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Caroline Schimanski
Cristian Chagalj
Inder Ruprah

Hanken School of Economics, Helsinki, Finland
United Nations University – World Institute for Development Economics Research (UNU-WIDER), Helsinki, Finland
Universidad de San Andrés, Buenos Aires, Argentina
Inter-American Development Bank, Washington DC

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http://www.iadb.org

caroline.schimanski@gmail.com

CET@iadb.org

Gender-based Educational and Occupational Segregation in the Caribbean

Caroline Schimanski[1,2], Cristian Chagalj[3], and Inder Ruprah[4]

Abstract

This study analyzes the evolution of gender-based educational and occupational segregation, from 1999 to 2016, for four Caribbean countries (The Bahamas, Barbados, Jamaica, and Trinidad and Tobago). The focus is on the role of educational segregation in explaining occupational segregation. There are four major findings. First, aggregate gender–based educational and occupational segregation have remained almost constant over time at approximately 7.5 percent and 18.5 percent, respectively. This is observed despite working women's education levels increasingly exceeding those of working men and significant differences in female labor force participation across countries. Educational segregation ranges from 9 percent in Trinidad and Tobago to 4 percent in The Bahamas. Second, a disaggregated analysis by educational and occupation categories shows highly segregated labor markets. Educational segregation is rising in all countries at the university level in favor of women. In all countries, over 22 percent of employed younger women obtain university education compared to a stagnant to decreasing share of men. Of the university degree–holding employees, over 60 percent are women. Men strongly dominate agricultural occupations, plant and machine operators, and crafts–related jobs, while women dominate clerical positions to a similar extent. Third, for these highly segregated occupations, educational segregation is the main driver. Top and lower–end positions seem to be the least segregated in all countries. This distinction is particularly stark in The Bahamas and Barbados, but rising for the other two countries. Fourth, counterfactual analysis indicates that low segregation levels at the lowest occupational category are not necessarily justified, as older women are highly over represented in elementary occupations.

Keywords: Caribbean – Gender – Educational Segregation – Occupational Segregation
JEL Codes: J16 - J24 - J71 - N16

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[1]Hanken School of Economics, Helsinki, Finland
[2]United Nations University – World Institute for Development Economics Research (UNU-WIDER), Helsinki, Finland
[3]Universidad de San Andrés, Buenos Aires, Argentina
[4]Inter-American Development Bank, Washington DC

1. Introduction

Education and occupational segregation are essential factors in understanding the labor market outcomes of particular demographic groups, but there is a dearth of studies on the Caribbean. This paper addresses this shortfall with a focus on four Caribbean countries (The Bahamas, Barbados, Jamaica, and Trinidad and Tobago) for the period 1999–2016. An analysis of these countries is particularly interesting as The Bahamas, Barbados, and Jamaica have the highest female labor force participation not only in Latin American and Caribbean (LAC) but, with up to over 80 percent, also in comparison with the European Union and North America. The exception is Trinidad and Tobago, which falls just below the LAC average of 65 percent (Duryea and Robles, 2016; World Bank, 2016a; World Bank, 2016b).

Educational segregation is of concern in the Caribbean, as there is a growing underachievement of male students (Cobbett and Younger, 2012), while simultaneously existing a suspected strong labor market segregation favoring men. Even though there is a sizable literature on occupational segregation by gender in Latin America, within the Caribbean only Trinidad and Tobago has recently been studied (Sookram and Strobl, 2009), and around half a century ago Psacharopoulos and Tzannatos (1992) studied occupational segregation in Jamaica (See Table A.1 in the Appendix for a summary of relevant studies in this area).

To fill this gap in the literature, this study examines the magnitude, change, and relationship between educational and occupational segregation in the four countries, using methodologies based on variations of Duncan and Duncan's (1955) Duncan-Duncan segregation index and various decomposition techniques. Specifically, this study analyses: (i) the extent and evolution of educational and occupational aggregate segregation in each of the four countries and how this evolution compares within the Caribbean and with other countries; (ii) the heterogeneity of segregation levels across categories; and (iii) the decomposition of the factors explaining the evolution of segregation and the impact of educational segregation on subsequent occupational segregation. A further decomposition (iv) investigates how women would be distributed over occupations in the counterfactual case, given their characteristics, had they been men.

A review of the literature in the broader geographic region reveals that there is no uniform pattern of gender-based segregation levels and changes over time. Occupational segregation increased in Guyana from 29.7 percent to 37.4 percent between 1946 and 1960. On the contrary, in El Salvador it dropped in the period 1960–1980 from a very different level, from 62.3 percent to 40.8 percent (Jacobs and Lim,

1992). Moreover, Deutsch, Morrison, Piras and Ñopo (2001) find a large increase in segregation in Ecuador from 48.6 percent to 57.3 percent with data from 1960–1980, while segregation was constant at 38 percent from 1989–1997. Though not directly comparable as these studies use a different number of occupational categories,[1] also Borghans and Groot (1999) and Sookram and Strobl (2009) observed relatively small decreases or constant levels of occupational segregation from 1979 to 1994 and 1991 to 2004 in the Netherlands and Trinidad and Tobago, respectively. For Brazil (1987–2006) and Colombia (1986–2004), Salardi (2014) and Isaza Castro (2013), respectively, find only minimal decreases over time. Changes in observed occupational segregation have in the literature been attributed to various factors, such as alterations in total female labor market participation and changes in the size of certain occupational categories. Globally, for example, according to the International Labour Organisation (ILO) (2016), the services sector surpassed the agricultural occupational category in size as of 2015. Increases in the size of those categories with better gender balance may lead to decreases in overall occupational segregation. Apart from this, women are observed to be concentrating in different occupations varying by the country's level of development, as discussed by the ILO (2016). Hence, the apparent absence of consistent levels and patterns of labor market segregation across countries but potential convergence of country specific patterns over time stresses the need for segregation analyses specific to each country conducted in a comparable manner.[2]

The earlier literature had studied occupational segregation in isolation, neglecting the influence of educational segregation on occupational segregation. Recently, educational segregation has been increasingly included in studies on gender segregation (Borghans and Groot, 1999; Deutsch, Morrison, Piras and Ñopo, 2001; Sookram and Strobl, 2009; Salardi, 2014; and Smyth, 2005). However, the effects of educational segregation on occupational segregation vary. In the Netherlands, Borghans and Groot (1999) found that increases in educational segregation decrease occupational segregation, while Sookram and Strobl (2009) found that decreasing educational segregation hardly has any impact on occupational segregation in Trinidad and Tobago. Smyth (2005) on the other hand observed countries

[1] International comparability of labour market segregation measures however depends on using the same categorization, as the segregation level is increasing in the number of categories.

[2] Including an according to Blackburn (2009) optimal number of 200 categories provides more detail on the segregation within occupations, while measures of occupational segregation based on less than 20 categories should, based on Blackburn (2009) and Anker (1998), be treated with caution as they may severely underestimate gender segregation by being too aggregated. The larger number of categories comes however with a trade off on sample size within each category and comparability over time and across countries. Most importantly for international comparison, only the 1st-digits seem largely internationally standardized over time. More disaggregated occupational categories therefore neither allow cross-country occupational segregation analyses nor within country analyses over time spans marked by reclassifications of categories. Various authors have tried to account for the changes in occupational categories over time through reclassifications into consistent groups. In accounting for such changes in classifications, many authors have however frequently neglected the potential bias created through individual choices made in the reclassifications. As Blau, Brummund & Liu (2013) show, using US data, using different methods of reclassification of occupational categories over time can lead to very different conclusions about measured segregation.

with partly higher educational segregation to also have higher occupational segregation. Unlike multiple-digit[3] partly internationally standardized occupational categories, no such standardization exists for educational categories, making international comparisons more challenging. A cross-country study in Latin America solely on educational segregation by Cruces, Domenech, and Gasparini (2014) used years of schooling as a category to measure gender-based segregation within each year of schooling completed. Other authors, such as Borghans and Groot (1999) and Sookram and Strobl (2009), have used national training codes to form educational categories which resulted in 48 categories, while other authors, such as Hernandez (2005), Salardi (2014), and Smyth (2005) have used more aggregate categories referring to the major educational levels or a mix. This further highlights the need for studies that allow long-term comparability of occupational as well as educational categories within and across countries.

Our analysis not only contributes to the literature by covering a geographic area for which segregation had previously not been measured, but also provides evidence on the longer-term evolution of gender-based segregation in developing countries in a comparative manner. This can provide policy insights also based on relative segregation levels compared to neighboring countries, rather than solely on real levels and changes. In addition, by providing comparable gender segregation measures for developing countries with high female labor force participation, this study adds to the external validity of the impact of female labor force participation on gender-based educational and occupational segregation levels, which is currently available only for Nordic countries. Lastly, this analysis offers insights for local policymakers by providing evidence on the effects of the implementation of gender-related education and labor market policies.

The remainder of the paper is structured as follows: Section 2 introduces the data available for the four countries. Section 3 outlines the methodology. Section 4 presents the results of the segregation analysis and illustrates the dominance of men and women occupations. Section 5 further decomposes the segregation levels in terms of how the different types of segregation interact and presents counterfactual occupations for women given their characteristics. Finally, Section 6 concludes.

[3] A 4-digit International Standard Classification for Occupations has been developed by the ILO to provide a framework for international comparison and for countries to develop their own national classification of occupations.

2. Data

This study is based on data from Labor Force Surveys from The Bahamas, Barbados, Jamaica, and Trinidad and Tobago ranging from 1999 to 2016.[4] While the surveys were not conducted in a fully comparable manner across countries and years, all of them provide similar information on educational attainment and training certificates of the household members, their current employment status, occupation, as well as their age and gender.

Survey questions regarding educational attainment and highest certificate or training provided a variety of different response category options. These have, for comparability between the different countries, been grouped into the seven common categories (Table 1). These distinguish between levels or certificates of formal education and additional vocational, technical, or professional training. Based on the internationally standardized 1st-digit of the 4-digit occupational codes, this paper distinguishes further among nine[5] occupational categories (Table 2).

Table 1: Educational Categories (comparable between all four countries)

Category Number	Highest Education / Training
1	Primary or Less
2	Primary Education or Less with Training
3	Some Incomplete Secondary But no O Levels
4	Some Incomplete Secondary But no O Levels with Training
5	Secondary Completed with O' Levels or A'levels
6	Secondary Completed with O' Levels or A'levels with Training
7	University Degree

Source: Authors' own categories based on categories existing in the various surveys.

All the surveys have been conducted in some form of a stratified rotating household panel with a weighting factor for stratum, age, and gender to control for representativeness of these aspects within the population. These weighting factors are also included in the estimations of this study unless otherwise stated. The surveys are nationally representative but are not representative for each educational level and occupational category. However, the educational[6] and occupational composition of the data largely resemble countrywide labor market statistics.

[4] Given the lack of data availability regarding weights and some other key variables in some countries and within some surveys, this study is despite the existence and availability of additional survey years restricted to the following Labour Force Surveys: Bahamas: LFS 2006-2009,2011, 2013-2014; Barbados: LFS 2004-2016; Jamaica: LFS 2002-2014; Trinidad and Tobago: CSSP 1999-2015. Even though earlier rounds for Trinidad and Tobago corresponding to the 1991-1998 period have been used by Sookram and Strobl (2009); these have been excluded to avoid the inclusion of potential bias as weights are not available for these datasets.

[5] The 10th category, the one of defence workers has been excluded. The 4-digit disaggregation was not used because it is not available for all countries and is besides neither comparable across countries nor over time.

[6] One potential concern regarding the representativeness of educational categories is discussed in section 4.3.

Table 2: Occupational Categories

1-Digit Occupational Code	
1	Legislators, Senior Officials and Managers
2	Professionals
3	Technicians and Associate Professionals
4	Clerks
5	Service Workers and Shop and Market Sales Workers
6	Skilled Agricultural and Fishery Workers
7	Craft and Related Workers
8	Plant and Machine Operators and Assemblers
9	Elementary Occupations

Source: 1st digit of the ISCO occupational codes and categories existing in the various surveys.

Given that the surveys were conducted at differing frequencies in all countries with potentially non-randomly varying response frequencies, this study uses, in line with Sookram and Strobl (2009), only the first observation of any individual across all years, to avoid selection or seasonality bias.[7] The average yearly sample size across all years and countries lies at around 5,352 individuals. Yearly sample sizes are largest in Trinidad and Tobago and lowest in Barbados. Yearly unweighted sample sizes in Jamaica are, as Table 3 shows, highly volatile. After removing repeated observations, yearly sample sizes range from above 18,000 in 2007 to only 1,174 in 2010. This can be attributed to oversampling to achieve parish-level representativeness during some years and is likely also related to the selection of new master primary sampling units of the rotating panel every few years. In addition, the sample is restricted to individuals at least 15 years old,[8] but no older than 75,[9] for whom the educational information is available. To calculate occupational segregation, because of pre- and post-sorting following initial educational segregation, it is necessary to further restrict the sample to only the employed respondents.

[7] For the selection of only the first observation per individual, all duplicates in terms of individual id number, household number, dwelling, enumeration district, parish, stratum and gender, apart from the first observation were removed after initially also having sorted by year and quarter. Gender is included as an additional variable to avoid dropping excessive duplicates that are not actually duplicates, as the surveys were conducted at the household location level and these household and individual numbers could therefore be taken by different people if these newly moved into a house and replaced the previous inhabitants

[8] 15 years is the approximate legal minimum working age in all countries

[9] As this study purely focuses on the actual proportion of gender of workers that are working in a certain occupation this study also includes elderly workers despite potential selection bias of who works above retirement age

Table 3: Total Sample Observations per Country by Gender and Year (unweighted)

Country	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Total
Bahamas																			
Male								2727	2298	1925	1881		1616		1221	1202			12870
Female								2660	2170	1928	1950		1676		1280	1133			12797
Total								5387	4468	3853	3831		3292		2501	2335			25667
Barbados																			
Male						3027	1473	1239	1633	1197	958	678	2633	1380	1214	1506	1290	1128	19356
Female						2963	1306	1106	1470	1087	810	604	2431	1260	1186	1413	1236	1114	17986
Total						5990	2779	2345	3103	2284	1768	1282	5064	2640	2400	2919	2526	2242	37342
Jamaica																			
Male				9164	2245	9490	2399	1191	10594	3712	1145	634		9375	1433	927			52309
Female				7026	1642	7387	1859	917	8182	2829	903	540		7422	1118	721			40546
Total				16190	3887	16877	4258	2108	18776	6541	2048	1174		16797	2551	1648			92855
Trinidad and Tobago																			
Male	7055	2643	4374	3786	3659	3315	4033	3878	3861	3773	3610	2523	2468	4198	3386	3365	3492		63419
Female	4219	1705	2564	2324	2308	2286	2705	2659	2657	2736	2557	1816	1678	3173	2482	2492	2617		42978
Total	11274	4348	6938	6110	5967	5601	6738	6537	6518	6509	6167	4339	4146	7371	5868	5857	6109		106397

Source: Authors' sample restrictions based on LFS Bahamas, LFS Barbados, LFS Jamaica and CSSP survey Trinidad and Tobago.

Estimating the female labor force participation of women aged between 15–75, who are either employed or self-employed, among all women of this age range over time and by age group, as shown in Figures A.2 and A.3 in the Appendix, reveals large variations. Aggregate female participation rates based on the labor force survey sample (see Figure A.3 in the Appendix) have been increasing in Trinidad and Tobago from around 51 percent in 1999 to around 58 percent in 2014. In contrast to this, the rates have been fairly constant over time, at over 80 percent in The Bahamas, around 70 percent in Barbados, and around 60 percent in Jamaica during the sample period. These estimates are largely in line with the figures published by the World Bank (2016a; 2016b) in the World Development Indicators based on national estimates and modeled ILO estimates, as well as numbers based on household surveys in these countries analyzed by Duryea and Robles (2016), based on slightly different age groups.[10] The Bahamas, Barbados, and Jamaica are the leading countries in terms of female labor force participation in the region, while the rate in Trinidad and Tobago falls just below the LAC average of 65 percent based on the data from harmonized household surveys in the LAC region (Duryea and Robles, 2016).

A decomposition of participation rates by age group (see Figure A.2) displays a rise in participation rates for older women and a slight decrease for younger women, which might be explained by more years

[10] Female labour force participation rates reported in the World Development Indicators based on national estimates for 2013 for females 15+ are 69.8%, 62%, 55.5% (2012) and 51.3%; modelled ILO estimates for 2014 for females 15+ 69%, 66%, 56% and 53%; reported based on household surveys in Duryea & Robles (2016)'s graph 35 82%, 82%, 74.5% and 64%.

spent in school, for Barbados and Trinidad and Tobago when comparing just 2006 to 2013. For Jamaica the same shift is observed for the young though a rise only for the middle-aged women but not so for the older ones. Female labor force participation decreased for The Bahamas for all age groups over the same period. When comparing the share of women among all those employed or self-employed, women represent in The Bahamas and Barbados around 50 percent. This indicates a very gender-balanced working labor force, while Jamaica and Trinidad and Tobago are lagging behind. The participation rate has, however, again risen for all countries between 2006 and 2013, especially for the older age groups, while it slightly decreased for the respondents aged 15–24. The latter decrease for the young is particularly strong in Jamaica. Moreover, Figure A.2 displays a remarkable catch-up by Trinidadian women compared to 1999 (not displayed here) at all age groups. While Jamaican women presented already a larger share among the working Jamaicans in 2002 than Trinidadian, they subsequently did not further increase their share to a similar extent and remained instead just below the Trinidad and Tobagonian level. It is noteworthy that middle-aged women in The Bahamas and Barbados present in 2013 a lower share among the working population than seven years earlier. On the contrary, the data present a hike for Jamaica for this age group likely to have small children over the same period. Here, further research could investigate whether this pattern coincides with differential availability of child care facilities across countries over time.

3. Methodology

The segregation analysis follows the methodology developed by Borghans and Groot (1999). It uses the international comparable 1-digit occupational category level. This ensures comparability of the results across countries and time and sufficiently large sample sizes of subgroups. A consistent classification of categories across countries is necessary as the measured level of aggregate segregation depends on the number of categories, as discussed in Smyth (2005). We use a variation of the Duncan-Duncan Index developed by Karmel and MacLachlan (1988) to estimate the segregation levels.

3.1 Measuring Segregation

The traditional D-D Index quantifies the proportion of the other sex that would need to move into another category to achieve a gender balance. This index has the disadvantage that it does not take the initial proportion of men and women in the labor force into consideration. Hence, it measures switches that would be required, disregarding the size of the different categories.

In contrast, the Karmel and MacLachlan (1988), or the KM measure,[11] takes the initial distribution of men and women among all people employed T and the size of the respective categories T_i into account when estimating the proportion of men and women that would need to switch to achieve gender balance. The term $\frac{FM}{T^2}$ in the following formula expressed by θ hence controls for this. Herein, F stands for the total number of women and M for the total number of men employed. The subscript i indicates the respective of the n categories. Hence, F_i and M_i represent the number of women and men in each category i, respectively.

$$KM = \frac{1}{2}\sum_{i=1}^{n}\left|\frac{F_i}{T} - \frac{\frac{F}{T}T_i}{T}\right| + \frac{1}{2}\sum_{i=1}^{n}\left|\frac{M_i}{T} - \frac{\frac{M}{T}T_i}{T}\right| = \frac{FM}{T^2}\sum_{i=1}^{n}\left|\frac{F_i}{F} - \frac{M_i}{M}\right| \quad (1)$$

For both educational (ES) and occupational segregation (OS), the KM can be calculated over n-educational categories and m- occupational categories as follows:

$$ES = \theta\sum_{i=1}^{n}\left|\frac{F_i}{F} - \frac{M_i}{M}\right| \quad (2)$$

$$OS = \theta\sum_{j=1}^{m}\left|\frac{F_j}{F} - \frac{M_j}{M}\right| \quad (3)$$

A further disaggregated analysis by category was conducted solely using the KM segregation measure. For this the aggregate ES and OS formulas (2) and (3) were modified to reflect the relative segregation in each category weighted by the relative importance of each respective category $\frac{T}{T_i}$. This generates segregation measures, which are comparable across categories, despite their different number of total employees. These can be written as follows:

$$ES_i^{rel} = \theta\left|\frac{F_i}{F} - \frac{M_i}{M}\right|\frac{T}{T_i} \quad (4)$$

$$OS_j^{rel} = \theta\left|\frac{F_j}{F} - \frac{M_j}{M}\right|\frac{T}{T_j} \quad (5)$$

We only report the KM measures; however, we also estimate the standard DD index and the Gini Index[12] to determine the robustness of the results to different segregation measures and to illustrate the differences measured by the distinct indexes.

3.2 Determining Female Intensity of Occupations

To complement segregation measures, various authors have developed approaches to determine the (fe)male dominance of particular occupations, as the level of segregation in specific occupational and

[11] To allow an international comparison with the results of studies presented in Table A.1 the D-D measure is nevertheless calculated as well.

[12] This is calculated by the below equation and can as in the inequality literature be used to calculate other types of segregation (Silber (1989); Deutsch & Silber (2005)). (5) $G = \left(\frac{1}{2}\sum_{i=1}^{n}\sum_{g=1}^{n}\frac{M_g}{M}\frac{M_i}{M}\left|\frac{\left(\frac{F_g}{M_g} - \frac{F_i}{M_i}\right)}{F}M\right|\right.$

educational categories does not provide any insights on whether the segregation is driven by higher shares of women or men. This study also calculates shares of women in each educational and occupational category to provide a simple measure of female intensity. These results are subsequently compared with the results of three other approaches; the Flückiger and Silber (1999), the Oppenheimer, and the marginal matching approach.

The Flückiger and Silber (1999) approach considers all those occupations female-dominated, in which the percentage of female workers exceeds an imagined 10 percent higher than actual aggregate share of female workers in the overall working labor force. On the contrary, if the female share of workers in an occupation is less than the by 10 percent reduced total female share in the total working labor force, it is regarded as a male occupation. All other occupations are neutral, dominated by neither women nor men.

The Oppenheimer approach evaluates female versus male dominance based on the female-to-male employee ratio in an occupation, $\frac{F_i}{M_i}$, rather than as the percentage of women in the total. If this ratio exceeds 1.00 it is considered disproportionally female, while a value below 0.25 indicates male dominance. Ratios in between are considered to be gender-balanced (Oppenheimer, 1969; Flückiger and Silber, 1999).

The marginal matching approach developed by Blackburn, Jarman, and Siltanen (1993) ranks every occupation according to the highest share of female over male workers $\frac{F_i}{M_i}$. Subsequently it evaluates the rank at which the cumulative sum of the total number of workers per occupation $(F_i + M_i)$ exceeds the total number of female employees F. All occupations ranked above this threshold are hence considered female occupations, while the remaining ranks are male occupations, whose cumulative sum of workers equals the total male employed labor force. Unlike the other two approaches, this one does not contain an intermediate category of relatively gender-balanced occupations. Hence this approach can inform about changes at the threshold.

3.3 Decomposing Segregation

This study applies two decomposition techniques. First, Borghans and Groot's (1999) decomposition links educational segregation to occupational segregation (see also Sookram and Strobl [2009] for an earlier application on Trinidad and Tobago). Second, the Brown, Moon, and Zoloth (1980) approach

provides counterfactual occupations for female employees based on their characteristics had they only been men. [13]

3.3.1 Decomposition based on Borghans and Groot (1999)

Borghans and Groot (1999) identify three potential mechanisms through which educational segregation can affect occupational segregation, which are Reintegration, Decrease and Increase, denoted by R, D, and I, respectively. Reintegration occurs when men and women both followed the typical education path of their gender and end up in the same occupation. This mechanism will reduce occupational segregation despite the existence of educational segregation. The Decrease mechanism similarly reduces occupational segregation through men and women who obtained the same educational degree and subsequently pursued careers in the same occupation. Educational segregation will enhance occupational segregation through the Increase mechanism even if those men and women with the same educational background choose different jobs in different occupations. The relationship between these three mechanisms in relation to educational and occupational segregation can be written as follows:

$$OS = ES + I - D - R \quad (6)$$

Form this the impact can be calculated as: $\text{Impact}=\left(1-\frac{R}{ES}\right)*100$ (7)

Both formulas (14) and (15) can be adapted to either express the aggregate impact of educational segregation on occupational segregation or the relative impact for each occupational category, whereby in the latter case relative measures of I, D, and R need to be calculated as well.

3.3.2 Determining Counterfactual Occupations of Women

Alternatively, occupational segregation can be illustrated by the actual distributional share of women over the occupations compared to a counterfactual distribution of women over these occupations, had these women only been men, meaning had these women's characteristics lead to the same occupational outcomes as such characteristics for men, applying the approach proposed by Brown, Moon, and Zoloth (1980) in an analysis focusing on gender wage gaps.

Using a multinomial logit methodology allows the prediction of occupations of men based on a vector x of characteristics, such as educational level, age, experience, marital status, relation to household head,

[13] We also calculated the Shapely Decomposition methodology developed by Deutsch, Flückiger & Silber (2009) that identifies drivers of the change of aggregate segregation over time. Given the very limited changes in aggregate segregation latter this decomposition is presented in the appendix.

number of household members, nationality, ethnicity, number of children in education, age, urban/rural status, and island/district, and can be written as follows:

$$P_{ij} = prob(y_i = oc_j) = \frac{e^{x_i \gamma_j}}{\sum_{k=1}^{J} e^{x_i \gamma_k}} \; ; \; i = 1, \dots, N \; ; j = 1, \dots J \qquad (8)$$

The probability of an individual i to work in a particular occupation j is defined through a function of a vector of characteristics of individual i out of a total number of N individuals observed. To allow each of the occupations to be determined by a different production function $x_i y_j$, y_k represents a vector of coefficients of the k^{th} occupation. Based on the estimated coefficients for each of the occupations, it is possible to predict the counterfactual occupations for women given their characteristics.

4. Educational and Occupational Segregation over Time

4.1 Aggregate Segregation

The aggregate KM indices are displayed in Figure 1.[14] In aggregate terms, there are three key findings. First, the levels of segregation remain relatively constant over time for all four countries. While linear approximations show a statistically significant negative time trend for educational segregation in Barbados and a statistically significant increasing trend in occupational segregation in Trinidad and Tobago and educational segregation in Jamaica, these trends are very small.[15] There is no indication for potential turning points around the years in which equal employment and anti-discrimination acts came into force.[16]

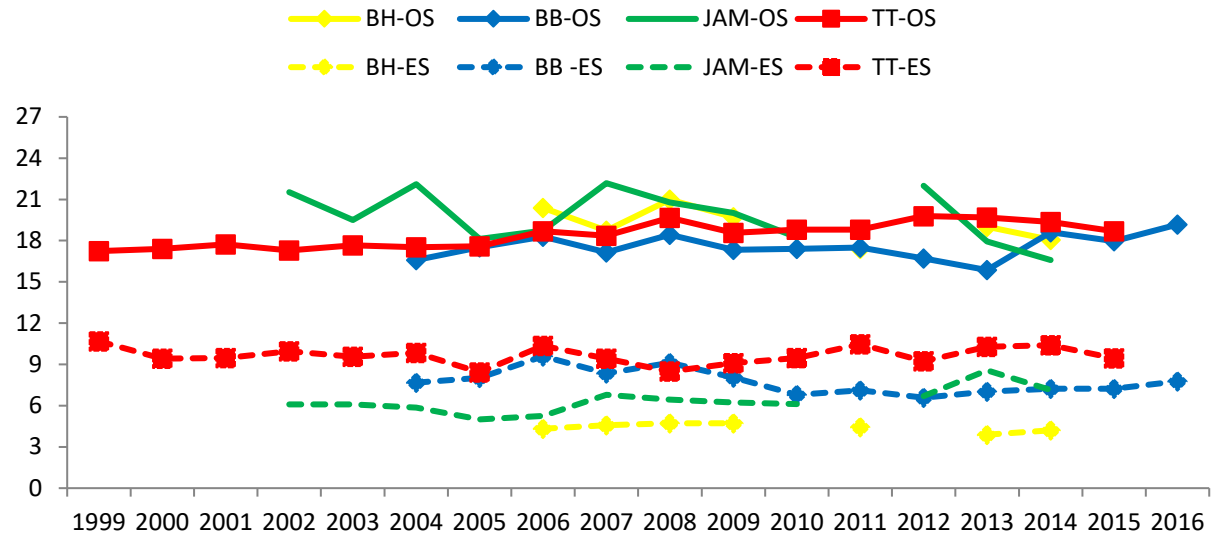
[14] It is, noteworthy though that the traditional D-D and Gini index measures presented in Table A.2a d in Appendix (subsection 8.1), appear more volatile than the KM measure, which adjusts the D-D measure by the gender distributions and relative size of the categories themselves. However, also these measures while moving at times in opposite directions do not provide an indication of the existence of a clear trend.

[15] The significance of the segregation trend over time is measured by regressing year on occupational and educational segregation respectively. Coefficients for the above mentioned significant trends observed are for Barbados, Jamaica and Trinidad and Tobago, -0.127**, 0.158** and 0.149***

[15] Bahamas established a "No discrimination" in Employment Act 321 A (article 6) in 2006; Barbados established "No discrimination" in the Employment Rights Act 2012 (article 30) in 2012; in Jamaica, the Employment (equal Pay for Man and Woman)- 1975 Act specifically talks about labour non-discrimination (http://moj.gov.jm/sites/default/files/laws/The%20Employment%20%28Equal%20Pay%20for%20Men%20and%20Women%20%20Act.pdf); in Trinidad and Tobago the Equal Opportunity Act Chapter 22:03, 2000, specifically discusses labour non-discrimination (http://rgd.legalaffairs.gov.tt/laws2/alphabetical_list/lawspdfs/22.03.pdf)

[16] The Bahamas established a "No discrimination" in Employment Act 321 A (article 6) in 2006; Barbados established "No discrimination" in the Employment Rights Act 2012 (article 30) in 2012; in Jamaica, the Employment (equal Pay for Man and Woman)- 1975 Act specifically talks about labour non-discrimination (http://moj.gov.jm/sites/default/files/laws/The%20Employment%20%28Equal%20Pay%20for%20Men%20and%20Women%20%20Act.pdf); in Trinidad and Tobago the Equal Opportunity Act Chapter 22:03, 2000, specifically discusses labour non-discrimination (http://rgd.legalaffairs.gov.tt/laws2/alphabetical_list/lawspdfs/22.03.pdf)

Figure 1: KM Index: Educational and Occupational Segregation



Source: Authors' own calculations based on BH LFS 2006–2014, BB LFS 2004–2016, JM LFS 2002–2014 and TT CSSP 1999–2014.
Note: All indices are in percentages.

Second, both types of segregation levels are very similar across countries, and occupational segregation exceeds educational segregation in all countries. This contrasts with the pattern in the European Union, where countries such as Sweden and Finland, with comparatively higher levels of female labor participation (World Bank 2016a) than other European countries, faced much lower occupational segregation (Smyth, 2005). Here, occupational segregation in Trinidad and Tobago is however largely like that in the other countries despite its lower female labor force participation. A direct comparison of the segregation levels measured by Sookram and Strobl (2009) for the initial five years (1999–2004) is, however, not possible. These authors did not restrict themselves only to the 1-digit occupational categories; they measured educational and occupational segregation on 37 and 48 categories respectively, which inevitably leads to a measurement of higher levels of segregation, than with fewer categories.[17]

A comparison among countries provides further external validity to the earlier findings discussed in the introduction that educational segregation does not come along with occupational segregation and vice versa. The Bahamas, for instance, exhibits simultaneously the lowest level of educational segregation and the second-highest level of occupational segregation. Trinidad and Tobago on the other hand faces

[17] Conducting as a robustness check an unweighted analysis based on only the first digit over the complete period 1991-2014, does not lead to a result of initial decreasing educational segregation. However, , replicating the segregation analysis the 37 and 48 educational and occupational categories respectively used by Sookram & Strobl (2009) as a robustness check leads to very similar results to those of Sookram & Strobl (2009); for 1991-2004 with educational segregation levels initially are strongly decreasing but remain practically constant from 1999 onward. Hence, only the post 1999 constant segregation appears consistent irrespective of number of categories.

over time consistently higher levels of educational segregation than the other three countries but is third in terms of the level of occupational segregation in the early sample years. From 2010 onward, occupational segregation in Trinidad is, however, found to be higher than in most and by 2013 higher than in all other countries. This is consistent with findings by Moore, Presbitero, and Rabellotti (2017) that the other three countries have larger shares of female-managed firms than Trinidad and Tobago.

Third, compared to occupational segregation in Europe, as estimated by Smyth (2005) for the beginning of the period studied here, the Caribbean countries' labor markets seem to be similarly segregated as most European countries. When comparing their D-D index values listed in Table A.1 to those in Table A.2 a)-d) these four Caribbean countries appear less segregated than Austria but more than Sweden, which represent the extremes at the upper and lower ends. Coppin's (1998) study includes an historical review of the education system in both Trinidad and Tobago and Barbados, pointing out that Barbados was first in eliminating gender-specific secondary school curricula and transforming single-sex schools to be coeducational institutions as well as in raising compulsory schooling age to 16 years. This may well have resulted in differential development and might be an explanation for the still observable slightly higher educational as well as occupational segregation over time for Trinidad and Tobago compared to Barbados. In an international comparison, Barbados seems to face, like Mexico, lower occupational segregation than most other countries in the region during that or a slightly earlier period, as estimates by Calonico and Ñopo (2008) indicate. On the contrary, Jamaica seems to surpass the region in the extent of occupational segregation in the early 2000s. While the D-D Index for occupational segregation in Trinidad and Tobago also crosses the 40 percent mark in later years, the occupational segregation is in earlier years still below the 42 percent and 43.88 percent peak segregation levels that Deutsch, Morrison, Piras, and Ñopo (2001) and Oliveira (2001) find for Uruguay and Brazil, respectively.

Despite the generally constant aggregate levels of educational and occupational gender segregation over time, a more disaggregated analysis of segregation by educational and occupational categories in the subsequent sections provides evidence for strong heterogeneity.

4.2 Occupational Segregation by 1-Digit Occupational Category

Figure 2 below displays the levels of segregation within each 1-digit occupational category over time. One group of occupational categories consistently displays segregation levels below 20 percent while the second group faces segregation levels above 25 percent. The first group, formed by the top (Legislators, Senior Officials and Managers, Professionals, Technicians, and Associate Professionals) and bottom end (Elementary Occupations, and Service and Sales Worker) occupations displays lower

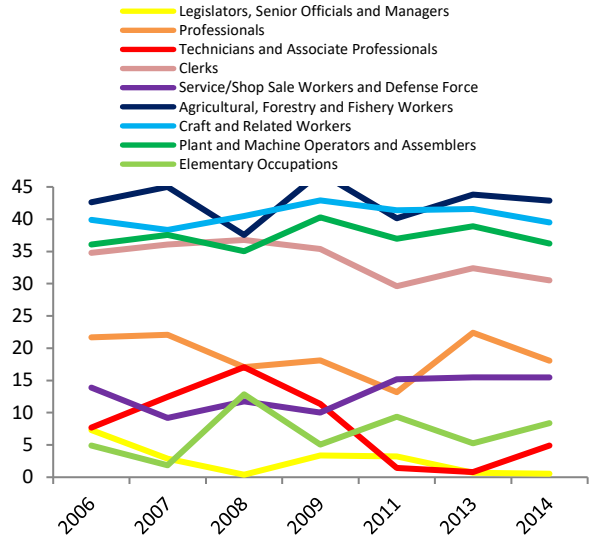
levels of segregation and faces a decreasing-constant trend over time. Within this group one could partly distinguish between two subgroups.

The elementary occupations (represented by the light green line) and the Legislators, Senior Officials and Managers (denoted by the yellow line) exhibit especially low levels of segregation for all countries, particularly in the case of Trinidad and Tobago, with segregation levels consistently below 5 percent. Segregation within the Technician and Associate Professionals and the Shop and Sales workers categories (the red and purple lines respectively) are consistently above that of the yellow and light green line for Trinidad and Tobago, with relatively constant segregation levels of around 16 percent. In the case of The Bahamas, for instance, segregation dropped significantly within the Technician and Associate Professionals category, while segregation in elementary occupations slightly rose. Despite some country-specific differences, the segregation levels of these occupational categories remain visibly lower than those of the occupational categories in the second group.

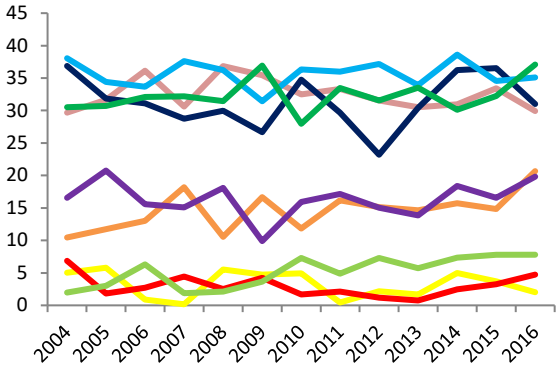
Those occupational categories, forming the second group, consist of the traditionally male-dominated occupations, Clerks, Skilled Agriculture and Fishery workers, Crafts and Related workers and Plant and Machine Operators and are characterised by significantly higher levels of segregation and an overall increasing trend. Crafts and Related Workers and Machine Operator professions segregation is rising over time in all countries though to a lesser extent in The Bahamas, as indicated by the light blue and dark green lines. Clerks, however, demonstrate a slight decrease in segregation, thereby dampening the overall trend in this category. Moreover, the occupational category of Skilled Agricultural and Fishery Workers shows large volatility in terms of segregation, though at generally high levels. The relatively larger volatility of this category is likely driven by the marginal impact that the extremely few women in this occupation, which is already characterized by its relatively small sample size, have on segregation.

Figure 2: Occupational Segregation by Category (KM index)

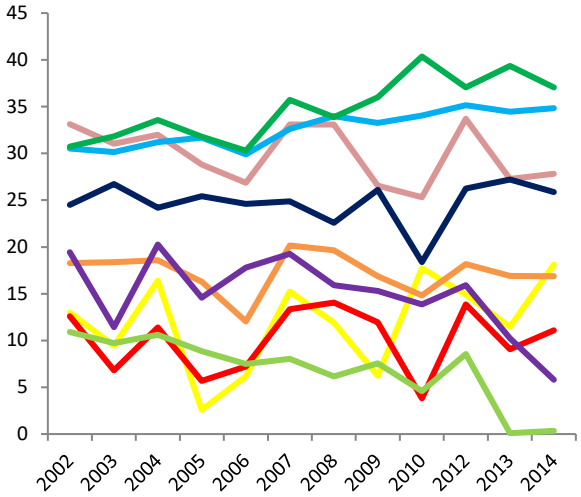
a) The Bahamas



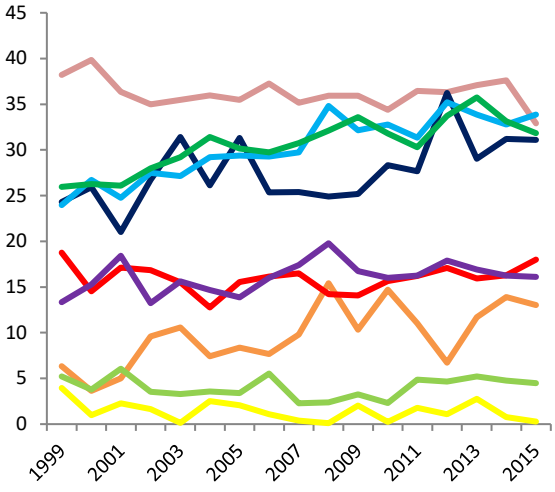
b) Barbados



c) Jamaica



d) Trinidad and Tobago



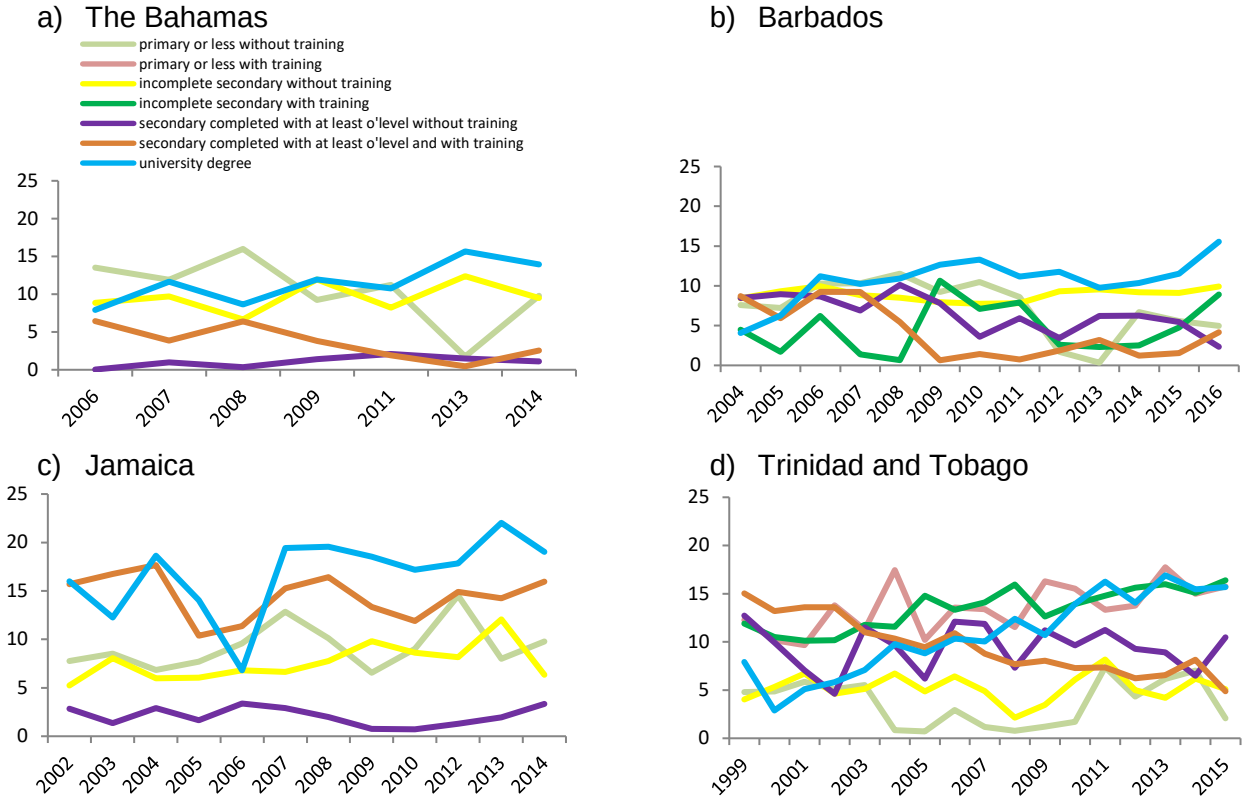
Source: Authors' own calculations based on BH LFS 2006–2014, BB LFS 2004–2016, JM LFS 2002–2014 and TT CSSP 1999–2015.
Note: All indices are in percentages.

Despite some country-specific variations, overall these graphs illustrate the existence of a consistent pattern in terms of levels of segregation of occupational categories across countries and a high discrepancy between levels of segregation among different occupational categories. Hence, this highlights the importance of analyzing occupational segregation at a disaggregated occupational category level.

4.3 Educational Segregation by Educational Level

The disaggregated analysis of educational segregation displays a high level of heterogeneity in segregation across educational levels (Figure 3).[18] Educational segregation ranges between zero to around 17 percent, but with values over 20 percent for university graduates in Jamaica, while segregation levels for Bahamas and Barbados stay below 15 percent. Interestingly, The Bahamas followed by Jamaica have (according to Figure 1) in aggregate terms the lowest level of educational segregation, but this seems (Figure 3a and c) largely driven by very low levels of educational segregation among respondents who completed secondary education with at least O Levels without further training. Hence, these two countries display overall a wider spread of segregation levels across educational groups, as educational segregation among those with university degrees is higher than in the other countries and increases significantly over time.

Figure 3: Educational Segregation by Category (KM index)



Source: Authors' own calculations based on BH LFS 2006–2014, BB LFS 2004–2016, JM LFS 2002–2014 and TT CSSP 1999–2015.
Note: All indices are in percentages

[18] Note that, The Bahamas and Jamaica are missing the categories "primary education or less with training" and "incomplete secondary with training" and Barbados misses just the former category. Despite respondents having had the opportunity to respond about their educational qualifications in a manner that would categorize them into these categories, too few did so in certain years for these countries, to be able to estimate segregation in those groups. Restricting the analysis for all countries to only five categories with only one at primary and one at incomplete secondary level each for all countries does not change the results, so that here the more disaggregated version is reported.

Educational segregation appears to be particularly low for those with completed secondary education without training in Bahamas and Jamaica and statistically significantly decreasing in Barbados and in Trinidad and Tobago. Moreover, there is a downward trend of educational segregation for the completed secondary education with training category for The Bahamas and Trinidad and Tobago. However, it is worth noting that the initial segregation at these educational levels of 15 percent is much higher for Jamaica and Trinidad and Tobago than in the other countries where it reaches just above 5 percent. These patterns are in line with the expectation that over time more people enter the working labor force and can thus be captured by the labor force survey that grew up during times with lower educational discrimination at the early levels.

Educational segregation for the primary education or less categories, be it with or without training, is volatile but remains generally at a relatively high level. This can be explained by the age composition of this group as it mainly consists of the older generations and very few young people fall into this category, as can be seen in Figure A.1 a)-d). Hence, educational segregation cannot be lowered by younger generations, who obtained this educational level in a less segregated environment. All those rather move to higher educational groups, mainly toward just completing secondary school at least with O Levels but without training. More generally, the same figure also shows that among the total working population women are more likely to have at least some secondary education than men. This is consistent with the results of Moore, Presbitero, and Rabellotti (2017) except for Trinidad and Tobago, where these authors observe men to be slightly more likely to have at least some secondary education.[19]

At the same time, this figure also displays potential concerns about the respondents' representativeness of the whole population. It seems counterintuitive that there are among the younger generations equal or fewer respondents in the two top educational groups for Jamaica and The Bahamas, while one would generally expect increased access to and popularity of higher education as reflected in increasing portions of these two top categories for Barbados and Trinidad and Tobago. For the youngest age group (15–24 years), such relative under-representation is still understandable, as those pursuing these educational levels have not yet entered the labor force and are thus not captured in this analysis. In the next-higher age groups, one would, however, expect to see a larger proportion of people with higher education.[20] It is furthermore striking that obtaining non-university degree training on top of having incomplete or completed secondary education is so much more prevalent in Trinidad and Tobago than

[19] Using the CSSP data, females are in recent years only in 2011 less likely than men to have at least secondary education, when not restricting the sample and those with an age below 75.
[20] A potential explanation might be that the samples are not weighted by educational levels as discussed in section 2.

in other countries, as the larger orange bars in Figure 3d compared to Figure 3a)-c) indicate. This may be a result of there being fewer training programs offered in other countries or deducible to varying levels of probing among enumerators for the surveys in the different countries. The large increase in having completed secondary education for the 15–24 year-old age group compared to their male counterparts of the same age and the female 25–35 year olds can however explain the observed decrease in Figure A.2 in the share of women among the Jamaican working young youth.

Turning back to the educational segregation, it is crucial to note that segregation seems to be increasing in the university degree group in all countries apart from Barbados, where the levels are extremely volatile. This segregation is unlike in other cases, however, a result of increasing female dominance of this educational level, as can be seen in Figures 4a)-d). The university degree level has an around 60 percent share of women in all countries. Furthermore, these graphs clearly depict that female intensity is higher for the higher educational levels, while women remain in the minority at the lower educational levels.

This observation highlights a drawback of the existing segregation indexes, in that it does not distinguish between female and male dominated segregation. This means that a certain educational or occupational category may seem equally segregated in two countries or over time, but in the one country or time period, segregation is induced by male dominance, while in the other women may dominate that category to a similar extent. The subsequent section therefore examines the extent of female versus male dominance in educational and occupational categories.

4.4 Female Intensity of Educational Levels and Occupational Categories

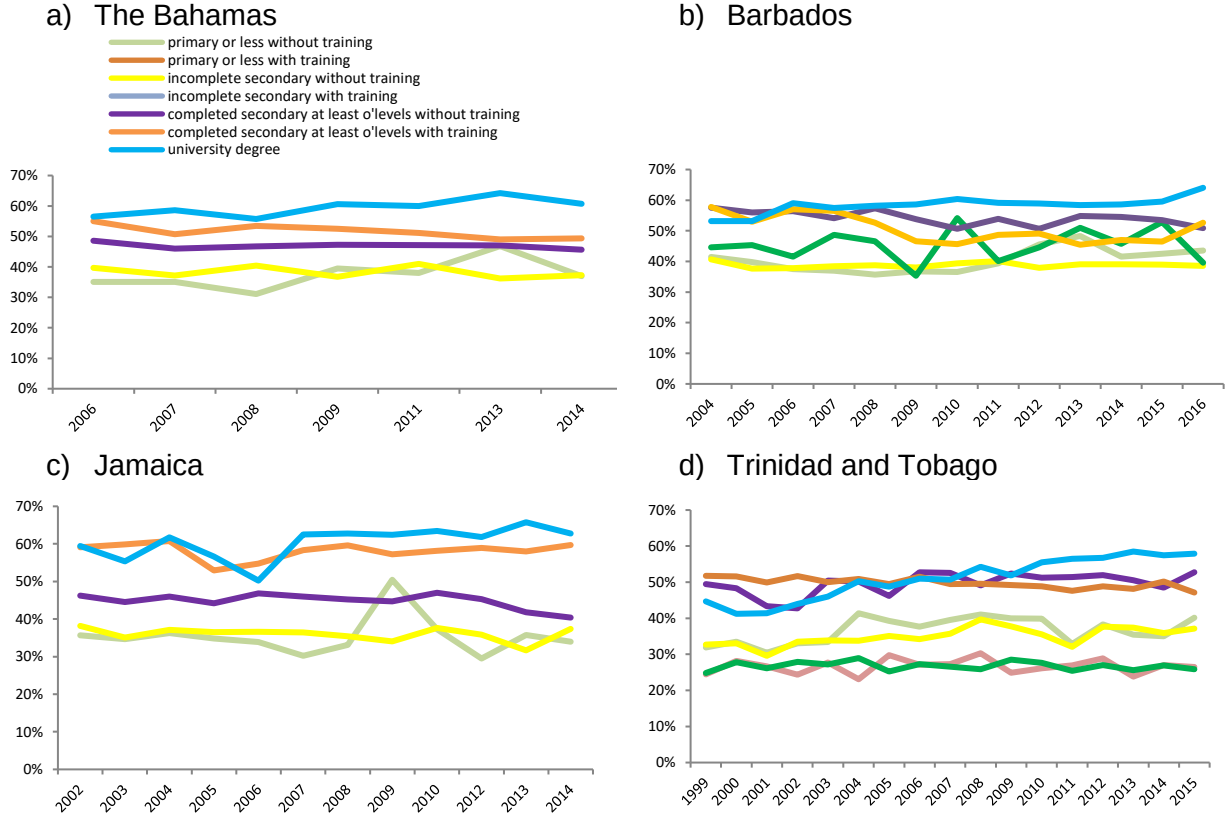
In terms of female intensity of occupations, three categories, namely, Skilled Agricultural and Fishery Workers, Crafts and Related Workers, and Plant and Machine Operators and Assemblers, stand out as having in all four countries very low percentages of women, ranging from 4.4 percent to 20 percent. On the other hand, more than three-quarters of the Clerk positions are filled by women.

While Figures 4a)-d) and Figures 5a)-d) display the female intensity of an educational level and occupational category as a percentage share of women out of total employees respectively, these numbers are not scaled to the female labor force participation relative to men. Therefore, further robustness checks have been conducted using three different methodologies identified in the literature to distinguish between female and male dominated occupations: one developed by Flückiger and Silber

(1999); a second established by Oppenheimer (1969); and the marginal matching method by Blackburn, Jarman, and Siltanen (1993).

Estimates of female intensity based on the Flückiger and Silber (1999) approach presented in Tables A.5-A.8 in the Appendix support the earlier observations and find the same three occupational categories to be continuously male-dominated.

Figure 4: Female Intensity by Educational Category

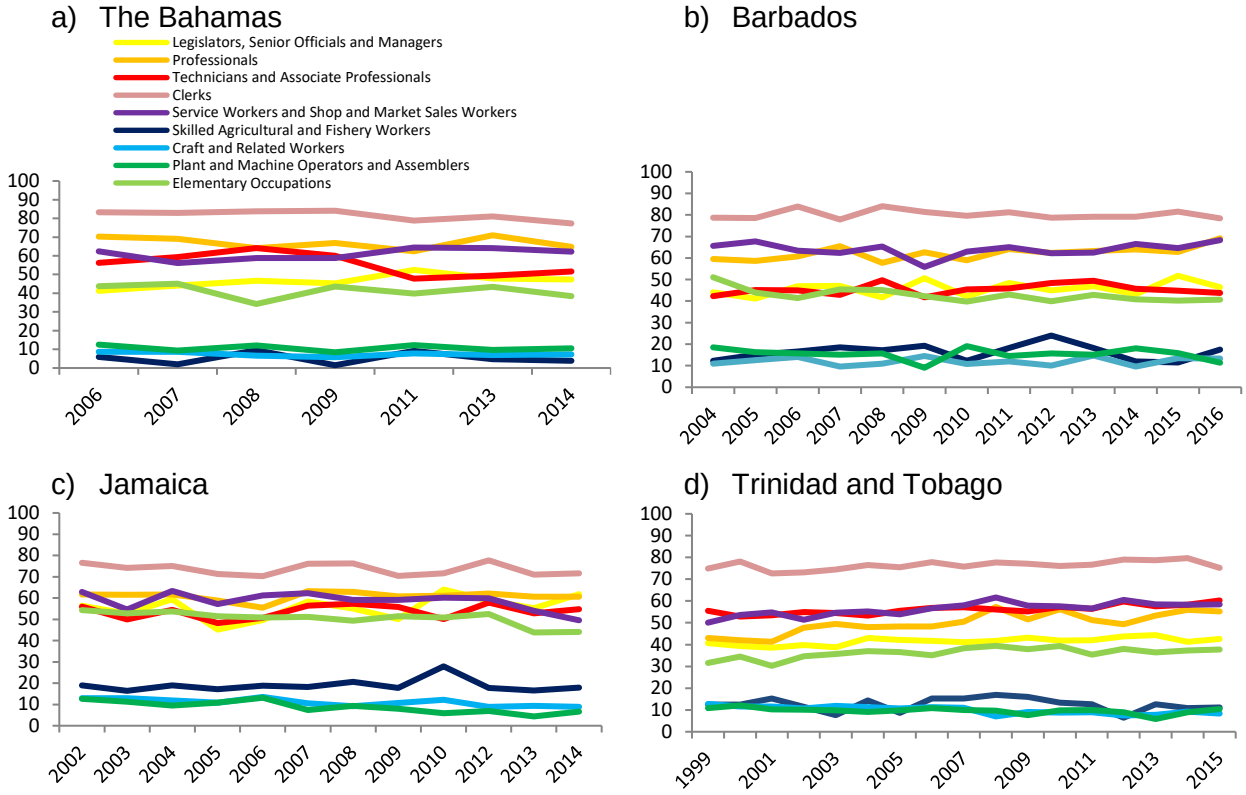


Source: Authors' own calculations based on BH LFS 2006–2014, BB LFS 2004–2016, JM LFS 2002–2014 and TT CSSP 1999–2015.

Also using the Oppenheimer approach (Tables A.9-A.12) the three earlier identified male occupations stand out again as clearly male dominated, while Professionals and Clerks as well as Service, Shop and Market Sales Workers are predominantly female occupations. Apart from in Barbados, Technicians and Associate Professional occupations are to the largest extent female-dominated. Lastly, also using the marginal matching approach (Tables A.9-A.12) developed by Blackburn, Jarman, and Siltanen (1993) leads to the same overall conclusions regarding female- and male-dominated occupations. For Barbados and Jamaica only, there are several switches between male and female dominance indicating close to

balanced gender shares for the Legislators and Technician categories in some years, which are grouped as neither female nor male dominated in the other approaches.

Figure 5: Female Intensity by Occupational Category



Source: Authors' own calculations based on BH LFS 2006–2014, BB LFS 2004–2016, JM LFS 2002–2014 and TT CSSP 1999–2015.

5. Decomposing Segregation over Time

Despite the absence of noteworthy changes in aggregate segregation over time, the observed differences in the segregation levels across different educational and occupational categories in each country over time provide a case for further decomposition. First, the results of the approach by Borghans and Groot (1999) in linking educational segregation to occupational segregation are presented. These results are followed by the counterfactual occupational distribution for women, if these with had with their characteristics been men.

5.2 Decomposition of Segregation following Borghans and Groot (1999)

The impact of educational on occupational segregation has been decomposed at the aggregate level (Tables 4–7) and at the disaggregated level (Tables 8–11). In the aggregate case, the impact values are

mostly in the high 80s and 90s, that is, they show that educational segregation has a strong impact on occupational segregation. This effect is largest in Jamaica and Trinidad and Tobago. In The Bahamas and Barbados, the effect is slightly more volatile where the impact drops in certain years to as low as 54.63 percent before rising again. The latter could, however, very likely be a result of the data quality; as such, sudden large and temporary changes in the labor force composition without a clear trend are highly unlikely.

Table 4: Bahamas: Aggregate Results (KM index)

Year	ES	ES (SE)	OS	OS (SE)	I	D	R	Impact (%)
2006	4.32***	0.55	20.38***	0.65	18.24***	1.87***	0.32	92.51***
2007	4.58***	0.65	18.73***	0.63	16.69***	1.85***	0.69**	84.96***
2008	4.71***	0.69	20.98***	0.72	18.08***	1.47***	0.34	92.79***
2009	4.72***	0.79	19.70***	0.75	16.93***	1.49***	0.47	90.12***
2011	4.43***	0.84	17.41***	0.78	15.22***	1.49***	0.76**	82.94***
2013	3.89***	0.71	19.03***	0.85	18.19***	1.29***	1.77***	54.63***
2014	4.20***	0.80	18.06***	0.95	16.05***	1.30***	0.89**	78.82***

Source: Authors' own calculations based on LFS 2006–2014.
Note: All indices are in percentages. Bootstrapped standard errors with 1000 iterations: ***p <1%, **p <5%, *p <10%

Table 5: Barbados: Aggregate Results (KM index)

Year	ES	ES (SE)	OS	OS (SE)	I	D	R	Impact (%)
2004	7.68***	0.63	16.60***	0.55	13.09***	3.61***	0.57	92.59***
2005	8.02***	0.90	17.52***	0.86	13.95***	3.15***	1.31***	83.74***
2006	9.59***	1.00	18.29***	0.93	13.14***	3.33***	1.11**	88.47***
2007	8.35***	0.86	17.15***	0.77	13.90***	3.79***	1.31***	84.30***
2008	9.12***	1.00	18.43***	0.89	15.45***	3.88***	2.25***	75.30***
2009	8.05***	1.17	17.34***	1.06	13.53***	3.18***	1.06*	86.88***
2010	6.80***	1.35	17.40***	1.26	14.79***	2.49***	1.70***	74.96***
2011	7.11***	0.67	17.50***	0.62	14.12***	2.91***	0.82**	88.41***
2012	6.58***	0.87	16.70***	0.86	14.22***	2.10***	1.99***	69.69***
2013	7.02***	0.95	15.86***	0.89	13.73***	2.61***	2.29***	67.37***
2014	7.22***	0.85	18.61***	0.82	14.88***	2.40***	1.09**	84.92***
2015	7.22***	0.94	17.97***	0.88	14.68***	2.86***	1.07*	85.13***
2016	7.76***	0.96	19.17***	0.94	15.20***	2.83***	0.96*	87.64***

Source: Authors' own calculations based on LFS 2004–2016.
Note: All indices are in percentages. Bootstrapped standard errors with 1000 iterations: ***p <1%, **p <5%, *p <10%

Table 6: Jamaica: Aggregate Results (KM index)

Year	ES	ES (SE)	OS	OS (SE)	I	D	R	Impact (%)
2002	6.08***	0.40	21.53***	0.34	17.69***	2.12***	0.12	98.03***
2003	6.10***	0.78	19.49***	0.68	16.10***	2.24***	0.47*	92.36***
2004	5.86***	0.40	22.11***	0.33	18.33***	1.97***	0.11**	98.14***
2005	5.00***	0.74	18.12***	0.61	15.52***	1.93***	0.48*	90.43***
2006	5.26***	1.06	18.74***	0.91	16.24***	2.07***	0.68	87.12***
2007	6.78***	0.39	22.18***	0.32	17.80***	2.30***	0.1	98.57***
2008	6.44***	0.67	20.78***	0.57	16.53***	2.06***	0.14	97.79***
2009	6.23***	0.93	20.02***	0.94	16.27***	2.10***	0.38	93.96***
2010	6.11***	1.28	18.25***	1.31	14.91***	2.03***	0.74	87.93***
2012	6.70***	0.40	21.98***	0.35	17.42***	2.04***	0.11*	98.43***
2013	8.57***	0.96	17.93***	0.82	14.13***	2.74***	2.03***	76.30***
2014	7.14***	1.18	16.59***	1.01	13.42***	2.50***	1.47**	79.41***

Source: Authors' own calculations based on LFS 2002–2014
Note: All indices are in percentages. Bootstrapped standard errors with 1000 iterations: ***p <1%, **p <5%, *p <10%

Considering the factors that determine the impact, all three mechanisms remain relatively constant over time with Increase being the strongest mechanism followed by Decrease and Reintegration. In the case of Jamaica, one can, however, observe a sudden increase in Reintegration in the last two sample period years. This means a lower impact of educational segregation on occupational segregation due to more male and female workers with different education getting a job in the same occupation. For The Bahamas, the Reintegration mechanism surpasses the impact of the Decrease mechanism in 2013.

Table 7: Trinidad and Tobago: Aggregate Results (KM index)

Year	ES	ES (SE)	OS	OS (SE)	I	D	R	Impact (%)
1999	10.68***	0.46	17.24***	0.44	10.81***	3.85***	0.40**	96.27***
2000	9.42***	0.70	17.41***	0.66	12.57***	3.63***	0.96**	89.82***
2001	9.47***	0.56	17.72***	0.52	12.01***	3.21***	0.54***	94.29***
2002	9.95***	0.62	17.29***	0.57	12.28***	3.74***	1.20***	87.97***
2003	9.57***	0.63	17.67***	0.6	12.58***	3.36***	1.11***	88.39***
2004	9.83***	0.59	17.51***	0.64	12.66***	3.38***	1.60***	83.74***
2005	8.43***	0.54	17.60***	0.55	13.19***	3.20***	0.82**	90.29***
2006	10.35***	0.59	18.69***	0.55	12.97***	3.79***	0.84***	91.92***
2007	9.41***	0.59	18.35***	0.54	13.40***	3.33***	1.13***	87.98***
2008	8.48***	0.57	19.66***	0.55	15.56***	3.09***	1.29***	84.78***
2009	9.10***	0.60	18.57***	0.55	13.37***	3.14***	0.76**	91.61***
2010	9.46***	0.71	18.79***	0.66	13.54***	3.06***	1.15***	87.85***
2011	10.47***	0.76	18.79***	0.72	13.14***	3.61***	1.22***	88.40***
2012	9.24***	0.58	19.79***	0.5	14.64***	3.50***	0.59**	93.59***
2013	10.27***	0.65	19.69***	0.57	13.77***	3.39***	0.96***	90.68***
2014	10.39***	0.62	19.35***	0.57	13.02***	3.49***	0.57*	94.51***
2015	9.44***	0.60	18.69***	0.57	13.55***	3.01***	1.30***	86.20***

Source: Authors' own calculations based on CSSP 1999–2015
Note: All indices are in percentages. Bootstrapped standard errors with 1000 iterations: ***p <1%, **p <5%, *p <10%

Table 8: Occupational Segregation (KM index) Derived from Pre- and Post-Sorting: Disaggregated Results. For Selected Years (2006 and 2013). BAHAMAS

Occupation	2006			2013		
	ES	OS	Impact (%)	ES	OS	Impact (%)
Legislators, Senior Officials and Managers	4.99***	7.31***	100***	5.94***	0.70	-15
Professionals	7.00***	21.67***	99***	10.64***	22.40***	96***
Technicians and Associate Professionals	4.21***	7.69***	51**	3.62***	0.80	-84
Clerks	2.92***	34.79***	100***	3.15***	32.40***	84***
Service Workers and Shop and Market Sales Workers	3.19***	13.89***	96***	2.72***	15.46***	92***
Skilled Agricultural and Fishery Workers	6.86***	42.61***	100***	4.11***	43.83***	76**
Craft and Related Workers	4.14***	39.89***	100***	2.50***	41.58***	100***
Plant and Machine Operators and Assemblers	3.69***	36.05* **	100***	3.62***	38.89***	100***
Elementary Occupations	5.46***	4.91***	92***	3.16***	5.24**	5

Source: Authors' own calculations based on LFS Bahamas
Note: All indices are in percentages. Bootstrapped standard errors with 1000 iterations: ***p <1%, **p <5%, *p <10%

Table 9: Occupational Segregation (KM index) Derived from Pre- and Post-Sorting: Disaggregated Results. For Selected Years (2006 and 2013). BARBADOS

Occupation	2006			2013		
	ES	OS	Impact (%)	ES	OS	Impact (%)
Legislators, Senior Officials and Managers	9.64***	0.9	-5.00	7.38**	1.67	0
Professionals	10.11***	13.02***	97***	8.27***	14.65***	87***
Technicians and Associate Professionals	9.51***	2.7	66**	6.98***	0.75	67**
Clerks	9.23***	36.13***	100***	7.14***	30.50***	100***
Service Workers and Shop and Market Sales Workers	9.37***	15.56***	100***	6.87***	13.87***	100***
Skilled Agricultural and Fishery Workers	9.80***	31.13***	100***	6.50***	30.42***	97***

Craft and Related Workers	9.55***	33.67***	100***	6.03***	33.92***	88***
Plant and Machine Operators and Assemblers	9.64***	32.07***	99***	7.02***	33.51***	100***
Elementary Occupations	9.74***	6.30***	100***	6.94***	5.71***	11

Source: Authors' own calculations based on LFS Barbados.
Note: All indices are in percentages. Bootstrapped standard errors with 1000 iterations: ***p <1%, **p <5%, *p <10%

Bearing in mind the heterogeneity of segregation across occupational categories, the impact of educational segregation on occupational segregation may well differ from the aggregate across occupational categories as well. Tables 9–12 present disaggregated decompositions for 2006 and 2013.[21]

Table 10: Occupational Segregation (KM index) Derived from Pre- and Post-Sorting: Disaggregated Results. For Selected Years (2006 and 2013). JAMAICA

Occupation	2006			2013		
	ES	OS	Impact (%)	ES	OS	Impact (%)
Legislators, Senior Officials and Managers	5.11***	6.16	-11	11.78***	11.47**	88***
Professionals	6.87**	12.04***	79	19.30***	16.90***	95***
Technicians and Associate Professionals	5.26***	7.23	100*	9.00***	9.07**	63
Clerks	3.97***	26.86***	91**	6.38***	27.28***	77***
Service Workers and Shop and Market Sales Workers	4.69***	17.80***	86***	5.74***	10.23***	100***
Skilled Agricultural and Fishery Workers	6.47***	24.61***	100***	8.28***	27.21***	93***
Craft and Related Workers	5.09***	29.90***	100***	6.70***	34.47***	97***
Plant and Machine Operators and Assemblers	25.05***	30.29***	100***	5.90***	39.36***	100***
Elementary Occupations	5.47***	7.49***	97***	6.91***	0.09	-41

Source: Authors' own calculations based on LFS Jamaica
Note: All indices are in percentages. Bootstrapped standard errors with 1000 iterations: ***p <1%, **p <5%, *p <10%

Table 11: Occupational Segregation (KM index) Derived from Pre- and Post-Sorting: Disaggregated Results. For Selected years (2006 and 2013). TRINIDAD AND TOBAGO

Occupation	2006			2013		
	ES	OS	Impact (%)	ES	OS	Impact (%)
Legislators, Senior Officials and Managers	10.32***	1.08	39*	11.16***	2.76	60***
Professionals	10.45***	7.68**	82***	16.28***	11.71***	84***
Technicians and Associate Professionals	11.05***	16.15***	87***	9.87***	15.92***	72***
Clerks	11.09***	37.25***	100***	8.48***	37.10***	100***
Service Workers and Shop and Market Sales Workers	10.74***	15.99***	96***	9.57***	16.92***	100***
Skilled Agricultural and Fishery Workers	7.77***	25.35***	90***	9.41***	29.05***	95***
Craft and Related Workers	12.13***	29.28***	100***	12.78***	33.86***	100***
Plant and Machine Operators and Assemblers	9.41***	29.74***	100***	9.28***	35.74***	100***
Elementary Occupations	8.44***	5.54***	100***	8.49***	5.23***	100***

Source: Authors' own calculations based on CSSP Trinidad and Tobago
Note: All indices are in percentages. Bootstrapped standard errors with 1000 iterations: ***p <1%, **p <5%, *p <10%

At the disaggregated level, one can distinguish different patterns across occupations, over time and by country group. First, the high observed aggregate impact of educational segregation on occupational segregation seems to be driven by certain occupations. These are the categories: Professionals, Clerks, Service Workers and Shop and Market Sales Workers, Crafts and Related Workers, and Plant and Machine Operators and Assemblers. For those the impact is approximately 100 percent and remains

[21] These are years that all countries' data sets have in common.

high. These are the same occupational categories that stood out in the earlier analysis of gender dominance as being highly (fe)male-dominated occupations. The same holds for elementary occupations in Trinidad and Tobago, which was a male dominated category in both years and for Technician and Associate Professionals in both Trinidad and Tobago and Jamaica, though to a lesser extent.

In contrast there is a sharp drop in the impact of educational segregation on occupational segregation for the elementary occupations in all countries except Trinidad and Tobago. Even though this result could according to the marginal matching approach in Jamaica be explained by a shift from female to male dominance of this category, this category appears according to other techniques to be gender neutral and not facing major fluctuations in dominance either for Jamaica or the other countries. Hence, changes or persistence of gender dominance cannot be a sole indicator for variations in the impact of educational segregation on occupational segregation.

The reduced impact to lower and even negative levels is a consequence of a rise in Reintegration, meaning more women and men with typical female and male educational background, respectively, ending up in the same occupation than before. In the cases of a negative impact, the extent of Reintegration exceeded that of educational segregation.[22] The observed fall in impact means that in 2013 more women with a clear female educational background joined men with a male educational background as Legislators, Technicians, and Associate Professionals and in Elementary Occupations in The Bahamas than in 2006, when the educational background was still more decisive for obtaining a job in these categories. The same holds for elementary occupations in Barbados and Jamaica. For the Legislator category in Jamaica and Trinidad and Tobago, the reverse seems to be the case, as the impact of educational segregation on the segregation of that occupational category has been increasing over those seven years. In Barbados, educational segregation does not seem to matter for the very limited occupational segregation of Legislators in either year, as the impact measure is close to zero and insignificant.

5.3 Counterfactual Occupations of Women

The above approaches inform about gender imbalances in occupations, which gender dominates and that occupational segregation originates to a large extent from earlier educational segregation. There remains the issue of what would be the justified share of women working in an occupation based on their characteristics if they were men. Table A.13 displays counterfactual distributional shares for the first and

[22] According to (7) explained earlier the impact of educational segregation on occupational segregation can be expressed as Impact $=\left(1-\frac{R}{ES}\right)*100$. This means that Impact <0 if R>ES following from $\left(1-\frac{R}{ES}\right)*100<0 \Leftrightarrow 1-\frac{R}{ES}<0 \Leftrightarrow 1<\frac{R}{ES} \Leftrightarrow ES<R$

last sample year for each country. It reveals a generational trend for the top and bottom occupations. In terms of a professional hierarchy, one observes a slightly inverted U-shape pattern with women being overrepresented at the middle group occupations and underrepresented in higher and lower end occupations, with the exception of the lowest occupations. Older women were in the beginning of the sample period highly overrepresented in elementary positions. On the contrary, younger women are, apart from in Jamaica, observed to the extent that matches their characteristics or underrepresented in these occupations in the last sample year. Confirming the previously identified three strongly male-dominated occupational categories, craft workers, plant and machine operators and assemblers, and skilled agricultural, fishery and forest workers, women are found to be strongly underrepresented based on their characteristics in all countries across generations.

Table A.13 illustrates an overrepresentation of women in the service, shop and sales worker, and clerical occupational categories, which is even larger among the younger workers. The actual as well as the counterfactual share of older women that are clerks in Jamaica is only half of that in Barbados and Trinidad and Tobago. This suggests that socio-economic characteristics of elder working women differed more across Caribbean countries but converged for the younger ones.

Cross-country and generational differences can also be observed for Technicians and Associate professionals. While older women were still overrepresented in 2006 in The Bahamas, eight years later, older women are underrepresented considering their characteristics, while young women have over time remained slightly overrepresented as technicians. In the remaining countries women are overrepresented as technicians throughout generations and time. In Jamaica, though, women make up only a third of the share that they make up in the three other countries. Similarly, legislators, senior officials and manager positions are, despite a slight but over time decreasing overrepresentation in actual as well as counterfactual terms, less frequently filled by women in Jamaica than by women in the other countries. Table A.13 also shows that, based on their characteristics, more women had been professionals in the counterfactual scenarios for all age groups, except in Trinidad and Tobago. In the latter case, the share of female employees in professional occupations is comparatively lower, but fully reflects the women's characteristics and would not differ had they been men. Despite the larger actual shares of women in legislator positions in Bahamas and Barbados, those shares could, as the counterfactual prediction shows, be even up to around 4 percent higher given their characteristics. Over time, however, one observes that the older generation of Bahamian women in 2016 are better represented in legislator positions than 2004. This development pattern cannot be observed for the younger or for the Barbadian women. Generally, one observes larger shares of older women taking up legislator positions. This is not

surprising, as experience is likely an important factor for such senior positions. Only in Trinidad and Tobago actual and counterfactual legislator shares coincide. This analysis shows that there are potentially other important drivers that induce segregation that cannot be explained based on differing characteristics. More research that can draw on more detailed occupational and educational distinctions may be able to provide further insights into the currently unexplainable segregation.

6. Conclusion

The literature has largely neglected gender-based labor market segregation in the Caribbean. To fill this gap this study examines: (i) the evolution of labor market segregation in The Bahamas, Barbados, Jamaica and Trinidad and Tobago for the period 1999–2016; (ii) the driving forces behind aggregate segregation and heterogeneity of segregation levels by category; (iii) the impact of educational segregation in explaining subsequent occupational segregation; and (vi) the counterfactual case for the choice of occupation if women had the productivity-related characteristics of men.

This leads to four major findings: First, the results suggest that aggregate gender-based segregation levels are very similar across countries and have remained almost constant over time. Educational and occupational segregation range around 7.5 percent and 18.5 percent in terms of the KM index, respectively. This is remarkable given the large variation in female labor force participation across countries combined with large increases in the shares of working women having secondary and tertiary training, while these rates have been largely stagnant or even decreasing for men. The segregation levels in the initial sample years[23] are comparable to the mean levels observed in European and Latin American countries. While occupational segregation is slightly higher than educational segregation, the gap between the two varies among countries. Jamaica faces the highest occupational segregation, while Trinidad and Tobago has the highest educational segregation.

Second, a decomposition of segregation within seven educational and nine 1-digit occupational categories demonstrates significant heterogeneity in segregation levels across occupations. Occupational categories can be divided into two broad groups of highly and less segregated occupations. Traditionally male-dominated occupations, plant and machine operators, crafts and agricultural and fishery occupations, and traditionally female-dominated clerical occupations remain highly segregated in

[23] There is no comparable data from other countries over the whole sample period.

all countries over the entire sample period. Tests for (fe)male dominance in each occupation, using alternative approaches, as segregation indices only inform about imbalances but not the direction, similarly do not indicate the existence of a certain trend or switches in segregation. However, these approaches also classify the medium segregated categories, professionals, service workers, and to some extent especially in more recent years also technicians and legislators, more likely as female dominated. As these all represent usually higher-paid occupations requiring higher levels of education, further research will consider how this development has affected gender wage gaps over time and whether higher female labor force participation seems to be a moderating factor of this effect.

Segregation levels across educational categories are less dispersed than across occupational categories, especially in Jamaica. Apart from rising educational segregation in the university degree category, particularly in Trinidad and Tobago, there are in all countries only very limited changes in segregation within educational groups. A closer look, however, reveals that the traditional segregation indexes do not account for shifts in segregation levels arising from shifts from male- to female-dominated categories or vice versa. The initial male dominance in university-level education has over time been replaced by similar female dominance in this educational category. A large part of the heterogeneity in the composition of highest education levels obtained by gender seems moreover to be the result of generational differences displayed by variation among age groups. This is an aspect requiring further research. Furthermore, the reasons for only a negligible number of respondents reporting having obtained additional training complementing primary education or incomplete secondary education in all countries but Trinidad and Tobago urge further analysis.

Third, a further decomposition of the importance of educational segregation on occupational segregation suggests that the former over time continues to fully explain the occupational segregation for the highly segregated occupations, while the importance of educational segregation on occupational segregation in other occupations is less clear. At the aggregate level, we observe some changes in the explanatory power of the educational segregation on occupational segregation. However, no clear trend can be observed in any country.

Fourth, a counterfactual analysis on women's distribution over occupations if they were to get jobs given their characteristics in occupations the way men do shows that there are large intergenerational differences in female over- and underrepresentation in certain occupations. The low segregation levels in elementary occupations may not be justifiable, as older women are largely overrepresented in elementary occupations given their characteristics.

Besides, some country-specific conclusions can be drawn. The Bahamas have persistently had the largest female labor force participation among the countries analyzed here as well as being among the top in international comparison. Moreover, women are continuously well represented at secondary and tertiary education levels. With around 4.4 percent, The Bahamas therefore display the lowest aggregate educational segregation but, at on average 19.2 percent, the second-highest occupational segregation among the four countries. The Bahamas especially faces the highest relative occupational segregation for the traditionally male-dominated occupations Crafts workers, Agricultural, Forestry and Fishery workers, and Plant and Machine operators and assemblers and traditionally female-dominated clerical occupations among the four Caribbean countries and a very high overrepresentation of especially younger women in service and sales jobs, compared to their counterfactual representation based on their characteristics. While high levels of reintegration meaning that large shares of individuals chose the same occupation despite gender-specific different educational backgrounds may suggest a reduction of occupational segregation in the long run, this trend has yet to show in the segregation levels. This suggests that simply encouraging women to pursue higher education and participate in the labor market may not be enough to achieve lower occupational segregation levels across occupations. Even though still at high levels, lower female participation rates in 2013 than 2006 especially for younger and older women, and a lower share of women in the 25–35 years age group having obtained tertiary education than their slightly older peers raise concerns whether this may hint at a lack of child care facilities and flexibility of job contracts replaced by (grand)mothers staying home, or mothers not completing university degrees and opting for service and sales occupations with more flexible work schedules.

Barbados, unlike The Bahamas, has seen a much lower female participation rate of older and especially younger women despite continuously rising female secondary and tertiary education levels and faces with 7.7 percent the second-highest educational segregation among the four Caribbean countries. While having surpassed The Bahamas in the share of women completing university degrees, the total share of women completing secondary or university degrees still lags behind that of The Bahamas. Nevertheless, Barbados displays with 17.6 percent the lowest aggregate occupational segregation levels. Like in The Bahamas, in Barbados the same traditionally male- and female-dominated occupations keep their higher relative segregation levels compared to other occupations, and relative educational segregation continues to have a very strong impact on relative occupational segregation, except for elementary occupations for which educational background is less important. However, women are, with respect to their characteristics, over-proportionally moving out of elementary occupations. This suggests a need for further policy emphasis on continued promotion of secondary education among women, as well as

university and secondary education among men, who seem to have been left behind, and breaking the traditional gender associations with specific occupations.

At on average 19.8 percent, Jamaica faces the highest aggregate occupational segregation among the four countries, but a lower variation in relative segregation levels of the different occupations. However, while elementary occupations have become relatively less segregated over time and educational segregation plays a smaller role in explaining the remaining barely existent relative occupational segregation, there appears to have evolved a slightly increasing male-dominated relative segregation trend for plant and machine operators and assemblers and crafts and related worker occupations. This can be almost fully explained by relative educational segregation. Despite Jamaica's relatively low aggregate educational segregation levels of about 6.4 percent, the second-lowest among the four countries, and having together with Barbados the highest share of tertiary-educated women and additionally over 90 percent of the younger employed women having completed at least secondary education, female participation rates are especially of younger women in childbearing age very low. Participation rates for these age groups range between 20 and 40 percent. For men, secondary and especially tertiary education completion rates are much lower, which highlights the large spread of relative educational segregation. Moreover, for both genders, obtaining training after secondary school completion appears much less common than in other countries. More research is needed to determine whether gender-based educational level discrepancy is a result of only the most educated women participating in the labor market and getting employed or a phenomenon of the whole population. Nevertheless, these findings suggest a need to create an environment that facilitates young women's labor market participation and employment and to promote occupations beyond their traditional gender affiliations.

Trinidad and Tobago like Jamaica represents the lower tail of female participation rates but Trinidad and Tobago displays, at an average of 9.6 percent, a higher and the highest level of educational segregation compared to the other countries studied here. In Trinidad and Tobago university level education is particularly highly segregated with an overrepresentation of women. While among women there has been an increase in the share of university graduates over time, the share of men with university degrees has stagnated. Similarly, we do not observe a rapid increase in secondary school completion rates among the 35–44 year old males to the younger generations, as we observe for Trinbagonian women and in the other three countries. On the other hand, Trinbagonians caught up in terms of overall education levels compared to the other three countries, from 50 percent of the 55–75 year olds having only primary education to 95 percent of the 15–24 year olds having at least incomplete secondary education.

Moreover, a larger share of people opt for additional training after their primary, incomplete or completed secondary degrees than in any other of the four Caribbean countries. Despite the shift in educational segregation from male- to female-dominated higher educational levels, aggregate occupational segregation remained constant over time but is, with 18.4 percent, the second-lowest among the four Caribbean countries. In relative terms there is a slight decrease in segregation in clerical occupations but an increase among craft-related workers and plant and machine operators and assemblers. Except for the highly skilled occupations, the estimated occupational segregation is fully explainable by the preceding educational segregation. Nevertheless, women appear, also based on their overall characteristics, overrepresented in clerical, service and sales, and technical associate positions but underrepresented in craft worker and plant and machine operator and assembler occupations, compared to Trinbagonian men. This suggests that existing policies aiming at reducing educational and occupational segregation have not lead to a reduction in segregation levels. Besides, the findings suggest a continued need to stimulate higher education especially among men.

While this analysis provides first suggestive comparative evidence on the extent, evolution, and driving forces of educational and occupational segregation in four Caribbean countries, further research that differentiates by age group and uses more detailed educational and occupational categories is needed for specific policy recommendations. This, however, requires that future rounds of labor force surveys solicit this information in a comparable manner, based on a sufficiently large sample.

Nonetheless, the findings suggest that increasing female labor force participation and educational attainment appear to be insufficient policy tools to affect the aggregate segregation of the labor market in these four countries. While labor market participation rates are converging and women have surpassed men in terms of education, the labor markets remain characterized by low but persistent segregation. There may therefore be a need for more proactive labor market policies, such as providing equal opportunities by increasing the availability of child care facilities to raise younger to middle-aged women's labor market participation, or affirmative action. Affirmative action programs, designed to increase the share of women in traditionally male-dominated occupations, can have a strong effect on decreasing occupational segregation, as shown in the case of ProJoven in Peru by Ñopo, Robles, and Saavedra (2007). Alternatively, affirmative action could be realized through quotas within organizations and hierarchy levels, such as was recently implemented in the public sector or for board members of private companies in some European countries.

7. References

Blackburn, R. M., Jarman, J., and Siltanen, J. 1993. The Analysis of Occupational Gender Segregation over Time and Place: Considerations of Measurement and Some New Evidence. *Work, Employment and Society 7*(3): 335–362.

Borghans, L. and Groot, L. 1999). Educational Presorting and Occupational Segregation. *Labor Economics 6*(3): 375–395.

Brown, R. S., Moon, M., and Zoloth, B. S. 1980. Incorporating Occupational Attainment in Studies of Male-Female Earnings Differentials. *Journal of Human Resources* 15: 3–28.

Calónico, S. and Ñopo, H. 2008. Gender Segregation in the Workplace and Wage Gaps: Evidence from Urban Mexico 1994–2004. Research Department Working paper series 636. Washington D.C.: Inter-American Development Bank.

Cobbett, M., and Younger, M. 2012. Boys' Educational 'Underachievement' in the Caribbean: Interpreting the 'Problem'. *Gender and Education* 24(6), 611–625.

Coppin, A. 1998. A Comparison of Male-Female Earnings Differences across two Caribbean Economies. *The Journal of Developing Areas* 32(3): 375–394.

Cruces, G., Domenech, C. and Gasparini, L. 2014. Inequality in Education: Evidence for Latin America. In Cornia, G. A. (Ed.) Falling Inequality in Latin America: Policy Changes and Lessons. New York: Oxford University Press, 318–339.

Deutsch, R., Morrison, A., Piras, C. and Ñopo, H. (2001). Working Within Confines: Occupational Segregation by Gender for Three Latin American Countries. Sustainable Development Department Technical Papers Series. Washington D.C.: Inter-American Development Bank.

Deutsch, J., Flückiger, Y., and Silber, J. 2009. Analyzing changes in occupational segregation: The case of Switzerland (1970–2000). In *Occupational and Residential Segregation*. Bingley, UK: Emerald Group Publishing Limited. pp. 171–202.

Duncan, O. D., and Duncan, B. 1955. A Methodological Analysis of Segregation Indexes. *American Sociological Review* 20 (2): 210–217.

Duryea, S. and Robles, M. 2016. Social Pulse in Latin America and the Caribbean 2016: Realities & Perspectives. Monograph (462). Washington, D.C.: Inter-American Development Bank.

Flückiger, Y. and Silber, J. 1999. The Measurement of Segregation in the Labor Force. Heidelberg: Physica Verlag.

Hernández, B. M. 2005. Female Labor Market Conditions in Urban Bolivia. Working Paper MpD 003/2005. La Paz: Universidad Católica Boliviana.

Isaza Castro, J. G. 2013. Occupational Segregation, Gender Wage Differences and Trade Reforms: Empirical Applications for Urban Colombia. Doctoral dissertation. University of Sussex.

Jacobs, J. and Lim, S. 1992. Trends in Occupational and Industrial Sex Segregation in 56 Countries, 1960–1980. *Work and Occupations* 19(4): 450–486.

Karmel, T. and Maclachlan, M. 1988. Occupational Sex Segregation—Increasing or Decreasing? *Economic Record* 64 (3): 187–195.

Moore, W., Presbitero, A.F. & Rabellotti, R. 2017. The Gender Gap in the Caribbean: The Performance of Women-Led Firms. In Dohnert, S., Crespi, G. & Maffioli, A. (Eds.). Exploring Firm-Level Innovation and Productivity in Developing Countries: The Perspective of Caribbean Small States. pp. 85–106. Washington D.C.: Inter-American Development Bank.

Ñopo, H., Robles, M., and Saavedra, J. 2007. Occupational Training to Reduce Gender Segregation: The Impacts of ProJoven. Working Paper No. 623. Washington, D.C.: Inter-American Development Bank.

Oliveira, A. M. 2001. Occupational Gender Segregation and Effects on Wages in Brazil, XXIV General Population Conference Iussp 2001 Session 38 Labor Force, La Force De Travail.

Oppenheimer, V. K. 1969. The Female Labor Force in the United States: Demographic and Economic Factors Governing its Growth and Changing Composition. Institute of International Studies, University of California, Berkeley.

Psacharopoulus, G. and Tzannatos, Z. 1992. Women's Employment and Pay in Latin America: Overview and Methodology. Washington, DC: The World Bank.

Salardi, P. 2014. The Evolution of Gender and Racial Occupational Segregation across Formal and Non-formal Labor Markets in Brazil, 1987 to 2006. *Review of Income and Wealth*, 1–22.

Smyth, E. 2005. Gender differentiation and Early Labor Market Integration across Europe. *European Societies* 7(3): 451–479.

Sookram, S., and Strobl, E. 2009. The Role of Educational Choice in Occupational Gender Segregation: Evidence from Trinidad and Tobago. *Economics of Education Review* 28(1): 1–10.

Silber, J. G. 1989. On the Measurement of Employment Segregation. *Economics Letters* 30(3): 237–243.

World Bank. 2016a. Labor force participation rate, female (percent of female population ages 15+) (national estimate). World Development Indicators. Washington, D.C.: World Bank Group.

World Bank. 2016b. Labor force participation rate, female (percent of female population ages 15+) (modelled ILO estimate). World Development Indicators. Washington, D.C.: World Bank Group.

8. Appendix

Table A.1: Literature Review for International Comparison

Author	Data source	Years covered		Countries included (Latin American and Caribbean Countries in bold)	Occupational Category Detail	Segregation measures	1-digit Occupational Segregation based on Duncan Duncan Index		OB/ES
		Initial year	Last year				Initial in %	Final in %	
Calónico & Ñopo (2008)	National Survey of Urban Employment (ENEU)	1994	2004	**Mexico**	1-digit	Duncan Index, Representation ratio	34.90	32.50	OB
Deutsch, Morrison, Piras and Ñopo (2002)	Household surveys	1989	1997	**Costa Rica** **Ecuador** **Uruguay**	1-digit / 2-digit	Duncan Index, Karlem Maclachlan, Hakim Siltanen, Marginal Margin, representation ratio	32.00 38.00 37.00	37.00 38.00 42.00	OB, ES
Hernández (2005)	MECOVI 2002 and Census 2001 data	2001		**Bolivia**	1-digit	Duncan Index, KM	37.78		OS
de Oliveira (2001)	Demographic Household Surveys (PNAD)	1981	1999	**Brazil**	1-digit, 2-digit, 3-digit	Duncan Index	36.76	43.88	OS
Smyth (2006)	Labor Force Surveys	2000		Austria Netherlands Sweden Finland France Belgium Greece Spain Hungary Slovenia Romania Slovakia	1-digit / 2-digit / 3-digit	Duncan Index	45.50 32.30 30.80 35.60 37.30 31.60 36.10 42.10 37.70 34.90 36.40 37.60		OB, ES

Note: Studies assessing segregation and changes in occupational segregation on 1-digit occupational categories in the recent past (end 1990s onwards).OS (occupational segregation), ES (educational segregation).

Table A.2 a-d: Educational and Occupational Segregation Indexes by Country

a) Bahamas

Year	ES			OS		
	DD	KM	Gini	DD	KM	Gini
2006	0.0866	0.0432	0.1332	0.4078	0.2038	0.5448
2007	0.0920	0.0458	0.1343	0.3761	0.1873	0.5246
2008	0.0945	0.0471	0.1419	0.4210	0.2098	0.5518
2009	0.0945	0.0472	0.1331	0.3942	0.1970	0.5374
2011	0.0886	0.0443	0.1194	0.3483	0.1741	0.4701
2013	0.0779	0.0389	0.1138	0.3808	0.1902	0.5175
2014	0.0843	0.0420	0.1228	0.3627	0.1806	0.4788

Source: Authors' own calculations based on LFS 2006–2014. Bootstrapped standard errors for indices are based on 1000 iterations. All indexes are significant at the 1% level.

b) Barbados

Year	ES			OS		
	DD	KM	Gini	DD	KM	Gini
2004	0.1537	0.0768	0.1660	0.3320	0.1660	0.4620
2005	0.1611	0.0802	0.1761	0.3517	0.1752	0.4834
2006	0.1922	0.0959	0.2003	0.3666	0.1829	0.5011
2007	0.1675	0.0835	0.1827	0.3440	0.1715	0.4805
2008	0.1829	0.0912	0.2020	0.3698	0.1843	0.5129
2009	0.1620	0.0805	0.1888	0.3491	0.1734	0.4840
2010	0.1366	0.0680	0.1731	0.3491	0.1740	0.4742
2011	0.1424	0.0711	0.1679	0.3505	0.1750	0.4846
2012	0.1320	0.0658	0.1694	0.3351	0.1670	0.4624
2013	0.1405	0.0702	0.1709	0.3174	0.1586	0.4423
2014	0.1446	0.0722	0.1738	0.3726	0.1861	0.4925
2015	0.1447	0.0722	0.1764	0.3600	0.1797	0.4812
2016	0.1553	0.0776	0.1981	0.3837	0.1917	0.4973

Source: Authors' own calculations based on CLFSS 2004-2016. Bootstrapped standard errors for indices are based on 1000 iterations. All indexes are significant at the 1% level.

c) Jamaica

Year	ES			OS		
	DD	KM	Gini	DD	KM	Gini
2002	0.1241	0.0610	0.1554	0.4383	0.2153	0.5036
2003	0.1243	0.0610	0.1682	0.3970	0.1947	0.4730
2004	0.1197	0.0587	0.1459	0.4507	0.2210	0.5208
2005	0.1030	0.0504	0.1339	0.3705	0.1811	0.4546
2006	0.1069	0.0526	0.1191	0.3815	0.1874	0.4574
2007	0.1383	0.0678	0.1764	0.4525	0.2219	0.5324
2008	0.1313	0.0644	0.1727	0.4235	0.2078	0.5107
2009	0.1258	0.0620	0.1820	0.4068	0.2004	0.4805
2010	0.1229	0.0611	0.1742	0.3671	0.1825	0.4572
2012	0.1358	0.0669	0.1878	0.4459	0.2197	0.5196
2013	0.1741	0.0857	0.2341	0.3643	0.1793	0.4694
2014	0.1450	0.0714	0.1657	0.3370	0.1659	0.4561

Source: Authors' own calculations based on LFS 2002–2014. Bootstrapped standard errors for indices are based on 1000 iterations. All indexes are significant at the 1% level.

d) Trinidad and Tobago

Year	ES			OS		
	DD	KM	Gini	DD	KM	Gini
1999	0.2299	0.1068	0.2674	0.3710	0.1724	0.4909
2000	0.1993	0.0942	0.2289	0.3681	0.1741	0.4968
2001	0.2048	0.0947	0.2319	0.3832	0.1772	0.4994
2002	0.2108	0.0995	0.2529	0.3665	0.1729	0.4913
2003	0.2011	0.0957	0.2255	0.3715	0.1767	0.5006
2004	0.2039	0.0983	0.2446	0.3633	0.1751	0.4944
2005	0.1756	0.0843	0.2147	0.3667	0.1760	0.4984
2006	0.2145	0.1035	0.2439	0.3874	0.1869	0.5160
2007	0.1950	0.0941	0.2310	0.3803	0.1835	0.5124
2008	0.1742	0.0848	0.2161	0.4040	0.1966	0.5471
2009	0.1879	0.0910	0.2293	0.3834	0.1857	0.5191
2010	0.1946	0.0946	0.2361	0.3866	0.1879	0.5136
2011	0.2177	0.1047	0.2541	0.3908	0.1879	0.5150
2012	0.1888	0.0924	0.2309	0.4045	0.1979	0.5397
2013	0.2115	0.1027	0.2615	0.4052	0.1969	0.5345
2014	0.2132	0.1039	0.2499	0.3970	0.1935	0.5253
2015	0.1935	0.0944	0.2486	0.3830	0.1869	0.5096

Source: Authors' own calculations based on CSSP 1999–2015.Bootstrapped standard errors for indices are based on 1000 iterations. All indexes are significant at the 1% level.

8.2 Shapley Decomposition

8.2.1 Shapley Decomposition Methodology

The literature has identified various aspects that may contribute to changes in the educational and occupational segregation levels over time. The factors addressed in the literature review (i-iii) can be decomposed following the Shapely Decomposition methodology developed by Deutsch, Flückiger, and Silber (2009). The change in the total share of employees working in a particular occupation is referred to as a change at the horizontal margin, while changes in the share of women among all employees is considered a change at the vertical margin. A change in the gender composition of employees in a particular occupation is referred to as a change in internal structure. The KM segregation measure can be rewritten as follows:

$$I = \sum_{i=1}^{I}\sum_{j=1}^{J}\left|\frac{T_{ij}}{T} - \frac{T_{i\cdot}}{T}\frac{T_{\cdot j}}{T}\right| = \sum_{i=1}^{I}\sum_{j=1}^{J}\left|p_{ij} - q_{ij}\right| \quad (1)$$

where the subscript i indicates the occupational categories and the subscript j indicates the gender (male or female) and T is defined as follows.

$$T = \sum_{i=1}^{I}\sum_{j=1}^{J} T_{ij} \quad (2)$$

The changes in the segregation index can be decomposed into the above-listed three components following these formulas, whereby v, p, s, l, k, w, c and f each represent a matrix of margins:

$$\Delta I = I(v) - I(p) = C_{\Delta m} + C_{\Delta is} = C_{\Delta h} + C_{\Delta t} + C_{\Delta is} \quad (3)$$

Internal structure: $C_{\Delta is} = \frac{1}{2}[I(w) - I(p) + I(v) - I(s)]$ (4)

Horizontal margins $C_{\Delta h} = \left(\frac{1}{2}\right)^2 [I(l) - I(p) + I(s) - I(k)] + I(w) - I(c) + I(f) - I(w)$ (5)

Vertical Margins $C_{\Delta t} = \left(\frac{1}{2}\right)^2 [I(k) - I(p) + I(s) - I(l)] + I(w) - I(f) + I(c) - I(w)$ (6)

For more details on the specific calculation approach of the Shapley decomposition see Deutsch, Flückiger, and Silber (2009).

8.2.2 Shapley Decomposition of Changes in Aggregate Segregation

The Shapley decomposition, which identifies the drivers of changes in aggregate segregation between two time periods, distinguishes between two types of changes. One type consists of changes in the "internal structure" of particular occupations, that is, capturing changes in the participation rates of men and women in particular occupations. The second type of changes consists of changes in the "margins," that is, capturing changes in the occupational structure or differences in the gender composition of the total labor force over time.

Given the hardly determinable changes in aggregate segregation over time, even for those time series that were estimated to show a significant trend, this approach solely decomposes here the variation

between two arbitrary years, the first and last sample year. These two years may, however, even in cases where there are very small but significant trends, represent outlier years from the trend. In general, the identified mechanisms explaining the variation in the segregation between the two years may thus just be explaining some noise. Therefore, one should be aware that these decomposition results may give too much importance to specific components that have in reality only had a miniscule effect.

Changes in the KM measure for educational segregation over time are, for Barbados and Jamaica, mainly a result of variation in the horizontal margins and internal structure, meaning changes in the importance of certain occupational groups and changes in the share of women in a particular occupation. For Barbados these changes have effects in opposing directions. Changes in the proportion of the labor force made up of women are not a major explanatory factor for the changes in educational segregation observed. For the other countries, the changes in educational segregation are not significant over time. Regarding changes in occupational segregation, these can, in Trinidad and Tobago, mainly be explained by changes in internal structure and rising female labor force participation, which raises the proportion of women in the labor force. In the remaining countries, the changes in occupational segregation do not exhibit significant variation over time.

Apart from the fact that the changes in educational and occupational segregation are very minimal and may be noise rather than an actual long-term significant change, the Shapley decomposition measures extreme changes at especially the horizontal margin and in internal structure, particularly for Barbados. The importance of changes at any margin and in internal structure should therefore be considered relative to the actual change in segregation. Moreover, rather than actual changes, the decomposed shifts in internal structure and at the margin may reflect slight differences in the composition of the surveyed sample, as sampling weights do not ensure representativeness by occupational category or educational level.

Table A.3: Occupational Segregation Decomposition

KM index	Bahamas	Barbados	Jamaica	Trinidad and Tobago
ΔI	-0.0237	0.0256	-0.0484	0.0221
$\Delta I\%$	-12%	15%	-23%	14%
$C_{\Delta is}$	9%	89%	4%	56%
$C_{\Delta h}$	77%	13%	98%	-40%
$C_{\Delta t}$	14%	-2%	-2%	84%

Source: Bahamas (2006–2013), Barbados (2004–2016), Jamaica (2002–2014), Trinidad and Tobago (1999–2015).

Table A.4: Educational Segregation Decomposition

KM index	Bahamas	Barbados	Jamaica	Trinidad and Tobago
ΔI	-0.0014	0.0820	0.0105	-0.0071
$\Delta I\%$	-3%	1%	18%	-7%
$C_{\Delta is}$	-227%	-174%	47%	-512%
$C_{\Delta h}$	311%	288%	52%	374%
$C_{\Delta t}$	16%	-14%	1%	238%

Source: Bahamas (2006–2013), Barbados (2004–2016), Jamaica (2002–2014), Trinidad and Tobago (1999–2015)

8.3 Female- versus Male-dominated Occupations

Table A.5: Flückinger and Silber Approach. BAHAMAS

Occupation	2006	2007	2008	2009	2011	2013	2014
Legislators, Senior Officials and Managers	41.26^	44.03	46.68	45.32	52.44	47.87	47.30
Professionals	70.24*	69.02*	64.16*	66.82*	62.41*	70.97*	64.85*
Technicians and Associate Professionals	56.26*	59.38*	64.13*	60.07*	47.79	49.37	51.68*
Clerks	83.36*	83.00*	83.85*	84.09*	78.84*	80.97*	77.30*
Service Workers and Shop and Market Sales Workers	62.46*	56.12*	58.82*	58.72*	64.42*	64.03*	62.25*
Skilled Agricultural and Fishery Workers	5.96^	1.94^	9.52^	1.49^	9.10^	4.74^	3.91^
Craft and Related Workers	8.68^	8.60^	6.59^	5.78^	7.85^	6.99^	7.29^
Plant and Machine Operators and Assemblers	12.52^	9.35^	12.05^	8.41^	12.25^	9.68^	10.54^
Elementary Occupations	43.67^	45.08	34.22^	43.61^	39.86^	43.33^	38.39^
(F/T)*0.9	0.44	0.42	0.42	0.44	0.44	0.44	0.42
(F/T)*1.1	0.53	0.52	0.52	0.54	0.54	0.53	0.51

Notes: ∗ female dominated occupations are measured as (Fi/Ti > F/T ∗ 1.1).
◦male dominated occupations are measured as (Fi/Ti < F/T ∗ 0.9).
Source: Authors' own calculations based on LFS 2006-2014

Table A.6: Flückinger and Silber Approach. BARBADOS

Occupation	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Legislators, Senior Officials and Managers	44.05^	41.18^	46.87	47.08	41.7^	50.68	42.12^	48.39	45.03	46.97	43.25	51.76	46.45
Professionals	59.54*	58.69*	60.79*	65.41*	57.75*	62.64*	58.87*	64.12*	62.34*	63.3*	63.96*	62.88*	69.16*
Technicians and Associate Professionals	42.23	45.13	45.04	42.82	49.70	41.74	45.38	45.85	48.38	49.40	45.72	44.77	43.78
Clerks	78.77*	78.61*	83.9*	77.88*	84.05*	81.39*	79.53*	81.3*	78.77*	79.14*	79.15*	81.47*	78.4*
Service Workers and Shop and Market Sales Workers	65.67*	67.73*	63.33*	62.33*	65.29*	55.86*	62.98*	65.1*	62.25*	62.52*	66.6*	64.63*	68.3*
Skilled Agricultural and Fishery Workers	12.22^	15.12^	16.64^	18.48^	17.24^	19.3^	12.33^	18.28^	24^	18.22^	11.96^	11.49^	17.49^
Craft and Related Workers	11.01^	12.59^	14.11^	9.6^	10.97^	14.52^	10.73^	11.96^	10.02^	14.72^	9.59^	13.5^	13.39^
Plant and Machine Operators and Assemblers	18.59^	16.25^	15.7^	15.06^	15.74^	9.05^	19.1^	14.5^	15.63^	15.13^	18.08^	15.82^	11.4^
Elementary Occupations	51.07	43.99	41.47	45.37	45.08	42.29	39.77^	43.08^	39.92^	42.93^	40.84^	40.25^	40.69^
(F/T)*0.9	0.44	0.42	0.43	0.43	0.42	0.41	0.42	0.43	0.42	0.44	0.43	0.43	0.44
(F/T)*1.1	0.54	0.52	0.53	0.52	0.52	0.51	0.52	0.53	0.52	0.54	0.53	0.53	0.53

Notes: ∗ female dominated occupations are measured as (Fi/Ti > F/T ∗ 1.1).
◦male dominated occupations are measured as (Fi/Ti < F/T ∗ 0.9).
Source: Authors' own calculations based on LFS 2004-2016

Table A.7: Flückinger and Silber Approach. JAMAICA

Occupation	2002	2003	2004	2005	2006	2007	2008	2009	2010	2012	2013	2014
Legislators, Senior Officials and Managers	56.38*	52.6*	59.49*	45.16	49.58	58.32*	55.13*	50.14*	63.99*	58.9*	55.21*	61.84*
Professionals	61.71*	61.5*	61.67*	58.85*	55.47*	63.25*	62.85*	60.77*	61.11*	62.19*	60.63*	60.61*
Technicians and Associate Professionals	56.01*	49.95*	54.51*	48.23*	50.66*	56.43*	57.26*	55.85*	50.1*	57.88*	52.81*	54.83*
Clerks	76.55*	74.19*	75.1*	71.39*	70.29*	76.17*	76.29*	70.45*	71.6*	77.72*	71.02*	71.58*
Service Workers and Shop and Market Sales Workers	62.88*	54.57*	63.35*	57.15*	61.22*	62.35*	59.11*	59.28*	60.15*	59.92*	53.96*	49.55*
Skilled Agricultural and Fishery Workers	18.92^	16.4^	18.9^	17.13^	18.82^	18.22^	20.62^	17.77^	27.9^	17.77^	16.53^	17.88^
Craft and Related Workers	12.88^	12.97^	11.87^	10.87^	13.53^	10.46^	9.21^	10.65^	12.22^	8.86^	9.26^	8.89^
Plant and Machine Operators and Assemblers	12.71^	11.31^	9.54^	10.77^	13.14^	7.36^	9.31^	7.91^	5.92^	6.97^	4.38^	6.69^
Elementary Occupations	54.32*	52.8*	53.65*	51.42*	50.92*	51.14*	49.36*	51.46*	50.85	52.6*	43.83	44.08
(F/T)*0.9	0.39	0.39	0.39	0.38	0.39	0.39	0.39	0.40	0.42	0.40	0.39	0.39
(F/T)*1.1	0.48	0.47	0.47	0.47	0.48	0.47	0.48	0.48	0.51	0.48	0.48	0.48

Notes: ∗ female dominated occupations are measured as (Fi/Ti > F/T ∗ 1.1).
◦male dominated occupations are measured as (Fi/Ti < F/T ∗ 0.9).
Source: Authors' own calculations based on LFS 2002–2014

Table A.8: Flückinger and Silber Approach. TRINIDAD AND TOBAGO

Occupation	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Legislators, Senior Officials and Managers	40.69*	39.3	38.6	39.8	38.8	43.1	42.1	41.7	41.1	41.7	43.2	41.9	42.0	43.8	44.4	41.3	42.5
Professionals	43.06*	42.0	41.3*	47.71*	49.54*	47.96*	48.35*	48.32*	50.48*	57.24*	51.49*	56.31*	51.25*	49.4*	53.3*	55.94*	55.27*
Technicians and Associate Professionals	55.5*	52.86*	53.42*	54.97*	54.48*	53.29*	55.54*	56.79*	57.16*	56.05*	55.25*	57.25*	56.43*	59.75*	57.51*	58.32*	60.25*
Clerks	74.95*	78.19*	72.65*	73.12*	74.44*	76.49*	75.49*	77.88*	75.83*	77.76*	77.09*	76*	76.68*	78.99*	78.69*	79.67*	75.16*
Service Workers and Shop and Market Sales Workers	50.07*	53.6*	54.7*	51.36*	54.57*	55.19*	53.86*	56.63*	58.07*	61.62*	57.9*	57.61*	56.48*	60.57*	58.51*	58.29*	58.37*
Skilled Agricultural and Fishery Workers	12.43^	12.43^	15.28^	11.4^	7.55^	14.41^	8.68^	15.28^	15.28^	16.92^	15.98^	13.29^	12.57^	6.44^	12.55^	10.86^	11.14^
Craft and Related Workers	12.77^	11.64^	11.55^	10.63^	11.82^	11.31^	10.63^	11.36^	10.95^	7.03^	9.03^	8.83^	8.91^	7.46^	7.73^	9.27^	8.4^
Plant and Machine Operators and Assemblers	10.78^	12.09^	10.21^	10.15^	9.78^	9.12^	9.86^	10.9^	9.92^	9.71^	7.58^	9.81^	9.95^	8.95^	5.85^	8.91^	10.44^
Elementary Occupations	31.53^	34.6	30.24^	34.6	35.7	37.0	36.6	35.1	38.4	39.4	37.9	39.3	35.38^	38.00^	36.36^	37.3^	37.78^
(F/T)*0.9	0.33	0.35	0.33	0.34	0.35	0.36	0.36	0.37	0.37	0.38	0.37	0.37	0.36	0.38	0.37	0.38	0.38
(F/T)*1.1	0.40	0.42	0.40	0.42	0.43	0.45	0.44	0.45	0.45	0.46	0.45	0.46	0.44	0.47	0.46	0.46	0.46

Notes: ∗ female dominated occupations are measured as (Fi/Ti > F/T ∗ 1.1).
◦male dominated occupations are measured as (Fi/Ti < F/T ∗ 0.9).
Source: Authors' own calculations based on CSSP 1999–2015

Table A.9: Marginal Matching and Oppenheimer Approaches. BAHAMAS

Occupation	2006	2007	2008	2009	2011	2013	2014
Legislators Senior Officials and Manage	0.70m	0.79m	0.88m	0.83m	1.10∗f	0.92m	0.90m
Professionals	2.36∗f	2.23∗f	1.79∗f	2.01∗f	1.66∗f	2.44∗f	1.84∗f
Technicians and Associate Professionals	1.29∗f	1.46∗f	1.79∗f	1.50∗f	0.92m	0.97f	1.07∗f
Clerks	5.01∗f	4.88∗f	5.19∗f	5.29∗f	3.73∗f	4.25∗f	3.41∗f
Service Workers and Shop and Market Sale	1.66∗f	1.28∗f	1.43∗f	1.42∗f	1.81∗f	1.78∗f	1.65∗f
Skilled Agricultural and Fishery Workers	0.06◦m	0.02◦m	0.11◦m	0.02◦m	0.10◦m	0.05◦m	0.04◦m
Craft and Related Workers	0.10◦m	0.09◦m	0.07◦m	0.06◦m	0.09◦m	0.08◦m	0.08◦m
Plant and Machine Operators and Assemble	0.14◦m	0.10◦m	0.14◦m	0.09◦m	0.14◦m	0.11◦m	0.12◦m
Elementary Occupations	0.78f	0.82m	0.52m	0.77m	0.66m	0.76m	0.62m

Notes: Marginal Matching approach, f female dominated if cumulative sum of (Fi + Mi) > F of categories sorted in decreasing order of Fi/Mi) and male dominated if cumulative sum of (Fi + Mi < F of categories sorted in decreasing order of Fi/Mi). Oppenheimer approach, ∗female dominated (Fi/Ti > 1) and ◦male dominated (Fi/Ti < 0.25).
Source: Authors' own calculations based on LFS 2006–2014.

Table A.10: Marginal Matching and Oppenheimer Approaches. BARBADOS

Occupation	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Legislators, Senior Officials and Manage	0.79m	0.70m	0.88f	0.89f	0.72m	1.03∗f	0.73m	0.94f	0.82m	0.89m	0.76∗m	1.07∗f	0.87f
Professionals	1.47∗f	1.42∗f	1.55∗f	1.89∗f	1.37∗f	1.68∗f	1.43∗f	1.79∗f	1.66∗f	1.72∗f	1.77∗f	1.69∗f	2.24∗f
Technicians and Associate Professionals	0.73m	0.82f	0.82m	0.75m	0.99f	0.72m	0.83f	0.85m	0.94f	0.98f	0.84f	0.81m	0.78m
Clerks	3.71∗f	3.68∗f	5.21∗f	3.52∗f	5.27∗f	4.37∗f	3.89∗f	4.35∗f	3.71∗f	3.79∗f	3.80∗f	4.40∗f	3.63∗f
Service Workers and Shop and Market Sale	1.91∗f	2.10∗f	1.73∗f	1.65∗f	1.88∗f	1.27∗f	1.70∗f	1.87∗f	1.65∗f	1.67∗f	1.99∗f	1.83∗f	2.15∗f
Skilled Agricultural and Fishery Workers	0.14◦m	0.18◦m	0.20◦m	0.23◦m	0.21◦m	0.24◦m	0.14◦m	0.22◦m	0.32m	0.22◦m	0.14◦m	0.13◦m	0.21◦m
Craft and Related Workers	0.12◦m	0.14◦m	0.16◦m	0.11◦m	0.12◦m	0.17◦m	0.12◦m	0.14◦m	0.11◦m	0.17◦m	0.11◦m	0.19◦m	0.15◦m
Plant and Machine Operators and Assemble	0.23◦m	0.19◦m	0.19◦m	0.18◦m	0.19◦m	0.10◦m	0.24◦m	0.17◦m	0.19◦m	0.18◦m	0.22◦m	0.16◦m	0.13◦m
Elementary Occupations	1.04∗f	0.79m	0.71m	0.83m	0.82m	0.73m	0.66m	0.76m	0.66m	0.75m	0.69m	0.67m	0.69m

Notes: Marginal Matching approach, f female dominated if cumulative sum of (Fi + Mi) > F of categories sorted in decreasing order of Fi/Mi) and m male dominated if cumulative sum of (Fi + Mi < F of categories sorted in decreasing order of Fi/Mi). Oppenheimer approach, ∗female dominated (Fi/Ti > 1) and ◦male dominated (Fi/Ti < 0.25).
Source: Authors' own calculations based on LFS 2004–2016

Table A.11: Marginal Matching and Oppenheimer Approaches. JAMAICA

Occupation	2002	2003	2004	2005	2006	2007	2008	2009	2010	2012	2013	2014
Legislators, Senior Officials and Manage	1.29∗f	1.11∗m	1.47∗f	0.82m	0.98m	1.40∗f	1.23∗m	1.01∗f	1.78∗f	1.43∗f	1.23∗f	1.62∗f
Professionals	1.61∗f	1.6∗f	1.61∗f	1.43∗f	1.25∗f	1.72∗f	1.69∗f	1.55∗f	1.57∗f	1.64∗f	1.54∗f	1.54∗f
Technicians and Associate Professionals	1.27∗m	1.00m	1.20∗f	0.93m	1.03∗m	1.29∗f	1.34∗f	1.27∗f	1.00∗m	1.37∗m	1.12∗m	1.21∗f
Clerks	3.26∗f	2.87∗f	3.02∗f	2.50∗f	2.37∗f	3.20∗f	3.22∗f	2.38∗f	2.52∗f	3.49∗f	2.45∗f	2.52∗f
Service Workers and Shop and Market Sale	1.69∗f	1.20∗f	1.73∗f	1.33∗f	1.58∗f	1.66∗f	1.45∗f	1.45∗f	1.51∗f	1.49∗f	1.17∗f	0.98f
Skilled Agricultural and Fishery Workers	0.23◦m	0.20◦m	0.23◦m	0.21◦m	0.23◦m	0.22◦m	0.26m	0.22◦m	0.39m	0.22◦m	0.20◦m	0.22◦m
Craft and Related Workers	0.15◦m	0.15◦m	0.13◦m	0.12◦m	0.16◦m	0.12◦m	0.10◦m	0.12◦m	0.14◦m	0.10◦m	0.10◦m	0.10◦m
Plant and Machine Operators and Assemble	0.15◦m	0.13◦m	0.11◦m	0.12◦m	0.15◦m	0.08◦m	0.10◦m	0.09◦m	0.06◦m	0.07◦m	0.05◦m	0.07◦m
Elementary Occupations	1.19∗m	1.12∗f	1.16∗m	1.06∗f	1.04∗f	1.05∗m	0.97m	1.06∗m	1.03∗m	1.11∗m	0.78m	0.79m

Notes: Marginal Matching approach, f female dominated if cumulative sum of (Fi + Mi) > F of categories sorted in decreasing order of Fi/Mi) and m male dominated if cumulative sum of (Fi + Mi < F of categories sorted in decreasing order of Fi/Mi). Oppenheimer approach, ∗female dominated (Fi/Ti > 1) and ◦male dominated (Fi/Ti < 0.25).
Source: Authors' own calculations based on LFS 2002–2014.

Table A.12: Marginal Matching and Oppenheimer Approaches. TRINIDAD AND TOBAGO

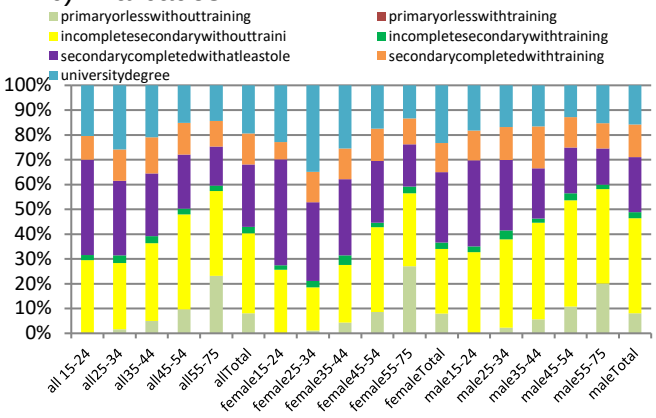
Occupational	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Legislators, Senior Officials and Managers	0.69^{m}	0.65^{m}	0.63^{m}	0.66^{m}	0.63^{m}	0.76^{m}	0.73^{m}	0.72^{m}	0.7^{m}	0.72^{m}	0.76^{m}	0.72^{m}	0.72^{m}	0.78^{m}	0.8^{m}	0.7^{m}	0.74^{m}
Professionals	0.76^{f}	0.72^{m}	0.7^{f}	0.91^{m}	0.98^{f}	0.92^{f}	0.94^{f}	0.93^{f}	1.02^{*f}	1.34^{*f}	1.06^{*f}	1.29^{*f}	1.05^{*f}	0.98^{f}	1.14^{*f}	1.27^{*f}	1.24^{*f}
Technicians and Associate Professionals	1.25^{*f}	1.12^{*f}	1.15^{*f}	1.22^{*f}	1.20^{*f}	1.14^{*f}	1.25^{*f}	1.31^{*f}	1.33^{*f}	1.28^{*f}	1.23^{*f}	1.34^{*f}	1.30^{*f}	1.48^{*f}	1.35^{*f}	1.40^{*f}	1.52^{*f}
Clerks	2.99^{*f}	3.58^{*f}	2.66^{*f}	2.72^{*f}	2.91^{*f}	3.25^{*f}	3.08^{*f}	3.52^{*f}	3.14^{*f}	3.50^{*f}	3.37^{*f}	3.17^{*f}	3.29^{*f}	3.76^{*f}	3.69^{*f}	3.92^{*f}	3.03^{*f}
Service Workers and Shop and Market Sale	1.00^{*f}	1.16^{*f}	1.21^{*f}	1.06^{*f}	1.20^{*f}	1.23^{*f}	1.17^{*f}	1.31^{*f}	1.38^{*f}	1.61^{*f}	1.38^{*f}	1.36^{*f}	1.30^{*f}	1.54^{*f}	1.41^{*f}	1.40^{*f}	1.4^{*f}
Skilled Agricultural and Fishery Workers	0.14$^{\wedge m}$	0.14$^{\wedge m}$	0.18$^{\wedge m}$	0.13$^{\wedge m}$	0.08$^{\wedge m}$	0.17$^{\wedge m}$	0.1$^{\wedge m}$	0.18$^{\wedge m}$	0.18$^{\wedge m}$	0.2$^{\wedge m}$	0.19$^{\wedge m}$	0.15$^{\wedge m}$	0.14$^{\wedge m}$	0.07$^{\wedge m}$	0.14$^{\wedge m}$	0.12$^{\wedge m}$	0.13$^{\wedge m}$
Craft and Related Workers	0.15$^{\wedge m}$	0.13$^{\wedge m}$	0.13$^{\wedge m}$	0.12$^{\wedge m}$	0.13$^{\wedge m}$	0.13$^{\wedge m}$	0.12$^{\wedge m}$	0.13$^{\wedge m}$	0.12$^{\wedge m}$	0.08$^{\wedge m}$	0.1$^{\wedge m}$	0.1$^{\wedge m}$	0.1$^{\wedge m}$	0.08$^{\wedge m}$	0.08$^{\wedge m}$	0.1$^{\wedge m}$	0.09$^{\wedge m}$
Plant and Machine Operators and Assemblers	0.12$^{\wedge m}$	0.14$^{\wedge m}$	0.11$^{\wedge m}$	0.11$^{\wedge m}$	0.11$^{\wedge m}$	0.1$^{\wedge m}$	0.11$^{\wedge m}$	0.12$^{\wedge m}$	0.11$^{\wedge m}$	0.11$^{\wedge m}$	0.08$^{\wedge m}$	0.11$^{\wedge m}$	0.11$^{\wedge m}$	0.1$^{\wedge m}$	0.06$^{\wedge m}$	0.1$^{\wedge m}$	0.12$^{\wedge m}$
Elementary Occupations	0.46^{m}	0.53^{m}	0.43^{m}	0.53^{m}	0.55^{m}	0.59^{m}	0.58^{m}	0.54^{m}	0.62^{m}	0.65^{m}	0.61^{m}	0.65^{m}	0.55^{m}	0.61^{m}	0.57^{m}	0.59^{m}	0.61^{m}

Notes: Marginal Matching approach, ^{f} = female dominated if cumulative sum of (Fi+Mi> F of categories sorted in decreasing order of Fi/Mi) and ^{m}= male dominated if cumulative sum of (Fi+Mi< F of categories sorted in decreasing order of Fi/Mi).
Oppenheimer approach, ∗female dominated (Fi/Ti>1) and ◦ male dominated (Fi/Ti<0.25).
Source: Authors' own calculations based on CSSP 1999–2015.

Figure A.1: Educational Category of Employees by Age Group (2013)

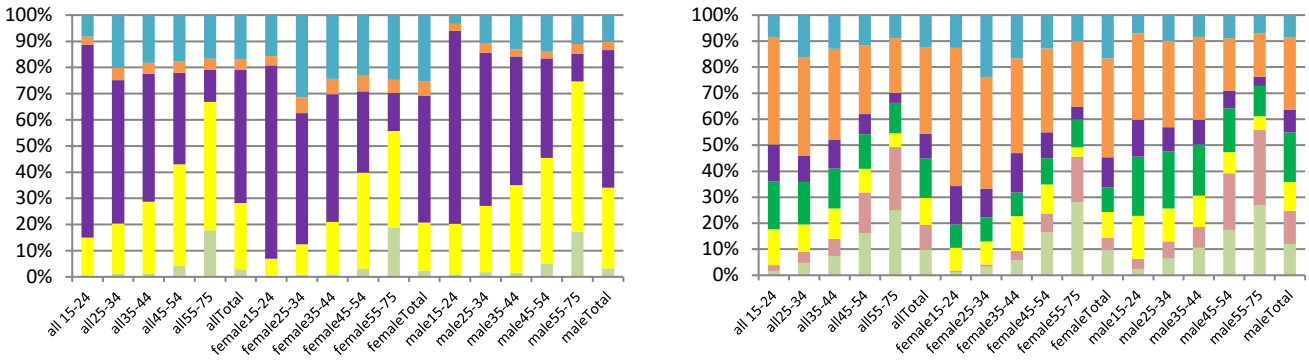
a) The Bahamas

b) Barbados



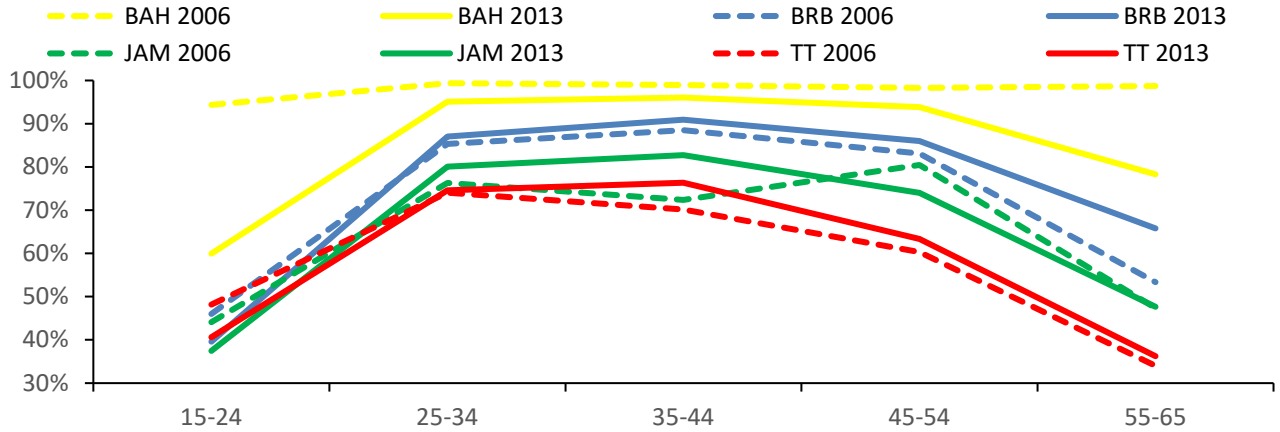
c) Jamaica

d) Trinidad and Tobago



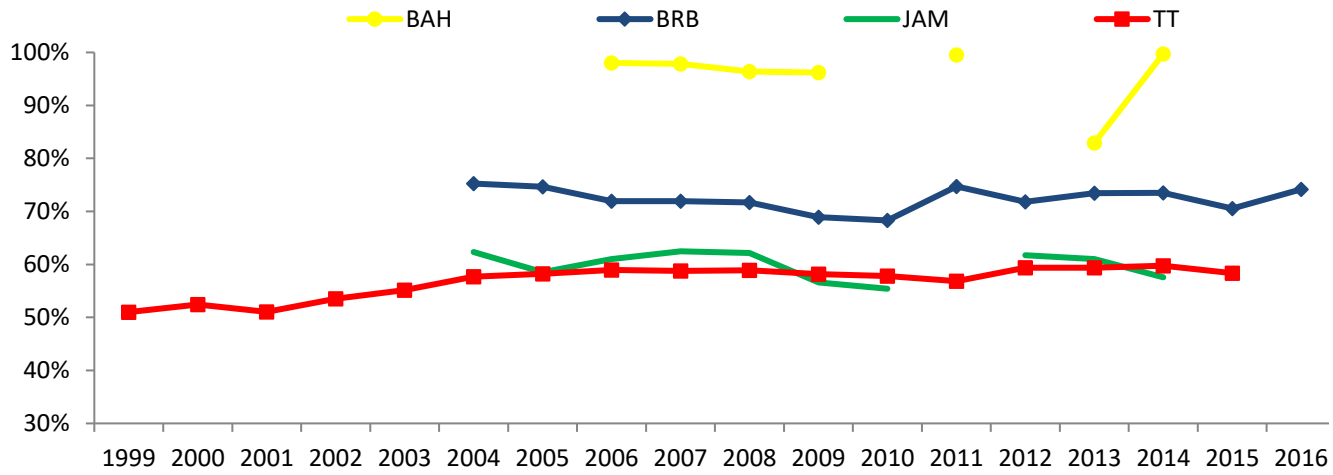
Source: Authors' own calculations based on BH LFS 2013, BB LFS 2013, JM LFS 2013 and TT CSSP 2013.
Note: This breakdown is based on the segregation analysis sample of employees with sufficient information on demographic characteristics.

Figure A.2: Female Participation Rate by Age Group ((Employed + self-employed+ unemployed)/15–65 year-old females)



Source: Authors' own calculations based on BH LFS 2006;2013, BB LFS 2006;2013, JM LFS 2006;2013 and TT CSSP 2006;2013
Note: This graph represents the participation rate irrespective of availability of educational and occupational category information, whereas the segregation analysis is based on only employed women with information on educational and occupational category

Figure A.3: Female Participation Rate by over Time ((Employed + self-employed+ unemployed)/15–65 year-old females)



Source: Authors' own calculations based on BH LFS 2006–2014, BB LFS 2004–2016, JM LFS 2002–2014 and TT CSSP 1999–2015
Note: This graph represents the participation rate irrespective of availability of educational and occupational category information, whereas the segregation analysis is based on only employed women with information on educational and occupational category

Table A.13: Counterfactual (CF) versus Actual (AC) Distribution of Women across Occupations

		Bahamas				Barbados				Jamaica				Trinidad and Tobago			
		2006		2014		2004		2016		2002		2014		1999		2015	
	Occupation	CF	AC	CF	AC	CF	AC	CF	AC	CF	AC	CF	AC	CF	AC	CF	AC
all age groups (15–75)	Legislators, Senior Officials and Managers	11.1	7.7	10.1	8.3	10.9	8.2	9.4	7.6	4.9	7.9	5.0	7.8	7.1	7.8	10.8	10.5
	Professionals	6.0	11.3	7.3	11.4	13.2	15.7	9.4	15.4	6.5	9.4	11.9	13.0	4.1	3.9	8.0	7.7
	Technicians and Associate Professionals	10.7	12.7	9.4	10.2	11.8	7.3	13.5	9.6	4.8	6.9	5.7	7.5	11.1	16.4	10.8	17.8
	Clerks	4.8	23.7	3.5	13.9	6.2	19.8	5.7	17.0	3.7	14.2	5.9	18.0	5.4	22.4	5.8	20.5
	Service/Shop Sale Workers	16.0	27.0	19.7	38.7	12.7	23.3	13.1	30.1	11.5	24.7	18.2	27.6	14.2	19.5	12.4	21.4
	Agricultural, Forestry and Fishery Workers	3.0	0.2	3.0	0.2	4.1	0.7	3.6	1.0	24.3	9.4	15.8	5.6	3.5	1.1	2.2	0.5
	Craft and Related Workers	26.3	2.8	22.3	1.9	19.0	2.7	19.2	3.4	22.3	4.1	16.8	2.5	22.8	5.9	22.6	3.1
	Plant and Machine Operators and Assemblers	8.5	1.2	7.6	1.1	7.2	1.9	9.6	1.5	10.0	1.8	8.1	0.8	11.8	2.8	11.9	2.1
	Elementary Occupations	13.5	13.4	17.1	14.5	15.0	20.2	16.4	14.5	12.0	21.8	12.7	17.2	20.1	20.3	15.6	16.5
old age groups (45–75)	Legislators, Senior Officials and Managers	16.5	11.1	15.8	15.3	14.0	9.4	11.7	8.4	6.9	10.0	7.3	9.7	11.9	12.8	15.1	14.7
	Professionals	8.0	13.5	8.6	14.0	14.5	17.0	7.2	15.2	6.2	9.4	9.3	12.0	5.2	4.6	6.8	6.3
	Technicians and Associate Professionals	11.7	14.3	9.6	7.7	11.7	5.6	13.1	8.2	3.5	5.5	4.7	5.6	12.2	16.1	10.6	17.0
	Clerks	2.8	15.8	2.7	10.6	3.8	14.0	3.7	13.8	2.0	5.7	1.1	7.4	4.1	13.0	4.1	14.2
	Service/Shop Sale Workers	13.3	21.3	13.5	28.3	9.8	17.5	9.0	25.8	7.1	19.7	14.6	21.8	8.0	12.1	7.9	16.3
	Agricultural, Forestry and Fishery Workers	3.9	0.3	3.0	0.5	5.2	0.9	3.7	1.6	39.5	18.3	24.9	12.0	5.8	2.3	3.1	0.8
	Craft and Related Workers	24.5	3.6	24.9	2.9	18.6	3.4	24.3	3.3	15.8	3.5	17.9	4.2	17.8	6.2	22.8	4.7
	Plant and Machine Operators and Assemblers	9.2	1.3	8.7	1.1	7.7	1.7	11.7	1.9	9.2	0.7	8.9	1.9	13.6	2.4	14.1	2.3
	Elementary Occupations	9.9	18.8	13.1	19.6	14.6	30.6	15.7	21.9	9.8	27.2	11.2	25.5	21.3	30.5	15.5	23.8
young* age groups (25–44)	Legislators, Senior Officials and Managers	11.3	7.2	10.0	6.2	10.8	8.6	9.3	7.2	4.2	7.7	5.0	7.8	6.8	7.5	10.7	9.4
	Professionals	5.9	11.6	7.9	12.6	12.1	16.4	12.9	17.6	7.3	9.9	14.1	16.3	4.3	4.2	9.6	9.6
	Technicians and Associate Professionals	10.4	12.9	10.9	12.4	12.2	7.9	15.3	10.6	5.6	7.3	5.5	8.0	11.5	17.5	11.0	19.3
	Clerks	4.4	24.7	3.5	15.9	6.5	21.6	6.4	20.9	3.3	15.0	7.7	15.5	5.8	23.3	5.9	21.3
	Service/Shop Sale Workers	16.1	27.5	19.0	36.6	13.3	24.3	16.1	30.3	13.0	25.1	17.0	30.8	14.8	19.3	14.1	22.2
	Agricultural, Forestry and Fishery Workers	3.0	0.1	3.4		3.1	0.8	2.5	0.6	19.1	6.1	11.7	3.6	3.4	0.9	1.8	0.4
	Craft and Related Workers	26.5	2.3	23.2	1.2	19.9	2.6	14.2	3.7	24.4	4.7	19.2	2.1	22.6	6.2	21.7	2.0
	Plant and Machine Operators and Assemblers	9.0	1.1	7.1	1.2	7.4	2.3	9.0	1.2	11.4	2.4	8.0	0.5	12.3	2.9	11.8	2.0
	Elementary Occupations	13.4	12.5	15.0	13.8	14.6	15.5	14.3	7.8	11.7	21.8	11.9	15.3	18.5	18.3	13.4	13.8