public relations specialists, pharmacists and veterinarians and teachers are examples here (Adams, 2010; Prentice, 1977; Reskin & Roos, 1990). After the initial entry of women into these types of occupations, horizontal segregation becomes intractable and less subject to change. The essentialist explanation of occupational segregation says this occurs because employers internalize essentialist presumptions and allocate workers to jobs based on these principles; at the

same time, workers internalize these essentialist preferences and aspire to jobs that satisfy their preferences (Charles, 2003; Charles & Grusky, 2018).

Vertical segregation is defined as occupational segregation along a hierarchy of advantage defined by occupational status or prestige and/or earnings. In today's post-industrial economy, vertical segregation is considered more changeable than horizontal segregation. Liberal equality policies, such as publicly funded day care, rising university attainments of women, policies on employment equity and equal pay for work of equal value and more general norms of equality that influence educational aspirations, family and labour market choices, can all reduce vertical segregation over time. Women may also benefit from public sector and professional employment in more meritorious cultures, especially when gender-biased cultures and bureaucratic equity practices are visible (Charles, 2003).

To date, two Canadian studies have explicitly investigated the horizontal and vertical dimensions of gender segregation over time, employing measures that differ from the recent American use of O*Net indicators. Both situate the research within the context of increasing female labour force participation. Building on early research by Hakim (1979), Moore (1985) uses several measures, including sex typing (the percentage of women workers in a specific occupation) of 14 large occupational groupings, to depict trends between 1901 and 1981. She shows that women are increasingly concentrated in white-collar occupations compared to men but are over-represented in the lower-status clerical occupations and under-represented in proprietary and managerial occupations. Moore also incorporates Hakim's conceptualization of vertical segregation as referring to higher and lower grades of work within an occupation (e.g., fire chief, fire captain,

fire fighter). A different conceptualization and more sophisticated methodology are offered by Brooks et al. (2003) based on earlier research by Siltanen et al. (1995). These researchers decompose the summary Gini index (Duncan & Duncan, 1955) into measures of vertical and horizontal segregation. The vertical segregation measure is obtained by ranking occupational titles according to independently derived indicators of occupational earnings. Horizontal segregation is defined as part of the Gini index not captured in the vertical segregation measure (see Appendix 2). Brooks et al. (2003) show over a 15-year period, 1981-1996, vertical segregation substantially decreased, meaning that men's advantage in working in higher earning occupations over women declined. Meanwhile, horizontal segregation, or differences not associated with occupational earnings inequalities, modestly increased. The researchers attribute the increase in horizontal segregation to women entering occupations that are heavily female concentrated, such as nurses or librarians. No additional research exists after 1996, thus motivating the following research questions which rest on the approach and methodology of Brooks et al. (2003):

Question 3: Does gender occupational segregation decline over time when an alternative measure, the Gini index, is used instead of the index of dissimilarity to track occupational segregation? What are the trends during 1991-2016? What are the intercensal changes? How closely do they parallel results using the dissimilarity index?

Question 4: During the 1990s and into the twenty-first century, does vertical segregation continue to decline, and does horizontal segregation increase or remain stable?

Collectively, by answering questions 1 through 4, we update what is known about gender segregation in Canada from the 1990s to the first two decades of the twenty-first century. This

benchmark knowledge is relevant for ongoing narratives and debates on Canada's stalled gender revolution. It also is relevant for current investigations into the intersectional indicators of difference and disadvantage. We briefly return to these issues in the conclusion.

DATA AND METHODS

Data

We study gender occupational segregation using the 1991, 1996, 2001, 2006 and 2016 Censuses of Population and the 2011 National Household Survey available through the Research Data Centres. The 2011 NHS is a voluntary survey, but comparison of the 2011 NHS estimates with those of a pooled sample from the 2010-2012 Labour Force Survey data indicates 2011 NHS results are robust.

The population of interest is defined as individuals aged 25-54 who report as female or male and also report an occupation in the 1991-2016 censuses (or the 2011 National Household Survey). Depending on the year, the long form of the Canadian census collects detailed socioeconomic data on 20-33 percent of the population, thereby providing robust information on occupations. In census data, occupation usually refers to the occupation held during the census reference week. If a respondent did not work in that week, the main occupation held since January 1 of the previous year is recorded. Moreover, the age range of 25-54 is often deemed as a core or prime working age in labour force research (OECD, 2022; Statistics Canada, 2022). Focus on this age group allows us to minimize the effects of full-time schooling of younger adults or early retirement of older adults on their employment outcomes (Borrowman & Klasen, 2020). Furthermore, the

census question on sex allows respondents to identify only as female or male. Despite growing interest in the topic (del Rio & Alonso-Villar, 2019; Finnigan, 2020), past census data collection decisions hamper the study of temporal trends in the occupational segregation of those who declare themselves to be lesbian, gay, bisexual and transgender (LGBT) people. Starting with the 2001 census, same-sex couples are now identified, but LGBT people who are not in a couple relationship are not identified.

Segregation indices are sensitive to the number of occupational titles; generally the more occupational titles in a classification, the larger the index. Thus, our analysis requires the use of an invariant occupational classification with the same number of occupational titles across all censuses. In principle, the four-digit National Occupational Classification provides the most detail, with more than 500 occupation unit groups available. However, changes in occupational categories at the four-digit code level from the NOC-S 2006 (available in the 2006 Census and 2011 NHS) to the NOC 2011 and 2016 (available in the 2011 NHS and 2016 Census, respectively) are so extensive that it is impossible to fully harmonize the 1991-2006 Census, and the 2011 NHS and 2016 Census data (Statistics Canada, 2013, 2015a). Instead, we create hybrid occupation categories that harmonize three- and four-digit occupational titles across multiple occupational classifications over the 25-year study period.

We first apply the three-digit 1991 Standard Occupational Classification to the 1991, 1996, 2001 and 2006 Censuses. Next, we harmonize the SOC 1991 and NOC 2011/2016 using Statistics Canada's concordance table for the NOC-S 2006 and NOC 2011 (Statistics Canada, 2015a). We obtain 146 hybrid occupation categories—137 three-digit titles and nine four-digit titles—that

are consistent throughout the study period. Appendix 1 shows the titles of all 146 occupation categories.

Occupational Segregation Measures

We use four measures of occupational segregation: the index of dissimilarity (DI); the Gini index (GI); a vertical segregation measure; and a horizontal segregation measure. As noted earlier, the DI measures the extent to which a minority group (e.g., women) would have to change occupations for the occupational distribution of the minority and majority groups (e.g., men) to be the same (Duncan & Duncan, 1955). The DI and the GI are related. The latter measures inequality as a Lorenz curve, where a score of zero represents no inequality, and a score of 1 (or -1) represents complete inequality. A GI between 0 and 1 (or -1) can be represented as the area of a curve underneath/above the diagonal of a triangle. The DI is the maximum vertical distance between the diagonal and the curve (Duncan & Duncan, 1955; also see: James & Taeuber, 1985).

Each measure can be decomposed to provide additional insight into gender segregation.

Temporal changes in the index of dissimilarity can be decomposed into: 1) changes due to changing gender composition within occupations; 2) changes due to alterations in the overall occupational structure of the economy; and 3) the interaction between the two (Blau & Hendricks, 1979; also see Das Gupta, 1987). As noted earlier, the Gini index can be decomposed into horizontal and vertical segregation (Blackburn et al., 2001; Brooks et al., 2003). The vertical segregation measures require occupations to be ranked according to one or more measures of dis/advantage, such as pay, prestige or other indicators of social or economic dis/advantage

(Brooks et al., 2003). Here, we use the median employment income of each occupation for women and men combined as the inequality measure. Additional details on our measures are in Appendices 2-4.

RESULTS

Trends in Gender Occupational Segregation, 1991-2016

In this section, we multiply the index of dissimilarity and vertical/ horizontal/ overall segregation values by 100 for ease of interpretation. Consistent with Question 1, trends in gender occupational segregation use the DI, the most common measure of occupational segregation. As Figure 1 shows, the decline in gender occupational segregation among workers aged 25-54 in Canada has been slow over the past 25 years. In 1991, the DI stood at 54.6, so 55 percent of women (or men) would have to change their occupation to reach gender occupational parity. By 2016, the DI dropped below 50 (49.2), suggesting slightly less than half of women (men) workers would need to change their occupation to reach occupational parity with men (women). As discussed in detail later, the decline in gender occupational segregation had already slowed in the 1990s, with a decline of just 3.8 percentage points between 1991 and 2001 (two percentage point decrease in five-year intervals, from 1991 to 1996 and from 1996 to 2001). It slowed even more in the new millennium. Between 2001 and 2011, the DI decreased by only one percentage point (50.8 to 49.7).

[Figure 1 about here]

How can we put the gender occupational segregation trends for 1991-2016 into a broader historical context? Figure 2 shows the plot of the DIs for the period 1991-2016, along with the results from Fox and Fox (1987), Gunderson (1998), Fortin and Huberman (2002) and Brooks et al. (2003), who calculate the DIs for 1941-1981, 1971-1991, 1961-1996 and 1981-1996, respectively.

[Figure 2 about here]

We caution against a direct comparison of our results with these four studies for three methodological reasons. First, our analysis focuses on the core working age population aged 25-54, while the other studies select a different age range (e.g., age 16-69 by Fortin & Huberman, 2002) or do not specify an age range.⁵ Second, the number of occupational categories considered in the calculation of DIs differs for all five studies. This influences the DI values, as a greater number of occupational categories tend to produce higher DIs. As such, the 1996 DI in our analysis may be lower than that of Brooks et al. (2003) because we analyze 146 hybrid occupational categories, while those researchers use four-digit codes of the 1991 Standard Occupational Classifications, yielding 514 groups. Meanwhile, the 1996 results of Fortin and Huberman (2002) are based on their analysis of the 1997-1998 Labour Force Survey data, not the 1996 Census data. The difference in data sources may explain why Fortin and Huberman's DI (42) is much lower than Brooks et al.'s and ours (55 and 53, respectively). Third, occupational classifications differ across studies. While we use the 1991 SOC as the basis for harmonizing codes across the 25-year period, the earlier studies adopt different occupational classifications

for different census years. For example, Brooks et al. (2003) apply the 1980 SOC and 1991 SOC for the 1986/1991 and 1996 census data, respectively.

Despite these methodological differences, Figure 2 confirms a steep decline in gender occupational segregation in the 1960-1980 period. By the 1990s (when our analysis starts), the decline had started to slow, and by the 2000s, intercensal change was small. During the 1960-1980 period, the DI declined by more than five percentage points per decade (5.4, 6.3 and 7.9 percentage-point drops in the 1960s, 1970s and 1980s, respectively). By the 1990s, the decline in the DI was down to 3.8 percentage points.

What Accounts for the Decline in Gender Occupational Segregation?

Turning to Question 2, we decompose the change (decline) in gender occupational segregation in five-year intervals: 1991-1996, 1996-2001 and 2001-2006. We are not showing the decomposition results for 2006-2016 for three methodological reasons. First, we draw on the 2011 results from the 2011 National Household Survey; it is a voluntary survey and considered less comparable with earlier long-form censuses (Statistics Canada, 2013). Second, minimal changes in DIs since 2001 do not produce meaningful decomposition results. Changes in a small-size occupation (with fewer workers) may have a large impact on the results. Our finding (not shown here) that the large, positive interaction effect in the 2006-2011 and 2011-2016 results counterbalances the larger negative contributions of changes in gender composition within occupations and occupational structure are also observed in Fox and Fox's (1987) 1941-1951 and 1961-1971 results where the observed changes in DI are small (-1.3 and -0.8 percentage

points, respectively).⁶ Finally, our use of the National Occupational Classifications (NOC 2011/2016) to harmonize the 2011 and 2016 occupational titles to the 1991 SOC (used for the 1991-2006 results) may have created some minor discrepancies in the compatibility of occupational titles between pre- and post-2011 data.

Table 1 shows throughout the 1991-2006 period, gender compositions in many occupations were indeed changing, contributing to 60-75 percent of the decline in the observed DIs (4.5 percentage point decline, from 54.6 to 50.1). A closer look at gender compositions within our 146 harmonized occupational categories (results not shown here) suggests gender compositions were changing particularly in professional and managerial occupations that were somewhat gender integrated (10 to 40 percent women) in 1991. For example, the share of women in D01 physicians, dentists and veterinarians rose from 28 percent (1991) to 44 percent (2006), reflective of the feminization in health care professions (Adams, 2010). Similarly, the percentage of E01 judges, lawyers and Quebec notaries increased from 29 percent in 1991 to 46 percent in 2006, resonating with Kay, Alaire and Adjei's (2016) analysis of women lawyers in Canada.

In contrast, women's share in the most male-dominated occupations (less than 10 percent women) remained virtually unchanged, while men's presence in female-dominated occupations (over 80 percent women) slightly increased.

[Table 1 about here]

The decline in DIs also derives from alterations in occupational structure of economy. Figures 3, 4 and 5 display the distributions of total, women and men workers in each census year (1991-2016), sorted by the gender compositions of occupations in 1991; these figures further help unpack the changes in occupational structure (Blau & Hendricks, 1979). Figure 3 suggests the contraction of the most female-dominated occupations (over 90 percent women), namely clerical occupations, was the main source of changes in occupational structure contributing to desegregation (also see Boyd, 1992; Fortin & Huberman, 2002). Relatedly, the share of women in the most female-dominated occupations dropped from 25 (1991) to 20 percent (2006) (Figure 4).

Occupations that were 80-90 percent women in 1991 also declined in size, although the decline was not as linear as it was in the most female-dominated occupations. A notable decline occurred between 1996 and 2001, from a share of 9.6 percent (396,000 workers) to 8.0 percent (291,000 workers), driven by the decline of B53 financial and insurance clerks (Figure 3). We can speculate that the contraction of clerical occupations resulted from computerization/ automation; the work previously done by women clerical workers possibly became part of a job description of high-skill professionals/ managers with a wider use of personal computers and the internet (Hughes, 1996).

In comparison to those female-dominated occupations (80-100 percent women) whose rapid decline in size contributed to the decline in DIs, more male-dominated occupations (0-60 percent women) barely changed in size over time. Of note are the most male-dominated occupations (0-10 percent women), whose share was stable at around 17-18 percent throughout 1991-2016

(Figure 3). An exception was H01 contractors and supervisors, trades and related workers; its total labour force declined from 154,000 workers to 109,000 workers in 1991-1996 (Figure 3).

As Figure 5 suggests, the distribution of men workers across occupations with different shares of men (and women) remains static throughout the 1991-2006 (and 2006-2016) period.

In summary, gender desegregation within occupations was mainly driven by women workers in 1991-2016. They left traditionally female-dominated clerical occupations, as these occupations rapidly disappeared through automation/ computerization in white-collar service-sector workplaces (Hughes, 1996). Meanwhile, women increasingly moved into more gender-integrated professional/ managerial occupations (20-80 percent women in 1991). Nevertheless, more male-dominated occupations (0-20 percent women) remained more or less intact.

Trends in the Gini Index and in Vertical and Horizontal Segregation, 1991-2016

Question 3 invites us to compare temporal trends in gender segregation using the Gini index (overall segregation). Specifically, does the “glacial” pace of gender occupational desegregation found in the index of dissimilarity hold when we use a GI? Figure 6 supplies an affirmative answer. As acknowledged by Brooks et al. (2003), the values of segregation calculated with the GI tend to be higher than those using the DIs. However, the general trend holds whether we use the DI or GI; the decline in segregation stalled in the 2000s. From 2001 and onward, the GI declined by less than one percentage point every five years. When we compare our results with those of Brooks et al. (2003), we see the decline in overall segregation definitely slowed (Appendix Figure A8).

[Figure 6 about here]

Figure 6 displays the trends in vertical and horizontal segregation, addressing Question 4 which asks if the earlier trends continue. More specifically, does vertical segregation continue to decline, while horizontal segregation does not? The figure shows that while horizontal segregation was relatively stable over the 25-year period (around 62-65), vertical segregation almost halved, dropping from 33.0 in 1991 to 17.7 in 2016. This indicates that men's advantage over women in better paid occupations still persists as the positive value of vertical segregation (Somers' -d) suggests; however, the temporal declines indicate that the concentration of women in lower paid occupations is diminishing. Although this is welcoming evidence for declining gender inequality at work, researchers caution that this overall trend does not tell a whole story. Women's rising educational attainment and growing earnings returns to higher education may be masking a disconcerting trend of the devaluation of occupational pay as a result of women's entry to better paid occupations (Levanon, England & Allison, 2009; Mandel, 2018).⁷

CONCLUSION

The questions asked in this paper derive from earlier Canadian research showing declining gender segregation in occupations, particularly during the 1960s, 1970s and 1980s. Our analyses confirm that the slowdown in the decline in gender segregation observed in the 1990s continued into the start of the twenty-first century. In fact, since 2001, only small changes occur in the index of dissimilarity. Our classification of 146 occupational titles shows the dissimilarity index declines by 0.65 points between 2001 and 2006, 0.40 points between 2006 and 2011 and 0.50 points between 2011 and 2016. We also note that current levels of gender occupational

segregation remain high. In our analysis of segregation across 146 occupational groups in 2016, the index of dissimilarity is 49.2, indicating that nearly half of women (or men) holding occupations would have to shift out of their current category to achieve complete gender integration.⁸ The Gini Index is 66 for these occupations, down from 72 in 1991 while the horizontal segregation measure hovers between 63-65 throughout the 25 year period.⁹ These results are consistent with observations by U.S. researchers (Charles & Grusky, 2004; Levanon & Grusky, 2016) that earlier declines in their measures of horizontal segregation reflected women's movement into male occupations that were easy to occupy, but the existence of a threshold has made it harder for women to continue to move into highly male-dominated occupations.

The results of our analysis are consistent with recent literature on the “stalled” status of the gender revolution. Broadly speaking, the gender revolution started in the 1960s and 1970s with the rising labour force participation of women and growing pressure on governments to implement policies to eradicate female labour market disadvantages, relative to men. After the rapid and revolutionary changes in North America in the 1960s, 1970s and 1980s, stock taking was inevitable. Several compendiums show temporal trends using multiple indicators (Cotter, Hermsen & Vanneman, 2004; England, 2010; Guppy & Luongo, 2015). In all analyses, listless declines in the indices of dissimilarity for gender occupational segregation provide major support for the “stalled revolution” mantra. Our results confirm the continuation of this stall.

Our findings provide additional insights into the narratives of the “stalled revolution” and suggest new research agendas. First, between 1991 and 2016 vertical segregation in Canada almost halved, indicating that the segregation of women employed in low wage occupations rapidly declined. In addition, we find the decline in the dissimilarity index reflects the rising shares of women in professional/ managerial occupations (e.g., physicians, managers in public administration), as well as a declining employment in the most female-dominated clerical occupations (e.g., secretaries). These are optimistic stories, indicating that, despite little overall change in occupational segregation, some improvement for women in the labour force is occurring. However, strongly male-dominated occupations, defined as 0-20 percent women, experienced little change over the period. Overall, our results show while women continued to make inroads from the 1990s and onward, the rate slowed considerably from earlier periods, and women moved into somewhat less female-dominated professional/ managerial occupations, but not into male-dominated ones. In short, the observed progress is asymmetrical, with little change observed for men.

Our study also provides a benchmark for future research on gender segregation in Canada that focuses on diverse subgroups. Our findings update gender segregation for the entire Canadian population between 1991 and 2016, but we do not pursue inquiries into gender segregation for marginalized groups, defined either by the intersection of gender with disadvantages associated with work conditions or by the intersection of gender with race and/or nativity. In terms of specific types of employment, British scholars in the 1990s observed the polarization of women’s employment into full- and part-time work with women in full-time work advantaged relative to part-time women workers. This polarization underlies the argument that the overall

level of gender segregation is the sum of two opposing temporal trends: for full-time workers, gender segregation declines but is stable or increasing for part-time workers (Hakim, 1993; Humphries & Rubery, 1992). In fact, whether or not full-/part-time work is a powerful force for the labour force segmentation of women and men varies substantially across European countries (Fagan & Rubery, 1996). However, in the only Canadian study to date, Brooks et al. (2003) find full-time and part-time workers exhibit different patterns in vertical segregation indices over time. They conclude full-time women workers (but not part-time women workers) are an advantaged segment of the female labour force with respect to gaining ground in occupations that are desirable in terms of pay. Our early research confirms these trends for 1991-2022, indicating that full- and part-time employment distinctions remain an important source of gender stratification in the Canadian work force (as do distinctions between precarious/nonstandard and standard employment).

Our early research also confirms that women, visible minorities and immigrants are most likely to be employed as part-time workers, indicating labour market disadvantages often are not uniformly experienced by Canadians but instead reflect the intersections of multiple social categories. This intersectionality also underscores the need to move beyond the study of all women and men workers as a monolithic population in future occupational segregation research. As a result of policy shifts and high levels of immigration in the second half of the twentieth century and into the millennium, the immigrant share of the population is the highest since 1911. Changing source countries also have transformed the racial composition of Canada such that one in five of those in the 2016 labour force are members of visible minorities with South Asian,

Chinese and Black groups being the largest. Yet, many migrants and visible minorities face disadvantages at work, as well as in other areas such as housing and education.

Of course, gender remains an important signifier of labour market differences, and gendered labour market inequalities do exist within these sub-groups. But the inequalities produced by the intersection of gender, race and/or immigrant status are not “additive” but instead are unique (Brown & Misra, 2003; Collins, 2015; McCall, 2005). In terms of occupational segregation, intersectionality implies that occupational distributions will vary both by gender and by race and/or by immigrant groups. This complexity also means that the temporal trends of gender segregation may differ depending on what immigrant groups or what visible minority groups are studied. Further, American and Spanish studies find minority and immigrant women are far less segregated from white women than from men of their own racial group or immigrant group, suggesting that gender differences surpass those of race (Cotter, Hermsen & Vanneman, 2003; del Rio & Alonso-Villar, 2012; Mintz & Krymkowski, 2010; Reskin & Cassirer, 1996). The applicability of these diverse findings for Canada is a question that likely will stimulate continuing research on occupational segregation in the years to come.

ENDNOTES

¹ Using data for 496 occupations, Gunderson (1998) reports the DI of 53 in 1990 (down from 59 in 1980). In their analysis of temporal trends in wage gaps, Fortin and Huberman (2002) use data from 250 occupations to calculate the DIs of 57 in 1981, 47 in 1991 and 42 in 1997-1998, while Brooks et al. (2003) report the DIs of 61, 57, 53 and 55 in 1981, 1986, 1991 and 1996, respectively.

² The NOC classification is the backbone of a recent study on highly sex-typed occupations and on temporal changes within 10 broad occupational groups for 1991-2016 (Quin, Harper, Rydz, Smith, Koehoorn & Peters, 2021). It finds that a statistically significant change in the gender gap, defined as the number of women and the number of men, exists only in the natural and applied sciences, with the gap narrowing over time. For other major categories, the magnitude of the female/male gap is stable over time, and intercensal changes do not meet the criteria of statistical significance (Quin et al, 2021: Table 4).

³ We note that the impact of occupational segregation on the gender wage gap is debated. First, several scholars in both Canada and the United States suggest effects can be minimal (Fortin & Huberman, 2002; Baker & Fortin, 1991; Cotter, Hermesen & Vanneman, 2004). Second, several comparative studies also find an “earnings paradox,” namely that countries such as Sweden have high values of segregation but low levels of gender inequalities in earnings (Jarman, Blackburn & Racko, 2012; Charles & Grusky, 2004). Third, some studies do not incorporate actual measures of occupational segregation into the analyses but instead include occupational specific percentages of women, thereby focusing on occupational-specific concentration of women.

⁴ At the time of writing this paper, Canada does not have a classification of occupational traits similar to O*Net (USDOL/ETA, no date) that correspond to the NOC in effect since 1991. Several concordances do exist between 8-digit United States occupational codes and the 4- or 6-digit Canadian codes. These crosswalks purportedly allow O*Net occupational traits to be attached to Canadian census 2016 National Occupational Classification; however, such concordances are in their infancy, and the correspondence between United States and Canadian classifications requires a number of assumptions and decisions that make the O*Net application to Canadian data far from perfect. In addition, these concordances exist only for one time point,

creating roadblocks for studies of temporal changes in Canadian gender segregation of occupations.

⁵ Our analysis of the 2016 Census data suggests the inclusion of younger (e.g., aged 15-24) and older workers (e.g., aged 55-64) would slightly decrease and increase segregation measures, respectively (both in DIs and vertical/ horizontal segregation).

⁶ In their decomposition analysis of educational attainment among the children of immigrants in different admission categories, Hou and Bonikowska (2017) similarly do not report decomposition results for the small differences in educational attainment between children of business class immigrants and children of skilled worker immigrants.

⁷ We must note, however, that our vertical segregation index does not directly measure gender pay gaps within specific occupations or between individuals, as is done in the well-established gender wage gap research.

⁸ Our analysis of 146 aggregated occupational titles using the 2020 Labour Force Survey data shows a dissimilarity index of 48.7, down 0.5 points from the 2016 index.

⁹ In fact, all these indices likely under-estimate the real amount of gender segregation at work for three reasons. First, underestimation can occur if current occupational classifications contain finer divisions for the occupations held mostly by men than occupations held mostly by women (OECD, 2005; Sen, Geroge & Ostlin, 2002: 21). This possibility rests on the legacy of earlier occupational classification systems which were developed with a male work force in mind, and it is consistent with arguments that early data collection and dissemination by Statistics Canada either ignored gender or privileged men when conceptualizing the measurement of heads of households and “work” (Morris, 2018; Thomas, 2010; Waring, 1988). Having more occupational titles for male-dominated occupations than for female-dominated occupations would mask

additional differences between women and men with respect to occupational location and titles, thus depressing the value of the index of dissimilarity and the Gini index relative to the values that would otherwise be observed. Second, occupational classifications purport to group and classify similar jobs, which refer to the tasks required to perform work. However, occupations can be quite heterogenous with respect to the type and range of tasks (Martin-Caughey, 2021; Sakamoto & Wang, 2020). This internal variation is missed when occupations are the unit of analysis. Stated differently, gender segregation indices are higher when job titles rather than occupational titles are used (Martin-Caughey, 2021: Figure 4). This finding implies that occupation-based indices can mask gender differences and produce lower estimates of gender inequalities. Third, research on occupational segregation at the firm level produces similar conclusions. When firm-specific employment is ignored, overall levels of gender occupational segregation are lower than when within-firm segregation is studied. Firms often are highly gender segregated with respect to jobs and occupational titles, and many employ primarily (or only) women or vice versa (Bielby & Baron, 1986; Carrington & Troske, 1995). Yet, information on job titles and on firms is rarely collected. Instead, a long tradition exists of governments funding the collection of occupational information which in turn reinforces the study of occupations (Leicht, 2021).

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TABLES

TABLE 1 Sources of changes in occupational segregation, 1991-2006

Period	actual changes in dissimilarity indices (DIs)	changes in gender composition (COMP)	changes in occupational mix (MIX)	interaction between COMP and MIX
1991-1996	-1.94	-1.18	-0.87	0.10
(% contribution)		60.8	44.5	-5.3
1996-2001	-1.85	-1.17	-1.03	0.35
(% contribution)		63.0	55.8	-18.8
2001-2006	-0.65	-0.49	-0.16	0.00
(% contribution)		74.6	24.8	0.6

Sources : The 1991, 1996, 2001 and 2006 Census Masterfiles.

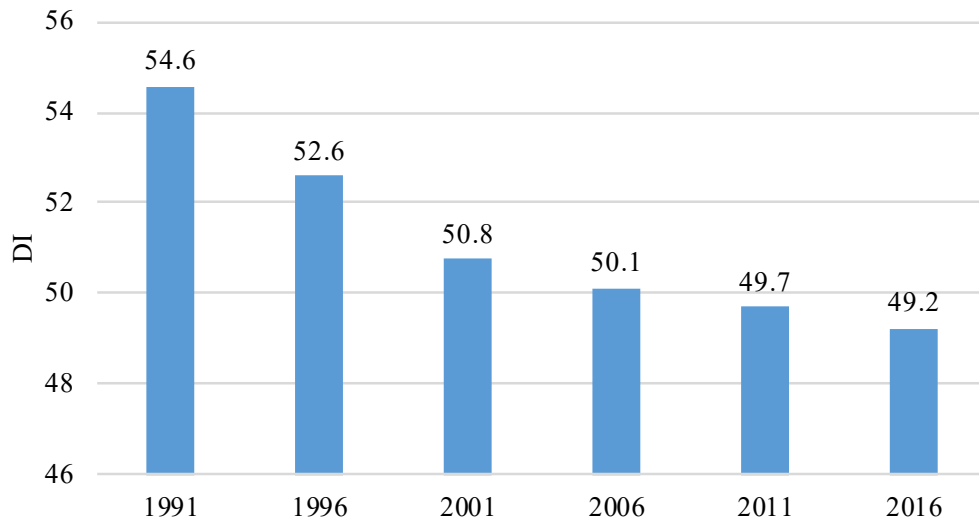
FIGURES

FIGURE 1 Gender occupational segregation trends in index of dissimilarity, 1991-2016
Sources: The 1991, 1996, 2001, 2006 and 2016 Census Masterfiles and the 2011 National Household Survey Masterfile.

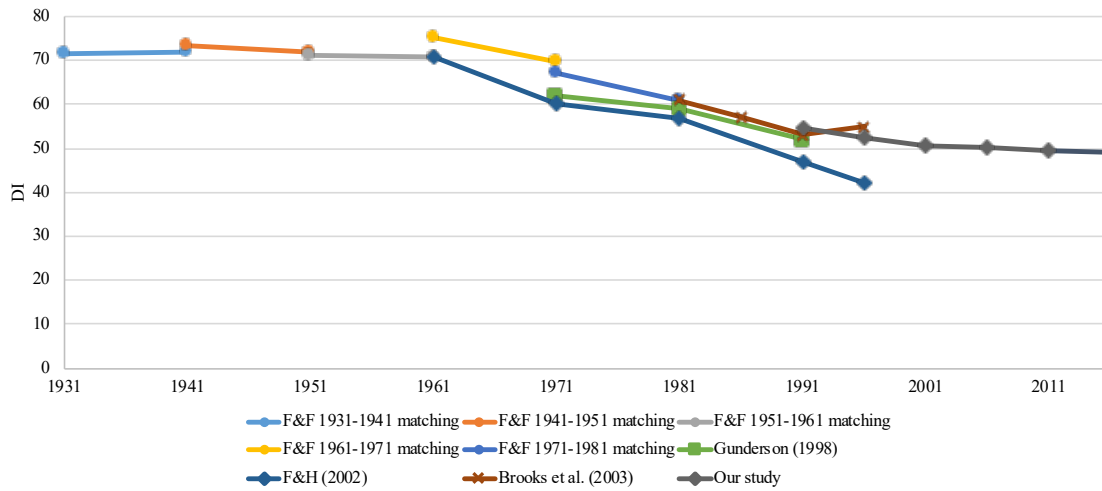


FIGURE 2 Gender occupational segregation trends in index of dissimilarity, 1931-2016

Sources: Brooks et al. (2003), Fortin and Huberman (2002), Fox and Fox (1987) and Gunderson (1998).

Notes: Fox and Fox (1987) matched occupational categories of published tabulations from adjacent censuses (1931-1941, 1941-1951, 1951-1961, 1961-1971 and 1971-1981) by Dominion Bureau of Statistics and Statistics Canada. For the 1981 results, they used a special census tabulation which adopted the 1971 occupational codes produced by Statistics Canada.

Gunderson (1998) considered 496 occupations in his calculation of DIs.

Fortin and Huberman (2002) harmonized occupational codes for the 1961-1991 census data, which produced about 250 occupational categories.

Their 1996 results are based on the 1997-1998 Labour Force Survey data, given that an occupational classification in the 1996 Census (1990 National Occupational Classification) was incompatible with those of previous census data (i.e., the 1980 Standard Occupational Classification).

Brooks et al. (2003) applied the 4-digit level 1971 Occupational Classification Manual (OCM) and 1980 and 1991 Standard Occupational Classifications for the 1981, 1986/1991 and 1996 census data, respectively, with over 500 occupational categories.

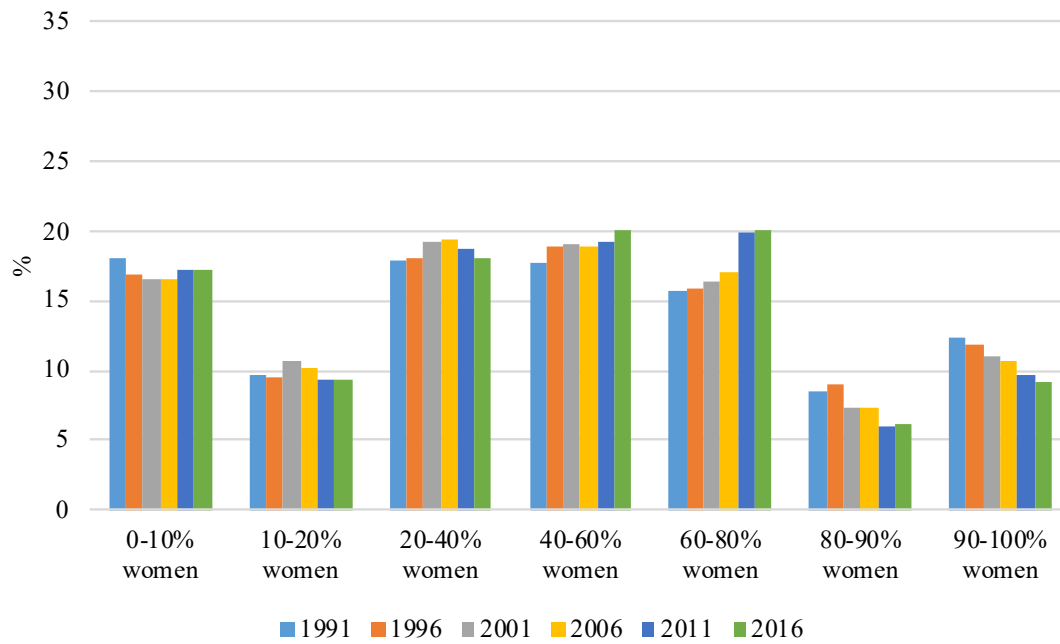


FIGURE 3 Percentage of total workers by gender composition of occupational category (% women in 1991), 1991-2016

Sources : The 1991, 1996, 2001, 2006 and 2016 Census Masterfiles and 2011 National Household Survey Masterfile.

Note: The actual percentage values are available in Appendix Table A5.

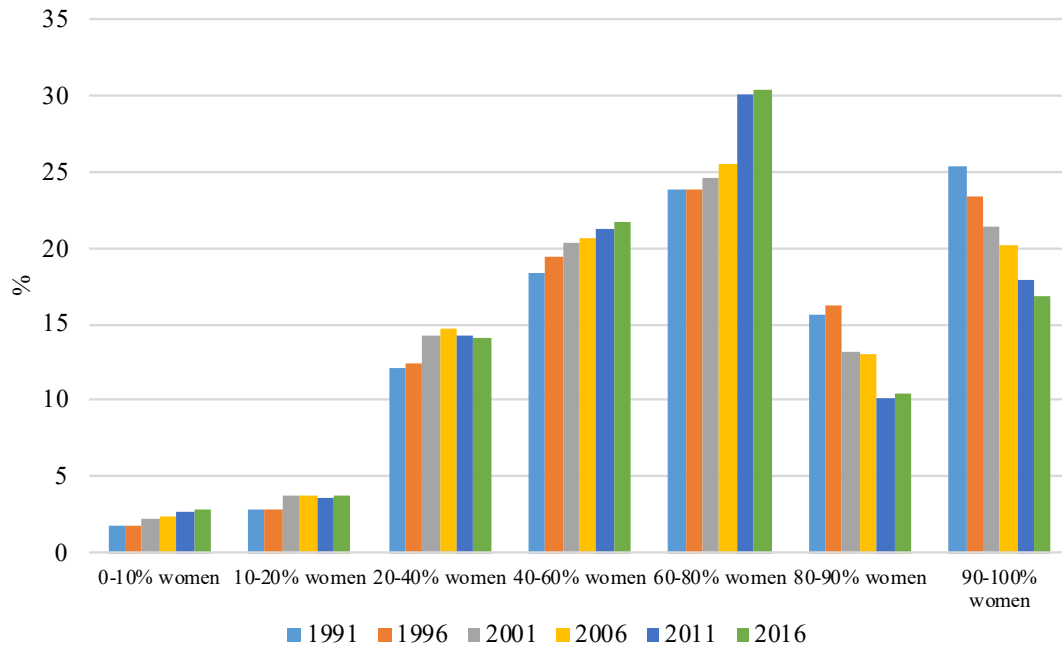


FIGURE 4 Percentage of women workers by gender composition of occupational category (% women in 1991), 1991-2016

Sources : The 1991, 1996, 2001, 2006 and 2016 Census Masterfiles and 2011 National Household Survey Masterfile.

Note: The actual percentage values are available in Appendix Table A6.

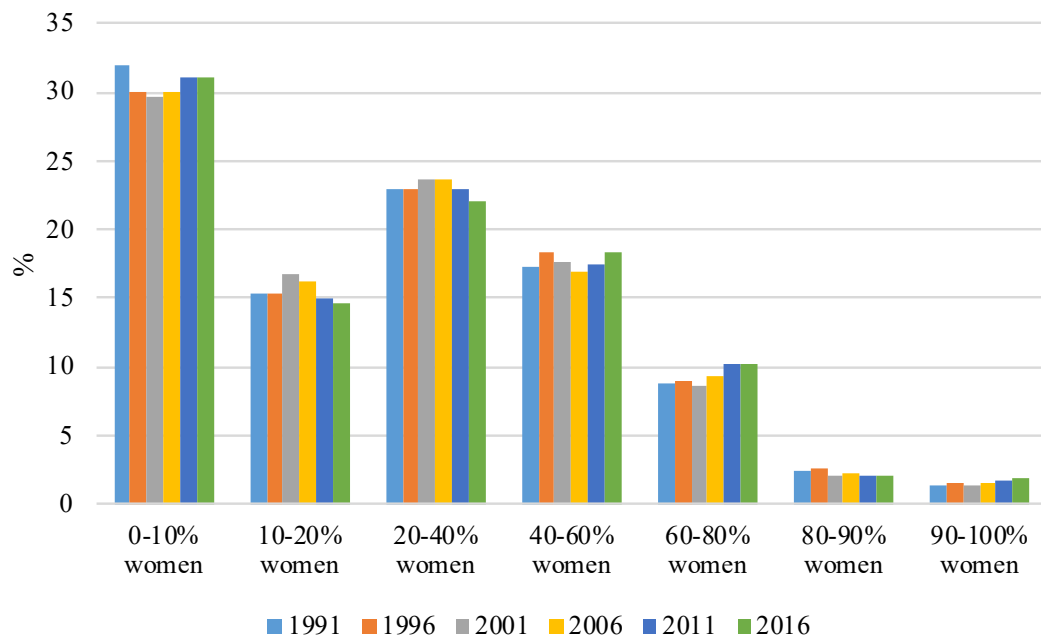


FIGURE 5 Percentage of men workers by gender composition of occupational category (% women in 1991), 1991-2016

Sources : The 1991, 1996, 2001, 2006 and 2016 Census Masterfiles; 2011 National Household Survey Masterfile.

Note: The actual percentage values are available in Appendix Table A7.

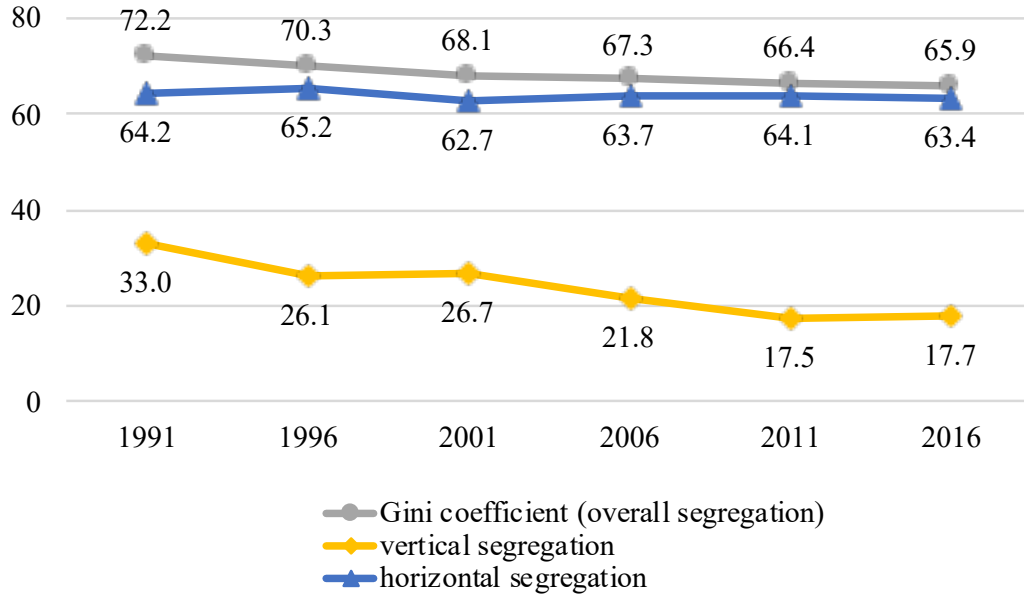


FIGURE 6 Gender occupational segregation trends (Gini index overall, vertical, and horizontal segregation), 1991-2016

Sources: The 1991, 1996, 2001, 2006 and 2016 Census Masterfiles and the 2011 National Household Survey Masterfile.

ONLINE APPENDICES

Appendix 1. List of Harmonized Occupational Titles Used in this Paper

We harmonized the 3-/4-digit NOC 2011 in the 2011 NHS and the NOC 2016 in the 2016 Census data to the 3-digit SOC 1991 (available in the 1991-2006 Census data) using the NOC-S 2006 (available in the 2006 Census data). We were able to achieve perfect a one-to-one or many-to-one match of 65 percent of the 3-digit NOC 2011/2016 titles (88 out of 136). An example of the one-to-one match is 001 Legislators and senior management in the NOC 2011/2016; this is equivalent to A01 Legislators and Senior Management in the SOC 1991. An example of the many-to-one match is 031 Managers in health care and 042 Managers in education and social and community services; these two 3-digit NOC 2011/2016 titles are equivalent to A32 Managers in Health, Education, Social and Community Services in the SOC 1991.

Moreover, we were able to harmonize 11 other 3-digit titles (8 percent) by extracting some 4-digit titles and making them standalone categories. For instance, we removed a 4-digit title 9217 Supervisors, textile, fabric, fur and leather products processing and manufacturing from 921 Supervisors, processing and manufacturing occupations, which is virtually equivalent to J01 Supervisors, Processing Occupations in the SOC 1991 except that only “Supervisors, textile processing” in 9217 Supervisors, textile, fabric, fur and leather products processing and manufacturing is part of J01 in the SOC 1991. Similarly, we pulled 9127 from J02 Supervisors, Assembly and Fabrication, which is almost equivalent to 922 Supervisors, assembly and fabrication, except that part of 9217 “Supervisors, fabric, fur and leather products manufacturing” (3-digit title 921) belongs to J02. At the 4-digit level, 9217 is equivalent to J016

Supervisors, textile processing, and Supervisors, fabric, fur and leather products manufacturing and J025 Supervisors, fabric, fur and leather products manufacturing in the SOC 1991.

Finally, we were unable to perfectly harmonize 37 3-digit SOC 1991 titles (27 percent) with the NOC 2011/2016, as some elements (jobs) in 4-digit NOC 2011/2016 belong to multiple 3-digit SOC 1991 titles.

	value label	2006 code label	Title (based on the 1991 Standard Occupational Classification titles)	Notes
1	100	A01	Legislators and Senior Management	
2	101	A11	Administrative Services Managers	
3	102	A12	Managers in Engineering, Architecture, Science and Information Systems	
4	103	A13	Sales, Marketing and Advertising Managers	
5	104	A14	Facility Operation and Maintenance Managers	
6	105	A21	Managers in Retail Trade	
7	106	A22	Managers in Food Service and Accommodation	
8	107	A30	Managers in Financial and Business Services	
9	108	A31	Managers in Communication (Except Broadcasting)	
10	109	A32	Managers in Health, Education, Social and Community Services	
11	110	A33	Managers in Public Administration	
12	111	A34	Managers in Art, Culture, Recreation and Sport	
13	112	A35	Managers in Protective Service	
14	113	A36	Managers in Other Services	
15	114	A37	Managers in Construction and Transportation	
16	115	A38	Managers in Primary Production (Except Agriculture)	
17	116	A39	Managers in Manufacturing and Utilities	

18	117	B01	Auditors, Accountants and Investment Professionals	
19	118	B02	Human Resources and Business Service Professionals	
20	119	B11	Finance and Insurance Administrative Occupations	
21	120	B21	Secretaries, Recorders and Transcriptionists	
22	121	B31	Administrative and Regulatory Occupations	
23	122	B41	Clerical Supervisors	
24	123	B51	Clerical Occupations, General Office Skills	
25	124	B52	Office Equipment Operators	
26	125	B53	Finance and Insurance Clerks	
27	126	B54	Administrative Support Clerks	
28	127	B55	Library, Correspondence and Related Information Clerks	
29	128	B56	Mail and Message Distribution Occupations	
30	129	B57	Recording, Scheduling and Distributing Occupations	
31	130	C01	Physical Science Professionals	
32	131	C02	Life Science Professionals	
33	132	C03	Civil, Mechanical, Electrical and Chemical Engineers	
34	133	C04	Other Engineers	
35	134	C05	Architects, Urban Planners and Land Surveyors	
36	135	C06	Mathematicians, Statisticians and Actuaries	This category was labelled as "Mathematicians, Systems Analysts and Computer Programmers" in the SOC 1991.
37	136	C07	Computer and Information Systems Professionals	This title did not exist in the 1991 SOC and was introduced in the NOC-S 2001. B521 (Computer Operators), C047 (Computer Engineers), C062 (Computer Systems Analysts) and C063 (Computer Programmers) in the SOC 1991 are classified into this group.
38	137	C11	Technical Occupations in Physical Sciences	
39	138	C12	Technical Occupations in Life Sciences	
40	139	C13	Technical Occupations in Civil, Mechanical and Industrial Engineering	
41	140	C14	Technical Occupations in Electronics and Electrical Engineering	
42	141	C15	Technical Occupations in Architecture, Drafting, Surveying and Mapping	
43	142	C16	Other Technical Inspectors and Regulatory Officers	
44	143	C17	Transportation Officers and Controllers	

45	144	D01	Physicians, Dentists and Veterinarians	
46	145	D02	Optometrists, Chiropractors and Other Health Diagnosing and Treating Professionals	
47	146	D03	Pharmacists, Dietitians and Nutritionists	
48	147	D04	Therapy and Assessment Professionals	
49	148	D11	Nurse Supervisors and Registered Nurses	
50	149	D21	Medical Technologists and Technicians (Except Dental Health)	
51	150	D22	Technical Occupations in Dental Health Care	
52	151	D23	Other Technical Occupations in Health Care (Except Dental)	
53	152	D31	Assisting Occupations in Support of Health Services	
54	153	E01	Judges, Lawyers and Quebec Notaries	
55	154	E02	Psychologists, Social Workers, Counsellors, Clergy and Probation Officers	
56	155	E03	Policy and Program Officers, Researchers and Consultants	
57	156	E11	University Professors and Assistants	
58	157	E12	College and Other Vocational Instructors	
59	158	E13	Secondary and Elementary School Teachers and Educational Counsellors	
60	159	E21	Paralegals, Social Services Workers and Occupations in Education and Religion, nec	
61	160	F01	Librarians, Archivists, Conservators and Curators	
62	161	F02	Writing, Translating and Public Relations Professionals	
63	162	F03	Creative and Performing Artists	
64	163	F11	Technical Occupations in Libraries, Archives, Museums and Art Galleries	
65	164	F12	Photographers, Graphic Arts Technicians and Technical and Co-ordinating Occupations in Motion Pictures, Broadcasting and the Performing Arts	This category was labeled as "Photographers, Graphic Arts Technicians and Technical Occupations in Motion Pictures, Broadcasting and the Performing Arts" in the SOC 1991.
66	165	F13	Announcers and Other Performers	
67	166	F14	Creative Designers and Craftspersons	
68	167	F15	Athletes, Coaches, Referees and Related Occupations	

69	168	G01	Sales and Service Supervisors	
70	169	G11	Sales Representatives, Wholesale Trade	
71	170	G12	Technical Sales Specialists, Wholesale Trade	
72	171	G13	Insurance and Real Estate Sales Occupations and Buyers	
73	172	G31	Cashiers	
74	173	G41	Chefs and Cooks	
75	174	G51	Occupations in Food and Beverage Service	
76	175	G61	Police Officers and Firefighters	
77	176	G62	Other Occupations in Protective Service	
78	177	G71	Occupations in Travel and Accommodation	
79	178	G72	Tour and Recreational Guides and Casino Occupations	
80	179	G73	Other Occupations in Travel, Accommodation, Amusement and Recreation	This category was labeled as "Other attendants in Travel, Accommodation and Recreation" in the SOC 1991.
81	180	G81	Childcare and Home Support Workers	
82	181	G91	Technical Occupations in Personal Service	
83	182	G92	Other Occupations in Personal Service	
84	183	G93	Cleaners	
85	184	G94	Butchers and Bakers	
86	185	G96	Food Counter Attendants, Kitchen Helpers and Related Occupations	
87	186	G97	Other Sales and Related Occupations	
88	187	G98	Other Elemental Service Occupations	
89	188	H01	Contractors and Supervisors, Trades and Related Workers	
90	189	H02	Supervisors, Railway and Motor Transportation Occupations	
91	190	H11	Plumbers, Pipefitters and Gas Fitters	
92	191	H12	Carpenters and Cabinetmakers	
93	192	H13	Masonry and Plastering Trades	
94	193	H14	Other Construction Trades	
95	194	H21	Electrical Trades and Telecommunication Occupations	
96	195	H22	Stationary Engineers and Power Station and System Operators	
97	196	H31	Machinists and Related Occupations	
98	197	H32	Metal Forming, Shaping and Erecting Trades	
99	198	H41	Machinery and Transportation Equipment Mechanics (Except Motor Vehicle)	
100	199	H42	Automotive Service Technicians	This category was labelled as "Motor Vehicle Body Mechanics" in the SOC 1991.

101	200	H43	Other Mechanics	
102	201	H51	Upholsterers, Tailors, Shoe Repairers, Jewellers and Related Occupations	
103	202	H52	Printing Press Operators, Commercial Divers and Other Trades and Related Occupations, nec	
104	203	H53	Other Installers, Repairers and Servicers	
105	204	H61	Heavy Equipment Operators	
106	205	H62	Crane Operators, Drillers and Blasters	
107	206	H71	Motor Vehicle and Transit Drivers	
108	207	H72	Train Crew Operating Occupations	
109	208	H73	Other Transport Equipment Operators and Related Workers	
110	209	H81	Longshore Workers and Material Handlers	
111	210	H82	Trades Helpers and Labourers	
112	211	H83	Public Works and Other Labourers, nec	
113	212	I01	Contractors, Operators and Supervisors in Agriculture, Horticulture and Aquaculture	
114	213	I02	Agriculture and Horticulture Workers	
115	214	I11	Supervisors, Logging and Forestry	
116	215	I12	Supervisors, Mining, Oil and Gas	
117	216	I13	Underground Miners, Oil and Gas Drillers and Related Workers	
118	217	I14	Mine Service Workers and Operators in Oil and Gas Drilling	
119	218	I15	Logging Machinery Operators	
120	219	I16	Logging and Forestry Workers	
121	220	I17	Fishing Vessel Masters and Skippers and Fishermen / women	
122	221	I18	Other Fishing and Trapping Occupations	
123	222	I21	Primary Production Labourers	
124	223	J01	Supervisors, Processing Occupations	
125	224	J02	Supervisors, Assembly and Fabrication	
126	225	J11	Central Control and Process Operators in Manufacturing and Processing	
127	226	J12	Machine Operators and Related Workers in Metal and Mineral Products Processing	
128	227	J13	Machine Operators and Related Workers in Chemical, Plastic and Rubber Processing	
129	228	J14	Machine Operators and Related Workers in Pulp and Paper Production and Wood Processing	
130	229	J15	Machine Operators and Related Workers in Textile Processing	

131	230	J16	Machine Operators and Related Workers in Fabric, Fur and Leather Products Manufacturing	
132	231	J17	Machine Operators and Related Workers in Food, Beverage and Tobacco Processing	
133	232	J18	Printing Machine Operators and Related Occupations	
134	233	J19	Machining, Metalworking, Woodworking and Related Machine Operators	
135	234	J21	Mechanical, Electrical and Electronics Assemblers	
136	235	J22	Other Assembly and Related Occupations	
137	236	J31	Labourers in Processing, Manufacturing and Utilities	
138	1001	B514/ B524	B514 Receptionists and switchboard operators/ B524 Telephone operators	Equivalent to 1414 Receptionists in the NOC 2011.
139	1002	D112/ D232	D112 Registered Nurses/ D232 Midwives and Practitioners of Natural Healing	Equivalent to 3012 Registered nurses and registered psychiatric nurses/ 3124 Allied primary health practitioners/ 3232 Practitioners of natural healing in the NOC 2011
140	1003	G211	G211 - Retail Salespersons and Sales Clerks	Equivalent to 5242 Interior designers and interior decorators/ 6421 Retail salespersons in the NOC 2011
141	1004	G631/ G625	G631 - Security Guards and Related Occupations/ G625 Other protective service occupations	Equivalent to 6541 Security guards and related security service occupations in the NOC 2011.
142	1005	J016/ J025	J016 Supervisors, textile processing, and Supervisors, fabric, fur and leather products manufacturing/ J025 Supervisors, fabric, fur and leather products manufacturing	Equivalent to 9217 Supervisors, textile, fabric, fur and leather products processing and manufacturing in the NOC 2011.
143	1006	J151/J153/J163	J151 Textile fibre and yarn preparation machine operators, Textile dyeing and finishing machine operators/ J153 Textile dyeing and finishing machine operators/ J163 Hide and pelt processing workers	Equivalent to 9441 Textile fibre and yarn, hide and pelt processing machine operators and workers in the NOC 2011.
144	1007	J154/ J164	J154 Textile inspectors, graders and samplers, and Inspectors and testers, fabric, fur and leather products manufacturing/ J164 Inspectors and testers, fabric, fur and leather products manufacturing	Equivalent to 9447 Inspectors and graders, textile, fabric, fur and leather products manufacturing in the NOC 2011.
145	1008	J197/ J228	J197 Other products machine operators/ J228 Other assemblers and inspectors	Equivalent to 9537 Other products assemblers, finishers and inspectors in the NOC 2011.

146	1010	B211/ B411/ B412/ B413/ B510/ B554	B211 Secretaries (except legal and medical)/ B411 Supervisors, general office and administrative support clerks/ B412 Supervisors, finance and insurance clerks/ B413 Supervisors, library, correspondence and related information clerks/ B510 General office clerks(including B511General office clerks & B512Typists and word processing in 1991 & 1996)/ B554 Survey interviewers and statistical clerks	Equivalent to 1211 Supervisors, general office and administrative support workers, 1212 Supervisors, finance and insurance office workers, 1213 Supervisors, library, correspondence and related information workers, 1241 Administrative assistants, 1251 Health information management occupations, 1411 General office support workers, 1454 Survey interviewers and statistical clerks, and 6314 Customer and information services supervisors in the NOC 2011.
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Notes:

-We dropped G63 from this list. We combined 4-digit title G631 - Security Guards and Related Occupations with G625 Other protective service occupations, and security guards and related occupations and treated it as a separate category.

-We dropped G21 (Retail Salespersons and Sales Clerks) from this list. We combined interior decorators and retail salespersons within this title together and as 5242 Interior designers and interior decorators/6421Retail salespersons. Interior designers within this title belong to F14 Creative Designers and Craftspersons.

-C18 Technical Occupations in Computer and Information Systems did not exist in the SOC 1991. We merged this category in the NOC 2011 and 2016 with 2174 (Computer programmers and interactive media developers), which we harmonized into C16 Mathematicians, Statisticians and Actuaries.

-We dropped G95 Elemental Medical and Hospital Assistants in the SOC 1991.

Appendix 2. Formula for Index of Dissimilarity

In this paper, we calculate the index of dissimilarity (DI) of gender occupational segregation as:

$$S = 0.5 \times \sum_i |q_i - p_i|$$

where

p_i = the proportion of women in occupation i ,

q_i = the proportion of men in occupation i .

This formula indicates the proportion of women in occupation i (p_i) who would have to change occupations for the occupational distribution of women and men to be the same. A DI value of 0 means complete equality, whereas a value of 1 indicates complete segregation (Duncan & Duncan, 1955; Fox & Fox, 1987).

Appendix 3. Decomposition of Changes in Indices of Dissimilarity Over Time

The index of dissimilarity (DI) builds on two aspects of the occupational distributions of two groups: 1) the extent of segregation within an occupation; and 2) the extent of the labour force in highly segregated occupations (Fox & Fox, 1987). Relatedly, the temporal changes in DI of gender occupational segregation can be decomposed into three components: 1) changes due to changing gender composition within an occupation (COMP); 2) changes due to changes in general occupation structure (mix) of the economy (MIX); and 3) the interaction between COMP and MIX (COMP * MIX) (Blau & Hendricks, 1979; Cotter et al., 1995; Fox & Fox, 1987).

Using mathematical notations, we calculate the COMP and MIX as follows:

$$COMP = \frac{1}{2} \left[\sum_i \left| \frac{q_{i2}T_{i1}}{\sum_i q_{i2}T_{i1}} - \frac{p_{i2}T_{i1}}{\sum_i p_{i2}T_{i1}} \right| - \sum_i \left| \frac{q_{i1}T_{i1}}{\sum_i q_{i1}T_{i1}} - \frac{p_{i1}T_{i1}}{\sum_i p_{i1}T_{i1}} \right| \right]$$

$$MIX = \frac{1}{2} \left[\sum_i \left| \frac{q_{i1}T_{i2}}{\sum_i q_{i1}T_{i2}} - \frac{p_{i1}T_{i2}}{\sum_i p_{i1}T_{i2}} \right| - \sum_i \left| \frac{q_{i1}T_{i1}}{\sum_i q_{i1}T_{i1}} - \frac{p_{i1}T_{i1}}{\sum_i p_{i1}T_{i1}} \right| \right]$$

where

T_{it} = total individuals employed in occupation i in year t

p_{it} = proportion of women in occupation i in year t

q_{it} = proportion of men in occupation i in year t

$t = 1$ the earlier time point

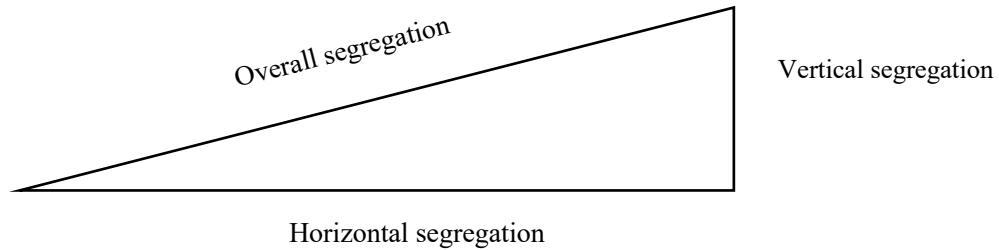
$t = 2$ the later time point

The formula for COMP shows changes in the DI from time 1 to 2 “that would have occurred if the size of each occupation had remained fixed” at time 1 (Blau & Hendricks 1979). This enables us to capture the source of variation in DI between time 1 and time 2 that is due to changes in the gender composition within occupations. In turn, the formula for MIX displays changes in the DI from time 1 to 2 that would have occurred if the gender composition within each occupation had

remained the same as time 1. This allows us to identify the source of changes in the change in DI between time 1 and 2 due to changes in the size of occupational categories (Blau & Hendricks, 1979). Finally, the interaction between COMP and MIX is the residual of the two: $(DI_{t2}-DI_{t1})-(COMP+MIX)$.

Appendix 4. Overall, Vertical and Horizontal Segregation

The relationship among overall, vertical, and horizontal segregation is visually demonstrated as follows:



Overall segregation in this variation of measurement is equivalent to the Gini index, which can be calculated as:

$$G = \sum_{i=2} \left[\sum_{1}^{i-1} \frac{F_t}{F} \times \sum_{1}^i \frac{M_t}{M} - \sum_{1}^i \frac{F_t}{F} \times \sum_{1}^{i-1} \frac{M_t}{M} \right]$$

where

n = total number of occupations

i = i th occupations in one's data

t = occupations included in the cumulative total (of occupations)

F_t = number of women in the occupation t

M_t = number of men in the occupation t

F = total number of women in the labour force

M = total number of men in the labour force

Vertical segregation: Somers'd, indicating indicates the strength and association between two ordinal variables (i.e., gender and occupations).

Horizontal segregation= $\sqrt{(\text{overall segregation})^2 - (\text{vertical segregation})^2}$ (Blackburn et al., 2001).

TABLE A5. Percentage of total workers by gender composition of occupational category (% women in 1991), 1991-2016

	1991	1996	2001	2006	2011	2016
0-10% women	18.1	16.8	16.5	16.6	17.2	17.2
10-20% women	9.6	9.5	10.6	10.2	9.4	9.3
20-40% women	17.9	18	19.2	19.3	18.7	18.1
40-60% women	17.7	18.9	19	18.8	19.2	20
60-80% women	15.7	15.9	16.4	17.1	19.9	20
80-90% women	8.5	9	7.4	7.4	6	6.2
90-100% women	12.4	11.8	11	10.6	9.6	9.1

Sources : The 1991, 1996, 2001, 2006 and 2016 Census Masterfiles and the 2011 National Household Survey Masterfile.

Note : The column percentages may not add up to 100 due to rounding errors.

Table A6. Percentage of women workers by gender composition of occupational category (% women in 1991), 1991-2016

	1991	1996	2001	2006	2011	2016
0-10% women	1.8	1.8	2.2	2.4	2.7	2.8
10-20% women	2.9	2.9	3.8	3.8	3.6	3.7
20-40% women	12.1	12.4	14.3	14.7	14.3	14.1
40-60% women	18.4	19.4	20.4	20.6	21.2	21.7
60-80% women	23.8	23.8	24.6	25.5	30.1	30.4
80-90% women	15.7	16.3	13.2	13	10.2	10.4
90-100% women	25.3	23.4	21.4	20.2	17.9	16.9

Sources : The 1991, 1996, 2001, 2006 and 2016 Census Masterfiles and the 2011 National Household Survey Masterfile.

Note: The column percentages may not add up to 100 due to rounding errors.

Table A7. Percentage of men workers by gender composition of occupational category
(% women in 1991), 1991-2016

	1991	1996	2001	2006	2011	2016
0-10% women	32	30.1	29.6	30	31	31
10-20% women	15.3	15.4	16.8	16.3	15	14.7
20-40% women	22.9	23	23.7	23.7	22.9	22
40-60% women	17.2	18.4	17.6	17	17.4	18.3
60-80% women	8.8	9	8.7	9.3	10.2	10.2
80-90% women	2.4	2.6	2.1	2.2	2	2.1
90-100% women	1.4	1.5	1.4	1.5	1.7	1.8

Sources : The 1991, 1996, 2001, 2006 and 2016 Census Masterfiles and the 2011 National Household Survey Masterfile.

Note: The column percentages may not add up to 100 due to rounding errors.

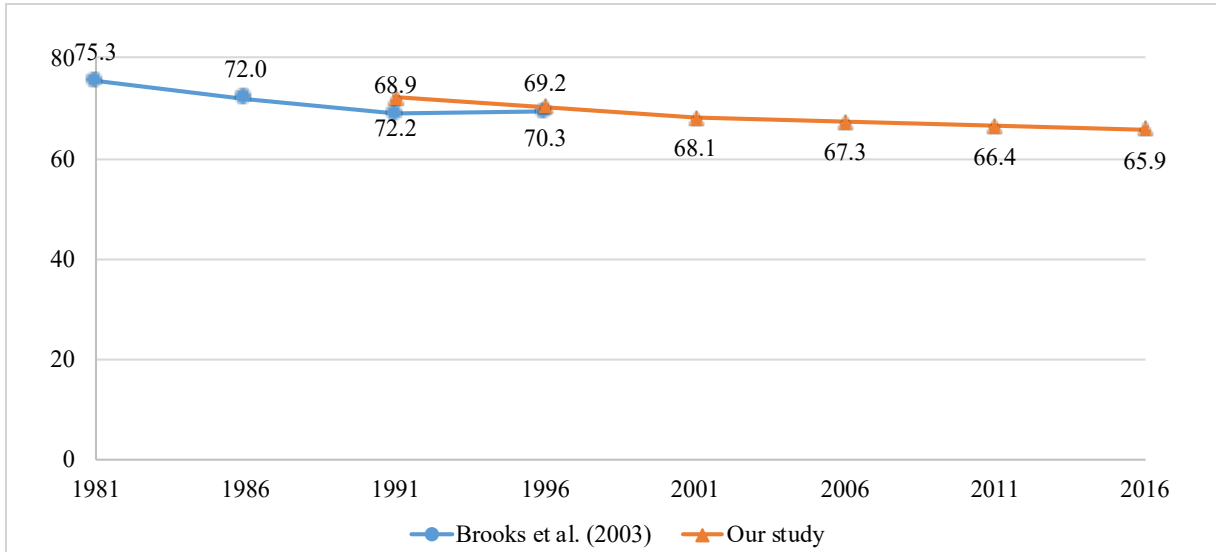


FIGURE A8. Gender occupational segregation trends (measured in the Gini index), 1981-2016

Sources : The 1991, 1996, 2001, 2006 and 2016 Census Masterfiles and the 2011 National Household Survey Masterfile.