Feminist Economics

ISSN: 1354-5701 (Print) 1466-4372 (Online) Journal homepage: https://www.tandfonline.com/loi/rfec20

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To cite this article: Carlos Herrera, Geske Dijkstra & Ruerd Ruben (2019) Gender Segregation and Income Differences in Nicaragua, Feminist Economics, 25:3, 144-170, DOI: 10.1080/13545701.2019.1567931

To link to this article: https://doi.org/10.1080/13545701.2019.1567931

Feminist Economics, 2019
Vol. 25, No. 3, 144–170, https://doi.org/10.1080/13545701.2019.1567931

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ABSTRACT

Despite having higher average education levels, Nicaraguan women still earn much less than men. Furthermore, the country has one of the highest levels of occupational gender segregation in Latin America. This paper aims to explain the gender income gap in Nicaragua, taking into account individual characteristics, engagement in specific occupations and sectors, and geographical location. Using a multilevel framework, the study finds that while a considerable part of the income gap can be explained by women's employment in occupations and sectors with low remuneration, another substantial part of this gap is attributable to the prevalence of patriarchal gender norms – and thus cannot be explained by human capital factors. These results show that understanding labor market segregation is vital for comprehending the perseverance of the gender income gap, and they further imply that women's progress in breaching the gender stereotypes in Nicaragua is still limited.

KEYWORDS

Labor market segregation, gender inequality, income, Nicaragua

JEL Codes: D31, J31, O54

INTRODUCTION

In almost all societies women are still earning less than men. Explaining this difference has been an important challenge. Traditionally, women's lower incomes were ascribed to their lower education and shorter work experience. Women's (assumed) preferences to stay at home for the children led to shorter careers, less experience, and lower investment in education (Mincer and Polachek 1974; Becker 1991). Yet, next to these individual characteristics, explanations have also been sought in job attributes such as occupations, job level, and firm size. Many authors have found that occupational segregation, or the fact that women tend to work in different jobs than men, is an important reason for their lower earnings. Women's tendency to work in occupations that are on average

lower paid may be the result of "preferences," in turn possibly determined by social norms or practical constraints, or of discrimination or exclusion by employers (Solberg and Laughlin 1995; Blau and Kahn 1996; Cohen and Huffman 2003b; Coelli 2014). Furthermore, occupations dominated by women may suffer from undervaluation, as a result of cultural norms about values of men's and women's work (Baron and Newman 1990; Nelson and Bridges 1999; Karamessini and Ioakimoglou 2007). Thus, occupational segregation may be related to fewer job opportunities and lower incomes for women. This situation prevents women from developing skills and from being able to break the poverty trap.

By 2006, Nicaragua had the largest gender income gap in Central America (World Bank 2012). A large part of the labor force works in the informal sector, where women are overrepresented (Tinoco and Vílchez 2003). Women's ownership of agricultural assets, participation in agricultural activities, and use of credit are all quite low. In addition, the gender segregation by occupations is one of the highest in Latin America (Monroy 2008). Nicaragua is therefore an interesting case to study the relationship between occupational segregation and the gender earnings gap. This study aims to investigate the effect of a range of relevant factors on income differences between men and women in Nicaragua. We examine the effect of type of income (formal versus informal sector), of occupational segregation, and of branch of activity and region on earnings differences. We use the 2009 Living Standards Measurement Survey (LSMS) to identify the population of working age Nicaraguans and their incomes.

To examine the effect of job or labor market characteristics next to that of individual characteristics on the gender earnings gap, most studies use individual data. However, these models assume that there are no relationships between factors at the individual level and factors at aggregate levels. This may result in biases, for example when investments in human capital are influenced by the work environment or when work in certain occupations is undervalued (lower paid) due to discrimination. This study uses multilevel models to explore gender segregation by occupation. Although multilevel models have been applied earlier for examining the effect of occupational segregation (Haberfeld, Semyonov, and Addi 1998; Cohen and Huffman 2003a, 2003b), to our knowledge this method has not been applied yet for explaining the gender income gap in developing countries.

EXPLAINING THE GENDER INCOME GAP: LITERATURE REVIEW

Traditionally, social scientists have explained the gender income gap by pointing to differences in productivity. According to Gary S. Becker (1991), the fact that women stayed at home to care for their children led to

comparative advantages for men in the labor market. Women have lower human capital as a result of the opportunity costs of children (Mincer and Polachek 1974). Expecting a shorter career, women were also assumed to invest less in formal education. Lower education and less work experience resulted in lower productivity and thus in lower wages. Later, researchers also began to adjust differences in pay levels for job characteristics such as occupations, job levels, firm size, and types of industries (Plantenga and Remery 2006). If women turn out to receive lower salaries even at the same job type and level and with the same human capital features as men, this was considered discrimination.

However, it is not so easy to determine the actual level of discrimination. On the one hand, there may be unobserved productivity differences between men and women leading to an overestimation of discrimination (Plantenga and Remery 2006). On the other, it is necessary to look at the reasons why women and men are occupied in different types of jobs. This occupational segregation may be a result of different preferences, but more likely these "preferences" are caused by gendered norms or practical constraints, like the need to combine paid with unpaid work. In addition, segregation may be due to the fact that women are excluded from higher paying sectors and jobs ("crowding"), or that jobs that are mainly performed by women attract lower wages as a result of cultural norms ("devaluation"; Gunderson 1989; Huffman 2004). In all these cases, the extent of discrimination will be underestimated.

Many empirical studies found that a large part of the gender pay gap can be explained by women working in occupations or sectors with lower salaries (Baron and Newman 1990; Groshen 1991; Solberg and Laughlin 1995; Blau and Kahn 1996; Espino 2013). Tony Tam (1997) concludes that if controlling for specific occupational training, this difference in pay between occupations disappears. However, Paula England, Joan M. Hermsen, and David A. Cotter (2000) contest this. When adding general education as a control variable, they find, with exactly the same data, that the sex composition of jobs does matter.

For Australia, Michael B. Coelli (2014) found that contrary to other studies on this country, occupational segregation does explain part of the gender pay gap, but he concludes that this finding is influenced by using a more disaggregated occupational structure. Young-Mi Kim and Sawako Shirahase (2014) found that higher gender wage gaps in Japan and South Korea than in Taiwan are due to both more occupational segregation and more job inequality.

A further question is whether the penalty for female-dominated jobs is more severe for women in these jobs. Michelle J. Budig (2002) found that men are earning more in jobs dominated by women and also in jobs dominated by men or jobs with an even distribution. On the other hand, Philip N. Cohen and Matt L. Huffman (2003a) and Matt L. Huffman

(2004) find that there is more gender wage inequality in jobs dominated by women. Some authors have explored one possible explanation for this, namely that women tend to be overeducated for jobs while men are more often undereducated. Mats Johansson and Katarina Katz (2007) find that this is indeed the case for Sweden, especially in the private sector. The part of the gender pay gap that is explained by this "skill mismatch" is about the same as that explained by industrial segregation, and larger than the part explained by human capital factors (Johansson and Katz 2007). Alma Espino (2013) finds that next to labor market segregation (by occupations and sectors), the overeducation of women and under education of men also explain part of the wage gap in Uruguay. This implies that gender wage inequalities may persist despite higher education levels for women because women tend to have lower returns to education. This also seems to be the case in Brazil, where the unexplained part of the gender wage gap is higher at higher levels of education (Ben Yahmed 2018).

Yet studies, and in particular comparative ones, also found that there is a third factor of influence on gender inequality in wages, and this is the general wage structure, in turn determined, for example, by supply and demand factors, technological developments, and labor market institutions (Plantenga and Remery 2006). Francine D. Blau and Lawrence M. Kahn (1996) compared several Western countries and found that more wage inequality in general leads to higher gender wage gaps. In another study, these authors found that the rewards for skills and employment in particular sectors have a huge effect on the gender income gap in the US (Blau and Kahn 2000).

Over time, the share of the wage gap that can be explained by human capital factors has decreased in most Western countries, while the share due to segregation and the particular wage structure has increased (Plantenga and Remery 2006; Goldin 2014). Claudia Goldin (2014) points out that the remaining wage gap in the US is mostly due to differences *within* occupations, and only for between 22 and 30 percent a result of occupational segregation. Common explanations for the pay difference within occupations are discrimination or women's lower ability to bargain or lower desire to compete. However, she argues that there is a more important explanation, and this is based on the observation that the gender gap in hourly wages widens with age and is much larger in some occupations and sectors than in others.

In the corporate, financial, and legal sectors, for example, the number of hours worked is remunerated highly and in these occupations and sectors women continue to suffer from a child penalty. This again points to the relevance of the institutional structure of the labor market.

A further, fourth, factor that may influence the size of the gender wage gap is the geographic location or the regional labor market (Gunderson 1989). Hiau Joo Kee (2006) includes geographical variables as controls in

an analysis of wage gaps in Australia, but the effect of adding them on the wage gap is limited. Cohen and Huffman (2003a) examined the effect of regions in a multilevel framework and found that if the local labor market is more integrated (meaning that there is less occupational segregation), wages in female-dominated occupations are higher, but only for men. Yet, average wages in more integrated labor markets also proved to be higher, so women also benefit from this.

In conclusion, several factors have proved to be important for empirically explaining the earnings gap between men and women. First, there are individual human capital related factors such as education and experience; second, there are factors related to type of job, occupation, and sector; third, the general wage structure and institutional factors may be of influence; and fourth, there may be differences by geographical location. All these factors can be expected to play a role in the gender earnings gap in Nicaragua. Nevertheless, it is unlikely that they can fully explain the gap, as cultural factors and discrimination will probably also play a role.

EARNINGS DIFFERENCES IN NICARAGUA

Nicaragua is the highest ranking Latin American country in the Global Gender Gap index of the World Economic Forum, achieving a sixth rank overall (World Economic Forum 2017). The country scores well on the indicators for health (relative life expectancy and sex ratio at birth) and for political representation. In education, women's enrollment in all types of education is higher than men's enrollment. Over the past decades, women's educational achievement has grown faster than men's, but the level is still low. In 2006, women had on average 7.5 years of education while men had 6 years (World Bank 2012). Furthermore, the illiteracy rate among women is still above that for men. Women's labor market participation has increased steadily over the years. According to modeled estimates of the International Labor Organization, it increased from 39 percent in 2000 to 47 percent in 2010, and then to 50 percent in 2016. However, this contrasts with around 85 percent for men (World Bank 2018).

The increases in education and in labor force participation have hardly been accompanied by a change in gender norms on paid and unpaid work. According to the 2008 Latinobarómetro survey, more than half of both men and women in Nicaragua think that women should only undertake paid work if the income of the household is not sufficient (OIT et al. 2013). Regardless of whether women are engaged in paid work, they still have the main responsibility for reproductive activities. Furthermore, they suffer from sexual harassment and violence at work, while traveling to and from work, and often also in the household (Prieto-Carrón 2014).

Sarah Bradshaw (2013) examines the role of income versus ideology in decision-making power in households on the basis of a large number of

interviews in one rural and one urban low-income community in Nicaragua. Ideology, that is, traditional gender norms, play an important role, and they also influence the decision to participate in the labor market. Especially in rural areas, gendered norms on household work are strong. Engaging in paid work is seen as "helping men." Almost half of the urban women see paid work as an opportunity for becoming less dependent, but they indicate that the absence of childcare is a severe constraint.

This background influences the labor market choices of women. Most Nicaraguan women work in the tertiary sector (Table 1). All branches of economic activity in which women are overrepresented (based on 2005 data) are in the tertiary sector, in particular education, social services, and health, where the female share is 71 percent; communal, social, and personal services (70 percent); and commerce, hotels, and restaurants (53 percent). In terms of numbers, the commerce, hotels, and restaurants sector is quantitatively most important, occupying 35 percent of all women in the labor market, as compared with 19 percent working in communal and personal services, and only 11 percent in education and health (Monroy 2008). To the extent women work in the secondary sector, they are often employed in the Special Economic Zones, implying that their jobs are precarious, with high levels of uncertainty, low wages, and severe health and safety risks (Fernández-Pacheco 2006; Prieto-Carrón 2014).

As in other Latin American countries, women are overrepresented in the informal sector (Chant and Pedwell 2008). Although work in this sector may give more flexibility, for example for combining productive and reproductive activities, it also brings higher job insecurity, lower wages, and lower quality of other working conditions. In addition, the gender income gap is larger in the informal sector than in the formal sector (Chant and Pedwell 2008; OIT et al. 2013). The definitions of what constitutes the informal sector vary, however. Sometimes the emphasis is on the lack of regulation, so absence of taxes or social security, and in other cases it is defined by the size of the firm, with own account workers and workers in firms of up to five employees being included.

According to the Nicaraguan Social Security Institute (Instituto Nicaraguüense de Seguridad Social [INSS] 2011), and combining both

Table 1 Distribution of the economically active population by sector and sex (in %)

Sectors	*Primary*	*Secondary*	*Tertiary*	*Total*	*Share in employment*
Men	41	12	47	100	63
Women	7	15	78	100	37
Total	40	13	46		100

Source: Authors' calculations based on the LSMS (INIDE 2009).

definitions, the informal sector covers 80.6 percent of total employment in Nicaragua. Using data from the LSMS and operationally defining informal sector as the persons working in domestic services, in small enterprises, and as self-employed, Gilma Yadira Tinoco and Sonia Agurto Vílchez (2003) show that the size of the informal sector has increased from 52 percent in 1985 to 62 percent in 2001, and that women are overrepresented in this sector. The World Bank (2012) found that Nicaragua, Guatemala, and El Salvador registered the highest levels of informality in the Central American region around 2006, at almost 60 percent. In all these countries, women were overrepresented in this sector. This reflects serious barriers for women for accessing the formal sector (Gamboa, D'Angelo, and Kries 2007).

As in other Latin American countries, the earnings gap between men and women is larger in the informal than in the formal sector in Nicaragua (Fernández-Pacheco 2006; Monroy 2008). Janina Fernández-Pacheco (2006) also shows that the gender income gap in Nicaragua increases with age in both the formal and the informal sectors.

For Latin America in general, the gender income gap has decreased over time. The relative income of women as compared to men increased from 59 percent in 1990 to 76 percent in 2000, and then further to 78 percent in 2010 (OIT et al. 2013). A similar trend is visible in Nicaragua. For nonagricultural incomes, women earned on average only 56 percent of men's hourly income in 1993, and this increased to 69 percent in 1999 (Fernández-Pacheco 2006). Estela Monroy (2008) calculated the gender earnings gap in Nicaragua by computing the ratio of men's and women's hourly wages based on the LSMS of 2005. She found that men earn on average 19.8 percent more than women (implying that women's relative income increased to 83 percent). There are large differences by occupation and by sector. In agriculture and fisheries the income gap is largest, while it is smallest among unskilled workers.

While Nicaragua proved to have the largest gender income gap by 2006, the country also has the highest sectoral gender segregation in Central America (World Bank 2012) and a high level of occupational segregation (Monroy 2008). The Duncan Index calculated in Monroy's study uses the classification of occupation and industrial activity.[1] It proves to be 68 percent in the three-digits classification, indicating that to achieve gender parity in the distribution of occupations and industry groups, 68 percent of workers would need to change jobs. Interestingly, the occupational segregation is much less at higher levels of education. While the Duncan index is 71 percent for workers with only primary education, it is 39 percent for workers with a university degree. It also varies somewhat by age, with higher segregation levels at higher ages (Monroy 2008).

Previous studies that have attempted to decompose the gender earnings gap in Nicaragua (Enamorado, Izaguirre, and Ñopo 2009) use a matching

procedure for this decomposition, based on Hugo Ñopo (2008). When controlling for area, education, head of household, marital status, and occupation, women still earn less than men. This unexplained part of the earnings gap proved to be 16 percent.

Alejandro Hoyos and Hugo Ñopo (2010) used the same method to decompose the gender earnings gaps in Central America. After controlling for age, education, presence of children in the household, presence of another wage earner, urban/rural location, and occupation, they find that Nicaragua had the largest unexplained part of the gender earnings gap, at 20 percent.

Although the studies carried out so far shed some light on the extent of gender income inequality, its sectoral variation, and its components, they do not provide an in-depth analysis of the effect of individual characteristics like education and age on men's and women's incomes. More importantly, there is no systematic analysis yet of the effect of gender segregation in occupations and industries on the gender wage gap. We aim to analyze all these possible determinants of the gender earnings gap.

In line with previous studies on Nicaragua, our first hypothesis is that after controlling for individual characteristics such as education and age, women's incomes will be lower than men's incomes. Second, and in keeping with Monroy's (2008) finding that the unadjusted income gap in Nicaragua is smallest for unskilled workers, and Sarra Ben Yahmed's (2018) conclusion for Brazil, we assume that the unexplained gender income gap will rise with education. Third, the gender income gap will vary according to type of income (whether a person is employer, dependent wage worker, self-employed, or cooperative member). In particular, we expect that the gender income gap will be larger among informal sector workers.

Fourth, we expect that part of the gender income gap can be explained by occupational segregation: wages are lower when the share of women in an occupation is larger. Fifth, we expect that, in line with Cohen and Huffman (2003a), the gender income gap will be larger in occupations with a larger female share. Finally, as Hypotheses 6 and 7, respectively, we expect that location (region) and sector (branch of activity) are of influence on incomes, and also on income differences by sex.

ANALYTICAL APPROACH AND DATA

The gender income gap is usually conceptualized as the difference between men's and women's hourly wages as a percentage of men's wages. To isolate the gender effect from other factors explaining differences in wages, like human capital factors or job characteristics, a dummy variable can be included in a standard wage regression. In most studies, the gender pay

gap is analyzed by estimating men's and women's wages separately and then decomposing the difference into an explained and an unexplained part.

This method follows Ronald Oaxaca (1973) and Alan S. Blinder (1973) and is therefore called the Oaxaca–Blinder decomposition. While the early studies only included human capital factors, later studies also included characteristics related to occupation, type of jobs, sector, or firm size (Gunderson 1989; Plantenga and Remery 2006).

To capture the effect of the labor market structure, researchers have used the Juhn–Murphy–Pierce decomposition (Juhn, Murphy, and Pierce 1991). These authors decompose the gender pay gap *difference* between countries into four components. Next to inter-country differences in observable characteristics and in relative positions of men and women in the wage structure after controlling for measured characteristics, gaps can also be explained by inter-country differences in returns to observable and unobservable characteristics (Plantenga and Remery 2006).

In all of these studies, factors related to type of job or industries are measured at the individual level in the same regression analysis, implying that variables at the aggregate level are combined with individual-level variables. However, individual features may be influenced by factors at a higher level such as occupation and industry. This may produce biased significance tests because standard errors could be discrete. For these reasons, researchers have proposed multilevel or hierarchical models for estimating the effect of occupational segregation (Haberfeld, Semyonov, and Addi 1998; Cohen and Huffman 2003a; Huffman 2004).

Multilevel models are very effective for assessing cross-level interaction effects, like that between individual features and the gender composition of occupations. The reason is that they simultaneously estimate micro- and macro-level models (such as individual-level wage models and job-level equations). The regression coefficients corresponding to the association between individual-level characteristics and wages become the dependent variables in the job-level model. This also has the advantage of estimating the micro-level model separately for each job. Hence, hierarchical models can eliminate possible problems that stem from correlated error terms resulting from nested data. They do so by using corrected standard errors (Bryk and Raudenbusch 1992; Guo and Zhao 2000; Hox 2002). Therefore, multilevel models explicitly consider the hierarchical data structure and allow both micro- and macro-levels to be represented simultaneously in the same model without erring on the assumption of independent observations.

We attempt to identify the effect of occupational segregation on men's and women' incomes by adding a second level of analysis. In addition, we examine the effect of branch of economic activity (industry) and region in addition to the effect of occupational segregation, by adding a third level that represents either region or branch of activity.

The model

We start with a set of Mincerian equations to examine all possible factors that may influence income. In these equations, sex is a dummy variable, and we include dummies for type of income. In separate models, we include interaction terms for sex and education, and for sex and type of income, in order to test Hypotheses 2 and 3.

The general model at the individual level (level 1) is

$$Inc_{ijk} = \beta_{0jk} + \beta_{1jk} Sex_{ijk} + \beta_{lijk} X_{lijk} + u_{ijk} \quad (1)$$

Inc_{ijk} is the logged income of person i in job j and sector k, and β_{0jk} is the level-1 intercept. β_{1jk} is the regression coefficient associated with gender, which represents the average income difference between men and women in job j and sector k. X_{lijk} is a set of control variables at the individual level, for example education and age, but also type of income and the above-mentioned interaction terms, and β_{ljk} are the associated regression coefficients. Because all of the individual-level independent variables except sex are grand-mean centered, β_{0jk} is the predicted logged income of a man with mean values on all the control variables. Finally, u_{ijk} is an error term, assumed to be normally distributed with a mean of 0 and variance σ^2.

To assess the effect of occupational segregation, a second level is added in which the level-1 intercept, β_{0jk}, and the coefficient for the sex dummy, β_{1jk}, are allowed to vary across occupations. They are modeled as the outcomes of Equations 2 and 3.

$$\beta_{0jk} = \alpha_{00k} + \alpha_{01k} Pctage\_women_{jk} + average\_education_{jk} + \varepsilon_{0jk} \quad (2)$$

$$\beta_{1jk} = \alpha_{10k} + \alpha_{11k} Pctage\_women_{jk} + \varepsilon_{1jk} \quad (3)$$

As before, β_{0jk} is the average income for occupation j in sector k, and α_{00k} represents the average income for all occupations in sector k. $Pctage\_women_{jk}$ is the percentage of women in occupation j and sector k, as a measure of occupational segregation, and α_{01k} is the marginal effect of segregation on men's income in occupation j and sector k. If Hypothesis 4 is true for men, this coefficient should be negative. On this second level, one control variable is added, namely the average education level of occupations, $average\_education_{jk}$. This can be expected to influence incomes as well, over and above individual education levels. β_{1jk} is the effect of being a woman in occupation j and sector k on income. α_{10k} represents the average effect of being a woman on income in sector k. α_{11k} is the marginal effect of an increase in female occupancy on the income gap between women and men in sector k. If Hypothesis 4 is true for women,

we should find that the sum of α_{01k} and α_{11k} is negative. Furthermore, if we find that $\alpha_{11k}$is negative, Hypothesis 5 is true: the gender income gap increases with occupational segregation. ε_{0jk} and ε_{1jk} are level-2 errors terms.

On a third level, we allow α_{00k} and α_{10k} to vary across sectors (branches of activity), or regions.

$$\propto_{00k} = \gamma_{000} + \varphi_{00k} \tag{4}$$

$$\propto_{10k} = \gamma_{100} + \varphi_{10k} \tag{5}$$

γ_{000} is the average income for all economic activities, and γ_{100} is women's average income for all occupations and all sectors. φ_{00k} and φ_{10k} are the level-3 errors. At this level we do not include interaction terms. This means the relevant statistics are the variances of $\propto_{00k}$ and $\propto_{10k}$, as well as the computed percentage of explained variance that this level may add.

Variables and data

The dependent variable is the logarithm of individual income, which takes into consideration all payments that are mandatory by national labor law (such as commissions, vacations, and thirteenth month), as well as the monetized edible goods or any other kind of earning that is given in form of payment, and also goods that are taken from own businesses and used for self-consumption.

Individual-level variables included in the model are those normally used in the Mincer equation: years of education, age, and age squared as proxies of experience, sex (which is a dummy that takes the value of 0 when the respondent is a man or 1 when she is a woman), and the logarithm of hours worked in a month. We added a dummy for rural versus urban, as this may be important in the Nicaraguan context. Rural incomes are expected to be lower. We also include dummies to distinguish between types of income: whether the respondent is employee, business owner/self-employed, employer, or member of a cooperative. In this study, the category of business owner/self-employed is considered a proxy for gaining an income from the informal sector.[2] The variables included in second and third levels are already explained above.

We use the LSMS (National Institute for Development Information [INIDE] 2009) because it has national statistical representativeness in all geographical regions of Nicaragua (Pacific, Central, and Atlantic), as well as in rural and urban areas. It covers 6,515 households and 30,432 people. Since the first LSMS publication in Nicaragua in 1993 and subsequently in 1998, 2001, 2005, and 2009, its sections have not noticeably changed. The main information provided by the surveys includes: housing characteristics,

utilities, demographics, health, education, economic activities, basic food consumption, income, and household assets. However, previous LSMS do not contain the working category variable (employer, worker, self-employed, or cooperative member), so we cannot carry out a comparative analysis over time.

Although more recent employment and gender surveys are available, they do not have national or regional representation signifying a constraint for the development of a hierarchical model.

We use data from the Uniform Occupational Classifier (CUONIC) to define the occupations.[3] The CUONIC was published for the Seventh Population and Housing Census 2005 and based on International Occupational Classification (ISCO-88) standards. For separating occupations, we chose only two digits because they already contain a large number of specific activities.

In one of the analyses, we combine these two digits of occupations with digits representing regions to generate different categories in the same level. The study regards that being an unskilled worker in the Central region where agricultural activities are most important is different from being an unskilled worker in the Atlantic region where fishing activities are dominant.

For branches of economic activity or sectors, we use the seventeen sectors as defined in the Classification of Nicaraguan Uniform Economic Activities published by INEC in July 2005. These categories are based on uniform economic activities according to international industrial classification (ISIC; see Appendix A).

Because of the debate about whether hierarchical models can obtain good estimates if using groups that do not have sample representativeness, this study only uses regions with robust statistical representation. The most statistically representative household survey disaggregation was divided into seven regions: rural Atlantic areas, urban Atlantic areas, rural Central areas, urban Central areas, rural Pacific areas (excluding the department of Managua, capital of Nicaragua), urban Pacific areas (excluding the department of Managua), and Managua. Furthermore, each division represents a local labor market context.

RESULTS

Descriptive statistics

As can be observed in Table 2, the variables with the greatest disparities are income and education showing a high coefficient of variation. On average, women's incomes are 13 percent lower than men's, with the largest differential represented in members of cooperatives as shown in Table 3.

Table 2 Descriptive statistics for individual-level variables

Statistic	*Income (cordobas)*	*Education (years)*	*Age (years)*	*Sex (1 = woman)*	*Paid work time (hours per month)*
N	10,910	10,910	10,910	10,910	10,910
Average	3860.576	6.94	37.04	0.37	185.23
Coefficient of variation	1.224	0.707	0.390	1.299	0.364
Median	2737.714	6	35	0	192
Maximum	80550	23	97	1	392
Minimum	6.666667	0	10	0	4
Range	80543.33	23	87	1	388

Source: Authors' calculations based on the LSMS (2009).

Multivariate results

The results of the set of Mincerian equations are presented in Table 4. Normally a model for the determinants of income uses hourly earnings as dependent variable, but it implicitly assigns a restriction on the coefficient associated with hours of paid work, giving it a value of 1. By taking income as the dependent variable, such a restriction can be checked as shown in Models 1–10. In none of the models does the coefficient take values close to 1. Instead, it is found to be around 0.47, meaning each 1 percent increase in paid work hours leads to an increase of around 0.47 percent in income. The possible interpretation offered by some authors for finding a coefficient of less than 1 is the presence of diminishing marginal returns.

The variable *sex* in Model 1 shows that the difference in income between a man and a woman of the same age, education, and paid work hours is 17 percent. In Model 2 a correction is made for selection bias, and the coefficient rises from 17 percent to 23 percent.[4] As usual, experience has a positive effect on income, while the coefficient for squared age is negative, reflecting diminishing returns. The coefficients are quite stable across the different models. Similarly, the coefficient for the education variable is rather constant; each year of education yields about 6.1 percent additional income. Incomes in rural areas prove to be about 13 percent lower than urban incomes.

With respect to types of work, the dependent worker is the reference category. It includes employee/worker and laborer/peasant from the occupation categories in Table 3. As stated above, we consider the self-employed variable as a proxy for informality. Even if controlled for education and experience, self-employed workers have by far the lowest earnings, which would point to lower earnings in the informal sector than in the formal sector. Nevertheless, these results should be interpreted

carefully as informality is also to some extent present among dependent workers.

In Models 3–8, interactive variables are included to test the relationship between sex and education, and sex and types of income. The coefficient for years of education*sex is not statistically significantly different from 0. This means we cannot confirm Hypothesis 2, that the gender income gap is smaller at lower levels of education.

With respect to Hypothesis 3, that gender income gaps vary with type of income, we do find some evidence. All coefficients are negative, indicating that the gender income gap is spread across all occupation categories, at least at a 10 percent significance level. More interestingly, the unexplained part of the income gap remains large when we add information to the model. In the models that correct for selection bias, the unexplained part of the income gap drops slightly from 23 to 19 percent. We can conclude that taking into account possible variations in the gender income gap across types of income is relevant, and that the unexplained gender difference in Nicaragua is large, namely around 20 percent. The addition of the extra variables also improves the models by decreasing the log likelihood, hence resulting in a better model fit. In Models 9 and 10, an interactive variable among education and sex is added again. This slightly lowers the magnitude of the unexplained gender income gap to 17 percent.

Finally, it is worth mentioning that the selection bias correction (rho) only has major significance in Model 2; in Models 4, 6, 8, and 10, it is only statistically significant at a 90 percent confidence level. However, it is also important to highlight that the gender income gap increases by around 4–5 percentage points when correcting for selection bias. This points to a larger gender income difference if we include all women, and not just those women who self-reported to be "economically active." The model accounts for women whose reserve wage is higher than the market price for labor. This is important because it suggests that segregation reduces productivity in the economy by keeping women away from work.

Continuing with the multilevel analysis, a first model does not include any variable in order to observe if there is a need for hierarchical specification.[5] The intraclass correlation coefficient ICC (rho1 in Table 5) shows that 33.6 (0.28/(0.28 + 0.55)) percent of income variation can be explained by differences between occupations, and the remainder, or 66.4 percent, by individual differences. This suggests that a second level is necessary, and 33.6 percent is actually quite high. The second model takes the second level of analysis further by introducing two second-level variables: percentage of women (as proxy of segregation) and average education level.

The coefficient for percentage of women is negative and significant (at 10 percent level), showing that Hypothesis 4, that gender segregation leads to lower incomes for men, is true. When summing that coefficient to the one

Table 3 Descriptive statistics for type of income

Occupation	*Percentage*	*Average income*	*Average male income*	*Average female income*	*Difference in %*
Employee/worker	36.81	C$4,598.43	C$4,928.41	C$4,188.89	− 15
Laborer/peasant	11.3	C$2,307.40	C$2,332.15	C$2,074.69	− 11
Employer	1.02	C$14,390.54	C$15,578.63	C$9,564.74	− 39
Self-employed	37.05	C$3,305.52	C$3,626.72	C$2,797.64	− 23
Cooperative member	0.02	C$8,578.34	C$9,655.99	C$4,880.00	− 49
Family worker with payment	13.67				
Family worker with no payment	0.13				
Total/average	**100**	**C$3,860.58**	**C$4,056.24**	**C$3,530.29**	**− 13**

Note: 2009 exchange rate is USD1 = 20.88COR.
Source: Authors' calculations based on the LSMS (2009) in Nicaraguan córdobas.

Table 4 Results of individual characteristics effects on individual income

	Model 1	*Model 2*	*Model 3*	*Model 4*	*Model 5*	*Model 6*	*Model 7*	*Model 8*	*Model 9*	*Model 10*
Ln (hours)	0.466***	0.467***	0.466***	0.466***	0.462***	0.462***	0.462***	0.462***	0.462***	0.463***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Age	0.051***	0.064***	0.051***	0.065***	0.051***	0.062***	0.051***	0.062***	0.051***	0.061***
	(0)	(0.01)	(0)	(0.01)	(0)	(0.01)	(0)	(0.01)	(0)	(0.01)
Age^2	− 0.001***	− 0.001***	− 0.001***	− 0.001***	− 0.001***	− 0.001***	− 0.001***	− 0.001***	− 0.001***	− 0.001***
	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Years of education	0.061***	0.062***	0.061***	0.062***	0.060***	0.062***	0.060***	0.062***	0.061***	0.062***
	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Sex	− 0.174***	− 0.226***	− 0.175***	− 0.234***	− 0.141***	− 0.186***	− 0.142***	− 0.186***	− 0.122***	− 0.169**
	(0.01)	(0.04)	(0.03)	(0.05)	(0.01)	(0.05)	(0.01)	(0.05)	(0.03)	(0.07)
Rural	− 0.132***	− 0.132***	− 0.132***	− 0.132***	− 0.136***	− 0.136***	− 0.137***	− 0.136***	− 0.135***	− 0.135***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Employer	0.744***	0.743***	0.744***	0.744***	0.846***	0.845***	0.846***	0.845***	0.846***	0.845***
	(0.09)	(0.09)	(0.09)	(0.09)	(0.11)	(0.11)	(0.11)	(0.11)	(0.11)	(0.11)
Self-employed	− 0.222***	− 0.221***	− 0.222***	− 0.221***	− 0.192***	− 0.193***	− 0.192***	− 0.193***	− 0.191***	− 0.192***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Cooperative member	0.432**	0.432**	0.432**	0.432**	0.478**	0.476**	0.440**	0.440**	0.442**	0.442**
	(0.2)	(0.2)	(0.2)	(0.2)	(0.23)	(0.23)	(0.2)	(0.2)	(0.2)	(0.2)

(*Continued*).

Table 4 Continued.

Years of education*sex	-	-	0	0.001	-	-	-	-	−0.002	−0.001
			(0)	(0)					(0)	(0)
Employer*sex	-	-	-	-	−0.348*	−0.343*	−0.348*	−0.343*	−0.348*	−0.344*
					(0.2)	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)
Self-employed*sex	-	-	-	-	−0.074**	−0.072**	−0.074**	−0.071**	−0.080**	−0.076**
					(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Cooperative member*sex	-	-	-	-	−0.226	−0.211	-	-	-	-
					(0.24)	(0.24)				
Cons	4.240***	3.904***	4.240***	3.898***	4.254***	3.971***	4.253***	3.970***	4.247***	3.989***
	(0.1)	(0.29)	(0.1)	(0.28)	(0.1)	(0.33)	(0.1)	(0.33)	(0.1)	(0.36)
Athrho cons	-	0.173*	-	0.178*	-	0.145*	-	0.146*	-	0.134*
N	10,910	23,755	10,910	23,755	10,910	23,755	10,910	23,755	10,910	23,755
R^2	0.332	-	0.332	-	0.333	-	0.333	-	0.333	-
Log likelihood* −2	47491.20		47491.12		47479.90		47479.98		47479.76	

Notes: Figures in parentheses are robust standard errors; ***, **, * denote statistical significance at the 1, 5, and 10 percent levels, respectively. The model included a correction for selection bias. The models used for the generation of the inverse Mills were: sex, age, age^2, marital status, years of education, number of people in the household, and the number of dependents in the household.

Table 5 Hierarchical linear models for assessing the effect of gender segregation on log incomes

	Model 1	*Model 2*	*Model 3*	*Model 4*
Variance				
Level 2				
Var (Intercept)	0.28	0.064	0.066	0.006
% of explained variance	0.337	0.124	0.131	0.014
Var (Percentage of women)	-	0.000	0.000	0.000
Level 3				
Var (Intercept)	-	-	0.021	0.066
% of explained variance			.0046	0.137
Total Variance	0.55	0.452	0.439	0.416
Group characteristics – Coefficients				
Percentage of women (α_{01k})	-	− 0.004*	− 0.005**	− 0.003***
		(0)	(0)	(0)
Average years of education	-	0.095***	0.093***	0.069***
		(0.01)	(0.02)	(0.01)
Percentage of women*sex (α_{11k})	-	− 0.002**	− 0.002**	− 0.001
		(0)	(0)	(0)
Cons	8.033***	4.751***	4.709***	5.107***
	(0.05)	(0.18)	(0.19)	(0.12)
Control Variables	Not included	Included	Included	Included
Goodness of Fit				
− 2*Log likelihood	24505.82	22393.42	22198.78	21596.8
X2 Change comparison – previous models	-	− 2112.4	− 194.64	− 601.98
AIC	-	22431.41	22238.78	21638.8
BIC	-	22570.06	22384.73	21791.75
Level 2	-	OCCUP (2)	OCCUP (2)	REGION + OCCUP (2)
Level 3	-	-	REGION	SECTORS
N	10,760	10,910	10,910	10,760
N (occupations)	29	120	29	120
N (sectors/region)			183	612
rho1	0.366	0.125	0.125	0.013
rho2	-	-	0.046	0.137

Notes: Figures in parentheses are robust standard errors; ***, **, * denote statistical significance at the 1, 5, and 10 percent levels, respectively. For the definition of regions, sectors, and occupations, please refer to Appendix A.

on percentage of women*sex, a negative figure results, proving that this hypothesis holds true for women as well. Furthermore, the coefficient on percentage of women*sex is negative and statistically significant, implying that higher levels of segregation are associated with larger gender income gaps. For example, a 10 percent increment in segregation (defined as percentage of women in a specific occupation) results in a 2 percent (-0.002) reduction in the income of women, while men's remains the same. This means that Hypothesis 5 is also confirmed. A large part of the gender income gap in Nicaragua can be explained by occupational segregation, and women suffer more than men from working in female-dominated jobs.

It is also worth noting that the average level of education in occupations has a large and significant influence on incomes, even after controlling for all individual characteristics and for occupational segregation. Therefore, the relevance of introducing this second level in explaining incomes is also due to the effect of average education per occupation.

The third specification takes into consideration the differences among regions as its third level of analysis. This does not add much explanatory value: the change in the X^2 is minimal, and the variance of α_{00k} and α_{01k} are small and 0, respectively. Taking into account all the other variables in the model, the addition of regions only adds 0.4 percent to the explanation of income variations. Hypothesis 6 can therefore not be confirmed.

Model 4, which includes branches of economic activity (or sectors) as third level, does provide more explanation. The variation by sector explains 14 percent of income differences overall, but the variance of the variable percentage of women is 0, indicating that there is no variation in gender income gaps by sector. Furthermore, only 1 percent of income differences are due to the variance in regional occupations, confirming the relative unimportance of regions as in Model 3. Thus, we can partly confirm Hypothesis 7, in the sense that sectors do explain part of income differences in Nicaragua.

Models 3 and 4 confirm the negative effect of gender segregation in occupations on both men's and women's incomes, as well as the larger gender income gaps in more segregated occupations. In Model 4 the impact of gender segregation on income is slightly lower, but still highly significant. It is possible that by including sectors as a third-level variable, the sector effect already captures part of the occupational characteristics at the second level. This assumption becomes more plausible when analyzing the random part: the variance of β_{0jk} (level 2) drops as compared to Model 3, while that of α_{00k} (level 3) increases.

Adding the random effects of occupations and sectors (Model 4) results in the fittest model among all, with the deviance improved by 601.98 compared to the previous model. Also, the results of AIC and BIC tests are the lowest at 21638.8 and 21791.75 respectively. This, along with the

intraclass correlation rho2 (14 percent), supports the validity of including three levels in our model.

CONCLUSION

Our review of empirical studies concluded that there are four groups of factors that may influence income differences between men and women: individual, human-capital-related factors such as education, factors related to type of job or sector, the general wage structure in a country, and geographical location. Yet, part of the income gap always remains unexplained and is thus due to social norms, discrimination, or unobserved productivity differences.

Nicaragua proved to have the largest gender income gap of Central America and one of the highest degrees of occupational segregation in Latin America. We analyzed the effect of human capital and other individual features, types of income (in order to conclude on the effect of the large informal sector), occupational segregation, and possible regional and sectoral influences. To analyze the effect of occupational segregation and of regions and sectors on incomes, we applied multilevel modeling.

On the basis of the literature including that on country context, we formulated seven hypotheses. The results are the following: When controlling for education, experience, rural versus urban residence, and type of income (employer, dependent worker, self-employed/informal sector, cooperative member), and controlling for selection bias, the unexplained gender pay gap is around 23 percent. We also find that workers in the informal sector (proxied by the self-employed category) prove to earn statistically significantly less than all other income categories.

While Monroy (2008) found that the raw (unadjusted) income gap was smaller for unskilled workers, we cannot confirm that the gender gap rises with education levels when we control for the above-mentioned factors. On the other hand, we do find evidence that women earn less than men in almost all income categories: dependent worker, self-employed, and employer. Moreover, if we add these interaction terms, the unexplained part of the income gap falls only slightly and remains high at between 17 and 19 percent. All in all, our conclusions on the unexplained income gap are broadly in line but slightly higher than the ones found in earlier studies on Nicaragua, in particular by Ted Enamorado, Ana Carolina Izaguirre, and Hugo Ñopo (2009; 16 percent) and Hoyos and Ñopo (2010; 20 percent). This high unexplained gap may be partly due to unobserved productivity differences between men and women, but more likely reflects persistent social and cultural norms and serious discrimination in the country. The latter two possibilities

are more in keeping with the sociological studies on Nicaragua that show the dominance of patriarchal gender norms, particularly in rural areas (Bradshaw 2013; Prieto-Carrón 2014). Our findings also imply that Nicaragua's high ranking in the Global Gender Gap Index is somewhat misleading.

In keeping with other studies (Baron and Newman 1990; Solberg and Laughlin 1995; Blau and Kahn 1996; Espino 2013; Coelli 2014), we also found that occupational segregation has a statistically significant influence on incomes: occupations dominated by women tend to have lower incomes. Moreover, we found that the gender income gap is larger in occupations with higher gender segregation. This means that women suffer more from occupational gender segregation than men. This contradicts Budig (2002), but is in line with Cohen and Huffman (2003a) and Huffman (2004). Johansson and Katz (2007) and Espino (2013) provide evidence for an explanation of this phenomenon, namely that women tend to be overeducated for their jobs, while men are often undereducated. Given that, on average, Nicaraguan women have more years of education than men, this explanation likely holds for Nicaragua as well.

When we added a third level of analysis, we found a statistically significant effect of sectors on the variation in incomes, but that of regions was not confirmed. The lack of evidence for an effect of regions on income variations confirms the weak evidence for this phenomenon in the literature.

The results indicate that gender occupational segregation is an important phenomenon for understanding the persistence of income differences between men and women in Nicaragua. These income differences are probably to a large extent an expression of gender inequality and are linked to a variety of nonmarket factors. Most likely, these factors work on both the supply and demand sides of the labor market. Women may have lower access to higher-paying sectors and jobs due to persistent gender norms, discrimination, practical constraints, and other barriers. On the other hand, there may be good reasons for women to feel attracted to tertiary sector activities in which they are overrepresented. Some of them offer women the flexibility that is necessary for combining productive with reproductive work (such as small-scale commerce, the catering industry, and to some extent domestic services). Others, like employment in healthcare or education, offer access to social security including maternity benefits. But, it is clear that these benefits come at the price of lower hourly wages.

Our paper also shows the benefit of using a hierarchical level approach for examining gender earnings differences. We overcome the aggregation bias problem by recognizing that the influence of being a man or a woman on wages is clearly different in different types of occupations and sectors,

particularly in a developing country like Nicaragua. Omitting occupational-level variables and running a standard regression analysis would lead to biased estimates of standard errors and possibly also of coefficients. The proper specification of the error structure in hierarchical models solves the problem of misestimated results; hence the results are more robust.

Several implications for public policy can be derived from our findings. First, to reduce the gender earnings gap, it is important to enhance women's labor market participation in all sectors and occupations so as to decrease the high level of occupational segregation. To achieve this, it is important to reduce practical constraints for women's access to higher-paying sectors and jobs, for example by offering childcare. It would also be good to expand the coverage of social security so that women have more occupational options for obtaining these important benefits. Moreover, expanding social security would also limit the number of women (and men) working in precarious informal jobs with the accompanying penalty on women's labor.

Second, the fact that the gender income gap does not increase with education is promising and means that expanding education for women will have positive effects on their incomes, while not increasing the gender income gap. Finally, a change in gender norms would probably be most conducive for reducing the income gap between men and women. This is something that public policies cannot easily accomplish. Ideally, all public policies and public communications should aim to become gender-neutral, avoiding male bias and the spreading of conservative traditional values. The current Nicaraguan government clearly does not have the political will to do this and instead leans heavily on the Catholic Church with its conservative gender norms. Yet, Nicaraguan nongovernmental organizations (NGOs) like Puntos de Encuentro have found innovative ways to promote gender-neutral values. Among other things, this NGO has produced two attractive television series to this aim. In addition, it can be expected that higher education levels will also contribute to changing patriarchal values and norms.

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SUPPLEMENTAL DATA

Supplemental data for this article can be accessed at 10.1080/13545701.2019.1567931

NOTES

[1] Duncan Index of Occupational Segregation is defined as the percentage of female workers who would have to change jobs to equalize the occupational distribution (Duncan and Duncan 1955).

[2] In the LSMS 2009, no questions were asked on access to social security or firm size. However, the data from LSMS 2001 show that 98 percent of the self-employed work on their own or in firms with up to four persons. So most self-employed will probably be working in micro-enterprises or with no social security.

[3] The classifier contains five groups or digits; the first digit represents the major groups, the second digit represents the main groups within the major groups, and so on until it reaches the final subgroups.

[4] Even though we are using the LSMS that covers all households, we only consider women that are economically active. Thus, the sample could suffer from selection bias.

[5] The intraclass correlation coefficient (ICC) presents the percentage that is explained by a second level of analysis, "level two"; usually when the value is greater than 10 percent, the use of an explanation of the dependent variable in more than one level is required.

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APPENDIX A

Regions: Rural Atlantic areas, Urban Atlantic areas, Rural Central areas, Urban Central areas, Rural Pacific area (excluding the Department of Managua, capital of Nicaragua), Urban Pacific areas (excluding the department of Managua), and Managua.

Sectors: Correspond to where the occupation originated; primary, secondary, and tertiary sectors.

Occupations: Two digits were chosen because of a large number of specific activities. Hierarchical models can be sensitive to the number of groups generated at different levels so robustness tests were performed with three digits. A list of occupational categories and their income differences is presented in Table A6 in the Supplemental Online Appendix.