



LUND UNIVERSITY

School of Economics and Management

Master in Economic Development and Growth

## Gender Earnings Gap in urban Ecuador: Looking beyond Averages

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*Abstract: This thesis explores the gender earnings gaps in urban Ecuador during the period between 2003 and 2012. The difference between the female average earnings and the male average earnings increases from 7% in 2003 to 12% in 2012. Thus, exploring if this increase is a common pattern of the gender earnings gap across the distribution, the links between the gaps and occupational segregation, the differences in the components of the gap when only occupations with a relevant participation of women are considered and the reasons of the increase of it are the four purposes of this paper. Decomposition techniques of the female/male differential across the distribution are performed. The study finds an increase in the gender earnings gap at the bottom of the distribution in 2012 associated with a higher participation of women as self – employed. Moreover, occupational segregation does not have an important link with the earnings differential. However, the glass ceiling effect is higher for occupations with a relevant participation of women than that of all the occupations. Finally, self-employment may have a major role in explaining the increase in the gender gap in 2012*

*Key Words:* Gender earnings gap, labor market, glass ceiling effect, sticky floor effect, occupational segregation, self-employment

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## **1. Introduction**

Sen (2001) argues that gender inequality is a phenomenon that has different dimensions. According to this author, inequality is evident in the differences in mortality rates, fertility rates, access to facilities, professional achievement, ownership of property and household allocation of labor. In this thesis, inequality in professional achievement is studied through a possible outcome of it: the gender earnings gap. Reducing the gap and promoting equality in the working conditions faced amongst women and men is a goal for policymakers. As determining the factors that contribute to the decrease of the gap is a useful tool to designing policies towards eliminating inequality. The underlying literature point towards a combination of both supply side and demand side factors which can explain the earnings differential. On the one hand, the allocation of time between household and market activities; the depreciation of female skills during career interruptions and the concentration of them in some occupations are determinants of the female/ male earnings differential (Mincer & Polachek, 1974, Becker, 1985, Mincer & Ofek, 1982). On the other hand, asymmetric information about the productivity of a person motivates employers to use schooling, gender, ethnicity, as proxies of the competence of people to do a job (Cain, 1976, Phelps, 1972). Moreover, there might be a link between occupational segregation and the gender earnings gap. Bergmann (1974) argues that occupational segregation crowds people of the discriminated group in some occupations and lowers their wages as a result. It is likely that the interaction of all such factors contributes to the disparities in earnings. Therefore singling out the main determinants with the aim of establishing the most appropriate policies, is a difficult task.

In this context, empirical studies have focused on decomposing the gender earnings gap into a composition effect and structure effect. The former accounts for the differences in human capital characteristics and the latter considers the disparity in the returns to these characteristics (Oaxaca, 1973). The original studies which performed this type of decompositions used the differences between the average female and male wages to obtain conclusions that would be generalized across the entire population (Oaxaca, 1973 and Blinder, 1973). However, studying the averages might mask the potential disparities that

specific groups face such as people at different percentiles of the earnings distribution. Consequently, in order to solve the first problem, some authors have proposed methodologies to decompose the earnings gap across its distribution (Firpo, Fortin & Lemieux, 2009 and Machado & Mata, 2005). Thus, focusing on average terms is a good way to begin the analysis of the problem. Nevertheless, the conclusions obtained after examining what happens beyond the averages should be preferable for policy makers.

The decomposition methods are based on the comparison of a treatment group with a counterfactual group where usually the first group is formed by women or and ethnic minority while the second, by men or an ethnic majority (Firpo, Fortin & Lemieux, 2010). Nonetheless, Black et al. (2008) argue the importance of having women and comparable men to perform the decomposition techniques. Thus, in a context of gender occupational segregation, a question that arises is: can the male working population be a good counterfactual of the female working population?

Ecuador is selected as the case of study for this thesis due to two interesting characteristics of its labor market: a small difference between the average male earnings and the average female earnings and a persistent level of occupational segregation. The raw gender wage gap in Ecuador has been fluctuating between 7.1% and 11.2% from 2003 to 2007 (Gallardo & Ñopo, 2009). Furthermore, if only urban areas are considered, the gender gap was 7% in 2003 and increases to 12% in 2012. Even though, there is an increment in the last year, the differential is fluctuating within the same range. At the same time, the levels of occupational segregation are still high in the country. The Duncan Index of Dissimilarity was 0.54 in 1997 (Deutsch et al., 2002) and 0.56 in 2003 and 2012, so that there have not been any changes on segregation in the country<sup>1</sup>. Hence, women are not equally distributed in all occupations and 87.92% of them are concentrated in 5 out of 10 occupations<sup>2</sup> in 2012.

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<sup>1</sup> The Duncan Index of Dissimilarity gives the proportion of women that should change their occupation to have a complete integration in the labor market (Duncan & Duncan, 1955). More details about their computation are provided in Section 4.

<sup>2</sup> Service Workers and Shop and Market Sales Workers, Elementary Occupations, Professionals, Clerks, Technicians and Associate Professionals.

Consequently, all the male working population may not be a good counterfactual of the female working population to study the differences in earnings.

The research questions of this thesis are: 1. is the increase of the raw gender earnings gap between 2003 and 2012 a common pattern across the earnings distribution? 2. Is there a link between the persistent occupational segregation and the gender earnings differential? 3. What are the differences in the decomposition of the gender earnings differential when only occupations with a relevant female participation are taken into account? 4. How can the increase of the gender earnings differential between 2003 and 2012 be explained?

The period of study is between 2003 and 2012. The reason for this choice is due to the availability of comparable data from the Survey of Employment, Unemployment and Underemployment (ENEMDUR). Therefore, it is possible to analyze the changes in the labor market regarding the gender earnings differential and occupational segregation across almost a whole decade. Moreover, our choice for this period coincides with policy changes which have likely affected the earnings gap distributions. Ecuador has implemented regulations to improve the working conditions during the period of study, such as the elimination of laboural intermediation and the hourly labor contract, the increment of wages of domestic employees and the enforcement of their affiliation to the Social Security System and the modifications to the entitlement to parental leave.

A methodology to decompose the gender gap across the distribution based on Recentered Influence Functions is applied. The main advantage of this technique is that the contributions of each explanatory variable to the composition effect and the wage structure effect at each percentile of the earnings distribution can be computed (Firpo, Fortin & Lemieux, 2010). Previous studies for Ecuador have performed decompositions to the differences between mean averages (García & Winter, 2005) or used matching techniques (Gallardo & Ñopo, 2009). The disadvantage of the latter technique is that when many explanatory variables are the determinants of earnings, it is difficult to match men and women (Ñopo, Daza & Ramos, 2012). The main contributions of this thesis are: i. A decomposition of the gender earnings gap across the distribution is performed so that the impact of each explanatory variable to the wage structure and composition effect can be



examined. This detailed decomposition is useful to determine future lines of research aimed to promote gender equality in earnings. ii. The thesis shows that studies that go beyond the mean can provide better results in terms of policy implications. iii. The links between two major problems of the labor market in Ecuador are explored: occupational segregation and the differential in earnings.

The results of this study suggest that human capital endowments are important variables associated with the gender gap at the top of the distribution. However, at the bottom of the distribution the disparities in the returns of men and women of the same age in 2003 and those amongst self – employed in 2012 seem to be the most important contributors to the gap. Moreover, occupational segregation does not have an important association with the earnings differential. However, when a decomposition of the gender wage gap is performed for female dominated occupations, it is found that the glass ceiling effect in 2003 and 2012 is higher than that for all the occupations. Finally, the variation of the gender earnings gap in 2012 may be associated with an important increase of the proportion of women in self – employment.

The paper is structured as follows. Section 2 provides the theoretical framework and previous empirical research that are the basis of this study. Section 3 presents a brief description of some key aspects of the labor market in Ecuador. Section 4 describes the data sources and variables used in the empirical part. Section 5 explains the methodology for decomposing the gender earnings differential. Section 6 discusses the results and section 7 concludes.

## **2. Theory**

This section is divided into the following two parts: theoretical framework and previous research. Firstly, the present research takes into account seminal papers on gender wage gaps which were written in the 70s and 80s as the base of the theoretical approach. The reason for this is due to the fact they still represent the theoretical framework for the most

studies that explore the gender differential today. Secondly, a literature review is provided focusing on the road literature that examines differences in wages between males and females in Latin America and Ecuador.

## **2.1 Theoretical Approach**

Theories of human capital and sexual division of household labor, as well as theories of discrimination, have provided explanations for the gender wage differential. Regarding the first group, Mincer and Polachek (1974) argue that the allocation of time between non-market (household) and market activities may be influenced by the distribution of human capital. However at the same time, the accumulation of human capital may be determined by the future allocation of time. Besides these elements, Becker (1985) proposes that the energy required to accomplish an activity is also a factor that affects the decisions of allocation of time and investments in human capital. Thus, the gender wage gap may be a result of the low training of women that expect to interrupt their careers during motherhood and the depreciation of their human capital during child – rearing (Mincer & Polachek, 1974). But it can also evidence that women earn less than men because they are concentrated in low energy – intensity jobs that allows them to save energy to do household activities (Becker, 1985). Moreover, supporting the statement that career interruptions are responsible of the gender wage differential, Mincer and Ofek (1982) argue that the wages before a withdrawal from a labor market are greater than after it, showing a possible deterioration of the skills.

The focus of the human capital theory is the supply - side of the labor market, where individuals are encouraged to invest in skills formation with the aim of achieving a return in the labor market. This approach has to be complemented with the study of the behavior of the agents in the demand-side of the labor market. Blaug (1976) points out that employers use schooling as a proxy of the potential trainability of future workers during the hiring process and this fact may reinforce investments in human capital. Besides schooling,

skin color, congeniality and pliability are used as proxies of the productivity of individuals (Cain, 1976).

The use of devices to identify workers may be required due to the lack of information about their productivity. In fact, Phelps (1972) highlights that asymmetric information generates statistical discrimination. This entails that the valuation of the qualifications of one group (i.e. black or women) is lower than that of other group (i.e. whiter or men). In the same fashion, Arrow (1971) proposes that the employer assigns probabilities of being qualified to each of groups and if the probability of one group is lower, its wage will also be lower. In order to observe statistical discrimination in the labor market three assumptions must hold. Firstly, the costs of obtaining true information about the qualifications of individuals are not affordable by the employer (Phelps, 1972 and Arrow, 1971), secondly, the employer can identify the members of the groups at a low cost and thirdly, the distribution of the productivity in each group is known (Arrow, 1971).

Beyond pure statistical discrimination, taste discrimination and occupational segregation can also explain the gender wage gap. For the purposes of this research, it is considered that there is discrimination in the labor market when people with the same level of productivity have different returns to their human capital endowments which is presumably explained due to a racial, ethnic or gender condition (Altonji & Blank, 1999). Becker (1971) comments on the fact that taste discrimination can be observed in three situations: i. when workers of the discriminated group receive a lower wage than the rest of the workers; ii. when employees perceive their salaries to be lower than they actually are because they are working with people of a discriminated group; iii. when consumers perceive they are paying a higher price for a good produced by a discriminated group. Concerning the first situation, Marshall (1974) points out that employers that do not discriminate will hire individuals from the discriminated group in order to save costs. In the long run all employers will do the same and the equalization of wages in the economy will be promoted.

Cain (1976) argues that discrimination can be plausible through the assignment of jobs with different payments to workers that have the same qualifications which is known as occupational segregation. This idea is also proposed by Becker (1985) who considers that choosing occupations that suits the energy required for housework may lead to gender occupational segregation. Bergmann (1971, 1974) develops the crowding hypothesis. This idea states that occupational segregation constrains the participation of the discriminated group in some occupations while crowds them into others. The main effect of this phenomenon is that the marginal productivity and wages in the crowded occupations<sup>3</sup> will be lower even though the requirements of skills of them are the same as in the non-crowded occupations. Furthermore, an additional effect of occupational segregation is that people from the discriminated group that are hired in the non-crowded sector receive lower wages than the rest of the workers with the same human capital. This result is a consequence of the low opportunity cost of the discriminated group which is taken into account by the employer. Therefore, two elements of discrimination are identified by Bergmann (1974): the different distribution of women and men between occupations (occupational element) and the difference in earnings (wage element)<sup>4</sup>. Segregation may increase the female/male wage differential if there is an uneven increase in the returns to skills and endowments for the sectors where women do not participate (Blau & Kahn, 2003).

In conclusion, the wage gap is a consequence of the interaction of the employees, the employers and the labor institutions. Furthermore, from an empirical perspective it is difficult to determine if the gender differential is a response of the decisions regarding the allocation of time between market and non-market activities or if it is a result of the lack of information about the productivity of the workers. Thus, the focus of the majority of studies is the identification of two forces that explain the gap: differences in productivity that is linked to the human capital endowments of each individual and discrimination that is associated with different returns to the endowments (Oaxaca, 1973). The following section

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<sup>3</sup> Occupations with a high participation of the discriminated group.

<sup>4</sup> The approach of Bergmann (1974) is developed for blacks and whites; nevertheless, it can also be applied for men and women as the author mentions.

provides a further discussion about empirical studies mainly conducted for Latin America and Ecuador.

## **2.2 Previous Research**

This section provides a review of the most known studies that have developed a methodology to assess the gender wage differential and which are used as references for subsequent studies. Furthermore, it also goes through the empirical evidence of the wage gap in Latin America and Ecuador.

Regarding the studies that have proposed a methodology on the matter, Oaxaca (1973) and Blinder (1973) are the first ones to present a decomposition of the gender wage gap into a composition effect and a wage structure effect. The former is related with the part of the gap that can be explained by the observable characteristics of the individuals. These characteristics are their human capital endowments. The latter is associated with the part of the gap that is caused by the difference in the returns to the endowments and it is also treated as discrimination in the labor market. Meanwhile, Blinder (1973) makes a distinction between a structural wage equation and a reduced wage equation. The structural model considers that some of the determinants of the wage equation (i.e. education and occupations) are endogenous variables, so that a system of equations can be specified. Unbiased estimations in this model are obtained under the assumption that the error terms of all the equations of the system are not correlated. In the reduced wage equation, the explanatory variables have to be exogenous (i.e. age or family background). Thus, the estimated coefficients are definitely unbiased. However, there is a limitation in including the productive characteristics of the individuals due to their endogeneity and consequently, the study of the returns of them cannot be done.

The studies of Oaxaca (1973) and Blinder (1973) are conducted for difference in the average wage of two groups. However, it is also relevant to explore if there are changes in the wage differential and its determinants through the wage distribution. Machado and

Mata (2005) and Firpo, Fortin and Lemieux (2007, 2009) have proposed methods that can perform the same decomposition when the distribution of wages is. The method of Machado and Mata (2005) consists in the construction of a density function of the dependent variable based on a counterfactual distribution of the explanatory variables. Nevertheless, Firpo, Fortin and Lemieux (2010) point out that this method has problems to compute the contribution of the covariates to the composition effect in the decomposition. Meanwhile, the decomposition technique developed by Firpo, Fortin and Lemieux (2007, 2009) can be used to explore the influence of the variation in an explanatory variable on each quantile. Moreover, it is possible to compute the contributions of the covariates to both the composition and wage structure effects (Firpo, Fortin & Lemieux, 2010). Quantile analyses have been performed to study wage inequality in different points of the earnings distribution and determine if inequality can be attributed to changes in the composition or the wage structure (Juhn, Murphy & Pierce, 1993, Autor, Katz & Kearney, 2005, DiNardo, Fortin & Lemieux, 1996, Firpo, Fortin & Lemieux, 2007, Machado & Mata, 2005).

When the decomposition of the female/male differential is performed for the distribution, two additional definitions should be introduced: the glass ceiling and sticky floor effects. On the one hand, a glass ceiling effect is observed through a wider differential in the upper part of the distribution that entails that women encounter constraints to make progress in their careers (Albrecht, Björklund & Vroman, 2003). On the other hand, if the gap is wider in the bottom of the distribution, there is a sticky floor effect (Arulampalam, Booth & Bryan, 2007). Gender differences in entry wages may reflect a lower valuation of women if employers expect women to interrupt their careers and consequently, a sticky floor effect can be associated with statistical discrimination (De la Rica, Dolado & Llorens, 2008).

One of the purposes of this thesis is to explore the link between occupational segregation and the gender earnings gap. For that reason, studies related with this topic are also included in this review. Considering the overcrowding hypothesis proposed by Bergmann (1974), Backer and Fortin (2001) examine the variation of the gender wage gap that is associated to the changes in the proportion of females that are employed in an occupation (femaleness of the job) in Canada. Their results reveal a low contribution of the femaleness

to the earnings differential. Similarly, Fortin and Huberman (2002) explore the role of vertical and horizontal segregation in the Canadian labor market during the last century and find that the improvements in women's education are reflected in a lower vertical segregation. Nevertheless, horizontal segregation seems to be persistent. They argue that vertical segregation occurs among different hierarchical occupations within the same field of study. Whilst horizontal segregation entails that individuals with similar qualifications are located in fields of study with different payments.

The reduction of gender inequalities in Latin America can be observed through the increasing labor participation of women (Psacharopoulos & Tzannatos, 1992) and the reduction of the educational gap that nowadays is favorable for women (Duryea et al., 2007). Nonetheless, the gains in terms of equality are not evident in the differences in earnings and the female/male gap is especially wide for old, less educated, self – employed and informal female workers during the last decade (Atal, Ñopo & Winder, 2009). Furthermore, Abramo and Valenzuela (2005) highlight other negative aspects that characterize the participation of women in the labor market: i. a high female concentration in the informal sector, ii. an increase in unemployment of poor women, iii. low labour participation among the poor and less educated women, iv. poor coverage of social benefits for women.

The explanations of the gender earnings disparity, although similar in some cases, vary according to the country that is studied. In Argentina, Esquivel (2007) argues that women encounter difficulties to access to highly – paid jobs suggesting that there is vertical segregation. She also points out that there is a wage premium for all workers in female dominated occupations, but at the same time, there are disparities in the returns that both groups receive within this type of occupations. Montenegro (2001) highlights that the returns to education in Chile are similar in the upper part of the distribution and higher for women at the bottom of it. Meanwhile the returns to experience are lower for women in the top end of the distribution and similar in the lower end. Hence, the same explanatory variables of the gender gap have different effects depending on the part of the distribution that is examined. Furthermore, Perticará and Astudillo (2008) comment on the fact that

gender differential in Chile is wider for craft and related trade workers, laborers and skilled agricultural workers and narrower for professionals and workers in elementary occupations. Ñopo (2007) adds more insights to the debate of the gender differential in Chile and indicates that there is a glass ceiling effect. Furthermore, he finds that the gap is more pronounced for the most educated, old and married workers but also for those working in part – time jobs. Similar results are found for Peru where there is a glass ceiling effect and the disparity of earnings increases for workers that are married or have a high educational level (Ñopo, 2008). Badel and Peña (2010) study the case of Colombia and point out that there is a glass ceiling and a sticky floor effect in the earnings distribution that are mainly explained by the disparities in the returns. According to the authors the explanation for the sticky floor effect is associated with a concentration of people in the informal sector whose salaries cannot be regulated by the minimum wage law meanwhile, the glass ceiling effect might be a result of discrimination or a decision of women to allocate time in household and labor market activities. Additionally, married women in Colombia earn less than single ones and usually work in low – quality jobs (Olarte & Peña, 2010). Moreover, relative poverty is closely related with the gender gap met by women with low education (Angel – Urdinola & Wodon, 2006).

The link between gender occupational segregation and the earnings differential has also been studied in the region. One striking finding by Salas and Leite (2007) is that although occupational segregation is higher in Mexico than in Brazil, the wage gap is wider in the latter country. Tenjo, Ribeiro and Bernat (2005) remarks that occupational segregation may not be harmful for women if they work in highly – paid occupations. However, this does not guarantee the elimination of the gap since there might be gender differences within occupations according to them. Deutsch et al. (2002) find that the contribution of segregation to the wage gap is lower than those of human capital endowments and discrimination in Costa Rica, Ecuador and Uruguay.

In the case of Ecuador, it has been pointed out by Jakubson and Psacharopoulos (1992) that female labor participation has increased and its most important determinants are educational levels, household composition (i.e. young children in the household) and



marital status. Nevertheless, following a similar pattern as that in Latin America, there is a difference in earnings between men and women. García and Winter (2005) decompose the female/male differential among average wages and argues that the contributions of the wage structure and composition effects are similar during 1998 - 1999. Moreover, for the period between 2003 and 2007, Gallardo and Ñopo (2009) study the gender earnings gap using a matching technique. According to these authors, men are concentrated in highly paid jobs and women in lowly paid ones and women with the same human capital endowments as that of men usually earn less money. Moreover, they point out that the gender gap is wider at the bottom of the wage distribution. The matching technique developed by Ñopo (2008) consists in the following steps. Firstly, men and women with the same distribution of characteristics are matched. Hence, the difference in their distributions is the explained part of the gap. Secondly, there are unmatched men and women with particular characteristics that contribute to the gap so that it can be computed two other components of it (i.e. the component related with women working in occupations where it is difficult to find men). Finally, there is a part of the gap that remains unexplained. The problem with this methodology is that it is difficult to match men and women when many observable characteristics are included in the specification (Ñopo, Daza & Ramos, 2012). By means of the decomposition method that is used in this thesis (Firpo, Fortin & Lemieux, 2009) it is possible to examine the contributions of an explanatory variable to the composition part and wage structure part of the gap.

After the revision of the studies conducted for Latin America and Ecuador, some findings that should be taken into account for the empirical part are: i. Horizontal occupational segregation does not increase the gender differential since women usually work in well paid occupations in some countries of Latin America, ii. Hierarchical or vertical segregation that entails a low participation of women in highly paid jobs is related with the glass ceiling effect of some countries (i.e. Peru and Chile), iii. In Ecuador, both the composition and the wage structure effect seem to contribute in the same proportion to the differential of the average wages of women and men in 1998 – 1999. Besides, from 2003 to 2007, there might be a sticky floor effect. Indeed, throughout the rest of the thesis the sticky floor effect that is especially evident in 2012, is deeply studied.

### 3. Background: The Labor Market in Ecuador

The economically active population (EAP) in Ecuador comprises the employed and unemployed people above 15 years old. Among the employed, two categories can be identified: the fully employed and underemployed. The fully employed group is formed by people that satisfy one of the following conditions: 1. work at least 40 hours per week, earn more than the minimum wage and are satisfied with the number of hours worked, 2. work less than 40 hours, earn more than the minimum wage and are satisfied with the number of hours worked. Meanwhile, the underemployed group includes people that would like to increase the amount of hours worked. Finally, the unemployed are the people that did not work during the week before the survey but were searching for a job<sup>5</sup>.

Figure 1 presents the trends of the employment, underemployment and unemployment rates since 2007<sup>6</sup>. Even though, the unemployment rate presents a constant trend during the period, the underemployment rate is high and equal to 48% of the EAP on average and it exhibits a decreasing trend. Since 2011, the percentage of the EAP that is fully employed exceeds the percentage of underemployment and this fact may reflect a slight improvement of the conditions of the working population<sup>7</sup>. Nevertheless, there are important gender differences within the three categories (Figure 2). There are more underemployed than fully employed women in 2012 while the opposite is true for men<sup>8</sup>. Moreover, the underemployment levels are decreasing for men and women since 2007, however the decrease is faster for men. The unemployment rate increased during the international crisis for both groups; but the differences between men and women have decreased in 2012.

The classification of people according to the sector where they work should also be analyzed with a gender perspective. The informal sector accounts for the highest participation of women (44% of the female labor force) and the formal sector for that of

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<sup>5</sup> The definitions for fully employed, underemployed and unemployed are determined by the National Institute of Statistics in Ecuador (INEC).

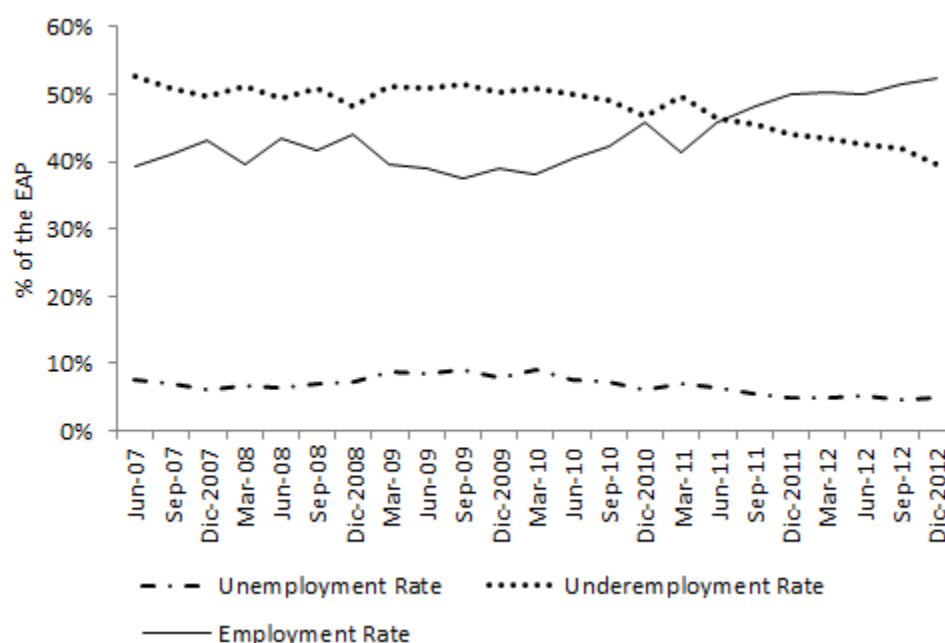
<sup>6</sup> The underemployment, employment and unemployment rates are the ratio of the total number of underemployed, fully employed and unemployed people divided by the economically active population.

<sup>7</sup> People between 15 and 65 years old.

<sup>8</sup> In 2012, 44.6% women are fully employed and 47.1% are underemployed. In the same year, 57.5% men are fully employed and 34.6% are underemployed.

men (45.2% of the male labor force) in 2012. Women are more concentrated in the services sector while men are more equally distributed between agricultural, industry and services sector<sup>9</sup>. Furthermore, both men and women are similarly concentrated in the private and self – employment sector. The participation of women in the latter category increases with age (Vásconez, 2010). Moreover, from 2003 to 2012, it is noticeable the decrease in 40% of female domestic employees and in 22% of male laborers in the urban areas.

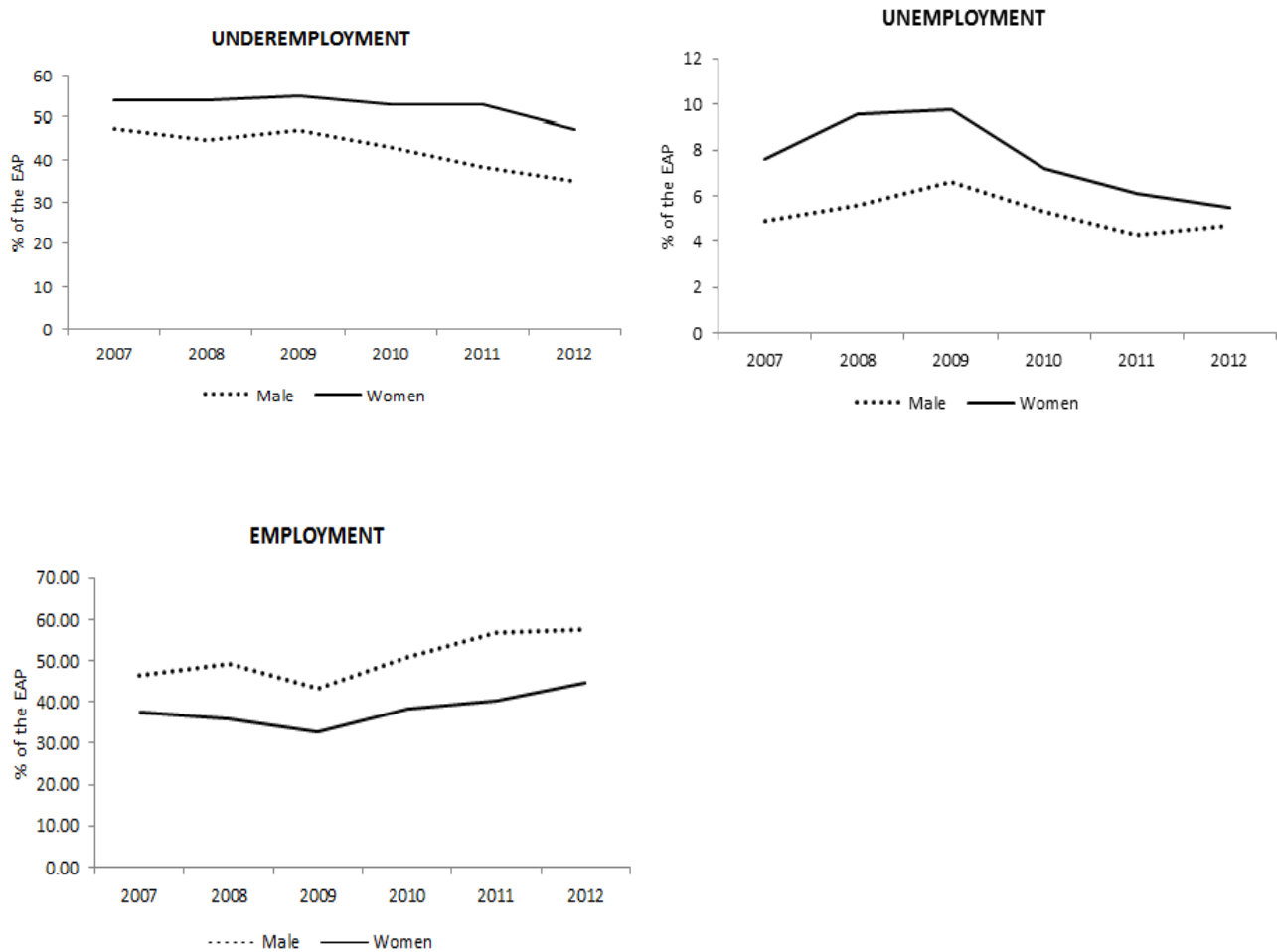
**Figure 1. Employment, Underemployment and Unemployment Rates in Urban Areas 2007 – 2012**



Source: INEC, Encuesta Nacional de Empleo, Desempleo y Subempleo 2007 - 2012

<sup>9</sup> According to the World Development Indicators, 64% of the total female employees work in the services sector, 25% in agriculture and 11% in industry between 2003 and 2010. The participation of men in the three sectors is equal to 43%, 34% and 23%, respectively. Besides, male employers are 6% of the total employment and 3% are female employers.

**Figure 2. Employment, Underemployment and Unemployment Rates in Urban Areas by Gender**



Source: INEC, Encuesta Nacional de Empleo, Desempleo y Subempleo 2012

Underemployment requires less working hours per day and the labor conditions are more flexible so that women could easily allocate their time between market and household activities, as Becker (1985) explains. The national survey with information about the use of time in Ecuador conducted by the National Institute of Statistics in Ecuador (INEC) indicates that women spent 24 hours per week in unpaid domestic activities on average and men spent 6 hours doing the same activities in 2012.

The wage setting institutions may have effects on the gender wage gap (Blau & Kahn, 2003, DiNardo, Fortin & Lemieux, 1996) and consequently, the changes in the law that regulates the working conditions between 2003 and 2012 should be taken into account. Firstly, in order to guarantee a better payment for workers, labor market intermediation and hourly labor contracts were eliminated in 2008<sup>10</sup>. Since then, the employment contract has to be directly negotiated by the employers and the job seekers. Furthermore, hiring companies that provide security, food, courier and cleaning services to others is the only type of intermediation that is allowed. Besides, workers of these companies have to be paid with at least the minimum general wage<sup>11</sup> or the minimum wage of the economic sector<sup>12</sup>. Secondly, the earnings of the domestic employees, who are mainly women, were regulated in 2010, so that at least, they have to receive the minimum general wage. Besides, the employers have to affiliate them to the Social Security System. Thirdly, the regulations to the entitlement to parental leave increased it to a paid 12-week period for women and 10-days for men since 2009. Women can work 2 hours less per day due to breastfeeding for a period of 12 months after giving birth<sup>13</sup>. The problem with the institutions that promote gender inequality for the working population is that they guarantee rights for women that are employed in the formal sector. Nevertheless, the presence of gender differences in the self-employment sector is a problem that needs to be considered.

## **4. Data**

### **4.1 Source Material**

Previous studies that explore the gender wage differential in Ecuador have used the Living Standard Measurement Survey (ECV) and the Employment, Unemployment and Underemployment Survey (ENEMDUR). However, the latest edition of the ECV was carried out in 2006. Therefore, the data for this study are drawn from the ENEMDUR,

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<sup>10</sup> Autor, (2004) says that labor market intermediation comprises “mechanisms or institutions that intercede between job seekers and employers”.

<sup>11</sup> If the worker does not belong to any economic sector, she has to earn the minimum general wage. For example, domestic employees are not included in any economic sector.

<sup>12</sup> These regulations were established in the Mandato Constituyente 8.

<sup>13</sup> Código del Trabajo de Ecuador (Labour Code) contains the regulations for the domestic work and parental leave entitlement.

spanning a period from 2003 and 2012. The surveys were performed in November in both cases. Even though the ENEMDUR has been performed since 1987, the changes in the methodology make them more comparable since 2003.

The ENEMDUR collects information of income, demographic and human capital characteristics of the individuals and occupational characteristics for a random sample of households of the three most populated regions of the country: Coast, Andean and Amazon Region. The Insular Region has been excluded from the sample; nevertheless, only 0.2% of the total population of the country live there in 2012<sup>14</sup>. The sample that is analyzed comprises employed or self-employed people between the ages of 15 and 65 years old that reported positive earnings in the surveys. Due to the fact that the changes in the laboural regulations may have effects on the sizes of the employed and self-employed population (Blau & Kahn, 2003), it is relevant to include both groups. Furthermore, self-employed are 33.55% of the total working population in 2003 and 35.99% in 2012<sup>15</sup>. Child labor and people in retirement age are ruled out from the sample<sup>16</sup>.

Taking into account the aforementioned considerations to the sample, the surveys comprise information of 14066 individuals in 2003 and 14629 in 2012. The participation of the population that is working between 2003 and 2012 has a slight change in favor of women, as it can be seen in Table 1.

**Table 1. Population by Gender (% of the total population)**

<b>Gender</b>	<b>2003</b>	<b>2012</b>
Men	62.89%	60.11%
Women	37.11%	39.89%
Total observations	14066	14629

Source: Author's calculations

<sup>14</sup> This information corresponds to the projections of the population computed by the National Institute of Statistics in Ecuador (INEC) based on the Census data of 2010.

<sup>15</sup> Self – employed people included those with and without employees.

<sup>16</sup> The conditions faced by children in the labor market are different than those to be captured in the wage regressions performed in the empirical part.

So as to have a measure that allows the comparisons of the earnings of people, the hourly wage is selected as the dependent variable of this paper.<sup>17</sup> The wage for the main occupation is taken into account due to the fact that the person is engaged to it for more hours.<sup>18</sup> The dependent variable in 2003 is deflated to 2012 prices using the Consumer Price Index in November 2012 which is the month when the information for the latter survey was collected<sup>19</sup>.

The selection of the explanatory variables for the equation of wages is based on the underlying theory and the literature review. Firstly, human capital of the workers are assessed with education and experience (Mincer, 1974). The survey provides information of the educational level and the year of education that has been completed within each level. Years of education is used as a proxy of schooling. It is constructed by associating the information of the educational level and the year completed (Table A1). A limitation of using years of education is that the variable does not take into account the disparity in quality of education or the differences in the capabilities developed by individuals throughout the learning process (Mincer, 1974).

Secondly, two proxies for experience are used: occupational tenure and potential experience. The first one corresponds to the total number of years worked in the actual occupation. Potential experience (calculated as  $\text{experience} = \text{age} - \text{years of schooling} - \text{age at starting education}$ )<sup>20</sup> is also used. Nonetheless, this variable may overestimate the laboural experience of women that interrupt their careers due to motherhood (Polachek, 2007).

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<sup>17</sup> It is computed as the ratio of the monthly wages and the total number of hours worked during the month. Since the survey asks the number of hours generally worked during a week, this number was multiplied times 4.3 to obtain an approximation of the total number of hours worked in one month.

<sup>18</sup> In the cases that the person allocates the same amount of hours to two occupations, the main occupation is that with a higher payment.

<sup>19</sup> Transforming the hourly wages to logarithmic terms entails a difficulty. There is a relevant proportion of the population that earns less than one dollar per hour (US\$ dollars is the national currency of Ecuador since 2000) so that they are negative numbers when converting to logarithms. In order to avoid a problem in the decomposition, wages are rescaled by adding one unit to all of them. This procedure does not affect the differences between female and male wages.

<sup>20</sup> The construction of potential experience is based on Mincer (1974). Generally, the age at starting education in Ecuador is five years old.

Thirdly, the demographic variables included are marital status, age and ethnicity. One dummy variable for marital status is created showing if the individual is married or not. Unfortunately, information regarding marital status is only available for the survey of 2012. The limitation of this variable is that it can have a positive effect on the productivity and wages of men and an opposite effect for women (Blau & Kahn, 2003, Korenman & Neumark, 1991).

Two questions in the survey can be used for ethnicity. While one of them determines the language that the person speaks, the other one is related to the ethnical self – identification of the person. The former can lead to an underestimation of the number of ethnic minorities (i.e. indigenous) since some of them speak Spanish instead of an indigenous language (Gallardo & Ñopo, 2009). Therefore, using self – identification is preferable. A dummy variable for ethnic groups that corresponds to be part of an ethnic group minority (indigenous, blacks, mulatos and other ethnic groups) or of an ethnic group majority (mestizos and whites) is used.<sup>21</sup>

The gender wage differential is analyzed by occupations with a high participation of females since one of the purposes of this research is occupational segregation. The ENEMDUR classifies occupations with four digits according to the International Standard Classification of Occupations (ISCO). Dummies that correspond to each occupation are not used in the regression because there is a potential problem of endogeneity. Indeed, the occupational distribution of a country may be a result of the differences in wages in occupations (Blau & Kahn, 2003). Besides, discrimination may influence both the gender wage gap and the selection of workers into occupations (Black, et al., 2008) such that the estimation of discrimination may be affected by the inclusion of occupational dummies as well as other similar variables (Blau & Ferber, 1987).

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<sup>21</sup> Mestizo is the main racial group in the country that comes from one indigenous parent and one white parent. Black group comprises mulatos that are the racial group with one black parent and one with parent.



In the decompositions methods, the participation of women as a percentage of the total number of workers in each occupation is also an explanatory variable that is employed to analyze the crowding hypothesis (Bergmann, 1974).

## 4.2 Descriptive Statistics

Atal, Ñopo and Winder (2009) point out that women are more educated than men in a representative sample of countries in Latin America. This is also a characteristic of the labor force of Ecuador as it could be observed in Table 2. The average years of educational attainment by educational level are similar for men and women in 2003 and 2012.

Table 3 provides the Composition of the Labor Force by occupations and Table 4 reports descriptive statistics by gender.

**Table 2. Educational Gap. Average Years of Schooling by Gender and Educational Level**

	2003			2012		
	Men	Women	Gap	Men	Women	Gap
<b>Elementary school</b>	6.266	6.105	0.161	6.357	6.196	0.160
<b>High school</b>	11.550	11.762	-0.212	11.887	11.910	-0.023
<b>Undergraduate studies</b>	17.111	16.928	0.183	16.899	16.916	-0.018
<b>Postgraduate studies</b>	20.115	20.123	-0.008	19.930	19.862	0.067

Source: Author's calculations

**Table 3. Composition of the Labor Force by Occupations (% of the total employees in each occupation)**

	2003			2012		
	Men	Women	Female wage / Male Wage	Men	Women	Female wage / Male Wage
Total Labor Market	62.89	37.11	93%	60.11	39.89	88%
Professionals	55	45	72%	43.14	56.86	87%
Service Workers and Shop and Market Sales Workers	49.66	50.34	81%	46.45	53.55	68%
Clerks	41.34	58.66	73%	48.61	51.39	86%
Technicians and Associate Professionals	51.35	48.65	85%	52.92	47.08	96%
Elementary Occupations	57.13	42.87	93%	57.22	42.78	87%
Legislators, Senior Officials and Managers	64.09	35.91	152%	60.23	39.77	56%
Craft and Related Trades Workers	85.74	14.26	80%	81.52	18.48	77%
Skilled Agricultural and Fishery Workers	86.76	13.24	182%	81.77	18.23	64%
Plant and Machine Operators and Assemblers	94.88	5.12	54%	91.92	8.08	85%
Armed Forces	97.53	2.47	79%	99.4	0.6	59%

Source: Author's calculations

The ratio of the female and male wages is 93% in 2003 but decreases to 88% in 2012 suggesting a worsening of the conditions faced by women. A closer inspection of Table 3 indicates that even though 39.89% of the total working people are women; there are some occupations where this percentage is lower (i.e. skilled agricultural and fishery workers, plant and machine operators and armed forces). If women are only in some occupations the questions that arise are: is it accurate to analyze the gender wage gap in aggregate terms? or is it more appropriate to make a decomposition of the gap considering the occupations where women and men participate in similar proportions? Answering these questions is a purpose of this thesis and it is examined in subsection 6.3. Nonetheless, some previous ideas can be taken from the inspection of the data.

Fortin and Huberman (2002) argue that there are two criteria to determine if an occupation is female dominated. According to the first one, if the participation of women in one occupation is above the female participation in the labor market, the occupation is female dominated. Regarding the second one, the workforce of a female dominated occupation should be formed by 45% of women. In this thesis, the first criteria is used so that between

2003 and 2012, the group that comprises professionals, service workers and shop and market sales workers, clerks, technicians and associate professionals and elementary occupations are the female dominated occupations. Besides, 4 out of the 5 occupations satisfy the second criteria to name a female dominated occupation<sup>22</sup>.

The distribution of men and women between occupations is presented in the Appendix (Table A2). Some relevant changes in the distribution of workers are the reduction of men and women in elementary occupations and the increase of the percentage of female professionals.

Table 4 shows that the gender wage gap increases with age. This may imply that women accumulate lower experience than men due to career interruptions as Mincer and Polachek (1974) suggest. Although it is difficult to confirm this hypothesis with the available data, another fact that contributes to this idea is that women have 2 years less occupational tenure than men. Furthermore, the distribution of population across educational levels is different for men and women. The majority of male workers have attended elementary or high school while the education of female workers corresponds to high school and college levels. In spite of this advantage in human capital endowments, women receive a lower payment than men with the same level of education. With regards to ethnic groups, gender inequalities have been reduced for indigenous people between 2003 and 2012 but increased for black, mestizos and whites. Differences are also evident between places of residence. The Andean Region is the most unequal regarding the gender earnings gap.

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<sup>22</sup> Only elementary occupations have a female participation below 45%.

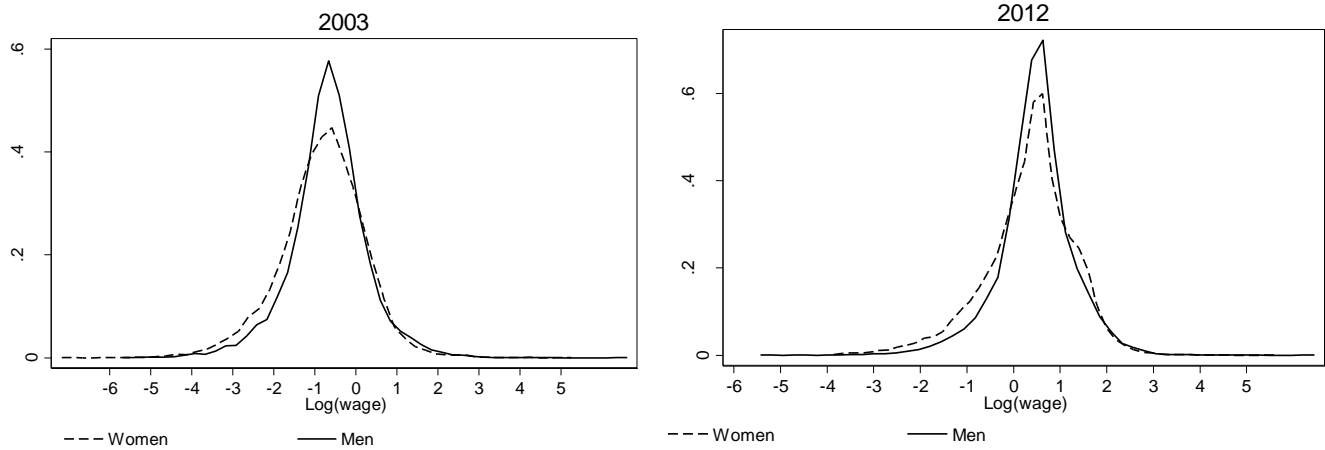
**Table 4. Descriptive Statistics by Gender**

	2003		2012		Female wage / Male Wage	
	Men	Women	Men	Women	2003	2012
<b>Age Groups (% of population)</b>						
15 - 25	23.5	24.3	17.95	15.71	89%	110%
25 - 35	26.25	27	26.4	27.24	139%	97%
35 - 45	24.74	26.15	21.4	23	78%	84%
45 - 55	16.91	16.51	20.73	22.04	79%	77%
55 - 65	8.61	6.05	13.51	12.01	67%	80%
Total	100	100	100	100		
<b>Education (% of the population)</b>						
Primary	33.45	26.94	26.35	21.34	71%	77%
High school	41.9	39.43	47.11	39.03	85%	75%
College	23.61	32.48	25.27	37.45	89%	86%
Postgraduate	1.04	1.15	1.27	2.19	69%	91%
Total	100	100	100	100		
<b>Ethnicity (% of the population)</b>						
Black	4.33	4.38	3.98	4.30	98%	79%
Indigenous	3.52	3.04	3.65	2.41	64%	78%
Mestizo and white	92.15	92.58	92.37	93.29	93%	89%
Total	100	100	100	100		
<b>Natural Region (% of the population)</b>						
Andean	42.1	48.48	39.35	43.86	88%	83%
Coast	55.86	49.5	58.38	53.94	95%	91%
Amazon	2.04	2.03	2.27	2.2	74%	94%
Total	100	100	100	100		
Average Age	36.69	35.86	39.10	39.35		
Average Schooling	11.19	12.01	11.80	12.74		
Average Tenure	9.30	7.14	9.58	7.82		

Source: Author's calculations

Figure 3 presents the kernel density functions of the hourly wages (in logarithm terms) in 2003 and 2012. A common characteristic in the two years is that the distribution of men is slightly located at the left of the distribution of women in the low part of the distribution of wages showing a possible sticky floor effect.

**Figure 3. Kernel Density Functions of Log Hourly Wages**



Source: Author's calculations

Figure 4 shows the raw wage differential for all the occupations (Panel A), for the female dominated occupations<sup>23</sup> (Panel B), and for the employed and self-employed (Panel C). The graphs indicate that there is a sticky floor effect when the raw wage gap is greater at the bottom of the distribution and a glass ceiling effect when it is higher at the upper part of it.

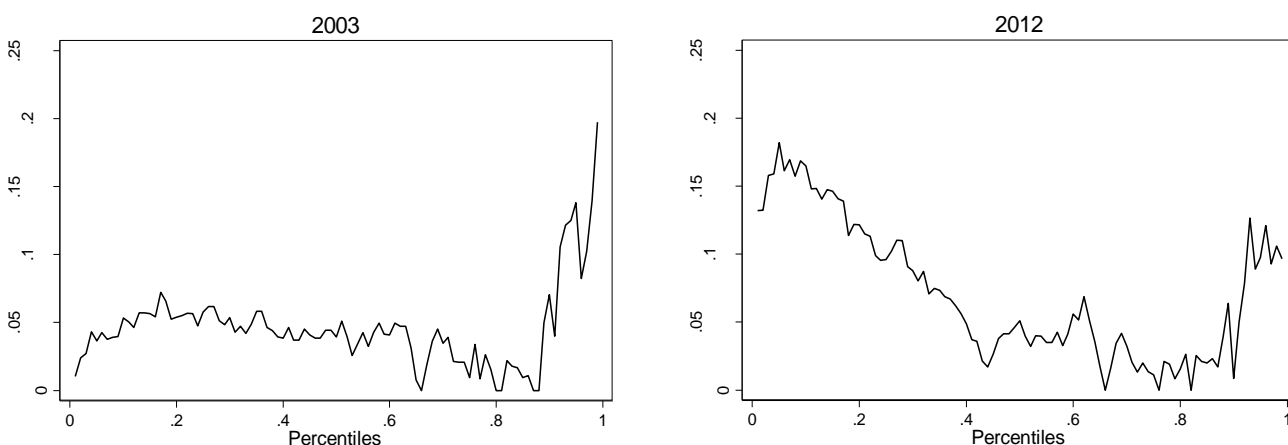
In Figure 4 (Panel A), it can be observed a decrease in the glass ceiling effect from 2003 to 2012 can be observed. Besides, in 2012 there is a stick floor effect that cannot be seen in 2003. This may be the reason of the deterioration of the gap in the last year. When only female dominated occupations are considered, there is a larger glass ceiling effect, suggesting that in occupations where women are actually participating, the barriers to achieve highly paid positions are likely to be strong (More discussion about this idea is provided in subsection 6.3). The most relevant finding in Figure 4 is the differences of the gaps for the employed and self-employed. On the one hand, there is gender equality amongst the employed and the differential is favorable for women in some points of the distribution of wages in 2012. This group of the population is more likely to be regulated by the laboural laws and which according to the graphs seem to have good results. Also,

<sup>23</sup> In 2003, the female dominated occupations are formed by 52.25% men and 47.75% women. In 2012, 49.79% of its workers are men and 50.21% are women. Furthermore,

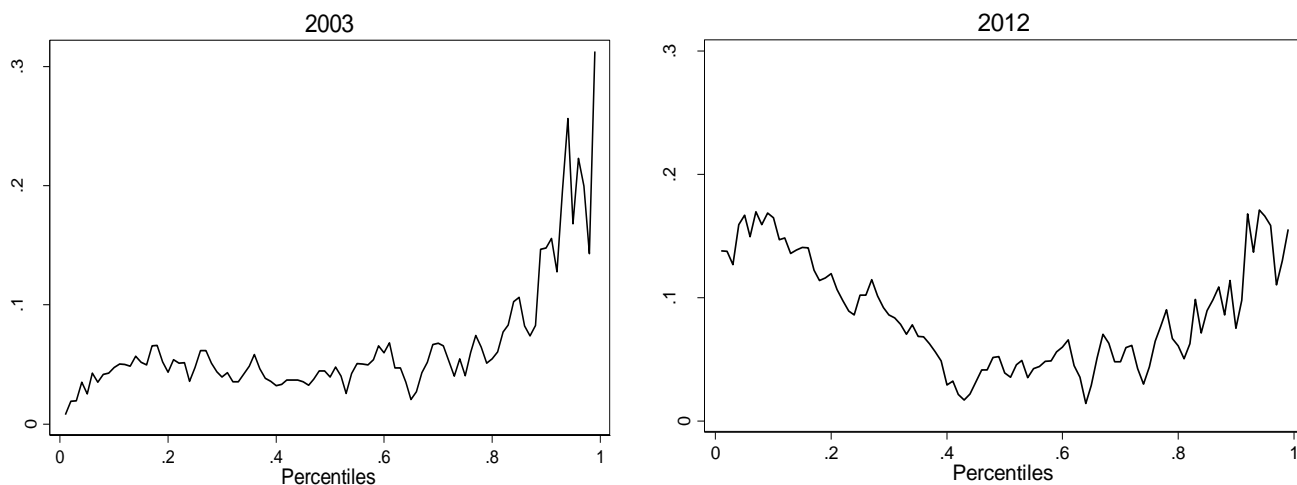
statistical discrimination would not be a feature of the Ecuadorian labor market since there is no gap between employed. On the other hand, the gender wage gap is wide for the self-employed in 2012 and it increases across the wage distribution. In 2003, there was only a glass ceiling effect for the self-employed. The reasons for this change are explored in the empirical part (subsection 6.4).

**Figure 4. Raw Gender Wage Gap by Quantiles**

**Panel A. All Occupations**

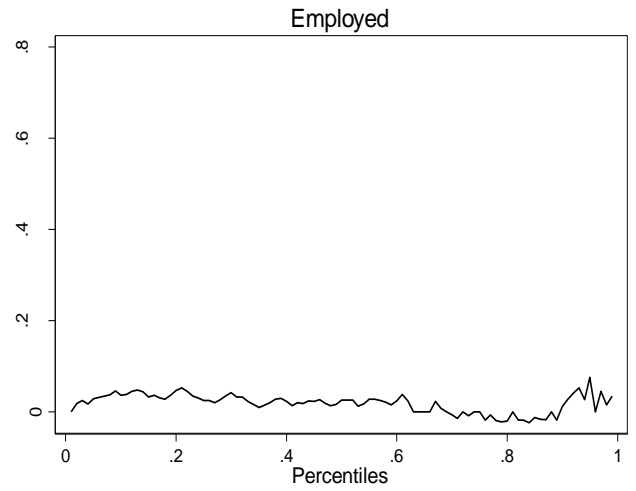
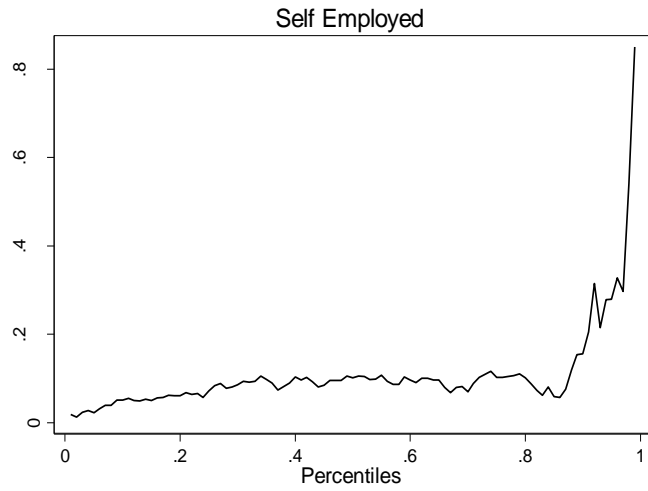


**Panel B. Female Dominated Occupations**

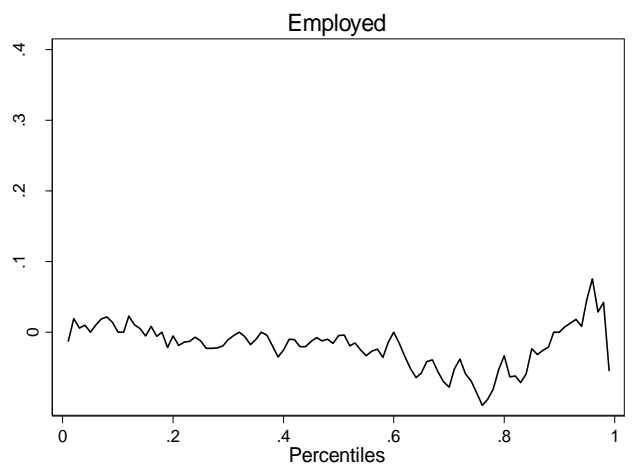
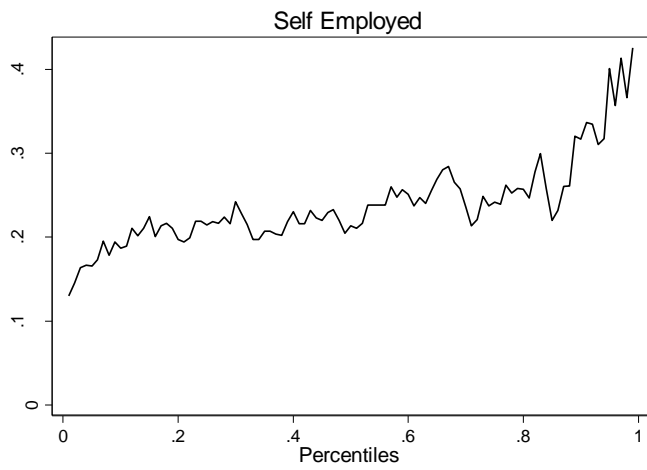


### Panel C. Self – Employed vs. Employed

2003



2012



Source: Author's calculations

An inspection of the data suggests that there is occupational segregation in the labor market in Ecuador (Tables 3 and A2). Therefore, the Duncan Index of Dissimilarity, the Karmel and Maclachlan Index and Occupational Segregation Curves are computed<sup>24</sup>.

The Duncan Index of Dissimilarity is interpreted as the proportion of women that should change their occupation to have a complete integration in the labor market (Duncan & Duncan, 1955) or an identical distribution of the groups between the occupations (King, 2009). If the index is equal to 0, there is no segregation and if it is equal to one there is perfect segregation.

King (1992) highlights that even though the index has been widely used and it is easy to interpret; it can lead to misleading conclusions in its comparison throughout years when there are changes in the occupational categories. Another disadvantage of the index is related to its interpretation. If women switch occupations, there is a change in the occupational structure of the labor force which may hinder the achievement of complete integration in the labor market (Moir & Selby, 1979). Even though the Duncan Index is the most used index for measuring occupational segregation, it is also computed the Karmel and Maclachlan (KM) Index as a robustness check of the results. The index provides the number of people that should switch occupations in order to have perfect integration in the labor market and assuming that there are no changes in the occupational structure (Karmel & Maclachlan, 1988). Occupational segregation curves are also computed. They plot the cumulative proportion of females (ordinate) and the cumulative proportion of males (abscissa) ordered according to the ratio of the participation of males in the occupation  $j$  divided by the participation of women in the same occupation (Hutchens, 1991).

Deutsch et al. (2002) find that the Duncan Index was 0.58 in 1989, 0.54 in 1993 and 0.54 in 1997 and show that the differences across time are not statistically significantly different from zero. In 2003 and 2012, the levels of the Duncan Index are similar to previous years

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<sup>24</sup> The methodological aspects of the index are presented in Appendix B. The indexes were computed in Stata program using the command `dicseg`.



and equal to 0.56 (Table 5). Thus 56% of women should switch occupations to have a complete integration.

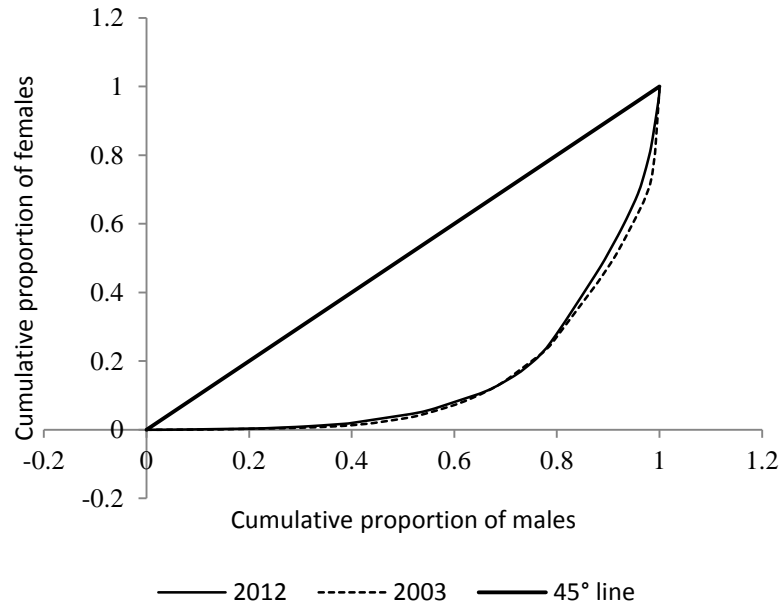
**Table 5. Occupational Segregation Indexes**

	<b>Duncan &amp; Duncan</b>	<b>KM Index</b>
<b>2003</b>	<b>0.556</b>	<b>0.26</b>
<b>2012</b>	<b>0.56</b>	<b>0.26</b>

Source: Author's calculations

The Duncan Index assumes that the distribution of people between occupations can vary (Salardi, 2013) while the Karmel and Maclachlan Index does not allow changes neither on the size of occupations nor on the size of the labor market (Watts, 1998). Therefore important differences between them are expected; nevertheless as Salardi (2013) points out, one can observe whether the trend and changes or both are similar. In the case of Ecuador, neither the Duncan nor the KM index has changed between 2003 and 2012. Figure 5 presents the Occupational Segregation Curve in 2003 and 2012 and confirms the previous results. None of the occupational segregation curves dominates the other one; therefore, none important changes in segregation have occurred and the increase of the gender earnings differential in 2012 may not be associated with segregation (subsection 6.2 examines the link between segregation and the gender differential).

**Figure 5. Occupational Segregation Curves**



Source: Author's calculations

Fortin and Huberman (2002) propose a decomposition of the gender wage differential with the aim of analyzing if occupational segregation has an effect on it<sup>25</sup>. According to the authors, the gender wage gap can be expressed in the following way:

$$Gap = \underbrace{\sum_{i=1}^k \theta_i \bar{w}_i (s_i^m - s_i^f)}_{\text{Between occupation component}} + \underbrace{\sum_{i=1}^k [\theta_i s_i^m (w_i^m - \bar{w}_i) - \theta_i s_i^f (w_i^f - \bar{w}_i)]}_{\text{Within occupation component}} \quad (1)$$

Between occupation component      Within occupation component

<sup>25</sup> The complete decomposition is presented in Appendix B.

**Table 6. Between and Within Occupations Component of the Gender Wage Gap. % of the average wage of men**

	Between occupations component	Within occupations component	Gender Wage Gap
2003	-5%	12%	7%
2012	-10%	21%	12%

Source: Author's calculations

The decomposition of the differential in 2003 and 2012 suggests that the between component contributes to the reduction of the gap. Consequently, occupational segregation plays an important role in the determination of the gap, but it does not contribute to its increase as it could be expected. In fact, it benefits women since they are concentrated in occupations with higher wages than the average. This effect of occupational segregation is also a characteristic of other countries in the region (Tenjo, Ribeiro & Bernat, 2005, Esquivel, 2007). Even though this result provides a preliminary view of the influence of occupational segregation on the female/male differential, in the empirical section the crowding hypothesis is tested (Bergmann, 1974), which constitutes another way to examine the effect of segregation.

## 5. Methods

### 5.1 Unconditional Quantile Regressions: Recentered Influence Functions (RIF)<sup>26</sup>

Decomposition methods of the gender earnings differential require the formulation of an equation for earnings as the following one:

$$\ln W_i = \alpha + \beta_i X_i + \varepsilon_i \quad (2)$$

Where  $W_i$  is the earnings of individual  $i$ ,  $X_i$  is a vector of variables that determine earnings,  $\varepsilon_i$  is a vector of unobserved characteristics and  $\beta$  are the returns to the characteristics. It is

<sup>26</sup> This section is based on Firpo, Fortin and Lemieux (2007, 2010) and Chi and Li (2008).

assumed that  $E(\varepsilon_i|X) = 0$ . Becker and Chiswick (1966) argue that earnings evidence the returns to innate ability and to the investments in human capital. Moreover, Mincer (1974) clarifies that schooling and the acquisition of experience are the investments in human capital that should be considered in the earnings equations. Besides, he highlights that a quadratic term for experience can be included to account for the fact that investments decrease over time. Thus, schooling, potential experience and potential experience squared are some of the explanatory variables used in this thesis.

It has been argued that other factors can determine the earnings such as marital status, number of children, type of job, firm size, place of residence, family background characteristics and ethnicity (Albrecht, Björklund & Vroman, 2003, De la Rica, Dolado & Llorens, 2008, Ñopo & Gallardo, 2009, Fortin, 2008). According to the available data, ethnicity, marital status and occupational category (whether the person is self – employed or not) are also considered in the model<sup>27</sup>.

Before explaining the decomposition techniques for the case of the quantiles, it is useful to understand the logic of them when average earnings are used. The gender earnings gap is defined in equation (3):

$$Gap = E(X_m) \hat{\beta}_m - E(X_f) \hat{\beta}_f \quad (3)$$

Where m corresponds to males and f to females. A counterfactual situation that reflects that under no discrimination, women should receive the same returns as men to their human capital characteristics can be expressed as  $\beta_m E(X_f)$ . This term is added and subtracted from equation 3.

$$Gap = E(X_m) \hat{\beta}_m - E(X_f) \hat{\beta}_f + \hat{\beta}_m E(X_f) - \hat{\beta}_m E(X_f) \quad (4)$$

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<sup>27</sup> Occupational tenure and age are used instead of potential experience as a robustness check. Marital status is only used in 2012. Mincer (1974) comments on the fact that using age might result on an underestimation of the returns to schooling.

$$Gap = [E(X_m) - E(X_f)] \hat{\beta}_m + [\hat{\beta}_m - \hat{\beta}_f] E(X_f)$$

$$Gap = [\bar{X}_m - \bar{X}_f] \hat{\beta}_m + [\hat{\beta}_m - \hat{\beta}_f] \bar{X}_f \quad (5)$$

Where  $[\bar{X}_m - \bar{X}_f] \hat{\beta}_m$  is the composition effect that measures the differences in the endowments of men and women assuming that both groups have the same returns ( $\hat{\beta}_m$ ) and  $[\hat{\beta}_m - \hat{\beta}_f] \bar{X}_f$  is the wage structure effect that assesses the difference in the returns of men and women given that both groups have the same endowments ( $\bar{X}_f$ ). The generalization of the estimated results to the population can be done since  $[E(W|X)] = E(W)$ .

Firpo, Fortin and Lemieux (2007, 2009) propose a technique to decompose quantiles that can allow the generalization of the results to the population. As they point out the property that holds for the conditional mean and unconditional mean, does not hold for the conditional and unconditional quantiles<sup>28</sup>. For that reason, these authors introduce the concept of the RIF to satisfy this property.

$$IF(W, q_\tau) = \frac{(\tau - \prod\{W \leq q_\tau\})}{f_w(q_\tau)} \quad (6)$$

Equation (6) presents the influence function that captures the influence of an observation on the quantile  $\tau$ .  $\prod\{.\}$  is an indicator function that takes the value of 1 when the observation  $W$  is below  $q_\tau$ ,  $f_w$  is the density function of  $W$  and  $q_\tau$  is the population  $\tau$  quantile of the unconditional distribution of  $W$ .

A RIF is obtained as follows:

$$RIF(W, q_\tau) = q_\tau + IF(W, q_\tau)$$

---

<sup>28</sup> Chi and Li (2008) comment on the fact that it is more interesting to study the effect of an explanatory variable on the population (unconditional quantiles) than the effect of it on a sample with specific characteristics (conditional quantiles).

And it can also be expressed in the following way:

$$RIF(W, q_\tau) = q_\tau + \frac{(\tau - \Pi\{W \leq q_\tau\})}{f_w(q_\tau)} \quad (7)$$

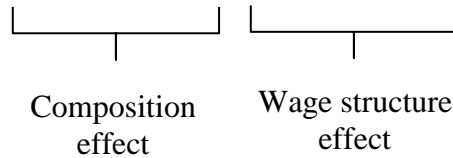
Salardi (2013) mentions that equation (7) is easy to calculate since  $q_\tau$  is the sample quantile,  $f_w(q_\tau)$  is the density function of  $W$  at point  $q_\tau$  and  $\Pi\{W \leq q_\tau\}$  is a dummy variable. Thus, the next step is to estimate the RIF using Ordinary Least Squares as in equation 8:

$$\widehat{RIF}(W, q_\tau) = \hat{\beta}_i X_i \quad (8)$$

Finally, the gender wag gap in a quintile  $\tau$  can be decomposed in a composition and wage structure effect using the estimated coefficients ( $\hat{\beta}_i$ ) in a similar way as it was explained for the gap at the average wages.

$$Gap = \hat{\beta}_m \bar{X}_m - \hat{\beta}_f \bar{X}_f$$

$$Gap = ([\bar{X}_m - \bar{X}_f] \hat{\beta}_m) + ([\hat{\beta}_m - \hat{\beta}_f] \bar{X}_f) \quad (9)$$



### 5.1.1 Limitations of the decomposition methods

In order to decompose the wage differential a counterfactual situation that reflects the absence of discrimination is built (Firpo, Fortin and Lemieux, 2010). Oaxaca (1973) uses the wage structure of one of the groups (i.e. whites or men) as the counterfactual. Using the male wage structure as the counterfactual implies the assumption that women's human capital endowments are undercompensated while using the female wage structure is equal

to make the assumption that male endowments are overcompensated (Oaxaca, 2007). Cotton (1988) demonstrates that the results of the decomposition are sensible to the wage structure that is chosen (the index number problem). As a solution, he argues that the counterfactual should be computed as a linear function of the wage structures of the all the groups, taking into account that none of the groups will receive the same returns if there is no discrimination in the labor market. Fortin (2008) proposes a modification to this method that consists on including two dummy variables one for females ( $F_i$ ) and one for males ( $M_i$ ) to the earnings function:

$$\ln Y_i = \alpha + \beta X_i + \alpha_f F_i + \alpha_m M_i + \varepsilon_i \quad (10)$$

$$s.t. \alpha_f + \alpha_m = 0$$

The coefficient  $\alpha_f$  captures the disadvantage of females while  $\alpha_m$  is the advantage of men in the labor market. Therefore, the RIF regressions are estimated taking into account the present modification.

Furthermore, another limitation of the decomposition techniques is that if there is a problem of omitted variables or a measurement error of the explanatory variables, the discriminatory component will capture the omitted influences (Cotton, 1988). Hence, instead of interpreting the wage structure effect as discrimination, it can be considered as an unexplained gap (Oaxaca, 2007).

Moreover, when categorical variables are included in the decomposition, it is difficult to separate the effect of being a man or a woman with the effect that accounts for the difference with the omitted category in the wage structure effect (Firpo, Fortin & Lemieux, 2010). Thus, the coefficients of the categorical variables can be interpreted as a higher or lower disparity in the returns in comparison with the omitted group (Chin & Li, 2008)

The two final drawbacks of the model deal with sample selection bias and an approximation error. The unobserved factors that determine the participation in the labor

market may influence the earnings function. If this is the case, the estimated coefficients are also affected (Oaxaca, 2007). Corrections for this problem have been proposed to the decomposition at the average levels (Heckman, 1979). However, to date there is not tool that can take into account this problem for RIF regressions due to its recent development. Furthermore, Salardi (2013) comments on the fact that there is a specification error in the decomposition based on RIF regression since the quantiles are a non-linear distribution function that is linearly approximated with the method. Hence, the results obtained in this thesis should be considered as a first approach to explain gender differences in earnings in quantiles.

Next section will proceed as follows. Firstly, decompositions of the gender earnings gap for all the occupations are performed to observe whether there is a glass ceiling or sticky floor effect. Thus, the results obtained in this part are used to support the relevance of the studies which go beyond averages. Secondly, we will examine if occupational segregation has an effect on the gender earnings gap. The crowding hypothesis (Bergmann, 1974) will thus be specified by including a variable that measures the proportion of women in each occupation. A positive sign of this variable is expected; indicating that the higher participation of women, the lower the earnings of them and the higher the differential. Thirdly, the decompositions for female dominated occupations are compared with those that correspond to all the population to observe the changes of the composition and wage structure effects. This can be seen as a robustness check for the changes considering a better counterfactual situation (since the participation of women and men in each female dominated occupation is similar). Finally, the reasons for the rise of the earnings gap in 2012 are explored.



## 6. Empirical Analysis

### 6.1 Gender earnings differential: sticky floors and glass ceiling effects

The differential between the average male wage and the average female wage rises from 7% in 2003 to 12% in 2012. Hence, the first purpose of this thesis is to unmask whether this increase is a common pattern across the earnings distribution.

Figure 4 (Panel A) suggests that there are no differences in earnings across the middle part of the distribution between men and women; however, there is some evidence of sticky floor and glass ceiling effects. Thus, this thesis presents the results of the decompositions of the 10<sup>th</sup> and 90<sup>th</sup> percentiles (although a common practice is to report the decomposition for the 50<sup>th</sup> percentile too). Tables 7 and 8 present the estimations of the earnings equation (Equation 2) for men and women in the 10<sup>th</sup> and 90<sup>th</sup> percentile in 2003 and 2012<sup>29</sup>. The simplest specification is based on a traditional Mincer equation where earnings is a function of schooling, potential experience and potential experience squared (Specification 1). Then, dummy variables for ethnicity, marital status and self-employment are considered (Specification 2). The main reason for using a dummy variable for self-employment is based on Figure 4 (Panel C), where a situation of equality in earnings between employed can be observed, together with sticky floors and glass ceiling effects for self – employed<sup>30</sup>.

The results of the regressions show that even though the majority of the explanatory variables have the expected signs, not all of them are statistically significantly different from zero or have a relevant effect in terms of its magnitude. Moreover, the most important determinants of wages vary depending on the quantile that is examined so that schooling is a key variable at the lower and top end of the distribution while self – employment and potential experience have great effects at the lower and upper part of the distribution, respectively.

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<sup>29</sup> OLS estimations of equation 8.

<sup>30</sup> A robustness check to this specification uses age, age – squared and occupational tenure instead of potential experience and potential experience- squared.

At the 10<sup>th</sup> percentile, one additional year of schooling is associated with an increase of 1.2% of the female wages and 1.1% of the male wages in 2003 and 2.8% of the female wages and 2.2% of the male wages in 2012. The positive association of schooling and earnings is expected according to Becker and Chiswick (1966) and Mincer (1974). There are not pronounced disparities in the returns of schooling at this part of the distribution. Moreover differentials are indeed favorable to women. It is striking to find that being a self – employed or employee makes a difference in the wage level; and the effect is even higher than that of schooling or experience. In 2003, self – employed men or women earned 13% less than employee and in 2012 the disparities increased. Hence wages of self – employed women and men were 42% or 29% less than those of the employee women and men, respectively. This finding evidences that the differences in wages at the bottom of the distribution might not be related with productive endowments (schooling or potential experience) as the human capital theory proposes.

As for the 90<sup>th</sup> percentile, human capital endowments are relevant factors in the wage equation. On the one hand, one more year of education is associated with an increase of 9% in female wages in 2003 and 2012 and of 14% and 12% in male wages in 2003 and 2012. Hence, inequalities regarding the returns to education are remarkable in this part of the distribution. On the other hand, if experience rises in one year, male wages increases in around 3.5% and female wages in 2.1% on average in the two years.

The results are similar when age, age squared and occupational tenure are used. The main difference is that the latter variable has a relevant influence on wages in the 90<sup>th</sup> percentile as it can be seen in the Appendix C (Tables C1 and C2).

**Table 7. Unconditional Quantile Regression (10<sup>th</sup> percentile)**

	2003				2012			
	(1)		(2)		(1)		(2)	
	women	men	women	men	women	men	women	men
Schooling	<b>0.0120***</b> (0.00149)	<b>0.0113***</b> (0.00102)	<b>0.0104***</b> (0.00137)	<b>0.0114***</b> (0.000957)	<b>0.0282***</b> (0.00370)	<b>0.0226***</b> (0.0023)	<b>0.0166***</b> (0.00292)	<b>0.0203***</b> (0.00221)
Potential Experience	-0.00145 (0.00142)	0.00424*** (0.00133)	0.000395 (0.00138)	0.00597*** (0.00127)	0.00442 (0.00334)	0.00781*** (0.00233)	0.00979** (0.00419)	0.0106*** (0.00252)
Potential Experience squared	0.00002 (0.00003)	-0.00008*** (0.0000277)	0.000004 (0.00003)	-0.0001 (0.0000273)	-0.000179** (0.0007)	-0.000184*** (0.00005)	-0.000208** (0.00009)	-0.000183*** (0.00005)
Ethnic minority			-0.0182 (0.0217)	-0.0415** (0.0206)			-0.0427 (0.0577)	-0.100*** (0.0358)
Married							0.0125 (0.0277)	0.0637*** (0.0208)
Self-employed			<b>-0.138***</b> (0.0138)	<b>-0.145***</b> (0.0132)			<b>-0.544***</b> (0.0412)	<b>-0.349***</b> (0.0266)
Constant	0.0423* (0.0256)	0.0502** (0.0219)	0.0796*** (0.0244)	0.0701*** (0.0189)	0.150** (0.0654)	0.336*** (0.0377)	0.387*** (0.0529)	0.383*** (0.0378)
R-squared	0.039	0.024	0.081	0.060	0.050	0.033	0.156	0.098
Observations	5,265	8,736	5,265	8,736	5,827	8,801	5,827	8,801

Bootstrapped Standard errors in parentheses (100 replications)

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Source: Author's calculations

**Table 8. Unconditional Quantile Regression (90<sup>th</sup> percentile)**

	2003				2012			
	(1)		(2)		(1)		(2)	
	women	men	women	men	women	men	women	men
Schooling	<b>0.0870***</b> (0.0111)	<b>0.134***</b> (0.0140)	<b>0.0886***</b> (0.00966)	<b>0.134***</b> (0.0133)	<b>0.0889***</b> (0.00663)	<b>0.111***</b> (0.0103)	<b>0.0879***</b> (0.00705)	<b>0.110***</b> (0.00946)
Potential Experience	<b>0.0267***</b> (0.00733)	<b>0.0457***</b> (0.00726)	<b>0.0256***</b> (0.00630)	<b>0.0449***</b> (0.00635)	<b>0.0165***</b> (0.00287)	<b>0.0242***</b> (0.00418)	<b>0.0163***</b> (0.00345)	<b>0.0202***</b> (0.00408)
Potential Experience squared	-0.000292** (0.000128)	-0.000542*** (0.000114)	-0.000285** (0.000111)	-0.000537*** (0.000108)	-0.00006 (0.0000505)	-0.000178*** (0.0000681)	-0.000414 (0.0000546)	-0.000119* (0.000709)
Ethnic minority			0.0777 (0.0795)	0.0713 (0.0773)			0.110* (0.0594)	0.0311 (0.0392)
Married							0.0454 (0.0319)	0.120*** (0.0321)
Self-employed			0.0904* (0.0512)	0.0699 (0.0519)			-0.0999*** (0.0334)	-0.0494 (0.0494)
Constant	-0.320* (0.182)	-0.965*** (0.238)	-0.359** (0.159)	-0.983*** (0.211)	0.281*** (0.101)	0.0643 (0.156)	0.293*** (0.112)	0.0606 (0.145)
R-squared	0.093	0.135	0.095	0.135	0.132	0.141	0.135	0.144
Observations	5,265	8,736	5,265	8,736	5,827	8,801	5,827	8,801

Bootstrapped Standard errors in parentheses (100 replications)

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Source: Author's calculations

### **6.1.1 Detailed Decomposition Results**

Based on the results of the unconditional quantile regressions, it can be argued that schooling, potential experience and self-employment have a relevant association with wages. Therefore, a decomposition of the gender earnings gap is performed to examine the determinants of it. An advantage of using decomposition based on RIF regressions is that the effects of any covariate on the composition effect and the wage structure effect can be explored (Firpo, Fortin & Lemieux, 2010). Table 9 contains the results of the estimation for the bottom of the distribution (10<sup>th</sup> percentile) and Table 10, for the upper part of it (90<sup>th</sup> percentile). The specification of earnings that is used has schooling, potential experience, ethnicity, marital status and self – employed as the explanatory variables.

The results obtained with regards to the decompositions of the RIF regressions should be considered as a first evidence of the possible problems that drive the difference in earnings between men and women. Furthermore, it is important to notice that it is better to interpret the results as correlations between variables instead of arguing causality. Mainly, due to the fact that there is not a correction for selectivity to participate in the labor market for the decomposition based on RIF regressions.

The differential in earnings at the 10<sup>th</sup> percentile is wider in 2012 than in 2003 and the wage structure effect is the responsible of the gap showing that human capital endowments do not have a major role, at least at this part of the distribution. Indeed, the composition effect is small and in some cases not statistically significantly different from zero. Moreover, the contribution of experience to the wage structure effect is relevant and indicates that men and women with the same level of experience receive different returns (Table 9, Column 1). However, due to the construction of this variable, potential experience has a strong link with age. Thus, when experience is replaced by age, it turns out that is also significant (Table C3 in the Appendix) and shows the disparities of the results of men and women of the same age. Similar results can be observed in Table 4 where the earnings differential is wider for older women. The effect of age can be associated with three explanations: i. it can reflect a higher discrimination faced by older people. ii. it can

evidence that older women accumulate less experience than men because of their career interruptions as Mincer and Polachek (1974) suggests or iii. it can be associated with the deterioration of their skills during the interruptions as Mincer and Ofek (1982) point out. Nevertheless, age as well as potential experience is only statistically significantly different from zero in 2003.

The main contributor to the wage structure in 2012 is the dummy variable for self – employed. Its positive sign is interpreted as women receiving lower returns than men when they are self – employed than when they are employed. Of the total number of working women below the 10<sup>th</sup> percentile, 89.18% are self – employed in 2012. The important participation of women in this sector in 2012 could be a reason of the presence of the sticky Moreover, the participation could be explained based on the theories of taste discrimination or the human capital theories. Self – employment may facilitate the allocation of time of women between household and labor market tasks as Taniguchi (2002) states. Additionally, taste discrimination (Becker, 1971) may entail not only that women receive lower salaries than men but also that they are not hired by employers so that self – employed may be an alternative for them. Self - employment is explored with more detail in subsection 6.3.

Regarding the upper part of the distribution (Table 10), the difference in earnings between men and women is statistically significantly different from zero only in 2012. The composition effect is relevant for determining the difference in earnings; nevertheless, the contribution of the wage structure effect is always higher. Human capital endowments matter in this part of the distribution unlike in the bottom of the distribution. The similar levels of education that men and women have (Table 2) are related with the negative sign of schooling in the composition effect and this means that the reduction of the educational gap contributes to the reduction of the earnings gap. Schooling is not only the most important determinant of the composition effect but also of the wage structure effect so that despite having similar levels of education, women receive lower returns to their schooling. Marital status is another factor that matters in this part of the distribution and the positive sign of the variable in the wage structure effect reflects that there are more discrepancies in the

returns of married people than in those of single people. According to the theory, there might be statistical discrimination against married women if employers believe they have lower productivity than married men (Phelps, 1972) or taste discrimination if they think that hiring married women will be costly due to their career interruptions so that they prefer to hire men (Becker, 1971). Furthermore, this disparity in the returns of married people might also evidence that married women have lower experience than married men due to a different allocation of time between household and market activities (Becker, 1985). The positive sign of experience in the composition effect support the latter fact: at the top end of the distribution, men have more experience than women so that this contributes to the increase in the earnings gap.

After the results obtained in this subsection it can be concluded that looking at averages masks the disparities in earnings in the lower and upper part of the distribution. Besides, the factors that contribute to the presence of a gap vary across the distribution. At the percentile 10, the female/male earnings differential is associated with the wage structure effect and it seems that being self-employed is a key aspect that increases the disparities in the returns in 2012. At the percentile 90, the earnings gap is related with differences in the returns to schooling; nevertheless, the similar educational level of men and women contribute to lower the gap.

In a study for 1998 – 1999, García and Winter (2005) show that the wage structure and composition effect have a similar contribution to the differences between the mean wages of men and women. However, analyzing the role of both components across the contribution, the results of this thesis indicate that the wage structure effect is the main driver of the gender differential. Similarly to Gallardo and Ñopo (2009), this thesis finds an important difference in earnings at the end of the distribution as well as the disparities in the returns to human capital endowments. However, this thesis evidences the increase in the sticky floor effect in 2012 that may be associated with self – employment and also presents the contributions of each explanatory variable to the wage structure and composition effects.

**Table 9. Decomposition of the gender Earnings Gap at the bottom of the Earnings Distribution (10<sup>th</sup> percentile)**

	2003		2012	
	(1)	(2)	(1)	(2)
Raw log wage gap	0.0431*** (0.008)	0.0431*** (0.008)	0.162*** (0.015)	0.162*** (0.016)
Composition effect	-0.00589*** (0.002)	0.00433 (0.003)	-0.00282 (0.007)	0.0211** (0.009)
<i>% of the raw wage gap</i>	<b>-14%</b>	<b>10%</b>	<b>-2%</b>	<b>13%</b>
Wage structure effect	0.0489*** (0.008)	0.0387*** (0.008)	0.165*** (0.015)	0.141*** (0.016)
<i>% of the raw wage gap</i>	<b>113%</b>	<b>90%</b>	<b>102%</b>	<b>87%</b>
<b>Composition effect</b>				
Schooling	-0.00910*** (0.001)	-0.00968*** (0.002)	-0.0187*** (0.003)	-0.0214*** (0.003)
Potential experience	0.00177** (0.0007)	0.00168** (0.0007)	0.000999 (0.001)	0.000697 (0.001)
Ethnic minority	-0.000143 (0.0002)	-0.000137 (0.0002)	-0.000901 (0.001)	-0.000693 (0.0005)
Married			0.0101*** (0.003)	0.00700*** (0.0026)
Self- employed	0.00159 (0.0015)	0.00160 (0.002)	0.00567 (0.004)	0.00708 (0.005)
Femaleness		0.0109*** (0.002)		0.0284*** (0.006)
<b>Wage structure effect</b>				
Schooling	-0.00242 (0.021)	0.000239 (0.021)	0.0411 (0.039)	0.0498 (0.049)
Potential experience	0.0483*** (0.015)	0.0479*** (0.016)	0.0314 (0.042)	0.0287 (0.040)
Ethnic minority	-0.00154 (0.002)	-0.00148 (0.002)	-0.00369 (0.004)	-0.00375 (0.005)
Married			0.0229 (0.018)	0.0233 (0.019)
Self- employed	0.00271 (0.005)	0.00289 (0.005)	0.0713*** (0.014)	0.0675*** (0.016)
Femaleness		0.0249 (0.026)		0.0119 (0.069)
Constant	0.00185 (0.03)	-0.0354 (0.042)	0.00197 (0.062)	-0.0364 (0.091)

Bootstrapped Standard errors in parentheses (100 replications)

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Source: Author's calculations



**Table 10. Decomposition of the Gender Earnings Gap in the upper part of the Earnings Distribution (90<sup>th</sup> percentile)**

	2003		2012	
	(1)	(2)	(1)	(2)
Raw log wage gap	0.0738 (0.049)	0.0738 (0.046)	0.0600* (0.036)	0.0600* (0.031)
Composition effect	-0.0665*** (0.012)	-0.0933*** (0.015)	-0.0746*** (0.012)	-0.134*** (0.019)
<i>% of the raw wage gap</i>	<b>-90%</b>	<b>-126%</b>	<b>-124%</b>	<b>-223%</b>
Wage structure effect	0.140*** (0.048)	0.167*** (0.049)	0.135*** (0.033)	0.194*** (0.037)
<i>% of the raw wage gap</i>	<b>190%</b>	<b>226%</b>	<b>225%</b>	<b>323%</b>
<b>Composition effect</b>				
Schooling	-0.0945*** (0.013)	-0.0930*** (0.013)	-0.102*** (0.012)	-0.0959*** (0.013)
Potential experience	0.0287*** (0.006)	0.0289*** (0.005)	0.0107* (0.006)	0.0107** (0.005)
Ethnic minority	0.000340 (0.0006)	0.000325 (0.001)	0.000600 (0.0005)	0.000574 (0.0005)
Married			0.0146*** (0.004)	0.0157*** (0.004)
Self- employed	-0.000967 (0.001)	-0.000998 (0.001)	0.00111 (0.001)	0.000955 (0.0007)
Femaleness		-0.0286** (0.012)		-0.0662*** (0.012)
<b>Wage structure effect</b>				
Schooling	0.596*** (0.001)	0.551*** (0.147)	0.279** (0.141)	0.234* (0.127)
Potential experience	0.257** (0.111)	0.271*** (0.085)	0.0324 (0.068)	0.0431 (0.066)
Ethnic minority	-0.000140 (0.007)	-0.000636 (0.007)	-0.00596 (0.005)	-0.00634 (0.005)
Married			0.0423* (0.025)	0.0486** (0.025)
Self- employed	-0.00469 (0.026)	-0.00242 (0.021)	0.0189 (0.020)	0.0255 (0.024)
Femaleness		0.215** (0.097)		0.0501 (0.075)
Constant	-0.708*** (0.245)	-0.867*** (0.202)	-0.232 (0.163)	-0.201 (0.190)

Bootstrapped Standard errors in parentheses (100 replications)

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Source: Author's calculations

## **6.2. The link between occupational segregation and the gender earnings gap**

The second purpose of this thesis is to explore the relation between occupational segregation and the gender differential in earnings through the crowding hypothesis. It states that there is a penalty in the returns of women that work in female dominated occupations (Bergmann, 1974). In order to test this idea, a variable of the proportion of women in each occupation is included in the decomposition (femaleness) as it could be seen in Specification 2 of Tables 9 and 10. The variable has a positive sign (in the wage structure effect) that indicates that if men and women work in an occupation with the same female participation, the returns to men are greater than those of women<sup>31</sup>. Nonetheless, it is only statistically significantly different from zero in 2003 at the 90<sup>th</sup> percentile. Even though, this is an indirect way to examine the link between occupational segregation and the gender earnings differential, it provides evidence that the former does not have a significant effect on the latter.

## **6.3 The effects of the composition effect and wage structure effect on the gender wage gap on female dominated occupations**

Exploring if the composition and wage structure effects follow a similar behavior when only female dominated occupations are considered is the third purpose of the thesis. The different distribution of women across the occupations motivates to contrast the decomposition of the earnings gap for all the occupations with that of the female dominated occupations. The main differences that can be observed in Table 11 are the larger glass ceiling effect in 2003 and 2012 for the female dominated occupations. In fact, unlike in all the occupations, the raw earnings gap in the percentile 90 in 2003 is statistically significantly different from zero. Moreover, it is noticeable the major role that plays the wage structure effect in determining the differential in both extremes of the distribution suggesting that in the occupations where women are concentrated the differences in earnings are correlated with the disparities in the returns.

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<sup>31</sup> A similar result is found by Salardi (2013) for Brazil.

**Table 11. Comparisons between the female – dominated occupations and all the occupations**

	10 <sup>th</sup> Percentile				90 <sup>th</sup> Percentile			
	2003		2012		2003		2012	
	All occupations	Female dominated occupations	All occupations	Female dominated occupations	All occupations	Female dominated occupations	All occupations	Female dominated occupations
Raw log wage gap	0.0431*** (0.008)	0.0417*** (0.009)	0.162*** (0.015)	0.162*** (0.018)	0.0738 (0.049)	0.164*** (0.049)	0.0600* (0.036)	0.147*** (0.0373)
Composition effect	-0.00589*** (0.002)	0.00171 (0.002)	-0.00282 (0.007)	0.0314*** (0.009)	-0.0665*** (0.012)	-0.00004 (0.014)	-0.0746*** (0.012)	-0.0161 (0.012)
% of the raw wage gap	<b>-14%</b>	<b>4%</b>	<b>-2%</b>	<b>19%</b>	<b>-90%</b>	<b>0%</b>	<b>-124%</b>	<b>-11%</b>
Wage structure effect	0.0489*** (0.008)	0.0400*** (0.009)	0.165*** (0.015)	0.131*** (0.018)	0.140*** (0.048)	0.164*** (0.047)	0.135*** (0.033)	0.164*** (0.038)
% of the raw wage gap	<b>113%</b>	<b>96%</b>	<b>102%</b>	<b>81%</b>	<b>190%</b>	<b>100%</b>	<b>225%</b>	<b>112%</b>

Bootstrapped Standard errors in parentheses (100 replications)

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Source: Author's calculations

#### **6.4 How can the increase of the gender earnings differential between 2003 and 2012 be explained? The Role of Self – Employment**

An increase of the gender earnings gap between 2003 and 2012 motivates the examination of the reasons that can explain it. Throughout the two years the glass ceiling is similar, but there is a sticky floor effect only in the last year. Previously, it was argued that an important factor that contributes to the sticky floor effect in 2012 is the participation in self-employment. Thus, the purpose of this subsection is to find evidence that links the increase of the sticky floor effect with the self-employment.

A probit model to determine the probability of women to be self-employed is performed based on Equation (11).

$$\Pr(\text{Self – employed}) = F(\text{sex}, \text{age}, \text{education}, \text{region}, \text{ethnicity}) \quad (11)$$

Where self – employed is a dummy variable that takes the value of 1 when the person is self – employed and 0 otherwise. Clark and Drinkwater (1998) comment on the fact that self – employment might be an option for ethnic groups that encounter discrimination in the labor market. However, Taniguchi (2002) argues that this effect is more related with individuals that otherwise would be working in low – paid jobs and indeed, in the top end of the earnings distribution, discrimination may have a different effect on self-employment evidencing a difficulty of minorities to succeed as self – employed. In order to see the effect of ethnicity, a dummy variable that takes the value 1 for minorities is considered in the model. Another factor related to the probability of being self – employed is age since human and financial capital that may be accumulated by old people can facilitate the starting up of a business (Leoni & Falk, 2008). Dummy variables for four of the five age groups are included in the regression (25 – 35, 35 – 45, 45 – 55 and 55 – 65 years old). Puentes, Contreras and Sanhueza (2007) find that not only age is an important variable to determine the likelihood of being self – employed in Chile, but also education, and the likelihood increases for old and less educated people and with few schooling. So as to examine the effect of education, dummy variables for educational levels are included (high school, college and postgraduate). Moreover, two dummy variables for the Regions in Ecuador are specified in the model (Coast and Amazon) to account for regional factors that may affect the likelihood. The strategy that is followed is to estimate the probit model for all the working population, including a dummy variable for sex. After that, it is conducted the model only for working women. The methodological aspects of the probit model are explained in Appendix B and the estimations of it are in Appendix C.

The probability of being self – employed increases in 2.6 percentage points in 2003 and in 3.6 percentage points in 2012<sup>32</sup> for women. This result provides a hint that women are more likely to be self – employed in the latter year. Thus, Equation 11 is estimated again but only for women. Besides the explanatory variables of the model, a dummy variable for having lower earnings than the average is included in the regression since the findings of the decomposition techniques suggest that the sticky floor effect in 2012 might be related with

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<sup>32</sup> These values are the marginal effects of the dummy variable sex that is statistically significantly different from zero at 1% significance level.

self – employed women at the bottom of the distribution. Hence, it is expected to see an increase in the probability for women with earnings below the average.

**Table 12. Marginal Effects on the Probability that a woman becomes a self-employed**

	2003	2012
<b>Age groups</b>		
25 - 35	0.164 (0.000)	0.124 (0.000)
35 - 45	0.263 (0.000)	0.232 (0.000)
45 - 55	0.268 (0.000)	0.269 (0.000)
55 - 65	0.371 (0.000)	0.331 (0.000)
<b>Region</b>		
Coast	0.017 (0.304)	0.089 (0.000)
Amazon	0.0323 (0.319)	-0.0239 (0.444)
<b>Education</b>		
High school	-0.060 (0.005)	-0.020 (0.419)
College	-0.203 (0.000)	-0.210 (0.000)
Postgraduate	-0.404 (0.000)	-0.216 (0.001)
<b>Ethnicity</b>		
Ethnic minority	0.0216 (0.485)	0.0082 (0.78)
<b>Income</b>		
< mean hourly wage	-0.001 (0.98)	0.140 (0.000)
<i>p values in parenthesis</i>		

Source: Author's calculations

According to the marginal effects presented in Table 12, the probabilities of being self – employed increases for older and less educated women. The marginal effects of ethnicity and regions are not statistically significant different from zero<sup>33</sup>. Furthermore, the most remarkable result is that the marginal effect related with the dummy variable of income is only statistically significantly different from zero in 2012 and it suggests that the

<sup>33</sup> Only the marginal effect of living in the Coast Region in 2012 is statistically significant. The probability of being self – employed increases in 8 percentage points for people that live in the Coast.

probability rises in 14 percentage point for women that earn less than the mean hourly wage. A limitation of using a dummy variable to indicate if the woman earns more or less than the average wage is endogeneity. As pointed out by Taniguchi (2002) for the case of ethnicity, it could be the case that women prefer to be self – employed as an alternative of being in a low – paid job. But also women may have a lower income than the average since they are self – employed. Even though the results show correlation between the variables not causation, the changes between 2003 and 2012 are notable and can be used as a first evidence for further research on the topic.

Due to the association between self – employment and the sticky floor effect in 2012, the characteristics of men and women that are below the percentile 10 are described in Table 13. Firstly, the increase of the mean hourly wage at this part of the distribution is higher for men than for women and this fact widens the female/male earnings differential. Secondly, there is a concentration of old people at the bottom of the distribution, especially in 2012, indicating that the sticky floor effect is not associated with constraints that women face at the beginning of their careers as it is suggested by De la Rica, Dolado and Llorens, (2008). Thirdly, there is a change of the distribution of people between occupational categories. The proportion of men and women that work as government and private employees decreases from 2003 to 2012. Furthermore, there is an increase of self – employed people and also a decrease of female domestic employees. The participation of women in the self – employment sector is 89.18% in 2012. Consequently, the findings presented in this subsection can be used as an evidence of the link between the change in the composition of the workforce in the lower end of the distribution and the increase in the gap in 2012.

**Table 13. Characteristics of People below the 10th Percentile**

Characteristics	2003		2012	
	Women	Men	Women	Men
<i>In 2012 US\$</i>				
Wages (2012 US\$)	0.11	0.14	0.37	0.62
<i>Years</i>				
Schooling (years)	9.24	9.22	9.96	9.65
Age	37.39	36.74	43.35	40.82
Tenure	7.223	9.521	7.95	10.49
<i>Job Characteristics(% total population)</i>				
Government employee	1.27	3.44	0.97	0.81
Private employee	16.81	22.54	4.87	17.12
Self - Employed	66.61	58.04	89.18	70.4
Domestic Employee	12.12	0.47	3.51	0.22
Other	3.19	15.51	1.46	11.45

Source: Author's calculations

## 7. Conclusion and Discussion

The bottom line of this thesis is to make evident that studying the gender earnings differential at average levels and aggregate terms may not be accurate in terms of the designing of policies that can improve the laboural conditions of all the individuals. The first question examined in this research was: is the increase of the raw gender earnings gap between 2003 and 2012 a common pattern across the earnings distribution? As a matter of fact, throughout this research, it was shown that the differences between female and male earnings are exacerbated in the upper part of the distribution of earnings in 2003 and in the upper and lower part of it in 2012. Furthermore, the determinants of the gaps at different points of the distribution vary. The results of the decomposition techniques suggest that the composition effect is negative in most of the specifications while the wage structure effect is positive. Hence, the fact that women have better human capital endowments, such as schooling, contributes to the reduction of the gap. At the same time, the wage structure effect acts like a counterforce that widens the differential and indicates that even though women and men have the same productive characteristics, the latter group receives superior returns. Moreover, a detailed decomposition displays a contrast between the reasons behind the presence of an earnings gap for the 10<sup>th</sup> and 90<sup>th</sup> percentile. At the end of the distribution, the contribution of the wage structure effect is more important than that of the composition effect. Moreover, potential experience is a relevant covariate within the structure effect in 2003. However due to its correlation with age, the positive effect of experience may reflect the disparities in the returns of men and women of the same age. According to the human capital theory, the allocation of time between market and household activities and the career interruptions of women during motherhood are related with a lower human capital accumulation (Mincer & Polachek, 1974). Thus, the disparities in the returns among people of the same age might reveal that women accumulate less labour experience than men. Nevertheless, this statement is difficult to confirm due to the lack of a variable for labor experience in the dataset. The effect of age can also be interpreted as old female cohorts having more discrimination than young ones. Exploring this two ideas go beyond the scope of this thesis but should be studied in future research.



Age is a good explanatory variable of the gender gap in 2003. However, in 2012, it turns out that the dummy variable for self – employed is statistically significantly different from zero and its effect is important. Hence, the differences in returns between men and women that are self – employed are above the disparities among the employed. The motivation of considering this variable in the earnings equation is based on Figure 4 (Panel C), where it is evident that gender inequality is a major problem for the self-employment sector.

In the upper part of the earnings distribution, schooling plays a fundamental role. It contributes to the reduction of the gap because women have similar years of education than men. Nevertheless, the disparity in the returns to schooling enlarges the earnings differential. Examining if the glass ceiling effect is a consequence of taste discrimination of employers that give better payments to men is a topic for future research. Besides, it can be explored if the gap at this point of the distribution is originated in the self-employment sector, reflecting the barriers that women may encounter to succeed as entrepreneurs.

Exploring the links between occupational segregation and the gender earnings gap was the second purpose of this research. Using the Duncan Index of Dissimilarity, it was computed that in 2003 and 2012, 56% of women should have switched occupations so as to have complete integration in the labor market. The Index suggests that segregation is relevant in Ecuador. A common but unfortunately indirect way to assess this link is by testing the crowding hypothesis (Bergmann, 1974). Indeed it was found that a variable that accounts for the female participation in each occupation has a positive sign that indicates that the male returns are above female ones when both groups work in occupations with a huge concentration of women. Nevertheless, it is not statistically significantly different from zero (it is only significant at the percentile 90 in 2003). Therefore, this result provides evidence that segregation does not have a relevant association with the differential in earnings.

Moreover, if women tend to have a high participation in some occupations and a low in others, it might be wrong to consider all the male working population as a good counterfactual of the female working population. Consequently, the third question of the thesis was: what are the differences in the decomposition of the gender earnings differential

when only occupations with a relevant female participation are taken into account?. A decomposition of the gender earnings gap of the female dominated occupations was performed to answer it. The results of this decomposition can be seen as a robustness check of the results obtained in the decomposition of all the occupations. The findings show that the glass ceiling in female dominated occupations is higher than that of all the occupations. Moreover, we corroborate that the gap is primarily explained by the wage structure effect in the bottom and top parts of the distribution. For this reason, correcting the results for participation in the labor market would be a way to obtain more accurate estimations from the decomposition techniques, which ought to be taken in future wage gap decompositions.

Finally, the most striking finding of the thesis is the association of female self – employment in the 10<sup>th</sup> percentile of the distribution with the sticky floor effect in 2012. In fact, the increase of the gender earnings gap between 2003 and 2012 may be explained by the role of self – employment. The likelihood of being self – employed increases in 2.6 percentage points in 2003 and in 3.6 points in 2012 for women. Besides, women between 45 and 65 years old and those with low educational levels are more likely to be self-employed. Additionally, in 2012, women with hourly wages below the average wages of the working population have a greater probability to be self – employed. An inspection of some of the characteristics of people below the 10<sup>th</sup> percentile indicates that there is a change in the composition of the occupational categories: a reduction of private, government and domestic employees and an increase of self-employed. The changes are deeper for women such that in 2012, there are 89.18% women in the self-employment sector. Consequently, if the increase of female self – employment is the responsible of the deterioration of the gap in 2012, it is important that policy makers explore what are the reasons of this increase and also propose solutions to guarantee gender equality in this sector. The high participation of women in self – employment may be a result of the household division of labor where women have to marry household with labor market activities (Taniguchi, 2002). Furthermore, it can also be a result of taste discrimination. If employers prefer to hire men as Becker (1971) states, self – employment may be a good alternative for women. Thus, the task of policy makers is to examine which one of the two explanations applies to the Ecuadorian case. Furthermore, Banerjee and Duflo (2011) point

out that the problem with self-employment at the bottom of the distribution is that poor people usually have small business that produce low returns and face credit market constraints. Therefore, as these authors argue, being entrepreneurs may not be a good alternative to escape poverty. Furthermore, according to the results of this thesis, self-employment may also have implications on gender inequality. Finally, policy design focus on achieving equality in earnings between men and women in Ecuador should study the problem starting in the self – employment sector but considering that a policy implemented for one sector might have effects on the other one as Blau and Kahn (2003) suggest.

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## APPENDIXES

### APPENDIX A

#### Description of the Data

**Table A1. Description of Educational Levels and Years of Education**

<b>Educational Level</b>	<b>Description</b>	<b>Years of schooling</b>
None	People that have never attended an educational centre	0
Elementary school	People that have completed at least one year of elementary school or of a literacy center	1 - 7
High school	People that have completed at least one year at high school	8 - 13
Undergraduate studies	People that completed at least one year at college	13 - 18
Postgraduate studies	People with master or doctoral studies	-

**Table A2. Distribution of the Men and Women between Occupations**

	2003			2012		
	Men	Women	Total population	Men	Women	Total population
Service Workers and Shop and Market Sales Workers	16.94	29.1	21.45	17.56	30.51	22.73
Elementary Occupations	21.16	26.91	23.3	18.1	20.4	19.02
Professionals	7.32	10.16	8.38	8.54	16.96	11.9
Clerks	4.36	10.48	6.63	6.93	11.05	8.58
Technicians and Associate Professionals	7.53	12.09	9.22	6.71	9.00	7.62
Craft and Related Trades Workers	22.53	6.35	16.52	21.08	7.20	15.54
Plant and Machine Operators and Assemblers	12.89	1.18	8.54	14.79	1.96	9.67
Legislators, Senior Officials and Managers	2.95	2.8	2.9	1.67	1.66	1.67
Skilled Agricultural and Fishery Workers	3.42	0.88	2.48	3.74	1.26	2.75
Armed Forces	0.89	0.04	0.58	0.87	0.01	0.53
<b>Total</b>	100	100	100	100	100	100

Source: Author's calculations

## APPENDIX B

### METHODOLOGICAL ASPECTS

#### The Duncan Index

Following Duncan and Duncan (1955), the Index of Dissimilarity is computed as the sum of the differences between the relative participation of women and that of men in each occupational category (Equation B1). The relative participation is defined as the ratio of the number of people of a group that works in occupation  $i$  divided by the total number of working people that belongs to the same group.

$$D = \frac{1}{2} \sum_{i=1}^k |f_i - m_i| \quad (B1)$$

$$i = 1, 2, \dots, k$$

$$f_i = \frac{F_i}{F} \quad m_i = \frac{M_i}{M}$$

Where,  $D$  is the Duncan Index,  $k$  is the number of occupations, the subindex  $i$  represents each one of the occupations,  $F_i$  ( $M_i$ ) is the number of women (men) that work in occupation  $i$  and  $F$  ( $M$ ) is the total number of women (men) that have a job<sup>34</sup>.

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<sup>34</sup> The index proposed by Duncan and Duncan (1955) was applied to compute residential segregation between whites and non-whites; nevertheless, it has been employed to measure labor market segregation.

### The Karmel and Maclachlan Index<sup>35</sup>

The number of people working ( $L_i$ ) on the  $i$ th occupation is equal to:

$$L_i = M_i + F_i \quad (B2)$$

The initial proportion of men working is equal to  $a$  and the distribution of people in each occupation that implies perfect integration is  $aL_i$  men and  $(1 - a)L_i$  women. Moreover, if it is assumed that

$$M_i > aL_i$$

$$F_i < (1 - a)L_i$$

Then, it is necessary that  $M_i - aL_i$  men work in an occupation different than occupation  $i$  and  $(1 - a)L_i - F_i$  more females work in occupation  $i$ , thus the total number of people that should change their occupations is:

$$M_i - aL_i + (1 - a)L_i - F_i \quad (B3)$$

After adding up the number of people that is shifting to or from all the occupations, it is possible to obtain an index of occupation segregation (Equation B4).

$$L_i = M_i + F_i$$

$$M_i - a(M_i + F_i) + (1 - a)(M_i + F_i) - F_i$$

$$2M_i - 2aF_i - 2aM_i$$

$$2|(1 - a) M_i - aF_i|$$

The previous equation is divided by 2 as a way to eliminate double counting and finally it is divided by  $L$  to obtain a percent of people that should switch occupations (Karmel & Maclachlan, 1988).

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<sup>35</sup> This methodology is based on (Karmel & Maclachlan, 1988).

$$I_p = \left(\frac{1}{L}\right) \sum |(1-a)M_i - aF_i| \quad (B4)$$

### Decomposition Methods: The role of labor market segregation<sup>36</sup>

The average wage of a group (i.e. females or males) can be written as the weighted sum of the mean wages of the group in each occupation where the weights are the proportion of the group that works in the occupation (Equation B5).

$$\bar{W}_m = \sum_{i=1}^k \theta_i^m w_i^m \quad (B5)$$

$$\bar{W}_f = \sum_{i=1}^k \theta_i^f w_i^f$$

$\bar{W}_m$  ( $\bar{W}_f$ ) is the average wage of men (women) in the labor market,  $\theta_i^m$  ( $\theta_i^f$ ) is the proportion of men (women) working in occupation i and  $w_i^m$  ( $w_i^f$ ) is the mean wage of men (female) in occupation i. Besides  $\theta_i^m$  and  $\theta_i^f$  can be defined in the following way:

$$\theta_i^m = \theta_i s_i^m$$

$$\theta_i^f = \theta_i s_i^f$$

where  $\theta_i$  is the proportion of workers in occupation i and  $s_i^m$  ( $s_i^f$ ) is the ratio of the proportion of men (women) that work in occupation i divided by the proportion of men (women) that work in all the occupations. Thus, the gender wage gap can be computed as in Equation B6.

$$Gap = \sum_{i=1}^k (\theta_i s_i^m w_i^m - \theta_i s_i^f w_i^f) \quad (B6)$$

Adding and subtracting  $\sum_{i=1}^k \theta_i s_i^m \bar{w}_i$  and  $\sum_{i=1}^k \theta_i s_i^f \bar{w}_i$  where  $\bar{w}_i$  is the average wage in occupation i.

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<sup>36</sup> This section is based on Fortin and Huberman (2002)

$$\begin{aligned}
Gap = & \sum_{i=1}^k (\theta_i s_i^m \bar{w}_i) - \sum_{i=1}^k (\theta_i s_i^f \bar{w}_i) + \sum_{i=1}^k (\theta_i s_i^f \bar{w}_i) - \sum_{i=1}^k (\theta_i s_i^m \bar{w}_i) + \sum_{i=1}^k (\theta_i s_i^m w_i^m) \\
& - \sum_{i=1}^k (\theta_i s_i^f w_i^f)
\end{aligned}$$

Finally, equation B7 shows that the gender wage gap can be decomposed in a between occupations component (first term of equation B7) and within occupations component (second term of equation B7).

$$Gap = \sum_{i=1}^k \theta_i \bar{w}_i (s_i^m - s_i^f) + \sum_{i=1}^k [\theta_i s_i^m (w_i^m - \bar{w}_i) - \theta_i s_i^f (w_i^f - \bar{w}_i)] \quad (B7)$$

### The Probit Model<sup>37</sup>

Equation (B8) specifies the probability that the individual is a self – employed given a vector  $X$  of explanatory variables (age, sex, region, education and ethnicity).

$$\Pr(Y = 1|X) = F(\beta_o + \beta_1 X_1 + \cdots + \beta_k X_k) \quad (B8)$$

$F$  is the standard normal cumulative distribution function that guarantees that the probability of being self – employed takes a value between 0 and 1. The effects of the changes of  $x$  on the probability that is estimated can be computed with equation (B9):

$$\frac{\partial p(x)}{\partial x_i} = F(\beta_o + \beta_1 X_1 + \cdots + \beta_k X_k) \beta_i \quad (B9)$$

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<sup>37</sup> This section is based on Wooldridge (2002)

## APPENDIX C

### ROBUSTNESS CHECKS

**Table C1. Unconditional Quantile Regression (10<sup>th</sup> percentile)**

	2003				2012			
	(1)		(2)		(1)		(2)	
	women	men	women	men	women	men	women	men
Schooling	<b>0.0128***</b> (0.00124)	<b>0.0107***</b> (0.000837)	<b>0.00986***</b> (0.00127)	<b>0.00959***</b> (0.000977)	<b>0.0318***</b> (0.00358)	<b>0.0241***</b> (0.00198)	<b>0.0165***</b> (0.00261)	<b>0.0191***</b> (0.00221)
Age	-0.00299 (0.00318)	0.0114*** (0.00305)	0.000957 (0.00294)	0.0139*** (0.00292)	0.00858 (0.00885)	0.0160*** (0.00427)	0.0195** (0.00761)	0.0198*** (0.00397)
Age squared	3.15e-05 (0.00004)	-0.000146*** (0.00004)	-3.56e-06 (0.0000385)	-0.000165*** (0.0003)	-0.000181 (0.000114)	-0.000219*** (0.0000528)	-0.000258*** (0.0000946)	-0.000235*** (0.000048)
Tenure	-0.000210 (0.000708)	5.44e-05 (0.000511)	-0.000272 (0.000852)	0.000417 (0.000491)	0.00509*** (0.00170)	0.00112 (0.00119)	0.00354** (0.00164)	0.00214* (0.00120)
Ethnic minority			-0.0181 (0.0222)	-0.0401* (0.0205)			-0.0420 (0.0477)	-0.0970*** (0.0371)
Married							0.0139 (0.0278)	0.0630*** (0.0178)
Self-employed			<b>-0.138***</b> (0.0135)	<b>-0.147***</b> (0.0119)			<b>-0.543***</b> (0.0418)	<b>-0.353***</b> (0.0251)
Constant	0.0774 (0.0581)	-0.107** (0.0539)	0.0689 (0.0554)	-0.112** (0.0507)	0.0103 (0.176)	0.0980 (0.0880)	0.106 (0.146)	0.114 (0.0825)
R-squared	0.039	0.026	0.081	0.062	0.052	0.033	0.156	0.098
Observations	5,265	8,736	5,265	8,736	5,827	8,801	5,827	8,801

Bootstrapped Standard errors in parentheses (100 replications)

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Source: Author's calculations



**Table C2. Unconditional Quantile Regression (90<sup>th</sup> percentile)**

	2003				2012			
	(1)		(2)		(1)		(2)	
	women	men	women	men	women	men	women	men
Schooling	<b>0.0728***</b> (0.00855)	<b>0.117***</b> (0.0145)	<b>0.0753***</b> (0.00976)	<b>0.117***</b> (0.0122)	<b>0.0733***</b> (0.00691)	<b>0.0980***</b> (0.00885)	<b>0.0719***</b> (0.00557)	<b>0.0981***</b> (0.00812)
Age	<b>0.0243**</b> (0.0104)	<b>0.0291***</b> (0.00950)	<b>0.0221**</b> (0.0112)	<b>0.0281***</b> (0.0101)	<b>0.00598</b> (0.00676)	<b>0.0185**</b> (0.00842)	<b>0.00544</b> (0.00726)	<b>0.0119</b> (0.00729)
Age squared	-0.000169 (0.000136)	-0.000161 (0.000122)	-0.000151 (0.000146)	-0.000154 (0.000133)	2.30e-05 (8.51e-05)	-9.50e-05 (0.000107)	3.84e-05 (9.12e-05)	-2.58e-05 (9.29e-05)
Tenure	<b>0.00558</b> (0.00344)	<b>0.00853***</b> (0.00315)	<b>0.00562*</b> (0.00299)	<b>0.00841***</b> (0.00316)	<b>0.0137***</b> (0.00200)	<b>0.0103***</b> (0.00196)	<b>0.0132***</b> (0.00248)	<b>0.0102***</b> (0.00198)
Ethnic minority			0.0773 (0.0892)	0.0783 (0.0737)			0.0927* (0.0552)	0.0301 (0.0369)
Married							0.0475 (0.0316)	0.126*** (0.0337)
Self-employed			0.0925* (0.0538)	0.0659 (0.0493)			-0.0859** (0.0347)	-0.0581 (0.0514)
Constant	-0.472** (0.237)	-1.062*** (0.297)	-0.486* (0.248)	-1.073*** (0.278)	0.416*** (0.158)	-0.0294 (0.200)	0.435*** (0.158)	0.0511 (0.161)
R-squared	0.093	0.133	0.095	0.133	0.144	0.145	0.147	0.148
Observations	5,265	8,736	5,265	8,736	5,827	8,801	5,827	8,801

Bootstrapped Standard errors in parentheses (100 replications)

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Source: Author's calculations

**Table C3. Decomposition in the bottom of the Earnings Distribution (10<sup>th</sup> percentile)**

	2003		2012	
	(1)	(2)	(1)	(2)
Raw log wage gap	0.0431*** (0.008)	0.0431*** (0.009)	0.162*** (0.017)	0.162*** (0.016)
Composition effect	-0.00661*** (0.002)	0.00327 (0.003)	-0.00297 (0.006)	0.0214*** (0.008)
<i>% of the raw wage gap</i>	<b>-15%</b>	<b>8%</b>	<b>-2%</b>	<b>13%</b>
Wage structure effect	0.0497*** (0.008)	0.0398*** (0.009)	0.165*** (0.018)	0.141*** (0.016)
<i>% of the raw wage gap</i>	<b>115%</b>	<b>92%</b>	<b>102%</b>	<b>87%</b>
<b>Composition effect</b>				
Schooling	-0.00792*** (0.001)	-0.00854*** (0.001)	-0.0176*** (0.0024)	-0.0202*** (0.0028)
Age	-0.000635 (0.0006)	-0.000568 (0.0007)	-0.00393*** (0.0012)	-0.00377*** (0.0012)
Tenure	0.000479 (0.001)	0.000167 (0.001)	0.00369** (0.0018)	0.00483*** (0.0014)
Ethnic minority	-0.000137 (0.0002)	-0.000132 (0.0002)	-0.000873* (0.0005)	-0.000675 (0.0005)
Married			0.0100*** (0.002)	0.00673** (0.0028)
Self- employed	0.00160 (0.001)	0.00161 (0.002)	0.00573 (0.005)	0.00711 (0.005)
Femaleness		0.0107*** (0.003)		0.0274*** (0.006)
<b>Wage structure effect</b>				
Schooling	-0.0159 (0.018)	-0.0140 (0.018)	0.0269 (0.048)	0.0350 (0.044)
Age	0.220*** (0.068)	0.218*** (0.077)	0.0410 (0.183)	0.0293 (0.152)
Tenure	0.00531 (0.006)	0.00542 (0.009)	-0.0114 (0.018)	-0.0130 (0.016)
Ethnic minority	-0.00146 (0.002)	-0.00140 (0.002)	-0.00354 (0.005)	-0.00362 (0.004)
Married			0.0220 (0.019)	0.0225 (0.017)
Self- employed	0.00225 (0.006)	0.00251 (0.007)	0.0697*** (0.016)	0.0662*** (0.017)
Femaleness		0.0266 (0.024)		0.0106 (0.057)
Constant	-0.161** (0.071)	-0.197** (0.087)	0.0204 (0.1900)	-0.00625 (0.154)

Bootstrapped Standard errors in parentheses (100 replications)

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Source: Author's calculations

**Table C4. Decomposition in the upper part of the Earnings Distribution (90<sup>th</sup> percentile)**

	2003		2012	
	(1)	(2)	(1)	(2)
Raw log wage gap	0.0431*** (0.008)	0.0431*** (0.009)	0.162*** (0.017)	0.162*** (0.016)
Composition effect	-0.00661*** (0.002)	0.00327 (0.003)	-0.00297 (0.006)	0.0214*** (0.008)
<i>% of the raw wage gap</i>	<b>-15%</b>	<b>8%</b>	<b>-2%</b>	<b>13%</b>
Wage structure effect	0.0497*** (0.008)	0.0398*** (0.009)	0.165*** (0.018)	0.141*** (0.016)
<i>% of the raw wage gap</i>	<b>115%</b>	<b>92%</b>	<b>102%</b>	<b>87%</b>
<b>Composition effect</b>				
Schooling	-0.00792*** (0.001)	-0.00854*** (0.001)	-0.0176*** (0.0024)	-0.0202*** (0.0028)
Age	-0.000635 (0.0006)	-0.000568 (0.0007)	-0.00393*** (0.0012)	-0.00377*** (0.0012)
Tenure	0.000479 (0.001)	0.000167 (0.001)	0.00369** (0.0018)	0.00483*** (0.0014)
Ethnic minority	-0.000137 (0.0002)	-0.000132 (0.0002)	-0.000873* (0.0005)	-0.000675 (0.0005)
Married			0.0100*** (0.002)	0.00673** (0.0028)
Self- employed	0.00160 (0.001)	0.00161 (0.002)	0.00573 (0.005)	0.00711 (0.005)
Femaleness		0.0107*** (0.003)		0.0274*** (0.006)
<b>Wage structure effect</b>				
Schooling	-0.0159 (0.018)	-0.0140 (0.018)	0.0269 (0.048)	0.0350 (0.044)
Age	0.220*** (0.068)	0.218*** (0.077)	0.0410 (0.183)	0.0293 (0.152)
Tenure	0.00531 (0.006)	0.00542 (0.009)	-0.0114 (0.018)	-0.0130 (0.016)
Ethnic minority	-0.00146 (0.002)	-0.00140 (0.002)	-0.00354 (0.005)	-0.00362 (0.004)
Married			0.0220 (0.019)	0.0225 (0.017)
Self- employed	0.00225 (0.006)	0.00251 (0.007)	0.0697*** (0.016)	0.0662*** (0.017)
Femaleness		0.0266 (0.024)		0.0106 (0.057)
Constant	-0.161** (0.071)	-0.197** (0.087)	0.0204 (0.1900)	-0.00625 (0.154)

Bootstrapped Standard errors in parentheses (100 replications)

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Source: Author's calculations

**Table C5. Probability of Being Self-Employed**

	<b>2003</b>	<b>2012</b>
women	0.0778** (0.0304)	0.108*** (0.0335)
25 - 35	0.475*** (0.0441)	0.444*** (0.0556)
35 - 45	0.750*** (0.0447)	0.833*** (0.0555)
45 - 55	0.841*** (0.0489)	1.039*** (0.0568)
55 - 65	0.998*** (0.0613)	1.171*** (0.0617)
Coast	0.0539* (0.0299)	0.203*** (0.0329)
Amazon	-0.0607 (0.0610)	-0.116* (0.0663)
high school	-0.0482 (0.0343)	-0.0355 (0.0403)
college	-0.356*** (0.0408)	-0.519*** (0.0440)
postgraduate	-0.732*** (0.168)	-0.806*** (0.154)
ethnic minority	0.113** (0.0550)	0.0163 (0.0545)
Constant	-0.967*** (0.0453)	-1.109*** (0.0568)
Pseudo R squared	0.06	0.09
Wald chi squared	561.32	790.04
Prob > chi squared	0.000	0.000
Observations	14,001	14,628

*Robust standard errors in parentheses*

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Source: Author's calculations

**Table C6. Probability of Being Self-Employed for Women**

	<b>2003</b>	<b>2012</b>
25 - 35	0.568*** (0.0743)	0.456*** (0.0939)
35 - 45	0.843*** (0.0746)	0.781*** (0.0934)
45 - 55	0.855*** (0.0832)	0.885*** (0.0970)
55 - 65	1.127*** (0.110)	1.057*** (0.107)
Coast	0.0515 (0.0501)	0.276*** (0.0537)
Amazon	0.0972 (0.0964)	-0.0797 (0.106)
high school	-0.166*** (0.0589)	-0.0559 (0.0691)
college	-0.610*** (0.0704)	-0.638*** (0.0789)
postgraduate	-1.928*** (0.293)	-0.662*** (0.228)
ethnic minority	0.0649 (0.0919)	0.0255 (0.0910)
< mean hourly wage	-0.00166 (0.0677)	0.442*** (0.0702)
Constant	-0.819*** (0.101)	-1.268*** (0.122)
Pseudo R squared	0.0869	0.1296
Wald chi squared	300.04	379.8
Prob > chi squared	0.000	0.000
Observations	5,265	5,827

*Robust standard errors in parentheses*

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Source: Author's calculations