Essays in Female Labor Supply in Ecuador

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Abstract

This is a solo-authored dissertation that contains three papers that each examines a specific aspect of labor supply in the Ecuadorian labor market between 2007 and 2017. The chapters of this dissertation all use data from the National Survey of Employment, Unemployment, and Underemployment, in Spanish *Encuesta Nacional de Empleo, Desempleo y Subempleo* (ENEMDU) to empirically examine labor supply in the Ecuadorian labor market, specifically female labor supply.

The first chapter analyzes the impact on labor supply of the last increment of the cash transfer under the Human Development Credit (BDH) program in Ecuador. This study employs a difference-in-differences approach, comparing poor households that receive the transfer with poor households that are not part of the program. Empirical results reveal that households that are part of the program, on average, increased their labor supply by 2.5 hours at the intensive margin and by 7.23 percentage points at the extensive margin. More importantly, results reveal that women increased their labor supply at the intensive and extensive margin by 1.65 hours, and by 5.63 percentage points respectively, while results for men are not statistically significant.

The second chapter explores married women's labor supply elasticities in Ecuador between 2007 and 2017. Specifically, the focus of this chapter is to examine how married women's hours of work respond to their income from labor, and non-labor income. Overall, empirical results suggest that between 2007 and 2017, hours wage elasticities increased, whereas hours non-labor income elasticities and participation non-labor income elasticities appear to had a minimum increment.

The third chapter adds to the second by analyzing the labor supply responses of single women in Ecuador between 2007 and 2017. Like in the second chapter, this chapter examines how single women's hours of work respond to their income from labor and non-labor income on the intensive and extensive margin. Empirical results show that during the last decade, the labor supply responsiveness of single women in Ecuador has remained relatively constant.

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Contents

List of Figures

List of Tables

Chapter 1

(Un)Conditional Cash Transfer Programs and Labor Supply: Evidence From Ecuador

1.1 Introduction

Several developing countries implement policies to lift their citizens out of poverty. One such policy, which countries have applied throughout the developing world, is conditional monetary transfers. The conditions that governments usually apply focus on the improvement of health and child education. In this sense, the policy could alleviate current poverty and incentivize the development of human capital so poverty can further decline in the long run.

Experts hold mixed views about the effectiveness of these policies. Some may view them as a populist mechanism to buy votes or increase the government popularity among the poor, and at the same time, encouraging them to work fewer hours. Others see transfer programs as a valid instrument to increase the welfare of those in need.

Several investigations assess the effect of these policies in alleviating poverty and improving conditions of its recipients in several developing nations. Asfaw et al. (2014); Banerjee et al. (2016); Parker and Todd (2017); Dessing (2002). A significant proportion of this literature focuses on measuring this impact in the labor market, specifically the effect of conditional and unconditional transfers on labor supply.[1] Although there is a generalized idea that conditional cash transfer programs give an incentive to the beneficiaries to work fewer hours, these studies have obtained

[1] For effects on labor supply in Brazil, see Ribas and Veras-Soares (2011); Foguel and Paes-Barros (2010); Firpo et. al. (2014); Calvacanti and Correa (2010). For the case of Mexico, see Parker and Todd (2017); Parker and Skoufias (2000). For the cases of Colombia, Uruguay and Peru, see Galama, et al. (2017); Amarante and Vigorito (2010); Fernandez and Saldarriaga (2014); respectively.

mixed results.

Previous research finds that, in the case of Ecuador, the conditional cash transfer program *Human Development Credit*, in Spanish *Bono de Desarrollo Humano* (BDH), increased the welfare of its recipients. For instance, the BDH program reduced child labor (Edmonds and Schady, 2012), increased rural households' expenditure on food (Schady and Rosero, 2008), improved school enrollment (Schady and Araujo, 2013; Oosterbek and Ponce, 2008), increased cognitive development and achievement of children (Paxson and Schady, 2012; Ponce and Bedi, 2010), improved children's health (Paxson and Schady, 2010), improved language skills, height by age, and hemoglobin concentration of young children (Fernald and Hidrobo, 2011), reduced anemia (Schady, 2012) and, in some cases, it reduced domestic violence (Hidrobo and Fernald, 2013). The majority of these studies evaluate the BDH program, focusing on the randomized roll-out of the BDH program between October 2003 and September 2004.

Nonetheless, studies do not examine two aspects as extensively as the ones mentioned above: (1) The effect of the BDH program on the labor supply decision of its recipients, and (2) the effect of the increments of the cash transfer on its beneficiaries.

Regarding labor supply, Gonzalez-Rozada and Llerena Pinto (2011) found that: (1) Mothers and workers living in households that are beneficiaries of the BDH program experience a longer duration in unemployment than the comparable group of workers that are not beneficiaries of the program; (2) the BDH program does not incentivize its beneficiaries (mothers and workers living in a household that receives the BDH transfer) to work in informal jobs, on the contrary, it seems that the BDH transfer financed the search process of formal jobs between 2005 and 2006, and (3) The BDH program increases the probability of separation for mothers that are beneficiaries of the program compared to mothers that do not receive the BDH transfer.

Moreover, Mideros and O'Donoghue (2014), find that in 2012 the BDH program had non-negative effects on household heads' labor supply, limited to a certain transfer level. Additionally, they find positive effects that are related to the notion that beneficiaries may be using the BDH transfer to solve liquidity constraints and pay transactional costs.

It is important to note that the amount of the BDH transfer changed since its beginning. In 2007 the transfer increased from 15 to 30 USD, then in 2009 the transfer increased from 30 to 35 USD, and in 2013, it increased to 50 USD. In this sense, no previous literature evaluates the increments of the amount transferred to the recipients of the BDH program in terms of labor supply decisions or recipients socio-demographic characteristics.

This investigation attempts to fill the gap in the literature by exploring the effect of the last increment of the BDH cash transfer on labor supply of poor individuals. This exploration examines how the last addition in the amount of the transfer in 2013 affected labor supply of the poorest households that received the transfer, compared with households with the same level of income who did not receive the transfer. This study uses a difference-in-differences approach, with controls for the number of household members, number of children, years of schooling, age, labor income, non-labor income, and the unemployment rate at the zone of residence.

The overall results reveal that, on average, households that are part of the program increased their labor supply by 2.5 hours after the cash transfer increased, with women increasing their labor supply by 1.65 hours. Regarding the extensive margin, beneficiaries on average increased their labor force participation by 7.23 percentage points and beneficiary women increasing by 5.63 percentage points.

The rest of this study is organized as follows. Section 2, presents a literature review of the effect of conditional and unconditional cash transfer programs on labor supply. Section 3, describes the BDH program. Section 4 presents a theoretical framework of income effects on the poor. Section 5 outlines the data used in this research. Section 6, contains the empirical methods and the regression results. Section 7 presents a robustness analysis using a different estimation method. Section 8 presents a discussion of the results obtained and its relationship with the income effect of the poor. And finally, Section 9 concludes.

1.2 Literature review

This study contributes and draws on the literature that investigates the impact of cash transfer programs (conditional and unconditional) on labor supply. These investigations show mixed results in different countries around the world. In the case of Brazil, the program *Bolsa Família* increased the participation of households' main source of labor income in the formal sector in metropolitan areas (Ribas and Veras-Soares, 2011). Also, regarding participation rate and the mean number of hours worked of men and women, the effects of the program are not significant (Foguel and Paes Barros, 2010). On the other hand, there is evidence that the size of the transfer has a negative effect on the employment rate and an undetermined effect on the unemployment rate (Calvacanti and Correa, 2010). Also, there is suggestive evidence that beneficiaries of the program manipulate their income by voluntarily reducing their labor supply in order to remain eligible. More importantly, the effect is large among women, especially single and divorced mothers (Firpo et al., 2014).

For the case of Mexico, the effects on labor supply of the *Progresa* program, later known as *Oportunidades*, are ambiguous and are derived by the income and cross-substitution effect of school subsidies, but the program does not generate strong disincentives for working in the short run (Parker and Todd, 2017). Also, the program did not reduce labor-market participation rates (Parker and Skoufias, 2000). Moreover, overall total household hours that women devote to child care increase and overall woman's leisure time is unaffected by the program (Parker and Skoufias, 2012).

In the case of Colombia, the conditional cash transfer program, *Familias en Acción Urbano*, increased income, consumption, and formal employment participation of the household head and partner (Galama et al., 2017). Meanwhile, in Peru, recipients of the conditional cash transfer *Juntos* reduce their labor supply by 6-10 hours in the week following the day they receive the transfer, with a larger effect for married women and mothers with young children (Fernández and Saldarriaga, 2014). In Uruguay, there is weak evidence that the conditional cash transfer program PANES has a positive effect on the probability of obtaining a job for participants (Amarante and Vigorito, 2010). In Kenya, the cash transfer program gave more flexibility to families in terms of

labor supply decisions (Asfaw et al., 2014). In Honduras, Indonesia, Morocco, Nicaragua, and the Philippines, cash transfer programs have no impacts on neither the propensity to work nor the overall number of hours worked, for either men or women (Banerjee et al., 2016).

This paper also contributes to the scarce literature of the relationship between the BDH program and labor supply. There have been no investigations that estimate the effect of increments of the BDH transfer in 2007, 2009 and 2013 with respect to labor supply. The investigations related to the BDH program and labor supply found that the program does not have distortive effects on the probability of finding an informal job for household heads who received the transfer during 2005 and 2006 (Gonzalez-Rozada and Llerena Pinto, 2011). It has also been found that the program, does not produce labor disincentives, but may be paying for housework and childcare provided by partners and single adults (Mideros and O'Donoghue, 2014).

Finally, this investigation also contributes to the literature on income and substitution effects that cash transfer programs may have in the labor supply. In the theoretical sense, considering a two-period model which includes the decision on amounts of schooling, leisure, and work, and also, assuming that leisure and consumption are normal goods. Conditional cash transfer programs may affect the time use of adults in the household, and the effects may differ compared to an unconditional cash transfer program. This is because an unconditional cash transfer program represents a pure income effect, which is expected to increase the consumption of leisure and reduce their time working (Parker and Todd, 2017).

On the other hand, seems that the poor may behave in a different way to pure income effects, as it is predicted by the canonical labor supply model. Specifically, the poor appear to work more as wages fall, in order to maintain income constant as they face a subsistence constraint. The result is a backward S-shaped labor supply schedule (Dessing, 2002). This hypothesis is tested empirically with information from the Laguna province in the Philippines, where the labor supply response of poor women becomes positive when work incentives increase sufficiently (Dessing, 2002). As is pointed out by Subramanian and Deaton (1996), who find similar results for the case of India, there exists empirical evidence that the labor market in developing countries does not behave according

to the predictions of the theory.

The approach in this paper is different as first, a different country is analyzed. The assessment is conducted on the fact that there is an increment on the amount transferred, not the program by itself, and also considers the different labor supply decisions that women and men may have. Among the studies mentioned above, no other paper examines the effect of the increment of the BDH program, nor the effect on labor supply decisions of poor women and men separately.

1.3 The BDH program in Ecuador

In September 1998, the program *Bono de Solidaridad* was created to compensate, through a monetary transfer, people with scarce resources. It replaced gas, electricity and gasoline subsidies. In this sense, as is referred by Oosterbek and Ponce (2008), the program was not created as a poverty alleviation policy, but as a mechanism to compensate for the welfare loss due to the suppression of these subsidies. Nevertheless, since the economic crisis that the country had in 1999, this program became one of the main mechanisms to help poor families.

In April 2003, with the objective to improve the quality of this social investment, the program *Bono Solidario* became the program *Bono de Desarrollo Humano* (BDH), intended to alleviate poverty and also to increase the responsibility and participation of parents with scarce resources in their children's health and education.

The BDH transfer is conditioned on schooling and health of the children. In terms of schooling, the requirements are that children between the ages of 6-16 years, have to be enrolled in school and show attendance rates of at least 80% for each schooling year they are under the BDH program.[2] In terms of health, the BDH beneficiaries have to take their children with ages 0-1 to a health center every two months for checkups. Meanwhile, children ages 1-5 need to have their checkups at a health center every six months. In these checkups, a specialist administers the necessary vaccines and also monitors the children's weight and height to detect any signs of malnutrition. Despite

[2] Children in indigenous schools are required only a 70% attendance rate, in order to allow for household seasonal migration in relation to the agricultural cycle.

having all these conditions there was no verification method to ensure that children attend school and health control checks.

1.3.1 Selection of beneficiaries

In order to select the beneficiaries, the government conducts the survey *Registro Social* in locations with the highest poverty rates due to Unsatisfied Basic Needs (UBN). This survey contains questions that are focused on knowing the living conditions of the potential beneficiaries. In this sense, the questions are related to housing, access to basic services, education, and household composition. Based on the responses to these questions, the government constructs a classification index, called the Selben index, to determine which households qualify to be part of the BDH program. Those households that are part of the first and second quintile of greater poverty according to the Selben index, become beneficiaries of the BDH transfer. This survey has been carried out in 2003, 2008 and the last time in 2013.[3]

The monetary transfer of the BDH program consisted of 15 USD per month. The person who receives the transfer is a representative of the household, preferably a woman that is the household head or partner of the household head.

In this sense, the only requirement needed to become a beneficiary of the BDH program is to be registered as part of the first and second quintile of the *Registro Social* (Schady and Rosero, 2008; Fernald and Hidrobo, 2011).

Over time the program included more beneficiaries identified as vulnerable. In 2006, the government created a sub-program of the BDH, *Pensión Asistencial*, to include people with disabilities over 40% and the elderly (65-year-old and older) in poverty conditions. These last beneficiaries did not have to meet any requirement to receive the transfer.

Between 2012 and 2013, the *Ministerio de Inclusión Económica y Social* (MIES), which is in charge of the BDH program, updated the *Registro Social* database in order to exclude those

[3] Before 2003, there was no technical selection of beneficiaries, nor an appropriate verification of the conditions required. It is estimated that in 1999, 30% of the beneficiaries were not poor.

beneficiaries that were not fulfilling the conditions established in the program. This ministry cross-referenced the beneficiaries' information with databases of other public institutions, such as the ones in charge of public health, public education and social security. By doing so, they could check the structure of the beneficiaries' household, if each semester the beneficiaries enrolled their children in a public school and if they took their children to a health center of the public network.

As can be seen in Figure 1 and Figure 2, between 2013 and 2014, this process led to an average reduction of 11.87% of the number of beneficiaries, in urban and rural areas. Nonetheless, most of the beneficiaries that were excluded in this process were working for the government, others were no longer poor, others were dead and others were no longer living in the country.

Table 1 shows how much the BDH transfer represented on monthly average income of households that received the transfer and on those that did not across rural and urban areas. Figure 3 and Figure 4, on the other hand, show the evolution of the average monthly income of households in rural and urban areas that received the transfer and those who were not part of the BDH program.

From this, it can be seen that the BDH transfer has a different impact on households depending on the area where they lie and, on the fact that they are beneficiaries or not. The BDH transfer seems to have a higher impact for households that lie in rural areas than those in urban areas.

It is important to mention that there is no public access to the *Registro Social* databases and that the survey does not have a measure of labor supply. In this sense, despite that the program defined comparable treatment and control groups, labor supply cannot be measured from these databases. And, on the other hand, the publicly available databases can only identify if an individual is a beneficiary of the BDH program.

1.3.2 Increments of the amount transferred

Throughout 2003-2017, the BDH program had three reforms regarding the amount of money transferred. The first occurred on January 25, 2007, where the transfer increased from 15 to 30 USD. The second took place on July 20, 2009, where the transfer increased to 35 USD. Finally, on

January 14, 2013, the transfer increased to 50 USD.[4]

The documents signed by the executive that authorize these changes do not mention any study that justifies the need of an increment nor the reason to raise the transfer in such magnitudes.[5] Nonetheless, it is important to note that these changes occurred before a presidential election, as it can be seen in Figure 5.

This study focuses on the last increment that happened in 2013. Presidential elections took place on February 17, 2013. During the campaign, in May 2012, Lucio Gutiérrez, candidate of the PSP party, announced that if winning his government will increase the BDH transfer from 35 USD to 50 USD. Gutiérrez did not specify how this increment will be financed. In response, Guillermo Lasso, the candidate from the CREO party, offered the same change. However, Lasso specified that this increment will be financed by reducing the government's expenditure on propaganda. Weeks after this announcement, president Rafael Correa, who was also a candidate in those elections from the PAIS party, announced that if winning the elections, his government will also increase the transfer in January 2013 and that the increment will be financed by taxing profits of banks.

Later on, Gutiérrez announced that if winning his government will increase the transfer to 80 USD, and later on, to 65 USD without announcing how this will be financed.

On November 20, 2012, the Ecuadorian Congress, which at the time had a majority of the president's party, approved the law to tax bank profits and that will permit the increment of the BDH transfer to 50 USD. In January 2013, the president signed the decree that increased the BDH transfer and on May 24, 2013, Correa is re-elected as president.

Finally, the candidate that ultimately won the last elections, which took place on February 18, 2014, offered to increase the BDH transfer from 50 USD to 150 USD.

[4] Since the year 2000, Ecuador has used the United States Dollar as legal tender. Because of this, there exists a low risk of inflation. Since then, Ecuador has reached historic low levels of inflation and one of the lowest inflation rates in the region. On the other hand, in 2013 the Purchase Power Parity conversion rate for Ecuador was 0.55 USD.

[5] Executive Decree No. 12 of January 17, 2007; Executive Decree No. 1838 of July 20, 2009, and Executive Decree No. 1395 of January 2, 2013.

1.4 Theoretical framework

According to the prediction of the canonical labor supply model, any variation in non-labor income will have a direct effect on labor supply. In this context, an increment of non-labor income will cause a pure income effect, which will lead the individual to work less and consume more. This result depends on the assumption that leisure is a normal good and that individuals are free to choose any amount of hours to work.

In this sense, Mideros and O'Donaghue (2015) present a detailed explanation of the effect of an increment of non-labor income for the poor. This model has two assumptions that characterize the reality of the poor. (1) Assumes that there exists a subsistence level of consumption. That is, if individuals consume below this level, then they obtain no utility. And, (2) limited access and opportunities in the labor market, stemming from labor demand limitations, transactional costs and opportunity costs.

In this sense, Figure 6 presents a graphical explanation, under these assumptions, of the labor supply responses of the poor to an increment in their non-labor income. Panel a) shows the notion of assuming a minimum level of consumption. Line AB shows the budget constraint of an individual that cannot afford the subsistence level of consumption and could not maximize its utility. If the increment of the cash transfer is large enough to shift the budget constraint to DE, then the time allocation of this individual will be a corner solution at point F.

On the other hand panels b) and c) show the possible effect of frictions that the poor may face in the labor market. Panel b) presents the case where an individual may not be able to work beyond L^1 given transactional or opportunity costs. In this sense, the budget constraints limits to AB. There are two cases to consider, one where the increment of the cash transfer is not sufficient to afford the minimum level of consumption and the individual will increase its consumption from A to D. On the other hand, as is shown in panel c), if the increment of the cash transfer is large enough to shift the budget constraint to DE, the individual may be able to pay for the transactional and opportunity costs, and reach the subsistence level of consumption by working more. Once the minimum level of consumption is reached, the static labor supply model will behave in the same

manner as the canonical model.

Hence, it could be expected that an increment of non-labor income may produce only non-negative effects on the labor supply of extremely poor individuals. This goes along results found in previous investigations like Rosenzweig (1998), Subramanian and Deaton (1996), and Dessing (2002).

1.5 Data

This research uses data from the *National Survey of Employment, Unemployment, and Underemployment*, in Spanish *Encuesta Nacional de Empleo, Desempleo y Subempleo* (ENEMDU), which is a quarterly survey conducted by the *Instituto Nacional de Estadísticas y Censos* (INEC) that tracks the evolution of the Ecuadorian labor market, income and general characteristics of the population.

This is a cross-section survey conducted quarterly on urban households. Nonetheless, on the second and fourth quarter, it also includes information from rural households.[6] Therefore, only the June and December surveys are nationally representative. Data is available from June 2007 to March 2019. Nevertheless, this investigation uses December surveys from 2010 to 2016.

Following the recommendations of the International Labor Organization (ILO), the sample of the survey rotates in a 2-2-2 scheme. Under this scheme, for two consecutive quarters a panel of households is surveyed (25% of the sample), for the next two quarters another panel of households is interviewed and in the following two quarters, the first panel of households is surveyed again. This scheme ensures a 50% overlap between consecutive quarterly samples, as well as observing the same sample in the same quarter in two consecutive years. One of the benefits that INEC obtains by using this scheme is that the likelihood of no response decreases, which is a common problem with repeated surveys.

The database used in this study focuses on individuals, with ages between 25 to 55 years old, who are not students, are not members of the military and are not retired. Additionally, the data-set

[6] Rural areas are defined to be settlements with a population no greater than 2,000 people.

was censored in terms of income, in order to focus on those individuals that are poor. In this sense, those observations with monthly income from labor or monthly non-labor income greater than 300 USD are excluded from the calculations.[7]

The measure of labor supply is reported weekly work hours. The analysis includes those individuals with reported non-negative hours in the previous week of being interviewed and those who reported that they have not worked in the previous week. Excluded from the analysis are those individuals who reported extreme working hours above the 90th percentile of the distribution (60 hours per week).

To calculate hourly wages, the reported monthly income from labor is divided by four to obtain a measure of weekly income. And then, this result is divided by the reported hours worked in the previous week. On the other hand, non-labor income is the reported non-labor income of the surveyed individual. Both income variables are converted to real dollars from the year 2014 using the consumer price index reported by INEC.

Finally, other variables that are included in this study are the individual's age, years of education, if is part of a minority, number of children under 16, the presence of children under 6, the number of household members, if the individual has an informal job, if works in agriculture, if does not have a stable job.[8] Also, geographic variables and the unemployment rate at the zone of residence are included.

Table 2 and Table 3 present the summary statistics of the database used in this study before and after the cash transfer increased, for the poor individuals that receive the BDH transfer and those who do not, and by gender.

Before the cash transfer increased in 2013, the average hours worked in the previous week of the women who were beneficiaries were similar to those women who did not receive the transfer.

[7] The minimum amount of money that a family requires to have in order to purchase the basket of subsistence goods in 2007 was 320 USD; in 2010, 380 USD; in 2013, 436 USD; and in 2015, 480 USD.

[8] Years of education is calculated by adding the number of years that correspond to their educational attainment plus the highest year passed. Minority includes those who do not consider themselves being *mestizo* or white. Informal job includes all jobs in unregistered or small-scale private enterprises that produce goods or services for sale. Self-employed street vendors, taxi drivers, and home-based workers, regardless of size, are all considered. Finally, not having a stable job is defined as having a temporary employment contract.

While for men, those who did not receive the transfer appear to have worked on average more hours. Monthly real income from labor remains relatively the same between men, independently of being a beneficiary of the BDH program or not. On the other hand, non-beneficiary women have a higher monthly real income from labor than women who receive the transfer. With regard to monthly real non-labor income, non-beneficiaries have higher values than those who are beneficiaries. In terms of labor force participation, beneficiaries are less attached to the labor force than non-beneficiaries, specifically men. Regarding age, having an informal job, having an unstable job, work in agriculture and the unemployment rate at the zone of residence, there are no substantial differences between beneficiaries and non-beneficiaries. Finally, beneficiaries seem to have on average more children, more likely to be part of a minority and more likely to live in a rural area than non-beneficiaries.

After 2013, when the cash transfer increased, there were no many variations when comparing beneficiaries and non-beneficiaries. Except for having an informal job, whereafter the transfer increased, the proportion of women who were receiving the BDH transfer was higher than the proportion of non-beneficiary women that had an informal job.

Finally, when comparing beneficiaries and non-beneficiaries before and after the cash transfer increased, it can be seen that the variables that decreased were hours worked in the previous week for men who received the BDH transfer, monthly real income from labor for both groups and monthly real non-labor income. The variables that increased after 2013, indistinctly of being a beneficiary or not were the number of children under 16 and the proportion of people living in the presence of children under 6. On the other hand, beneficiaries of the BDH program increased on average the number of hours worked in the previous week, their monthly real non-labor income, their labor force participation and having an informal job. Is important to mention that women who receive the transfer appear to have the highest increments in these variables after the transfer increased.

1.6 Empirical procedures and regression results

To identify the effect of the increment in the BDH transfer on labor supply, this investigation uses a difference-in-differences procedure. This study analyzes the effect on both the intensive and extensive margin over the beneficiaries of the BDH program. First, the study analyzes the effect on the recipients indistinctly of gender, and later, the effect on women and men separately.

The control group is defined to be individual i with monthly income lower than 300 USD, with age between 25 and 55 years old, who reported on December of year t to have worked in the previous week up to 60 hours, and that are not beneficiaries of the BDH transfer. The treatment group is another individual with similar characteristics as individual i, that is a beneficiary of the BDH transfer. Therefore, this last group of people experienced a pure income effect when the transfer increased by 15 USD in 2013.

This study uses a second-generation model of labor supply, following a similar procedure as Blau and Kahn (2007), Juhn (1992) and Juhn and Murphy (1997). Nonetheless, this study will face the same econometric difficulties that the majority of investigations in labor supply encounter. The first problem is not been able to observe wage offers for nonworkers. And the second one is related to measurement error.

For the first problem, this study will use imputed wages for nonworkers. This is done by assigning predicted wages for people with the same observed characteristics, separately for women and men. The variables used to estimate the predicted wages are cubics in age and years of education, indicator variables for being a minority, having an informal job, working in agriculture, working as a housemaid and having an unstable job. Additionally, included as regressors are a dummy for living in a rural area, province indicator and the unemployment rate at the zone of residence. Finally, standard errors are clustered at the city level.

On the other hand, the measurement error comes from the fact that the wage variable is calculated by first calculating weekly earnings and then dividing weekly earnings by the reported hours of work in the previous week. In this sense, results will have a downward bias.

The static labor supply model translates to individual i in year t supplying h_{it} hours of work per

week. These hours depend on the natural logarithm of the wage rate, $l\widehat{w}_{it}$, the natural logarithm of non-labor income (ly_{it}), and other variables which are included in Z_{it}. These variables are age, years of education, number of children under 16, presence of children under 6, dummies for informal job, job in agriculture, rural area, province dummies, and the unemployment rate at the zone of residence. Additionally, the equation includes BDH_{it}, which is a dummy variable that equals 1 if the individual i, in year t received the BDH transfer and 0 if not; T_{it} is a dummy variable that indicates when the changes on the amount of money transferred took place. Y_t are year fixed effects. Finally, ε_{it} is the error term, and standard errors are clustered at the city level to account for spatial correlation.

$$h_{it} = \beta_0 + \beta_1 \cdot BDH_{it} + \beta_2 \cdot T_t + \beta_3 \cdot (BDH_{it} \times T_t) + \beta_4 l\widehat{w}_{it} + \beta_5 ly_{it} + \beta_6 Y_t + \theta_{it} \cdot Z^h_{it} + \varepsilon_{it} \qquad (1.1)$$

Hence, β_3 is the coefficient of interest, as it represents the treatment effect of increasing the BDH transfer in 2013. It measures the effect on labor supply of the beneficiaries of the BDH transfer, given the increment in non-labor income (15 USD), and comparing it to a comparable group that did not receive this increment.

In order to estimate the effect on the extensive margin, equation 1 is re-estimated by replacing the reported hours worked in the previous week with participation in the labor force.

Table 4 presents the results of the difference-in-differences estimation of the effect of the increment of the BDH transfer in 2013 on the intensive and the extensive margin.

Column 1 presents the results of the estimation using the whole dataset. In this sense, the model predicts that after the cash transfer increased in 2013, on average beneficiaries increased the number of hours worked in the previous week by 2.503 hours. Furthermore, column 2 shows the result of the analysis considering only women. In this case, the increment of the BDH cash transfer meant on average a positive effect of 1.652 hours. These two results are statistically significant at the 1% level. On the other hand, if the analysis is conducted only on men, the difference-in-

differences estimation predicts a positive effect, which is not statistically significant, as column 3 presents.

Regarding the extensive margin, it can be seen from column 1 that when analyzing all the beneficiaries indistinctly of gender, the difference-in-differences estimation predicts a positive effect of 0.0723. If the same analysis is conducted for women only, the model predicts that on average, beneficiary women increased their participation in the labor force by 5.63 percentage points. As before, these two results are statistically significant at the 1% level. Finally, when analyzing the effect of the increment only on beneficiary men, the predicted effect is positive in magnitude, but as before, is not statistically significant.

1.7 Robustness analysis

As a robustness check, a Tobit estimation procedure was implemented to predict the effect of the increment of the BDH transfer in 2013 on labor supply. Equation 2 uses the same variables of equation 1 as dependent and independent variables. Also, standard errors are clustered at the city level as before.

$$h_{it}^{*} = \beta_0 + \beta_1 \cdot BDH_{it} + \beta_2 \cdot T_t + \beta_3 \cdot (BDH_{it} \times T_t) + \beta_4 l\widehat{w}_{it} + \beta_5 ly_{it} + \beta_6 Y_t + \theta_{it} \cdot Z_{it}^{h} + \varepsilon_{it} \qquad (1.2)$$

$$h_{it} = \begin{cases} 1 \text{ if } h_{it}^{*} > 0 \\ 0 \text{ otherwise} \end{cases}$$

Table 5 presents the results of the difference-in-differences estimation of the effect of the increment of the BDH transfer in 2013 on the intensive margin using a Tobit model. As before, if the analysis is conducted on all the observations indistinctly of gender, the estimated coefficient is 6.980, which implies a partial effect of 3.88 hours. On the other hand, when the model is used only on women, the estimated partial effect is 2.48 hours. As in the previous case, these coefficients are

statistically significant at the 1% level. For the case of men, the predicted coefficient is positive in magnitude but is not statistically significant.

As an additional robustness check, the base specification was estimated with only mothers that are identified as extremely poor. The rationale for this is that the BDH program specifies that is preferable that in a given household, mothers receive the cash transfer. In this sense, the treatment and control group become much more comparable as it is shown in Table 6. Additionally, Figure 9 shows the average hours worked of the treatment and control group before and after the BDH cash transfer increased.

Finally, Table 7 presents the estimated coefficients of the base specification on extremely poor mothers. At the intensive margin, extremely poor mothers that are beneficiaries of the program increased their labor supply by 1.018 hours. On the other hand, at the extensive margin, the change in the amount of the BDH cash transfer meant an increment of 2.75 percentage points. These two results are statistically significant at the 10% level.

1.8 Discussion

Results suggest that the increment of 15 USD of the BDH transfer in 2013 increased the number of hours that beneficiaries work and, the number of people working. Regarding the intensive margin, these results contradict the canonical labor supply model: given an increment in non-labor income, (a pure income effect), agents consume more leisure, and thus, work less.

Given that this study analyzes people at the bottom of the income distribution, those with a monthly income under 300 USD, these results suggest that those living below subsistence levels may have different preferences towards leisure. Meaning, if a person's income is not enough to let that person consume the basket of subsistence goods, they will have to work more hours. In this sense, this group of people could lack some elements required to work. Therefore, the canonical labor supply model does not account for subsistence levels and work choices of the poor, as is pointed out by Rosenzweig (1998), Subramanian and Deaton (1996), Dessing (2002), and Mideros and O'Donaghue (2013).

When separating the analysis between women and men, results show that the policy had specifically a positive effect on beneficiary women's labor supply in the intensive and extensive margin. This could be explained by the structure of the program, as women are the main recipients of the transfer. Also, it could be that given that men on average are already working close to 40 hours a week (37 hours a week) and women on average are working fewer hours (30 hours a week), it might be easier for women to find a job or to work more hours relative to men who are already working close to 40 hours a week.

Regarding the extensive margin, it can be seen that overall the number of people in the labor force, especially women has increased. This increment appears to be related to poor individuals working in informal jobs. In this sense, despite the apparent benefits of the policy on labor supply, job quality is an important area that also needs to be addressed.

The study contains a diagnostic test for parallel trends using leads and lags.[9] Figure 7 presents the average treatment effect before and after the BDH transfer increased in 2013. It includes the lags and leads coefficients with 99, 95, 90, 80 and 70 confidence intervals. It can be seen that the pattern after the increment of the BDH transfer shows a positive effect.

The ideal setup of this study, in terms of defining a control group, will require to have access to the *Registro Social* surveys of 2008 and 2013 and to identify and select those individuals slightly above the beneficiary selection index threshold, and compare their labor supply with the beneficiaries' labor supply. Given that there is no public access to the *Registro Social* databases, and that this survey does not measure labor supply, any other procedure used to define a control group will have limitations, that will necessarily depend on various assumptions. In previous versions of these paper, including the analysis at the block level and at the city level, results showed no significant difference in terms of direction, magnitude, and precision.

[9] This procedure allows testing the common trend assumption via a joint test on leads significance. For more details see: Cerulli and Ventura, (2017)

1.9 Conclusion

This study attempts to fill the gap in the literature in finding the effect of the last increment of the BDH cash transfer on labor supply of poor households in Ecuador. This is done by exploring how the last increase in the amount of the transfer in 2013 affected labor supply of the poorest households that received the transfer, compared with households with the same levels of income that did not receive the transfer.

By means of a difference-in-differences approach, this study compares poor households (income no greater than 300 USD) that receive the transfer to those who did not, with controls for household composition, individual characteristics, geographical characteristics and income.

The overall results are that on average, households increased their labor supply by 2.5 hours, after the cash transfer increased. Additionally, this study examines the effect of the last increment of the BDH transfer on labor supply decisions of women and men and finds that beneficiary women increased their labor supply on average by 1.65 hours. On the other hand, results for beneficiary men are not statistically significant. Furthermore, the study finds evidence that at the extensive margin, the policy had positive effects as labor force participation seemed to have increased by 7.23 percentage points. As before, beneficiary women increased their participation in the labor force by 5.63 percentage points, whereas for men results are not statistically significant.

Among the studies mentioned previously, no other paper examines the effect of the increment, nor the effect on labor supply decisions of women and men separately.

Beneficiary women appear to be more likely to increase their number of hours worked when the transfer increases. This effect could be explained by the way the BDH program is structured, as is preferable that women receive the transfer instead of men. Also, it could be that women are able to supply more hours of work than men, as on average, women work fewer hours than men.

Some possible extensions of this study involve analyzing not only the beneficiaries as the treatment group but all the members of a household where there is a beneficiary. Another possible extension is analyzing the labor supply decision within a beneficiary household. That is, analyzing the effect of the increment on those who effectively received the transfer and those who live in a

household that received the transfer. All these extensions will be the primary questions of future studies.

Studies of cash transfer programs around the world show ambiguous effects. This ambiguity seems to depend on the conditions imposed on the transfer, the amount that is transferred, the frequency of the transfer, the household member who receives the transfer, among others. Nonetheless, the results from this study parallel the ones found in labor supply studies conducted in other developing nations on poor individuals. In this sense, it appears that people living in subsistence conditions have different preferences towards leisure as is predicted by the canonical labor supply model.

The results presented in this paper could lead to a discussion on the role of women in poor households and could contribute in the assessment of the positive or negative impact in long run poverty alleviation and human capital development. Also, this could eventually help in the design of policies focused on including more women into the workforce.

Although it appears that that the increment of the BDH transfer on average had a positive effect, it may not be the case for all the beneficiaries. Specifically, those that are above the subsistence level and are more likely to follow the prediction of the canonical labor supply model. In this sense, it is necessary to incorporate better targeting strategies and verification methods that would allow the program to be much more effective.

Finally, it is important to study the effect of the increment of the BDH cash transfer on a broad spectrum of areas before implementing further changes. Only in this way, the BDH program may become a better policy tool that could improve the living conditions of its beneficiaries in the short and long run.

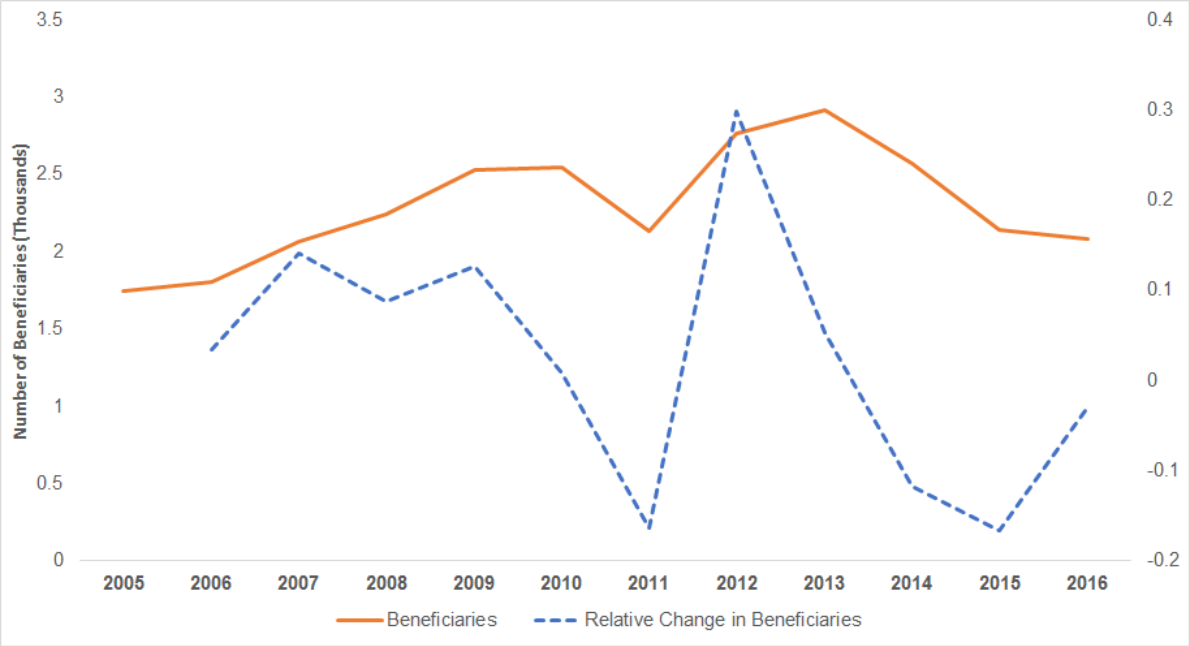

Figure 1.1: Evolution of beneficiaries in urban areas

Source: Author's calculations using data from INEC: *Encuesta Nacional de Empleo, Desempleo y Subempleo* (2010 - 2016).

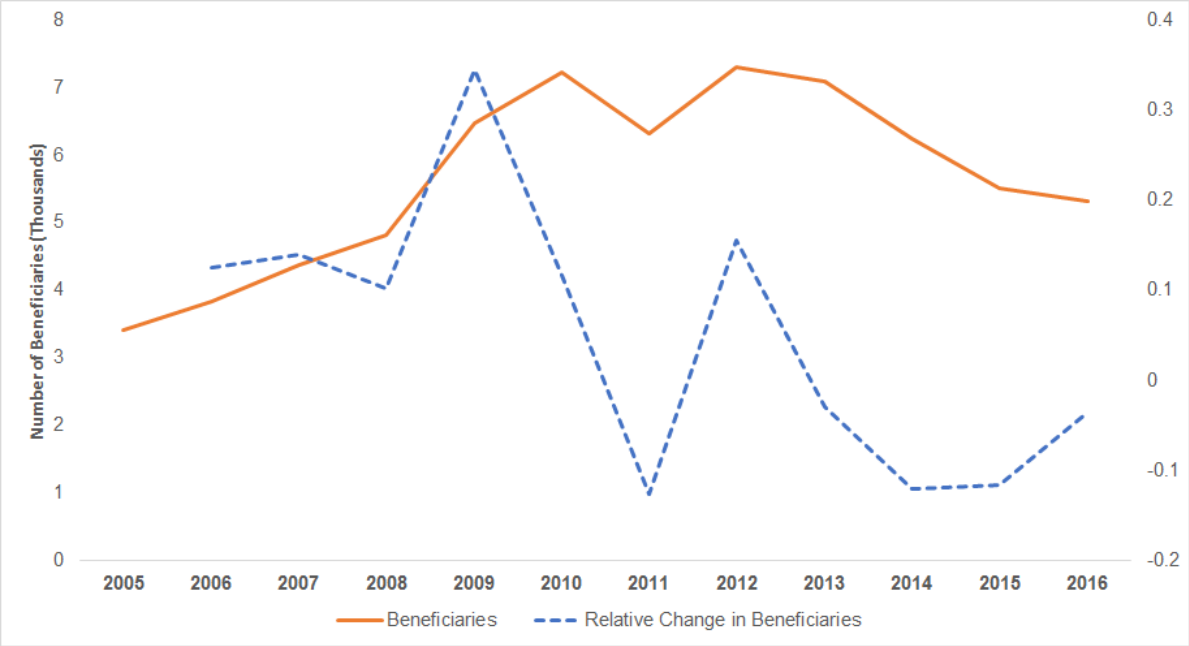

Figure 1.2: Evolution of beneficiaries in rural areas

Source: Author's calculations using data from INEC: *Encuesta Nacional de Empleo, Desempleo y Subempleo* (2010 - 2016).

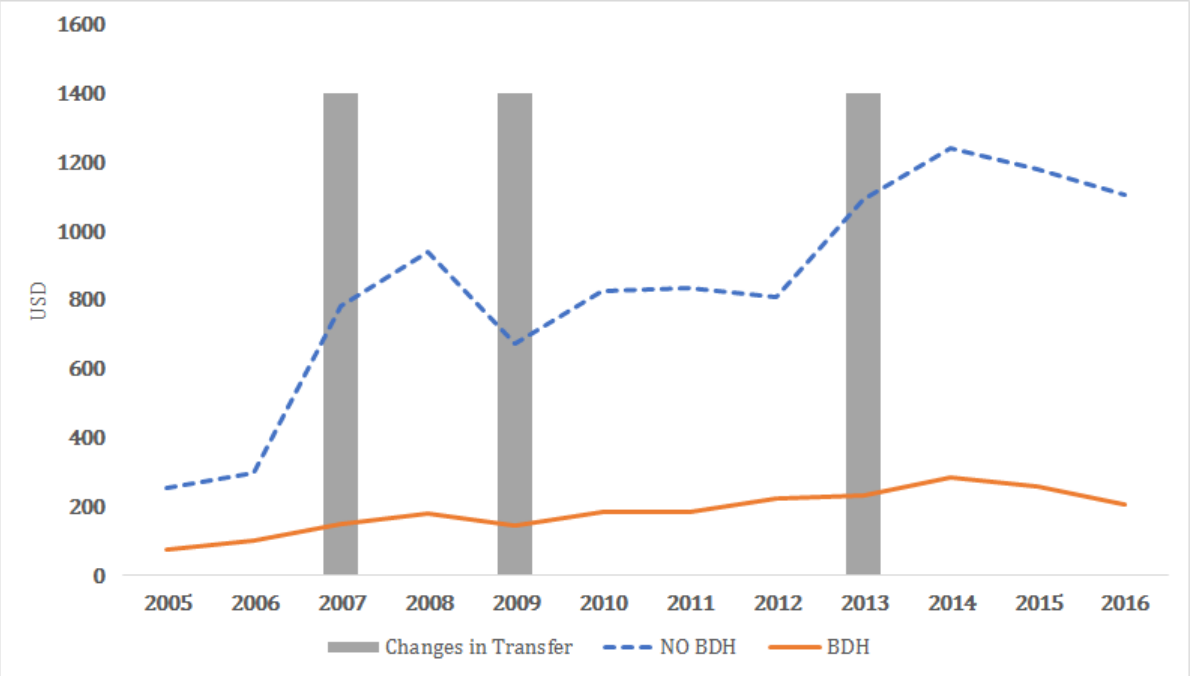

Figure 1.3: Average income in urban areas

Source: Author's calculations using data from INEC: *Encuesta Nacional de Empleo, Desempleo y Subempleo* (2010 - 2016).

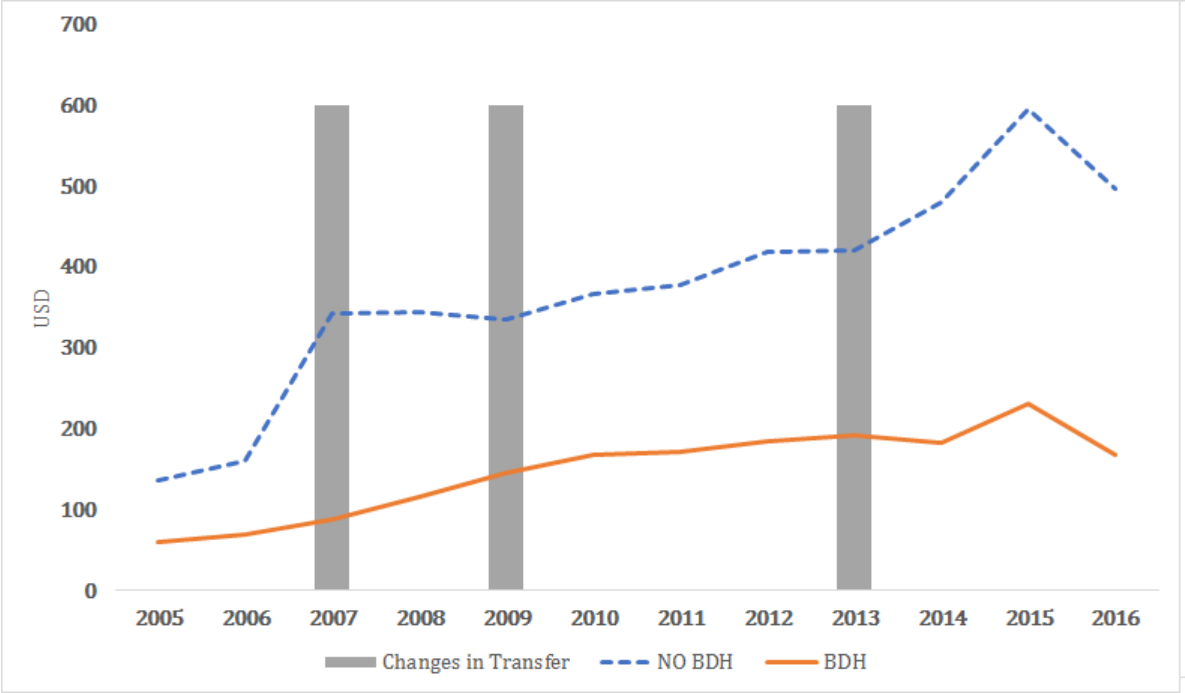

Figure 1.4: Average income in rural areas

Source: Author's calculations using data from INEC: *Encuesta Nacional de Empleo, Desempleo y Subempleo* (2010 - 2016).

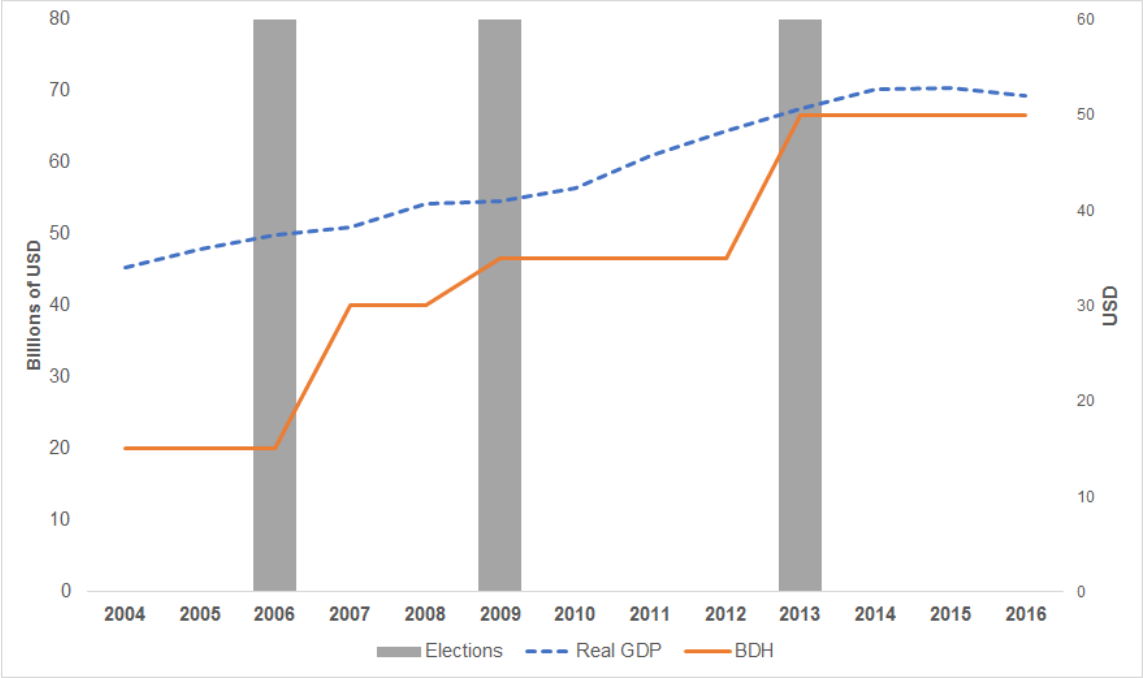

Figure 1.5: Evolution of BDH transfer, real GDP and elections in Ecuador

Source: Author's calculations using data from INEC: *Encuesta Nacional de Empleo, Desempleo y Subempleo* (2010 - 2016) and BCE: *Información Estadística Mensual* (2007-2016).

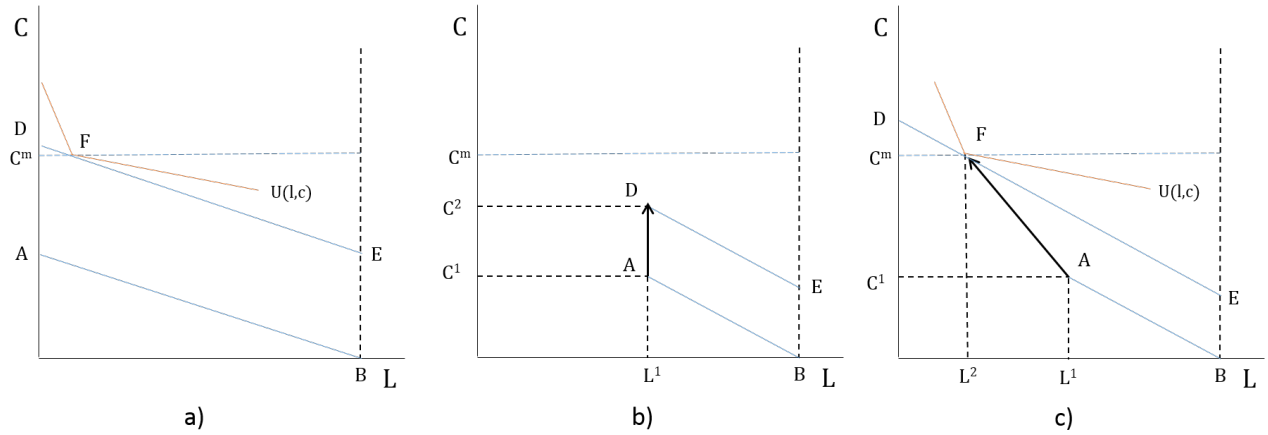

Figure 1.6: Labor supply and income effect of the poor

Source: Mideros, A., O'Donoghue, C. 2015. "The Effect of Unconditional Cash Transfers on Adult Labor Supply: A Unitary Discrete Choice for the case of Ecuador." *Basic Income Studies*, 10(2): 225-255.

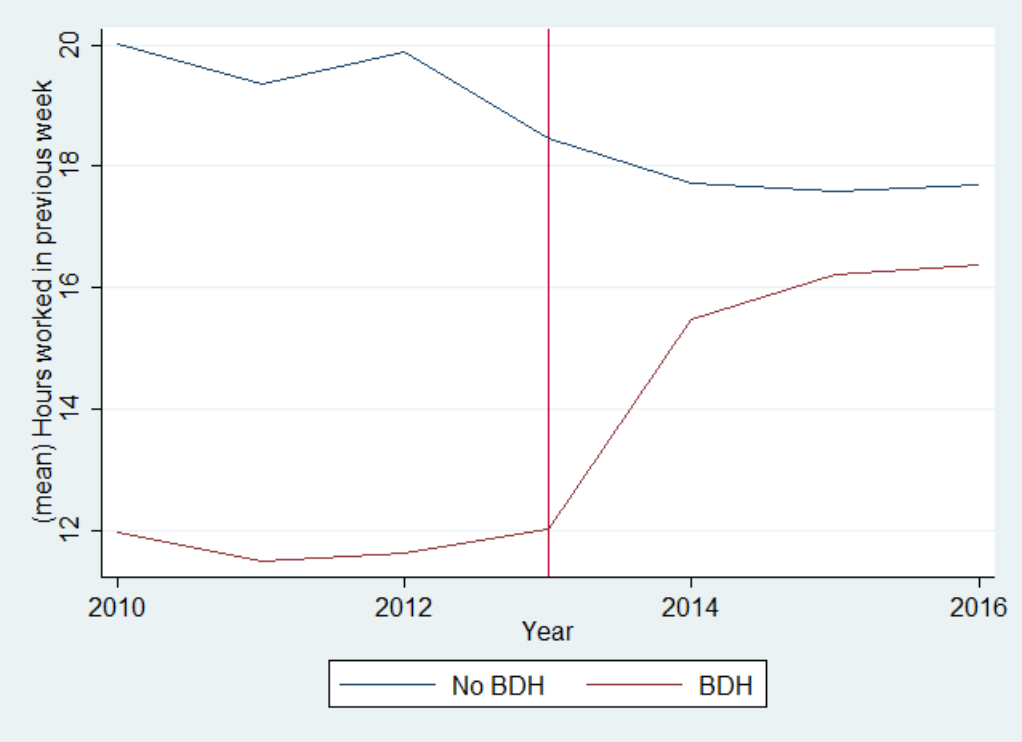

Figure 1.7: Hours worked in the previous week of BDH beneficiaries and not beneficiaries

Source: Author's calculations using data from INEC: *Encuesta Nacional de Empleo, Desempleo y Subempleo.* (2010 - 2016).

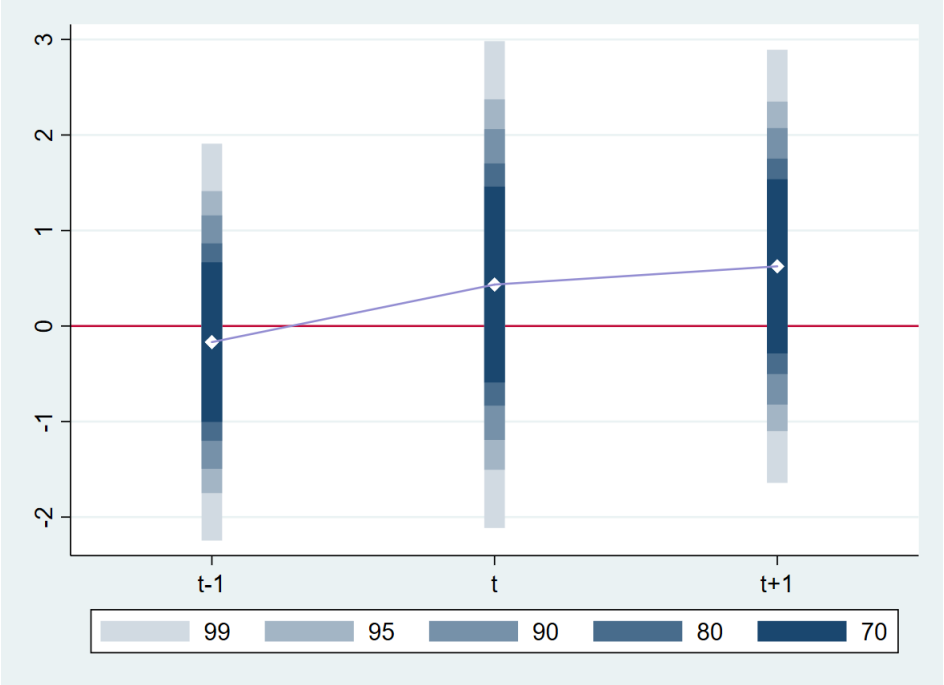

Figure 1.8: Average treatment effect before and after the policy change

Source: Author's calculations using data from INEC: *Encuesta Nacional de Empleo, Desempleo y Subempleo.* (2010 - 2016)

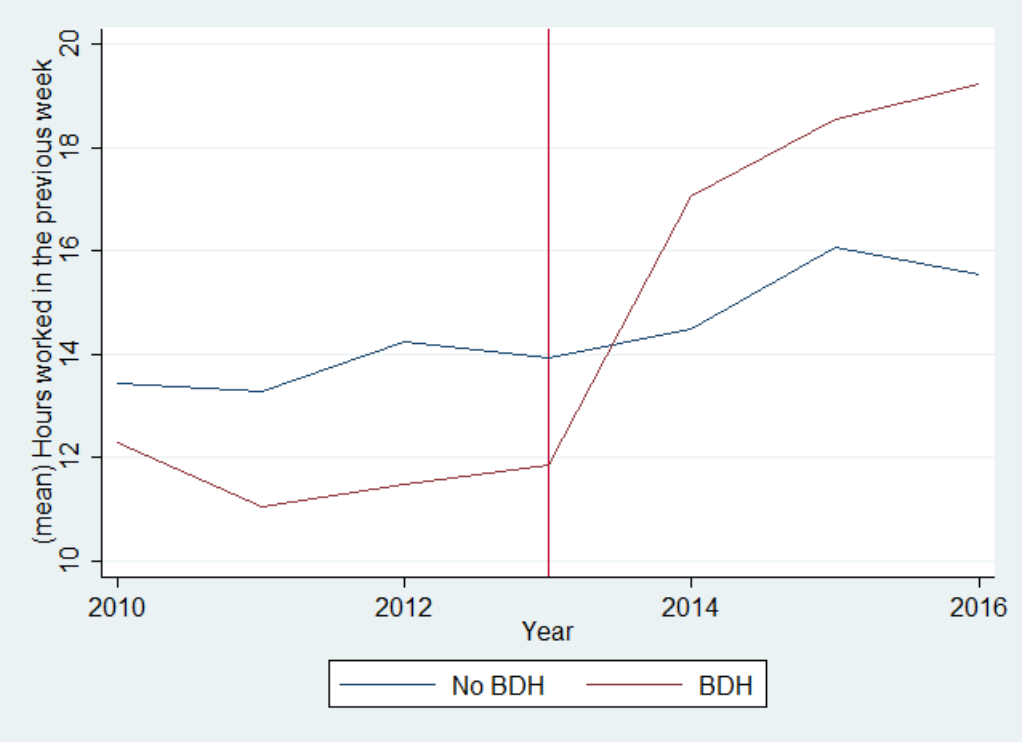

Figure 1.9: Hours worked in the previous week of extremely poor mothers that are beneficiaries and not beneficiaries of the BDH program.

Source: Author's calculations using data from INEC: *Encuesta Nacional de Empleo, Desempleo y Subempleo.* (2010 - 2016)

Table 1.1: Average monthly income of urban and rural households

	Urban		Rural	
Year	**No BDH**	**BDH**	**No BDH**	**BDH**
2005	5.91%	20.15%	11.03%	25.14%
2006	5.01%	14.65%	9.33%	21.90%
2007	3.82%	20.24%	8.77%	34.25%
2008	3.19%	16.73%	8.72%	25.90%
2009	5.18%	23.73%	10.43%	24.07%
2010	4.24%	18.93%	9.55%	20.87%
2011	4.20%	18.81%	9.24%	20.44%
2012	4.34%	15.65%	8.36%	18.95%
2013	4.57%	21.33%	11.86%	25.91%
2014	4.03%	17.45%	10.41%	27.46%
2015	4.23%	19.34%	8.40%	21.69%
2016	4.53%	24.29%	10.07%	29.84%
Average	4.44%	19.28%	9.68%	24.70%

Source: Author's calculations using data from INEC: *Encuesta Nacional de Empleo, Desempleo y Subempleo* (2010 - 2016).

Table 1.2: Summary statistics before 2013

	BDH			No BDH		
	Women	**Men**	**Total**	**Women**	**Men**	**Total**
Age	39.82	42.18	39.96	39.71	39.21	39.51
	(8.29)	(9.11)	(8.36)	(9.10)	(9.29)	(9.18)
Minority	0.30	0.27	0.30	0.13	0.23	0.17
	(0.46)	(0.44)	(0.46)	(0.33)	(0.42)	(0.37)
Years of education	5.9	4.45	5.82	9.49	8.12	8.95
	(3.63)	(3.87)	(3.66)	(4.77)	(4.80)	(4.83)
Number of household members	5.36	4.09	5.28	4.69	4.88	4.76
	(2.26)	(2.36)	(2.28)	(2.01)	(2.31)	(2.13)
Children under 16	1.76	0.56	1.69	0.93	0.93	0.93
	(1.69)	(1.19)	(1.69)	(1.22)	(1.45)	(1.32)
Presence of children under 6	0.54	0.36	0.54	0.37	0.47	0.40
	(0.81)	(0.75)	(0.81)	(0.65)	(0.77)	(0.69)
Hours worked in the previous week	11.25	19.24	11.72	12.81	30.41	19.76
	(17.09)	(19.29)	(17.34)	(18.08)	(17.53)	(19.83)
Monthly real income from labor	68.28	109.67	71.80	76.48	119.00	100.44
	(73.38)	(76.67)	(74.56)	(80.03)	(83.01)	(84.39)
Monthly real non-labor income	40.09	39.82	40.08	113.62	95.98	109.27
	(24.58)	(18.63)	(24.27)	(64.79)	(63.57)	(64.92)
Labor force	0.39	0.59	0.41	0.46	0.90	0.63
	(0.49)	(0.49)	(0.49)	(0.49)	(0.29)	(0.48)
Informal job	0.29	0.45	0.29	0.24	0.55	0.36
	(0.45)	(0.49)	(0.46)	(0.43)	(0.49)	(0.48)
Unstable job	0.99	0.99	0.99	0.98	0.98	0.98
	(0.07)	(0.08)	(0.08)	(0.13)	(0.13)	(0.13)
Agriculture	0.02	0.01	0.02	0.01	0.01	0.01
	(0.12)	(0.11)	(0.12)	(0.09)	(0.09)	(0.09)
Extreme poverty	0.25	0.27	0.26	0.13	0.28	0.19
	(0.44)	(0.45)	(0.44)	(0.34)	(0.45)	(0.39)
Rural	0.74	0.74	0.74	0.33	0.56	0.42
	(0.44)	(0.44)	(0.44)	(0.47)	(0.49)	(0.49)
Unemployment rate at zone of residence	0.03	0.03	0.03	0.04	0.04	0.04
	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)
Observations	10,458	656	11,114	18,992	12,414	31,406

Source: Author's calculations using data from INEC: *Encuesta Nacional de Empleo, Desempleo y Subempleo* (2010 - 2016). Standard deviation in parentheses.

Table 1.3: Summary statistics after 2013

	BDH			No BDH		
	Women	**Men**	**Total**	**Women**	**Men**	**Total**
Age	38.79	40.79	38.93	38.74	38.58	38.68
	(8.49)	(9.19)	(8.57)	(8.94)	(9.14)	(9.01)
Minority	0.40	0.29	0.39	0.17	0.28	0.20
	(0.49)	(0.46)	(0.49)	(0.37)	(0.45)	(0.40)
Years of education	5.79	5.19	5.74	9.63	8.76	9.35
	(4.32)	(3.59)	(3.65)	(4.59)	(4.70)	(4.65)
Number of household members	5.52	4.35	5.44	4.64	4.80	4.69
	(2.22)	(2.23)	(2.24)	(1.91)	(2.27)	(2.04)
Children under 16	2.22	0.74	2.11	1.19	1.13	1.17
	(1.79)	(1.37)	(1.80)	(1.28)	(1.53)	(1.37)
Presence of children under 6	0.72	0.49	0.72	0.46	0.59	0.49
	(0.89)	(0.83)	(0.89)	(0.70)	(0.83)	(0.74)
Hours worked in the previous week	14.52	16.89	14.68	12.56	28.46	17.80
	(17.40)	(18.65)	(17.50)	(17.21)	(17.64)	(18.89)
Monthly real income from labor	54.69	101.94	58.12	70.53	108.06	88.28
	(69.23)	(77.80)	(70.95)	(77.71)	(83.86)	(82.82)
Monthly real non-labor income	54.33	55.97	54.44	98.80	75.32	91.71
	(29.99)	(27.69)	(29.84)	(64.89)	(58.36)	(63.90)
Labor force	0.54	0.56	0.54	0.50	0.92	0.64
	(0.49)	(0.49)	(0.49)	(0.49)	(0.27)	(0.48)
Informal job	0.45	0.46	0.45	0.29	0.59	0.39
	(0.49)	(0.49)	(0.49)	(0.46)	(0.49)	(0.49)
Unstable job	0.99	0.99	0.99	0.98	0.98	0.98
	(0.08)	(0.07)	(0.08)	(0.13)	(0.13)	(0.13)
Agriculture	0.03	0.02	0.03	0.02	0.01	0.02
	(0.18)	(0.14)	(0.18)	(0.13)	(0.12)	(0.13)
Extreme poverty	0.27	0.22	0.27	0.11	0.29	0.17
	(0.44)	(0.42)	(0.44)	(0.31)	(0.45)	(0.37)
Rural	0.78	0.64	0.78	0.36	0.54	0.42
	(0.41)	(0.48)	(0.42)	(0.48)	(0.49)	(0.49)
Unemployment rate at zone of residence	0.03	0.03	0.03	0.04	0.04	0.04
	(0.04)	(0.04)	(0.04)	(0.05)	(0.05)	(0.05)
Observations	11,727	891	12,618	41,388	20,376	61,764

Source: Author's calculations using data from INEC: *Encuesta Nacional de Empleo, Desempleo y Subempleo* (2010 - 2016). Standard deviation in parentheses.

Table 1.4: Regression results at the intensive and extensive margin

	(1) *All*	(2) *Women*	(3) *Men*
	Hours worked in the previous week		
DID	2.503***	1.652***	1.120
	(0.337)	(0.342)	(1.470)
	Labor force participation		
DID	0.0723***	0.0563***	0.0171
	(0.00881)	(0.00976)	(0.0328)
Observations	87,785	66,715	21,070

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 1.5: Regression results at the intensive margin (Tobit)

	(1) *All*	(2) *Women*	(3) *Men*
	Hours worked in the previous week		
DID	6.980***	5.279***	1.076
	(0.824)	(0.932)	(1.672)
$P(h > 0\|X)$	0.556	0.469	0.935
Observations	87,785	66,715	21,070

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 1.6: Summary statistics of extremely poor mothers before and after 2013

	Before 2013		After 2013	
	BDH	**No BDH**	**BDH**	**No BDH**
Age	38.95	38.71	37.83	37.31
	(7.57)	(7.79)	(7.83)	(7.61)
Minority	0.35	0.23	0.49	0.34
	(0.47)	(0.42)	(0.49)	(0.48)
Years of education	5.64	7.26	5.67	7.62
	(3.39)	(4.23)	(3.33)	(3.94)
Number of household members	5.76	5.28	6.00	5.24
	(2.02)	(1.95)	(2.03)	(1.89)
Children under 16	2.88	2.48	3.21	2.57
	(1.54)	(1.43)	(1.60)	(1.41)
Presence of children under 6	0.59	0.58	0.67	0.62
	(0.49)	(0.49)	(0.47)	(0.48)
Hours worked in the previous week	11.68	13.59	16.29	15.23
	(17.38)	(18.17)	(17.70)	(17.53)
Monthly real income from labor	49.94	47.69	39.17	39.35
	(64.16)	(55.83)	(58.70)	(55.18)
Monthly real non-labor income	39.99	80.78	53.68	77.02
	(24.55)	(49.11)	(30.37)	(63.97)
Labor force	0.41	0.50	0.59	0.63
	(0.49)	(0.50)	(0.49)	(0.49)
Informal job	0.31	0.34	0.52	0.47
	(0.46)	(0.47)	(0.49)	(0.49)
Unstable job	0.99	0.98	0.99	0.99
	(0.08)	(0.10)	(0.05)	(0.08)
Agriculture	0.02	0.02	0.04	0.04
	(0.13)	(0.14)	(0.19)	(0.18)
Rural	0.78	0.51	0.83	0.57
	(0.42)	(0.50)	(0.37)	(0.49)
Unemployment rate at zone of residence	0.03	0.04	0.03	0.04
	(0.05)	(0.06)	(0.04)	(0.05)
Observations	4,522	1,282	5,744	3,028

Source: Author's calculations using data from INEC: *Encuesta Nacional de Empleo, Desempleo y Subempleo* (2010 - 2016). Standard deviation in parentheses.

Table 1.7: Regression results at the intensive and extensive margin of extremely poor mothers

	(1)
	Extremely poor mothers
	Hours worked in the previous week
DID	1.018*
	(0.598)
	Labor force participation
DID	0.0275*
	(0.0166)
Observations	14,576

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Chapter 2

Labor Supply Responses of Married Women in Ecuador

2.1 Introduction

Estimates of labor supply elasticities are important for policymakers as measures of the responsiveness of labor supply to tax rates, subsidies and other policies that affect income. Also, these elasticities are helpful in the creation of policies that focus on increasing labor force participation, especially in developing countries.

In the last decades, female labor force participation has undergone substantial changes around the world. Despite this, estimates of labor supply elasticities of women have not received enough attention in the literature and especially in developing countries. Results conducted in countries around the world show that married female labor supply elasticities are larger than for married men and, that female labor supply elasticities have dropped over the past decades.[1]

Despite the vast literature on female labor supply, especially on married women's labor supply, it has not been the case in Ecuador. For the Ecuadorian labor market, there are not many studies that focus on this area and, the ones that do, focus on the gender earnings gap and on the relationship of childcare and female labor supply.

This study tries to fill the gap in the literature by analyzing the magnitude and change of Ecuadorian married women's labor supply and participation elasticities. This investigation uses

[1] In the US, married women's labor supply elasticities show a decrease between 1978 and 2002 (Heim, 2007). In addition, there was a substantial decrease in the responsiveness of married women's labor supply to their own and husband's wages (Blau and Kahn, 2007). Moreover, labor demand does not account for the increment of female labor supply (Ginther and Juhn, 2001). In Canada, the labor supply of Canadian wives responded strongly to changes in husbands' wages during the 1980s. For the 1990s, cross-wage elasticities of wives display a greater dispersion (Morissette and Hou, 2008). In Mexico, labor supply elasticities of women decreased between 1990 and 2000 (Arceo, G. et al., 2010).

micro-level data from the *Encuesta Nacional de Empleo, Desempleo y Subempleo* (ENEMDU), in the period 2007 to 2017, with controls for individual characteristics, household composition variables, job characteristics, and partner's individual characteristics.

Empirical results show that, in the last decade, labor supply responsiveness of married women showed a minimal increase. The average hours wage elasticity grew by 15% between 2007 and 2017. Whereas the hours non-labor income elasticity, the participation wage elasticity, and the participation non-labor income elasticity, despite having a decreasing trend, have remained relatively constant across the last decade.

This investigation proceeds as follow. Section 2 presents a literature review of married women's labor supply. Section 3, describes the context of married women in the Ecuadorian labor market. Section 4, summarizes the data used in this study. Section 5, reports the empirical methods and the regression results. Section 6 tests the results from the base results with different empirical methods. Section 7 presents a discussion of the results obtained. Finally, Section 8 concludes.

2.2 Literature review

This study draws on the literature of female labor supply, specifically on the literature related to married women's labor supply decision. The findings around the world somewhat contrast the trends found in this study. In the US, married women's labor supply elasticities show a decrease between 1978 and 2002. There is evidence that suggests that changes in married women's preferences towards work explain this decrease (Heim, 2007). In addition, there was a substantial decrease in the responsiveness of married women's labor supply to their own and husband's wages (Blau and Kahn, 2007). Moreover, labor demand does not account the increment of female labor supply (Ginther and Juhn, 2001).

Outside of the US, married women's labor supply elasticities varied. In Canada, labor supply of Canadian wives responded strongly to changes in husbands' wages during the 1980s. For the 1990s, cross-wage elasticities of wives display a greater dispersion (Morissette and Hou, 2008).

In the case of Mexico, labor supply elasticities of women decreased between 1990 and 2000

(Arceo, G. et al., 2010).

For the case of Malaysia, educational attainment, women's age, and the number of children are major determinants of married women's labor supply. In contrast, own wage and cross-wage effects are statistically insignificant in determining the labor supply of married women (Ismail and Sulaiman, 2014).

While in Sudan, female participation and labor supply decisions respond positively and strongly to own-wage, and negatively and significantly to husband's wage. Non-labor income affects work decisions and hours negatively but is statistically insignificant. Small children discourage market participation and work but the response to their presence is only marginally significant. Older children, on the other hand, tend to encourage work activity but not significantly (Maglad, 1998).

In Hungary, labor force participation rates for Hungarian women, though decreasing, were still extremely high and comparable to male economic activity in western countries, own-wage elasticity is high and positive, while the income effect is consistent with leisure being a normal good (Saget, 1999).

This study also contributes to the limited literature on the Ecuadorian labor market, specifically, on the labor supply decision of married women. In 2012, there was an increase in the gender earnings gap, associated with higher participation of women as self-employed, which has a major role in explaining the increase in the gender gap (Guerra, 2010).

On the other hand, for Ecuadorian married women, a third child has a negative impact on labor supply. Meanwhile, for all women, there is a negative impact of 8 percentage points in "work outside home" and "paid work outside home" as measures of labor supply (Molina Vera, 2015)

Finally, there is evidence that in Ecuador, schooling has a positive effect on women's labor force participation rate and it has a negative effect on early motherhood. (De Paoli, 2010)

This study contributes to the literature in the following manner: (1) It studies the degree of change of married women's labor supply responsiveness in a developing country; and (2) this research measures how the labor supply decision of married women has changed between 2007 and 2017. From the research conducted, no other study examines the magnitude nor the direction

of change of married women's labor supply and labor force participation elasticities in Ecuador.

2.3 Population, labor supply, and income trends

As a way of contextualizing the Ecuadorian economy, Figures 1 through 6 show the evolution, between 2007 and 2017, of several variables that will explain the composition of the Ecuadorian labor market, specifically the context of married women.

Figure 1 shows the proportion of women by marital status. In Ecuador, during the last decade, on average married women represent around 38% of all Ecuadorian women ages 17 to 65. On the other hand, single women represent 28% of all women in Ecuador. Finally, the ones in a consensual union represent 20%. The average age of married women is 43 years and of single women is 28 years.

Figure 2 shows how the labor force participation rate of married women changed between 2007 and 2017. In the last decade, between 2007 and 2011, married women's labor force participation rate shows a decreasing trend with minimal variation. In 2012 it reached its minimum value (14.33%) and after this year, it increased to 14.79% in 2017. Given the lack of information for previous years, it cannot be argued that married women in Ecuador have experienced an increase in their labor force participation compared to other decades.

Figure 3 shows how hours worked in the previous week have changed over the period of analysis for married women. Working hours have maintained relatively constant around 20 hours per week. Nevertheless, looking at weekly working hours conditional on working, the results differ, as shown in Figure 4. Between 2007 and 2012, working hours increase from 36.67 hours per week in 2007 to 38.07 hours per week in 2012. After that, the variable decreases reaching its lowest value (34.92 hours per week) in 2016. A possible explanation for the change in working hours could be derived by the expansion of the Ecuadorian economy between 2009 and 2012, when oil prices rose and then, the abrupt deceleration derived from decreasing oil prices.

As can be seen in Figure 5, monthly income from labor for married women has increased from

339.56 USD in 2007 to 455.53 USD in 2017.[2] Non-labor income also shows an increasing trend between 2007 and 2017, augmenting from around 120 USD per month to 160 USD per month (Figure 6). Finally, the monthly income from labor of the husbands of the women in the database, display the same increasing trend, changing from around 540 USD in 2007 to almost 600 USD in 2017. A possible explanation for this change could be related to changes in the minimum monthly salary. In Ecuador, in the past 10 years, the minimum monthly salary has increased every year on average by 17.64 USD. In 2009, the minimum monthly salary was 218 USD, and in 2018 it was 386 USD.

In this sense, given the relative change in labor force participation, working hours, wages, non-labor income, and, income from labor of their husbands, it is probable that prime-age married women in Ecuador changed their responsiveness to wage, non-labor income and their husbands' income from labor across this last decade. Identifying and measuring this change is one of the goals of this study.

2.4 Data

This research uses data from the ENEMDU, which is a quarterly survey conducted by INEC that tracks the evolution of the Ecuadorian labor market, income and general characteristics of the population.

This investigation uses December surveys from 2007 to 2017. The database used in this study focuses only on married women, with ages between 25 to 55 years old, who are married to a male who identifies as the household head. Married women who report being students, members of the military and retired are excluded from the analysis. Hours of work are included for married women who reported working non-negative hours in the previous week of being interviewed and those who reported that they have not worked in the previous week.

In order to calculate hourly wages, the reported monthly income from labor was divided by the reported hours worked in the previous week times 4. As for the reported hours worked in the

[2] Since the year 2000, Ecuador has used the United States Dollar as legal tender.

previous week, the values that exceed the 90th percentile of the income from labor distribution are not considered in the analysis. This variable was converted to real dollars from the year 2014 using the Consumer Price Index that is calculated by the National Institute of Statistics and Census, in Spanish *Instituto Nacional de Estadísticas y Censos* (INEC).

This study assumes a secondary earner model. Therefore, the non-labor income variable is the summation of the non-labor income of the woman, the non-labor income of the man and the income from labor of the husband. This variable, as the wage rate, was also converted to real dollars from the year 2014.

Also, those individuals who reported working an extreme number of hours, as well as those who reported extreme levels of income were excluded from the analysis.[3]

Finally, other variables that are included in this study are the woman's and husband's age, years of education of the couple, if the woman is part of a minority, number of children under 16, the presence of children under 6, if the individual is poor, if has an informal job, if works in agriculture, if is the household head, if does not have a stable job, and if works as a housemaid.[4] Also, geographic variables and the unemployment rate at the zone of residence are included.

Table 1 displays the summary statistics of the database. Married women in Ecuador, between 2007 and 2017, had an average age of 40.91 years, their husbands' age on average was 44.64. In terms of education, married women and their husbands on average have 9.36 and 9.47 years of education, which is equivalent to the last years of primary school. The percentage of married women who consider themselves part of a minority is 17%. In terms of the number of children under 16, the average number of children in the house is 1.65 and 43% of the married women live in the presence of children under 6.

In terms of labor supply, between 2007 and 2017, the average number of hours worked in the

[3] The exclusion criteria used in this study was to remove those observations with values was greater than the 90th percentile of the distribution of each variable.

[4] Years of education is calculated by adding the number of years that correspond to their educational attainment plus the highest year passed. Minority includes those who do not consider themselves being *mestizo* or white. Informal job includes all jobs in unregistered or small-scale private enterprises that produce goods or services for sale. Self-employed street vendors, taxi drivers, and home-based workers, regardless of size, are all considered. Finally, not having a stable job is defined as having a temporary employment contract.

previous week by married women was 19.66 hours. The average real monthly income from labor was 222.21 USD and the average real monthly non-labor income was 125.47 USD. Also, 60% of married women in Ecuador, during the period under analysis, are part of the labor force, 29% have an informal job, 88% have an unstable job, 2% were worked as housemaids, 2% work in agriculture-related activities, 43% live in a rural area, and the unemployment rate at their zone of residence was 4%.

2.5 Empirical procedures and regression results

Despite the vast literature on married female labor supply, there is no generally agreed-upon standard estimation method to estimate married female labor supply (Heim, 2007). Therefore, this study will follow the method used in Blau and Kahn (2007). This consists of a second-generation model of labor supply that will obtain estimates at the intensive and extensive margins.

Like other investigations in labor supply, the results presented in this study will be affected by two problems. First, measurement error as the wage variable is obtained by first, calculating weekly earnings as monthly income from labor divided by four, and then this value divided by the reported hours worked in the previous week. In this sense, results will be underestimated.

The second difficulty is the lack of wages for nonworkers. In this sense, this study follows the procedures employed by Blau and Kahn (2007), Juhn (1992) and Juhn and Murphy (1997). That is, for the nonworkers wages are imputed by assigning the predicted wages for people with the same observed characteristics who had low working hours (under 16 hours per week). Additionally, wages are also imputed for the self-employed in a similar fashion, but the assigned predicted wages come from the observations with the same characteristics.

The regressors used to obtain the predicted values of log wages were cubics of age and years of education, dummies for being a minority, having an informal job, working in agriculture, working as a housemaid and having an unstable job. Geographical variables were also included, these are an indicator for living in a rural area, province dummies and the unemployment rate at the zone of residence.

In this sense, a static labor supply model can be defined as:

$$H_{it} = \alpha_{0t} + \alpha_{1t} l\widehat{w}_{it} + \alpha_{2t} ly_{it} + Z_{it}^{h} + \varepsilon_{it} \tag{2.1}$$

Where the married women i in year t supplies H_{it} hours of labor per week. These number of hours will depend on the primary regressors that are the natural logarithm of the wage rate, denoted $l\widehat{w}_{it}$, the natural logarithm of non-labor income (ly_{it}), and other variables which are included in Z_{it}^{h}. These variables are age and years of education of the couple, number of children under 16, presence of children under 6, dummies for the woman or the man having an informal job, housemaid work, job in agriculture, being poor, rural area, province dummies, and the unemployment rate at the zone of residence. Both wage and labor supply equations are estimated for each year of data.[5] Additionally, in the estimation of both equations, standard errors are clustered at the city level in order to account for spatial correlation.

After estimating the coefficients, elasticities are evaluated at the mean. That is:

$$\varepsilon_{wt}^{h} = \frac{\widehat{\alpha}_{1t}}{\overline{h}_{t}} \tag{2.2}$$

$$\varepsilon_{yt}^{h} = \frac{\widehat{\alpha}_{2t}}{\overline{h}_{t}}$$

In order to calculate the participation elasticities, Equation 1 is re-estimated using the participation in the labor force as the dependent variable. Finally, the estimated elasticities will be the estimated average derivative of participation to log wages and the estimated average derivative with respect to non-labor income.

Figure 8 contains the estimated wage and income elasticities on the extensive and intensive margins from the base specification. The figures include points that represent the estimated elasticities and a solid and a dashed line to smooth out the trends of the estimated elasticities. The solid line is obtained from a linear regression, whereas the dashed line represents a polynomial equation

[5] This is reflected by the subscript t in the coefficients.

of second order.

The estimated hours wage elasticities appear to have increased over the period under analysis. In 2007 the estimated hours wage elasticity was 0.7 while in 2017 it increased to 0.81, which meant an increment of 15%. On the other hand, the hours non-labor income elasticities decreased in magnitude by 50% changing from -0.02 in 2007 to -0.01 in 2017. Despite this, elasticities have remained relatively constant.

The estimated participation wage elasticities increased by 1.34% between 2007 and 2017. Nonetheless, across the last decade, elasticities show a decreasing trend. Finally, the participation non-labor income elasticities decreased in magnitude by 46.67%, changing from -0.015 in 2007 to -0.008 in 2017. As before, despite the increasing trend, elasticities have remained relatively constant.

In terms of the magnitude of these elasticities, the hours wage and participation wage elasticities are higher than estimations conducted in developed countries. Specifically for the US, between 1978 and 2002, hours wage elasticities lie between 0.883 and 0.357 for married women, whereas participation wage elasticities are in the range of 0.66 and 0.03. In this sense, hour wage and participation wage elasticities in Ecuador resemble more to the participation wage elasticities of American married women during the 1980s. On the other hand, hours and participation non-labor income elasticities are more similar to the same elasticities estimated for the US. In the US, between 1978 and 2002, hours non-labor income elasticities changed from -0.05 to -0.001, while participation non-labor income elasticities changed from -0.128 to -0.049. Moreover, Tables 2 and 3 summarize these results.

2.6 Robustness analysis

In order to test these results, and following the procedure conducted by Heim (2007), a two-step bias correction model is estimated to calculate the previous elasticities. The procedure consists of four stages, wherein each stage, the system of equations is calculated for each year of data.

The first stage involves a reduced form Probit, where $P_{it} = 1$ refers to participation in the

labor force, Y_{it}^0 denotes non-labor income and Z_{it}^P contains variables that affect the decision to be part of the labor market. Some of these variables are: cubics in age and years of education of the woman and her husband, a dummy for being a minority, number of children under 16, a dummy for presence of children under 6, and the geographical variables used before, which are: the unemployment rate and the zone of residence, if living in a rural area and a province indicator.

$$P_{it}^* = \alpha_{0t} + \alpha_{1t} Y_{it}^0 + \alpha_{2t} Z_{it}^P + \varepsilon_{it}^P \tag{2.3}$$

$$P_{it} = \begin{cases} 1 \text{ if } P_{it}^* > 0 \\ 0 \text{ otherwise} \end{cases}$$

The second stage estimates a wage regression for women observed to be working positive hours and therefore, have a direct income from labor observation. Here, Z_{it}^w includes cubics in age and years of education, a dummy for being a minority, the geographical variables from the previous regression and the inverse Mills ratio calculated from the first stage.

$$w_{it} = \beta_{0t} + \beta_{1t} Z_{it}^w + \varepsilon_{it}^w \tag{2.4}$$

The third stage involves a selection-corrected labor supply equation, that is estimated on women observed to be working positive hours. Here, $\widehat{w}_{it}^{FT}$ is the imputed second-stage income from labor, Y_{it}^{FT} denotes non-labor income and Z_{it}^h contains covariates like woman's age and years of education, husband age and years of education, number of children under 16, presence of children under 6, the geographic variables included before and the inverse Mills ratio from the first stage.

$$h_{it} = \gamma_{0t} + \gamma_{1t} \widehat{w}_{it}^{FT} + \gamma_{2t} Y_{it}^{FT} + \gamma_{3t} Z_{it}^h + \varepsilon_{it}^h \tag{2.5}$$

Once estimated the coefficients of this stage, specifically γ_{1t} and γ_{2t}, hours elasticities are calculated at the mean in the same manner as in the base specification.

To obtain the participation wage and non-labor income elasticities, Equation 5 is re-estimated with participation in the labor force as the dependent variable.

Figure 9 contains the estimated wage and non-labor income elasticities on the extensive and intensive margins from this specification. Hours wage elasticities show an increasing trend as before, but in this case, elasticities show a greater variation across the last decade. Also, elasticities under this specification appear to have a lower magnitude than the estimated previously, as they range between 0.17 to 0.62. Participation wage elasticities also show a greater variation throughout the period under analysis. Elasticities are much lower than the ones obtained by imputing wages, and also, the trend, in this case, diverges from the one obtained from the base specification.

Under this estimation method, hours non-labor income elasticities in between 2007 and 2017 were -0.03 and -0.02 respectively, while the participation non-labor income elasticities between the same period did not change. As in the base specification, hours and participation non-labor income elasticities have remained relatively constant during the last decade. Unlike the hours and participation wage elasticities, these elasticities are closer in magnitude to the ones estimated by imputing wages. Still, these are below the values obtained previously.

As before, Tables 4 and 5 outline the estimated coefficients of this specification.

As another robustness check, a Tobit model is used to estimate the labor supply responsiveness of Ecuadorian single women at the intensive margin in the last decade. In this sense Equation 6 uses the same variables of equation 1 as dependent and independent variables.

$$H_{it}^{*} = \beta_{0t} + \beta_{1t} l\widehat{w}_{it} + \beta_{2t} ly_{it} + Z_{it}^{h} + \varepsilon_{it} \tag{2.6}$$

$$H_{it} = \begin{cases} 1 \text{ if } H_{it}^{*} > 0 \\ 0 \text{ otherwise} \end{cases}$$

In order to measure the hours wage and non-labor income elasticities, the reported hours worked in the previous week are used as dependent variables. Once the coefficients for each year

are estimated, elasticities are calculated as before.

Figure 10 presents the predicted hours wage and non-labor income elasticities under a Tobit model. The estimated elasticities under this specification resemble more to the results from the base specification. Hours wage elasticities show a minimum increment in a much smaller magnitude as the estimated elasticities from the previous models. On the other hand, hours non-labor income elasticities obtained from the Tobit model are similar to the predicted elasticities of the base model, in magnitude and behavior during the period of analysis. Finally, Table 6 presents the estimated coefficients of this specification for each year.

2.7 Discussion

The results obtained in this study, to some extent, contrast with the evidence found in other countries around the world. First, estimated female labor supply elasticities in other countries are much smaller in magnitude than the ones estimated for Ecuador, specifically hours and participation wage elasticities. And second, the literature shows that in most countries, married women's labor supply elasticities decrease across time, especially in the last decade.

Some possible explanations for the first point are that married women in Ecuador may have higher hours and participation wage elasticities because they are less educated. In this sense, it can be argued that the less educated a person is, the lower its reservation wage will be. Therefore, if Ecuadorian married women have low reservation wages, the more responsive they are going to be to changes in their wages.

Additionally, on the demand side, a significant proportion of married women (on average around 20%) work as self-employed and 29% have an informal job. Therefore, if jobs are not offered and women work in unstable jobs, then the more responsive their labor supply will be to changes in their income from labor.

Regarding the second point, it could be said that the composition of married women may have changed across the decade and would have affected the estimation of elasticities. That is, married women, turning single which would imply that in the sample of married women only those with

high elasticities will remain. Or it could also be that single women are prone to get married and hence, will increase the magnitude of the estimates. These cases seem to be unlikely as the proportion of married women, divorced women, and separated women have remained relatively constant across the decade.

Another possible explanation for both points could be related to labor demand. It could be that the worsening of macroeconomic conditions may have had more pressure on the demand for labor. Which means that labor market conditions increased the responsiveness of married women's labor supply.

Also, as an explanation for the previous points. Results could be derived from own and society's idiosyncratic elements that affect women's decision to supply more labor. These possible explanations are speculative at best, given the lack of other studies that would help to shed light in the explanation of the results presented in this study.

Finally, nothing can be said about married women's labor supply behavior in previous decades, because of the lack of information at the required specification.

2.8 Conclusion

This study tries to fill the gap in the literature by analyzing the magnitude and change of Ecuadorian married women's labor supply and participation elasticities. This investigation uses micro-level data from the *Encuesta Nacional de Empleo, Desempleo y Subempleo* (ENEMDU), in the period 2007 to 2017, with controls for individual characteristics, household composition variables, job characteristics, and partner's individual characteristics.

Overall results show that the estimated hours wage elasticities appear to have increased over the period under analysis by 15%. On the other hand, the hours non-labor income, the participation wage, and the participation non-labor income elasticities have remained relatively constant in the period under analysis.

Regarding the magnitude of the estimated elasticities, the hours wage and participation wage elasticities are higher than estimations conducted in developed countries. Specifically, they resem-

ble to the participation wage elasticities of American married women during the 1980s.

There are some possible explanations for these results. Lower educational attainment may lower Ecuadorian married women's reservation wage, which will increase their labor supply responsiveness. Also, it could be that married women in Ecuador have jobs that are less stable. Furthermore, worse economic conditions may have affected labor demand and, in conjunction with the previous explanations, it could have increased married women's labor supply responsiveness. Finally, personal and social idiosyncratic factors may still affect married women's labor supply.

The contribution of this study to the literature is that it analyzes the labor supply behavior of married women of a country that has not been analyzed before. And, it estimates the behavior of married women's labor supply in the last decade.

In this sense, these results could help policymakers to measure the responsiveness of labor supply to tax rates, subsidies and other policies that affect income. Also, in the creation of effective policies that focus on increasing labor force participation of women. An important element is that these policies should take into account the demand and supply of labor. For example access to more and better education, job training, career development, childcare support and policies that encourage the development of job opportunities for women.

Although the results obtained in this study may explain part of Ecuadorian married women's labor supply, there are still many important research questions that need to be assessed regarding female labor supply not only in Ecuador, but in many other developing economies.

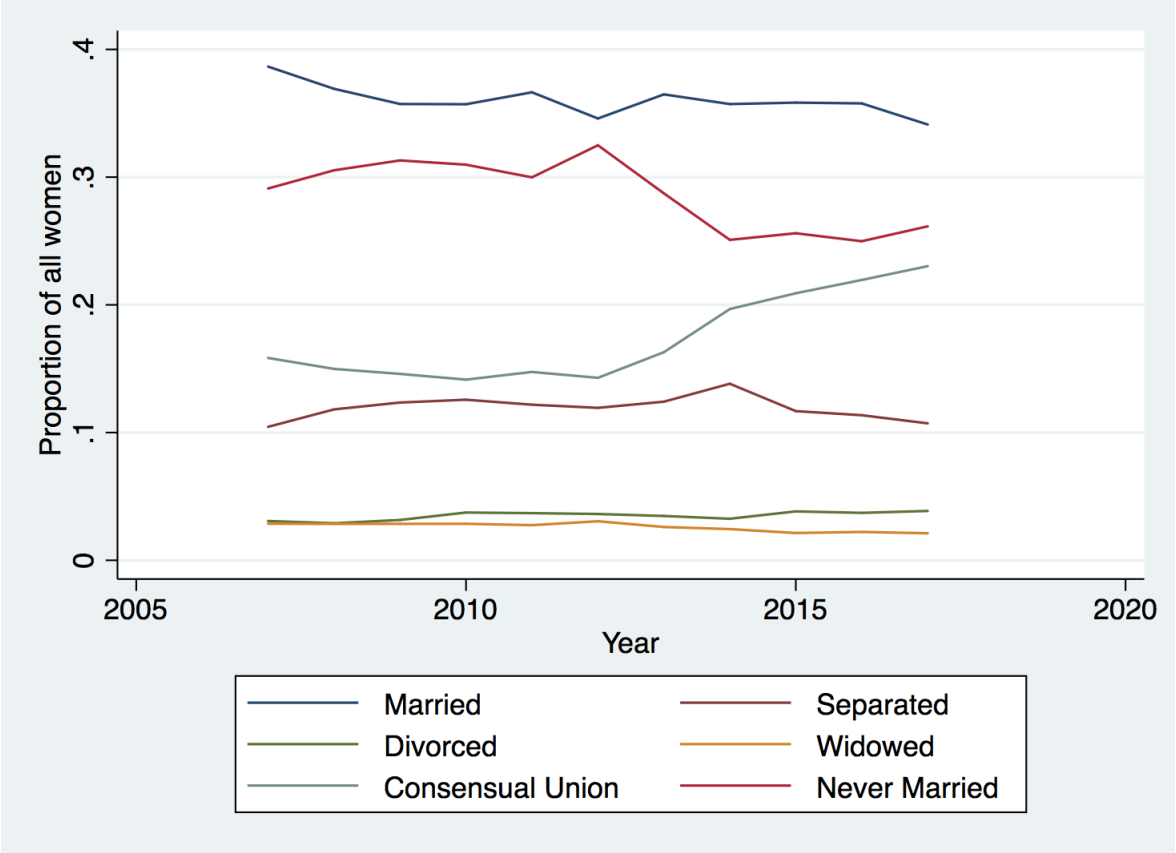

Figure 2.1: Proportion of women by marital status.

Source: Author's calculations using data from INEC: *Encuesta Nacional de Empleo, Desempleo y Subempleo.* (2007 - 2017).

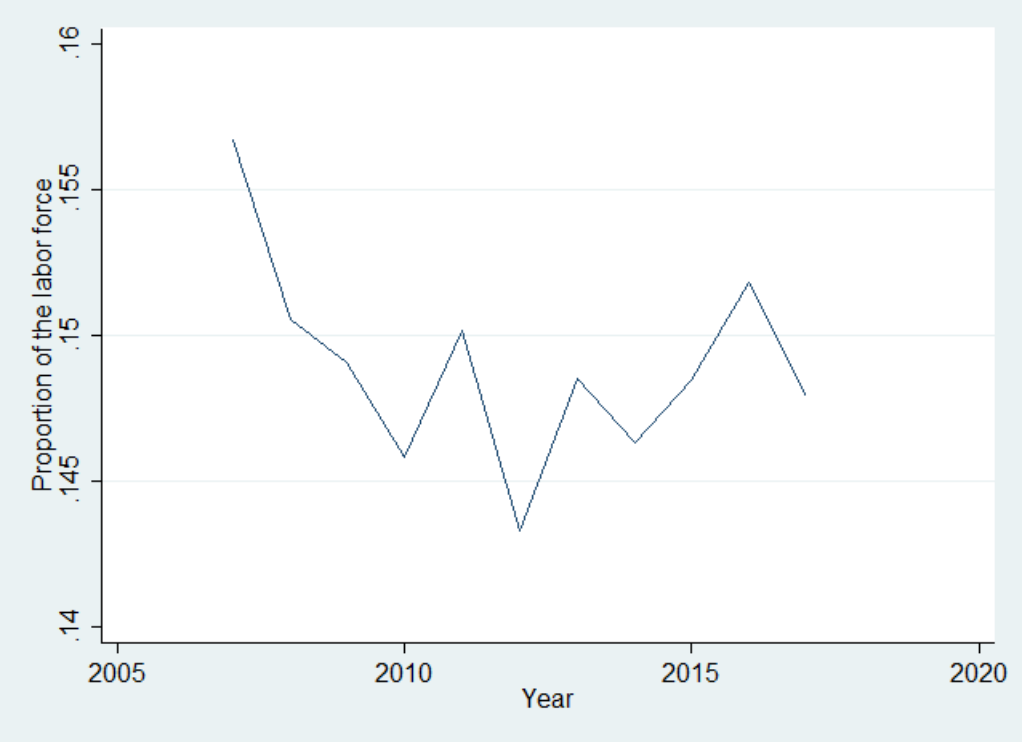

Figure 2.2: Labor force participation rate of married women.

Source: Author's calculations using data from INEC: *Encuesta Nacional de Empleo, Desempleo y Subempleo.* (2007 - 2017).

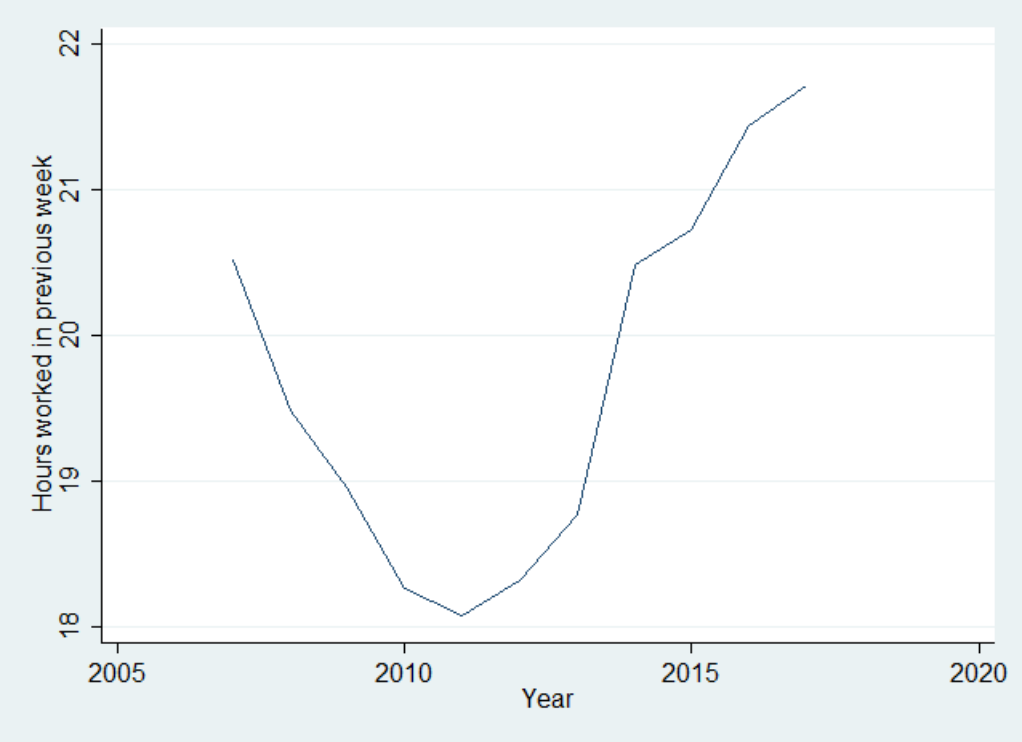

Figure 2.3: Average hours worked in the previous week

Source: Author's calculations using data from INEC: *Encuesta Nacional de Empleo, Desempleo y Subempleo.* (2007 - 2017).

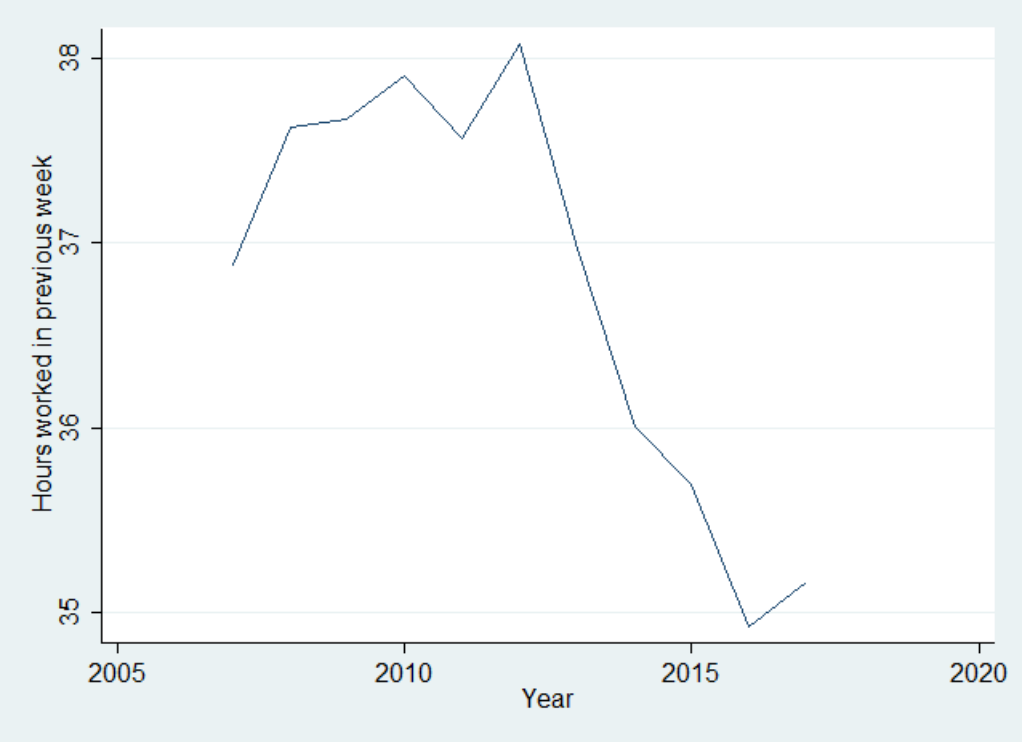

Figure 2.4: Average hours worked in the previous week conditional on working

Source: Author's calculations using data from INEC: *Encuesta Nacional de Empleo, Desempleo y Subempleo.* (2007 - 2017).

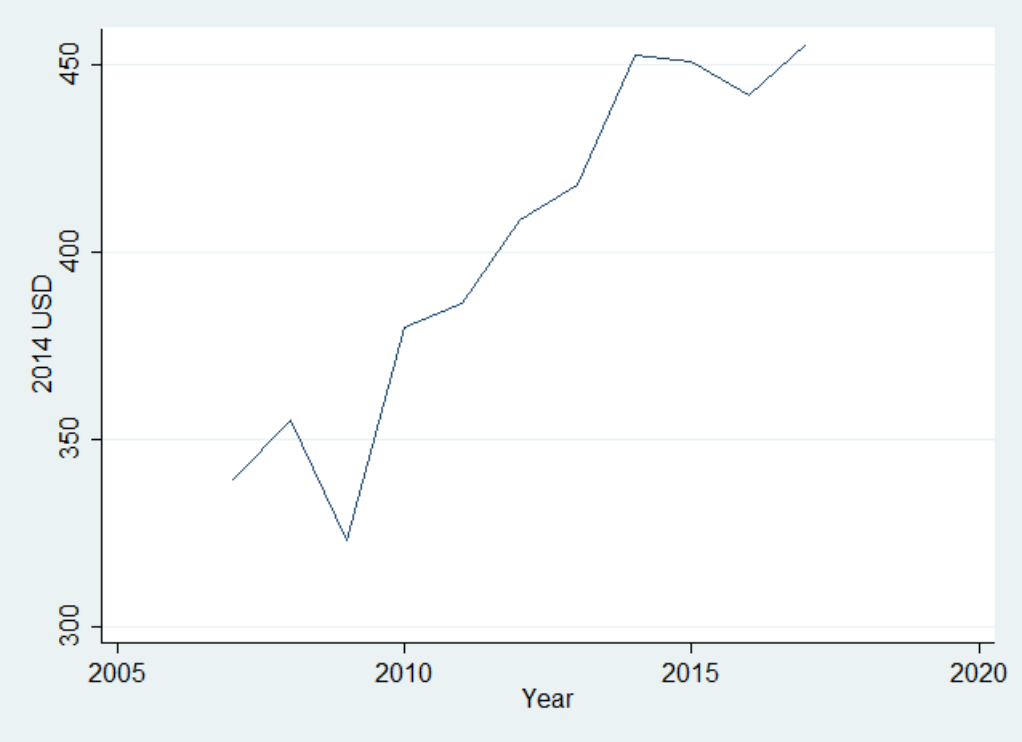

Figure 2.5: Real average monthly income from labor

Source: Author's calculations using data from INEC: *Encuesta Nacional de Empleo, Desempleo y Subempleo.* (2007 - 2017).

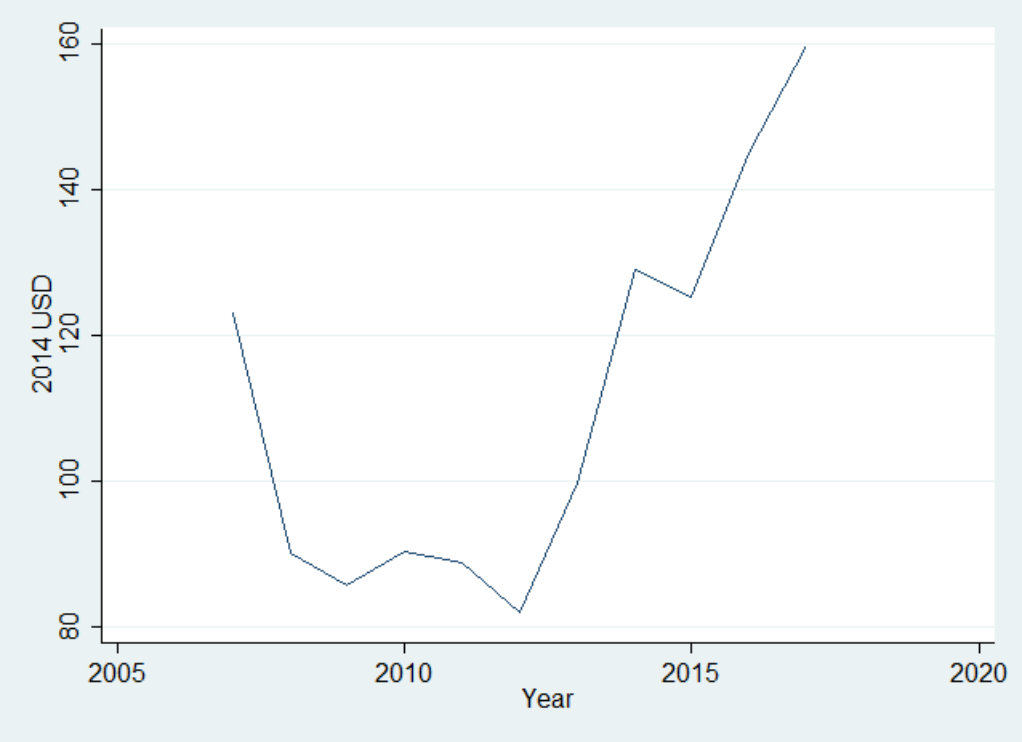

Figure 2.6: Real average monthly non-labor income

Source: Author's calculations using data from INEC: *Encuesta Nacional de Empleo, Desempleo y Subempleo.* (2007 - 2017).

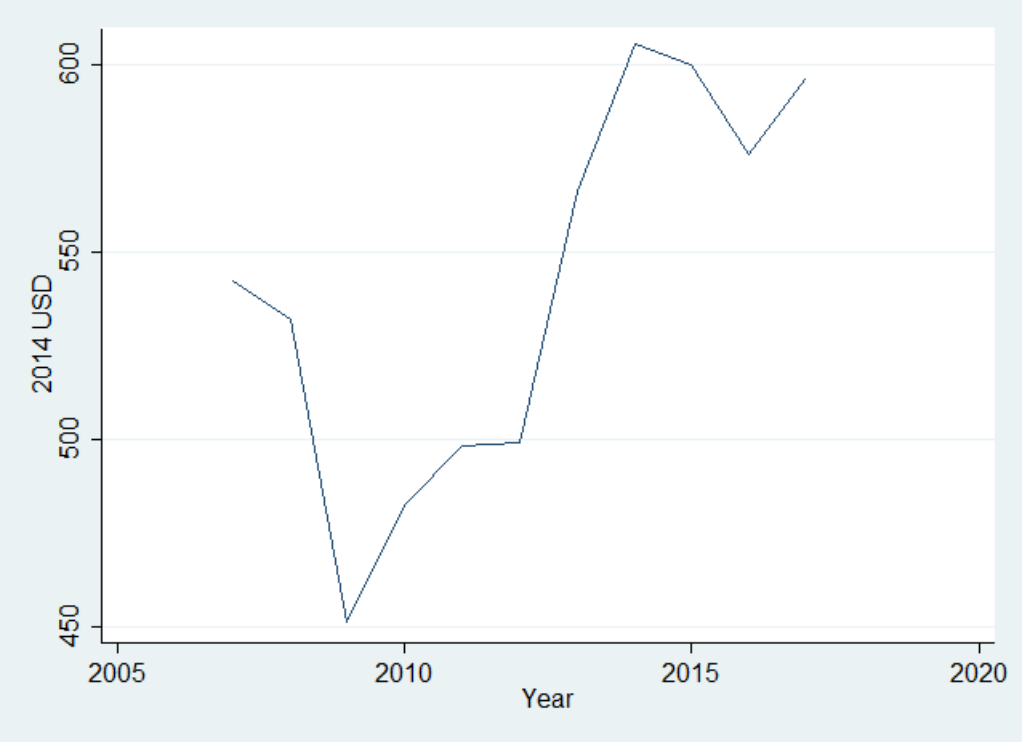

Figure 2.7: Real average monthly labor income of husband

Source: Author's calculations using data from INEC: *Encuesta Nacional de Empleo, Desempleo y Subempleo.* (2007 - 2017).

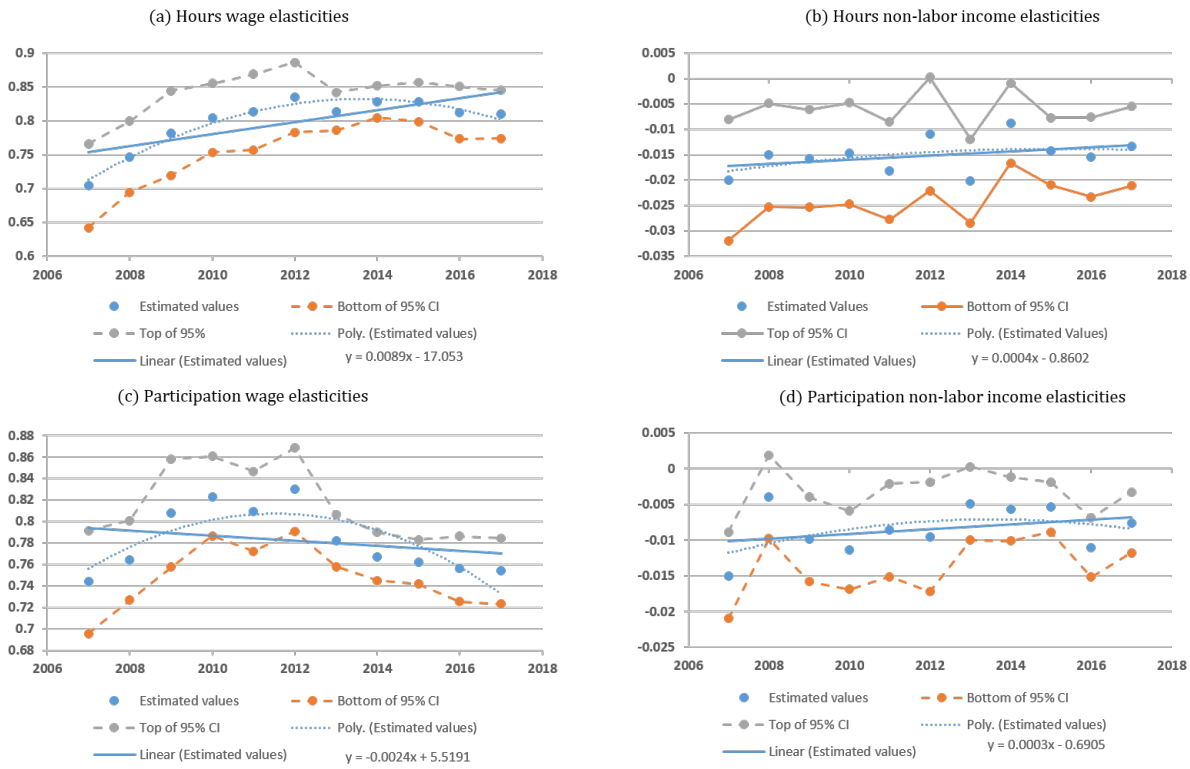

Figure 2.8: Estimated married women's labor supply elasticities, 2007-2017

Source: Author's calculations using data from INEC: *Encuesta Nacional de Empleo, Desempleo y Subempleo.* (2007 - 2017).

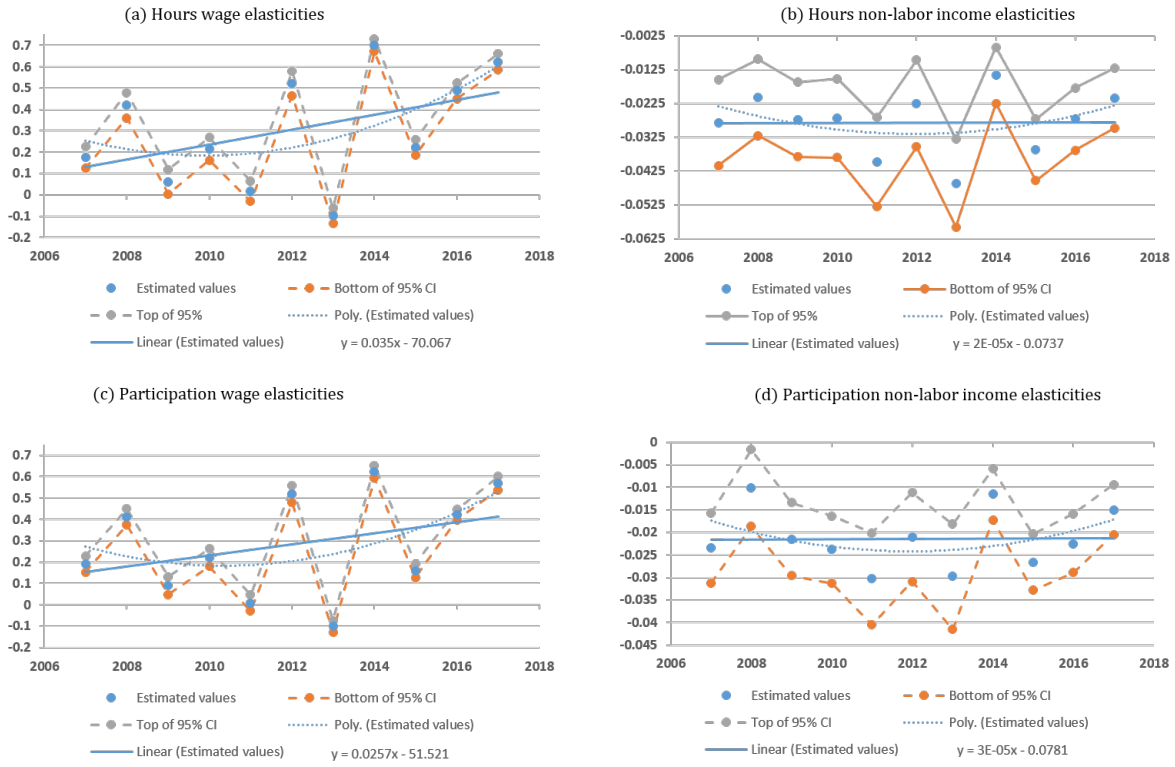

Figure 2.9: Estimated married women's labor supply elasticities (Heckman), 2007-2017.

Source: Author's calculations using data from INEC: *Encuesta Nacional de Empleo, Desempleo y Subempleo.* (2007 - 2017).

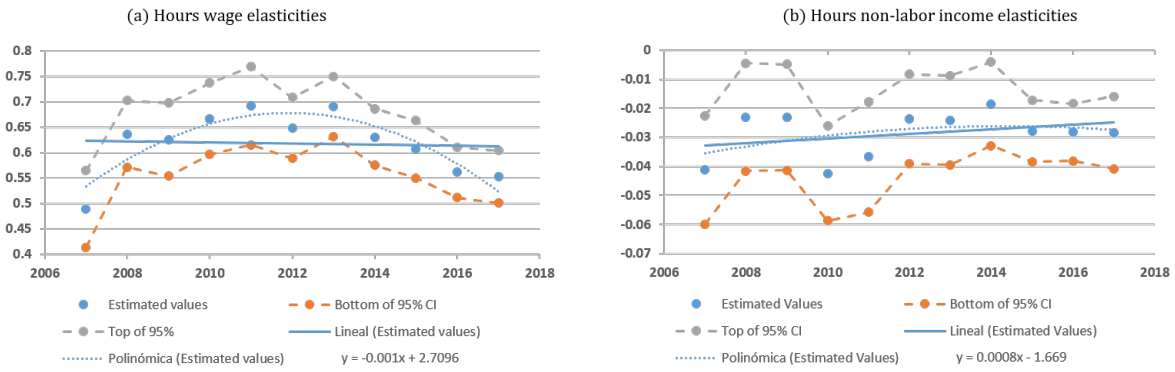

Figure 2.10: Estimated married women's labor supply elasticities (Tobit), 2007-2017.

Source: Author's calculations using data from INEC: *Encuesta Nacional de Empleo, Desempleo y Subempleo.* (2007 - 2017).

Table 2.1: Summary statistics.

	(1) Observations	(2) Mean	(3) Sd. Dev	(4) Min	(5) Max
Age	75,600	40.91	8.24	25	55
Husband's age	72,366	44.64	9.75	19	65
Years of education	75,600	9.36	5.03	0	21
Husband's years of education	72,366	9.47	4.95	0	21
Minority	75,600	0.17	0.38	0	1
Children under 16	75,600	1.65	1.43	0	11
Presence of children under 6	75,600	0.43	0.49	0	1
Hours worked in the previous week	75,600	19.66	20.19	0	60
Monthly real income from labor	45,597	222.21	258.72	0	999.60
Monthly real non-labor income	75,600	125.47	115.19	0	995.55
Labor force	75,600	0.60	0.49	0	1
Informal job	75,600	0.29	0.45	0	1
Unstable job	75,600	0.88	0.33	0	1
Housemaid	75,600	0.02	0.15	0	1
Agriculture	75,600	0.02	0.13	0	1
Poor	75,600	0.28	0.45	0	1
Rural	75,600	0.43	0.49	0	1
Unemployment rate at zone of residence	75,600	0.04	0.05	0	0.64

Source: Author's calculations using data from INEC: *Encuesta Nacional de Empleo, Desempleo y Subempleo* (2007-2017).

Table 2.2: Estimated coefficients hours equation

	(1) 2007	(2) 2008	(3) 2009	(4) 2010	(5) 2011	(6) 2012	(7) 2013	(8) 2014	(9) 2015	(10) 2016	(11) 2017
	Hours worked in the previous week										
Wage	24.91***	26.99***	28.46***	29.79***	29.92***	31.18***	29.61***	29.71***	29.29***	28.13***	28.52***
	(1.116)	(0.964)	(1.157)	(0.960)	(1.047)	(0.986)	(0.517)	(0.431)	(0.526)	(0.685)	(0.639)
Non-labor income	-0.709***	-0.545***	-0.573***	-0.547***	-0.668***	-0.409*	-0.736***	-0.315**	-0.507***	-0.537***	-0.468***
	(0.215)	(0.187)	(0.179)	(0.189)	(0.181)	(0.213)	(0.153)	(0.144)	(0.120)	(0.138)	(0.140)
Observations	4,922	5,167	5,025	5,054	4,421	4,458	5,098	7,286	7,094	7,252	6,722
R-squared	0.560	0.602	0.591	0.640	0.668	0.663	0.691	0.646	0.657	0.586	0.594

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Source: Author's calculations using data from INEC: *Encuesta Nacional de Empleo, Desempleo y Subempleo* (2007-2017).

Table 2.3: Estimated coefficients participation equation

	(1) 2007	(2) 2008	(3) 2009	(4) 2010	(5) 2011	(6) 2012	(7) 2013	(8) 2014	(9) 2015	(10) 2016	(11) 2017
	Participation in the labor force										
Wage	0.744***	0.764***	0.808***	0.823***	0.809***	0.830***	0.782***	0.767***	0.762***	0.756***	0.754***
	(0.0244)	(0.0189)	(0.0256)	(0.0188)	(0.0189)	(0.0197)	(0.0125)	(0.0114)	(0.0105)	(0.0155)	(0.0155)
Non-labor income	-0.0150***	-0.00396	-0.00990***	-0.0114***	-0.00861***	-0.00954**	-0.00487*	-0.00568**	-0.00536***	-0.0111***	-0.00759***
	(0.00306)	(0.00296)	(0.00300)	(0.00278)	(0.00330)	(0.00392)	(0.00265)	(0.00228)	(0.00178)	(0.00215)	(0.00217)
Observations	5,555	5,845	5,532	5,653	4,959	4,999	5,801	8,508	8,257	8,397	7,866
R-squared	0.755	0.779	0.770	0.816	0.834	0.822	0.848	0.833	0.811	0.784	0.792

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Source: Author's calculations using data from INEC: *Encuesta Nacional de Empleo, Desempleo y Subempleo* (2007-2017).

Table 2.4: Estimated coefficients hours equation (Heckman)

	(1) 2007	(2) 2008	(3) 2009	(4) 2010	(5) 2011	(6) 2012	(7) 2013	(8) 2014	(9) 2015	(10) 2016	(11) 2017
	Hours worked in the previous week										
Wage	6.184***	15.16***	2.202**	7.977***	0.637	19.47***	-3.577***	25.14***	7.817***	16.87***	21.94***
	(0.899)	(1.100)	(1.071)	(1.006)	(0.883)	(1.068)	(0.639)	(0.531)	(0.651)	(0.662)	(0.676)
Non-labor income	-0.995***	-0.747***	-0.992***	-0.994***	-1.463***	-0.841***	-1.677***	-0.508***	-1.280***	-0.940***	-0.736***
	(0.230)	(0.209)	(0.204)	(0.220)	(0.246)	(0.244)	(0.241)	(0.152)	(0.163)	(0.162)	(0.160)
Observations	5,555	5,845	5,532	5,653	4,959	4,999	5,801	8,508	8,257	8,397	7,866
R-squared	0.433	0.479	0.417	0.452	0.430	0.514	0.429	0.540	0.395	0.423	0.469

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Source: Author's calculations using data from INEC: *Encuesta Nacional de Empleo, Desempleo y Subempleo* (2007-2017).

Table 2.5: Estimated coefficients participation equation (Heckman)

	(1) 2007	(2) 2008	(3) 2009	(4) 2010	(5) 2011	(6) 2012	(7) 2013	(8) 2014	(9) 2015	(10) 2016	(11) 2017
	Participation in the labor force										
Wage	0.191***	0.412***	0.0895***	0.221***	0.00827	0.518***	-0.101***	0.623***	0.160***	0.421***	0.569***
	(0.0190)	(0.0191)	(0.0210)	(0.0207)	(0.0192)	(0.0202)	(0.0137)	(0.0152)	(0.0167)	(0.0125)	(0.0158)
Non-labor income	-0.0235***	-0.0102**	-0.0215***	-0.0238***	-0.0303***	-0.0210***	-0.0298***	-0.0115***	-0.0266***	-0.0225***	-0.0150***
	(0.00394)	(0.00434)	(0.00414)	(0.00380)	(0.00519)	(0.00502)	(0.00595)	(0.00288)	(0.00314)	(0.00331)	(0.00284)
Observations	5,555	5,845	5,532	5,653	4,959	4,999	5,801	8,508	8,257	8,397	7,866
R-squared	0.557	0.611	0.535	0.575	0.546	0.646	0.552	0.695	0.502	0.561	0.625

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Source: Author's calculations using data from INEC: *Encuesta Nacional de Empleo, Desempleo y Subempleo* (2007-2017).

Table 2.6: Estimated coefficients hours equation (Tobit)

	(1) 2007	(2) 2008	(3) 2009	(4) 2010	(5) 2011	(6) 2012	(7) 2013	(8) 2014	(9) 2015	(10) 2016	(11) 2017
	Hours worked in the previous week										
Wage	17.30***	23.01***	22.76***	24.70***	25.48***	24.23***	25.15***	22.62***	21.46***	19.44***	19.46***
	(1.361)	(1.207)	(1.338)	(1.327)	(1.446)	(1.141)	(1.093)	(1.018)	(1.023)	(0.877)	(0.929)
Non-labor income	-1.459***	-0.833**	-0.841**	-1.571***	-1.353***	-0.884***	-0.878***	-0.663**	-0.985***	-0.980***	-0.999***
	(0.338)	(0.342)	(0.338)	(0.307)	(0.358)	(0.293)	(0.285)	(0.263)	(0.191)	(0.175)	(0.224)
$P(H>0\|X)$	0.576	0.5519	0.5607	0.5523	0.5489	0.5575	0.5692	0.5897	0.5998	0.613	0.6261
Observations	4,922	5,167	5,025	5,054	4,421	4,458	5,098	7,286	7,094	7,252	6,722

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Source: Author's calculations using data from INEC: *Encuesta Nacional de Empleo, Desempleo y Subempleo* (2007-2017).

Chapter 3

Single Women's Labor Supply Elasticities in Ecuador

3.1 Introduction

Over the past decades, labor force participation among women of working age increased, marking one of the most important economic developments of the last time. Nonetheless, the female-to-male ratio in labor force participation rates, for most countries show that the participation of women is below than that of men (ILO, 2013).[1]

Despite this development, the literature in this area has mainly focused on the behavior and evolution of married women's labor supply in developed countries.[2] This is not the case for developing countries, as the literature on married women is just starting to expand in this area.

On the other hand, the analysis of single women's labor supply has received little attention in developed and developing countries, despite of being a representative share in the population composition and the labor force participation of most countries around the world.[3] This leaves an open question on what are single women's behavioral responses to changes in wages, tax, and transfer policies.

This study analyzes the extent of change in Ecuadorian single women's labor supply and labor

[1] The gender participation gap in Nordic countries is below 10 points, coinciding with insignificant gender differences in labor supply elasticities. In Spain or Greece, men's participation is above women's around 50 points, and the gender difference in elasticities is significant and larger than 45. Most European countries and the US are somewhere between these two extreme cases. (Bargain et al, 2012)

[2] Some studies that analyze the labor supply of married women in the US are: Blau and Kahn (2007), Heim (2007), Eissa (2001), Mroz (1987), Mincer (1962). For other developed countries: Morissette and Hou (2008), Saget (1999), Michaud and Tatsiramos (2005), Bick and Fuchs-Schündeln (2012). For developing countries: Arceo G., et al (2010), Wong and Levine (1992), Ismail and Sulainan (2014), Maglad (1998)and Newman and Gertler (1994), among others.

[3] According to estimates from Wang and Parker (2014), by the time today's American young adults reach the age of 50, one in four of them will have never married.

force participation elasticities during the period 2007-2017. This research exploits micro-level data from the *Encuesta Nacional de Empleo, Desempleo y Subempleo* (ENEMDU), with controls for individual characteristics, household composition variables and job characteristics.

In this study single women refer to women who have never been married. Divorced, separated and widowed are not included as on average, between the studied years, they represent the 1.38%, 4.57%, and 3.45% of the population respectively. Single women who cohabit with a male who is not a family member were also excluded as they only represent the 0.01% of the population.

Estimates show that between 2007 and 2017, labor supply responsiveness of Ecuadorian single women has remained relatively constant. Hour wage elasticities increased on average 0.9%, while hour income elasticities increased on average by 12.59%. On the other hand, participation wage elasticities decreased on average by 0.27%, and participation income elasticities have increased on average by 13,19%. Despite these results, the magnitude of these elasticities is comparable to the magnitude of elasticities estimated for married women in developed countries during the 1980s.

The structure of this study is the following. Section 2 details the literature review of single women's labor supply. Section 3, describes the Ecuadorian labor market, specifically the situation of single women in the labor market. Section 4, details the data used in this study. Section 5, reports the empirical methods and the regression results. Section 6 presents a robustness check of the method used in this study, section 7 contains a discussion of the results obtained. Finally, section 8 concludes.

3.2 Literature review

This study makes use of and contributes to the literature of female labor supply. Specifically on the scarce literature related to single women's labor supply in a developing economy. The findings in these studies differ from the trends found in this research.

In the literature, most of the studies focus on analyzing female labor supply as a whole, without taking into consideration some characteristics that might affect the labor supply decisions of women in a given country. Some of these characteristics are age, income, educational attainment,

marital status, among others.

In this sense, most of the studies have analyzed married women's labor supply, whereas only a few of them have analyzed single women's labor supply, despite the fact that single women represent a significant proportion of the population, and the labor market, in most countries around the world.

In the US, it has been shown that single women's labor supply elasticities have decreased between 1979 and 2003. Over this period, hours wage elasticities decreased by 82%, participation wage elasticities by 36%, and participation income elasticities by 57%. This decreasing trend suggests that changes in tax policy had a much larger effect on single mothers and divorcees in the early 1980s than they have had in recent years (Bishop et al., 2009). There is also evidence that younger cohorts have greater wage-supply elasticities, and elasticities are greater among younger women and married women (Pencavel, 1998). Specifically, it seems that in the US for nearly all groups of women without children under 18, and for women with children and with less than 16 years of education, the declines have continued through 2007 and 2009 (Macunovich, 2010). These decreases have changed the decision to supply labor of American women. There is evidence that when the economic reward of participating in the labor force increases, market work increases and housework decreases, with the decrease in housework accounting for approximately two-thirds of the increase in market work. (Gelber and Mitchell, 2012).

In Europe, it has been found that the variation of labor supply elasticities across countries (including the US) relates more to differences in individual and social preferences rather than tax benefits. Also, there is variation in own wage elasticities across countries among single women between 0.1 and 0.5 with larger elasticities for some countries like Belgium and Italy (Bargain et al., 2012).

In Colombia, the increase in labor force participation is driven mostly by the increase in the participation rates of married or cohabiting women and women with low educational attainment. Fertility status appears to be less important. Changes in the composition of the population by levels of educational attainment are also relevant in explaining the increase in labor participation.

In contrast, changes in composition by marital status or fertility are second-order effects (Amador, D. et al, 2013).

In Uruguay, there is evidence that inter-temporal elasticities are high and positive at the intensive and extensive margins, which indicates that women adjust their labor behavior to their life cycle wages. These results coincide with the findings of previous research in developed countries, and they differ from the findings in other developing countries as regards of the estimated elasticities. Furthermore, there is evidence that suggests the existence of different behaviors within the female labor supply. Specifically, the results are not defined by marital status, just by cohorts (Espino et al., 2014).

In other parts of the developing world, there is evidence that married women with children (not necessarily under the age of five) work more than single women at low but not at higher levels of GDP (Bhalotra and Umana-Aponte, 2010).

In the Ecuadorian labor market, there is scarce literature that focuses on female labor supply. Furthermore, this literature does not take into account the differences between married and single women. In this sense, there are no studies that focus on the labor supply decisions of single women. Despite this, there exists evidence that in 2012, there was an increase in the gender earnings gap, associated with higher participation of women as self-employed (Guerra, 2010). Nonetheless, it also has been shown that between 2003 and 2007, human capital characteristics account for only a small fraction of the gender wage gaps (Gallardo, L., and Ñopo, 2009).

Also, it has been shown that for all women, schooling is positively related to women's labor market participation rate and negatively to early motherhood (Molina Vera, 2015). Finally, evidence suggests that schooling increases women's labor force participation rate and decreases the probability of early motherhood (De Paoli, 2010).

This study contributes to the literature in the following manner: (1) It analyzes the labor supply responsiveness of single women in a developing country; and (2) it measures how the labor supply decision of single women in Ecuador has changed in the last decade. Among the studies mentioned above, no other study examines the direction and extent of change in Ecuadorian single women's

labor supply and labor force participation elasticities over the last decade.

3.3 Population, labor supply, and income trends

Figure 1 shows the proportion of women by marital status. In Ecuador, between 2007 and 2017, on average married women represent around 38% of all Ecuadorian women ages 17 to 65. On the other hand, single women are the second most representative group (28% of all women in Ecuador). Finally, 20% represent the ones in a consensual union. As can be seen in Figure 2, the average age of married women is 43 years, for single women is 28 years and women in a consensual union is 36 years. On average, 25.26% of single women live with at least one parent, 15,98% are household heads, and 13.17% live with at least one of their grandparents.

In terms of educational attainment, between 2007 and 2017, married women seem to be less educated than single women. Figure 3 shows that a greater proportion of married women completed only primary and secondary education, although the percentage of married women with only primary education decreased between 2007 and 2017. In contrast, the percentage of married women with a university degree remained relatively constant and below 8% of all women ages 17 to 65. On the contrary, the majority of women who never married have completed tertiary education, and the ones that have completed only primary education are the minority as is shown in Figure 4.

Between 2007 and 2017, the number of women in the labor force has remained relatively constant. Nevertheless, if the analysis is separated by marital status, as is shown in Figure 5, it can be seen that between 2007 and 2012, the proportion of married women in the labor force decreased and after 2012, it had a relatively small increment. On the other hand, the labor force participation rate of women who have never been married has remained relatively constant in the past decade.

On the other hand, as it is shown in Figure 6, the employment rate of married women has remained constant between 2007 and 2013, and had a minimal increment in the following years.[4] While, the employment rate for single women shows to be constant between 2007 and 2017.

With regard to labor supply, as Figure 7 shows, before 2011 women who never married on

[4] The employment rate is calculated as the summation of the full- and underemployed divided by all the labor force.

average worked more hours than married women. After 2011, both groups experienced a decrease in the number of hours worked in the previous week, where married women on average decreased less their labor supply than women who never married.[5]

Finally, when analyzing the evolution of income from labor and non-labor income of Ecuadorian single women, it can be seen from Figure 8 that real income from labor has increased through the last decade. Also, when compared with the real income from labor of married women, single women's income from labor is lower. On the other hand, non-labor income had an increasing behavior just after 2011, as is shown in Figure 9. Further, when comparing non-labor income between married women and single women, single women have a higher level of non-labor income than married women throughout the entire decade. One possible explanation for the increment of non-labor income could be the increment of the BDH transfer that occurred in 2013, as around 20% of the sample are beneficiaries of the BDH program.

3.4 Data

This research uses data from the *Encuesta Nacional de Empleo, Desempleo y Subempleo* (ENEMDU), which is a quarterly survey that tracks the evolution of the Ecuadorian labor market, income and general characteristics of the population. Data is available from the second quarter of 2007 to the fourth quarter of 2018. Only the surveys conducted on the second and fourth quarter of each year include information on urban and rural households. This research uses December surveys from 2007 to 2017.

The database used in this study focuses only on single women, with ages between 25 to 55 years old, who are not students, are not part of the military and are not retired. As mentioned before, this study focuses on single women who have never been married.

The measure of labor supply is reported weekly work hours. The analysis includes those indi-

[5] It is important to mention that Ecuador's main export is crude oil which represents 30% of national total revenue. In this sense, the economy expanded between 2009 and 2012 when oil prices rose and then, it experienced a deceleration derived from decreasing oil prices. This could be one possible explanation for the change in hours worked during this decade.

viduals with reported non-negative hours in the previous week of being interviewed and those who reported that they have not worked in the previous week. Additionally, excluded from the analysis are those individuals who reported extreme working hours above 60 hours per week.

Hourly wages are calculated in the following manner: First, reported monthly income from labor was divided by four. And then, this result divided by the reported hours worked in the previous week. Finally, non-labor income is the reported non-labor income of the surveyed woman. Also, the observations with extreme values of income from labor and non-labor income (900 USD and 305 USD respectively) were removed from the analysis.[6] Both income variables are converted to real dollars from the year 2014 using the consumer price index reported by the National Institute of Statistics and Census, in Spanish *Instituto Nacional de Estadísticas y Censos* (INEC).

Additionally, other variables that are included in this study are the woman's age, years of education, if is part of a minority, number of children under 16, the presence of children under 6, if the individual is poor, if has an informal job, if works in agriculture, if is the household head, if does not have a stable job, and if works as a housemaid.[7] Also, geographic variables and the unemployment rate at the zone of residence are included.

Table 1 presents descriptive statistics of the database used in this investigation. Between 2007 and 2017, Ecuadorian single women in their prime working years (25-55) have an average age of 35, 15% of them consider themselves being part of a minority group, on average they have completed secondary education (11 years of education), 25% declared being the household head, the average number of children under 16 is 0.27 (1.81 conditional on having children), and, 27% live in the presence of children under 6.

As regards the economic variables, the average number of hours worked in the previous week is 25 (37.29 hours conditional on working), the average monthly real income from labor and monthly

[6] Extreme values for the hours worked in the previous week, the income from labor and non-labor income, are defined as those values that exceed the 90th percentile of the distributions of each variable.

[7] Years of education is calculated by adding the number of years that correspond to their educational attainment plus the highest year passed. Minority includes those who do not consider themselves being *mestizo* or white. Informal job includes all jobs in unregistered or small-scale private enterprises that produce goods or services for sale. Self-employed street vendors, taxi drivers, and home-based workers, regardless of size, are all considered. Finally, not having a stable job is defined as having a temporary employment contract.

real non-labor income is 257 USD and 26 USD respectively. Approximately, 77% are part of the labor force, 26% have an informal job, 79% have an unstable job, 6% work as housemaid, 1% work in agriculture and 28% are under the poverty line.

Finally, regarding the geographical characteristics of the sample, 36% live in a rural area and the average rate of unemployment at the zone of residence is 5%.

3.5 Empirical procedures and regression results

As Bishop et al (2009) mention, there is no estimation methodology that is considered standard for estimating single women's labor supply. Unlike the case of married women, the labor supply estimation of single women simplifies as it is not necessary to consider a joint labor supply decision in the household.

The estimation method in this investigation will follow the procedure from Blau and Kahn (2007). This procedure is using a "second generation" model of labor supply. It will also include the estimation of labor supply elasticities at the intensive and extensive margin.

Like many other studies, this investigation contains the usual econometric difficulties associated with the estimation of labor supply. Two of these problems are measurement error and not having wage offers for the nonworkers. Measurement error in this context arises from the fact that the wage variable is calculated by first calculating weekly earnings and then dividing weekly earnings by the reported hours of work in the previous week. In this sense, results will have a downward bias.

To account for the second problem, for the nonworkers, wages are imputed by assigning the predicted wages for people with the same observed characteristics who had low working hours (under 16 hours per week). This procedure is similar to the ones used by Blau and Kahn (2007), Juhn (1992) and Juhn and Murphy (1997). Also, in order to include the self-employed in the analysis, wages were imputed in the same manner as before, that is, by assigning the predicted wages for people with the same observed characteristics.

The regressors used to obtain the predicted values of log wages were cubics of age and years of

education, dummies for being a minority, having an informal job, working in agriculture, working as a housemaid and having an unstable job. Geographical variables were also included, these are an indicator for living in a rural area, province dummies and the unemployment rate at the zone of residence.

Then the static labor supply model can be interpreted as woman i in year t supplying H_{it} hours of labor per week. These number of hours will depend on the primary regressors that are the natural logarithm of the wage rate denoted $l\widehat{w}_{it}$, the natural logarithm of non-labor income (ly_{it}), and other variables which are included in Z_{it}^{h}. These variables are: age, years of education, a dummy that indicates if the woman is the household head, number of children under 16, presence of children under 6, dummies for informal job, housemaid work, job in agriculture, being poor, rural area, province dummies, and the unemployment rate at the zone of residence.

$$H_{it} = \alpha_{0t} + \alpha_{1t} l\widehat{w}_{it} + \alpha_{2t} ly_{it} + Z_{it}^{h} + \varepsilon_{it} \tag{3.1}$$

Both wage and labor supply equations are estimated for each year of data.[8] Also, in the estimation of both equations standard errors are clustered at the city level in order to account for spatial correlation.

After estimating the coefficients, elasticities are evaluated at the mean. That is:

$$\varepsilon_{wt}^{h} = \frac{\widehat{\alpha}_{1t}}{\overline{h}_{t}} \tag{3.2}$$

$$\varepsilon_{yt}^{h} = \frac{\widehat{\alpha}_{2t}}{\overline{h}_{t}}$$

A similar procedure is conducted to calculate the participation-wage and participation-income elasticities. Equation 1 is re-estimated using participation in the labor force as a dependent variable. The elasticities, in this case, will be the estimated average derivative of participation to log wages and the estimated average derivative with respect to non-labor income.

[8] This is reflected by the subscript t in the coefficients.

Figure 10 contains the estimated wage and income elasticities on the extensive and intensive margins from the base specification previously described. In order to smooth out the trends in elasticities, the figure includes a solid line that represents the results from a linear regression. Also, includes a dashed line that represents the results from a polynomial equation of second order. The estimated elasticities are represented by the dots.

All the estimated elasticities appear to have remained relatively constant between 2007 and 2017. The hours wage elasticities changed from 0.55 in 2007 to 0.58 in 2017. On average this elasticity increased by 0.9% in the previous decade. The hours non-labor income elasticities show a negative trend that changed from -0.009 in 2007 to -0.023 in 2017. On average the hour non-labor income elasticities decreased by 12.59%. Additionally, the participation wage elasticities show no significant variation over the time period analyzed, on average it decreased by 0.27%. Finally, the participation non-labor income elasticity shows an increment of 13.19% as it changed from -0.0009 in 2007 to -0.0116 in 2017. Is important to mention that, unlike the previous results, for the case of the participation non-labor income elasticities, some of the coefficients of the regressions estimated, are not statistically significant.[9]

Besides that these elasticities did not change in the previous decade, it is important to mention that the estimated elasticities are high, compared to estimates of female labor supply elasticities in developed countries. For example, in the US single women's own wage labor supply elasticities range between 0.2, during the 1980s, to 0.02 in the 2000s. Furthermore, the participation wage elasticities in the US range between 0.2 and 0.02, between 1980 and the early 2000s. On the contrary, estimated hours non-labor income elasticities and participation non-labor income elasticities are more similar to the values estimated in the US for single women. Furthermore, Tables 2 and 3 summarize these results.

[9] Specifically, coefficients of the participation non-labor income are not statistically significant for the years 2010, 2011, 2012, 2014, 2016 and 2017.

3.6 Robustness analysis

As an alternative to imputing wages, a two-step bias correction model is estimated following Bishop, et al. (2009). The estimation is conducted in four stages. As before, the system of equations is calculated for each year of data. In this sense, the first stage is a reduced form Probit, where $P_{it} = 1$ means participation in the labor force, Y_{it}^0 denotes non-labor income, and Z_{it}^P contains variables that affect the decision to be part of the labor market. These variables are: cubics in age and years of education, dummies for being a minority and being the household head, number of children under 16, a dummy for presence of children under 6, and the geographical variables used before, which are: the unemployment rate and the zone of residence, if living in a rural area and a province dummy.

$$P_{it}^* = \alpha_{0t} + \alpha_{1t} Y_{it}^0 + \alpha_{2t} Z_{it}^P + \varepsilon_{it}^P \tag{3.3}$$

$$P_{it} = \begin{cases} 1 \text{ if } P_{it}^* > 0 \\ 0 \text{ otherwise} \end{cases}$$

In the second stage, a selection-corrected income from labor regression is estimated for women observed to be working positive hours and who have a direct income from labor observation. In this case, Z_{it}^w includes cubics in age and years of education, a dummy for being a minority, the geographical variables from the previous regression and the inverse Mills ratio calculated from the first stage.

$$w_{it} = \beta_{0t} + \beta_{1t} Z_{it}^w + \varepsilon_{it}^w \tag{3.4}$$

In the third stage, a selection-corrected labor supply regression is estimated on women observed to be working positive hours, where $\widehat{w}_{it}^{FT}$ is the imputed second-stage income from labor, Y_{it}^{FT} denotes non-labor income and Z_{it}^h contains covariates like woman's age, years of education, presence

of children under 6, number of children under 16, the geographic variables, and the inverse Mills ratio from the first stage.

$$h_{it} = \gamma_{0t} + \gamma_{1t}\widehat{w}_{it}^{FT} + \gamma_{2t}Y_{it}^{FT} + \gamma_{3t}Z_{it}^{h} + \varepsilon_{it}^{h} \tag{3.5}$$

After obtaining the estimates from this stage, hours elasticities are calculated at the mean in the same manner as in the base specification.

Finally, participation wage and non-labor income elasticities are calculated by estimating a structural participation equation. That is re-estimating equation 5 with participation in the labor force as the dependent variable.

Figure 11 contains the estimated wage and non-labor income elasticities on the extensive and intensive margins from this specification. As before, elasticities have remained relatively constant over the time period under analysis. The hours wage elasticity on average had an increment of 1.19%, ranging from 0.498 to 0.541. The hours non-labor income elasticities decreased from 0.003 in 2007 to -0.02 in 2017. On average it meant a decrease of 24.27%. The participation wage elasticities on average decreased by 0.09%. In 2007 the estimated elasticity was 0.408, while in 2017 it was 0.386. Finally, the participation non-labor from income elasticities also show an average decrease of 94.38% as it changed from 0.002 in 2007 to -0.017 in 2017. Again, as in the previous specification, some of the coefficients used in the estimation of the participation non-labor income elasticities are not statistically significant.[10] Tables 4 and 5 outline the estimated coefficients of this specification.

Additional to the analysis proposed by Bishop et al. (2009), a Tobit model was used to estimate the labor supply responsiveness of Ecuadorian single women in the intensive margin in the last decade. In this sense equation 6 uses the same variables of equation 1 as dependent and independent variables.

[10] In this case, the years were the coefficients of the participation non-labor income are not statistically significant are: 2010, 2011, 2013, 2016 and 2017.

$$H_{it}^{*} = \beta_{0t} + \beta_{1t} l\widehat{w}_{it} + \beta_{2t} ly_{it} + Z_{it}^{h} + \varepsilon_{it} \tag{3.6}$$

$$H_{it} = \begin{cases} 1 \text{ if } H_{it}^{*} > 0 \\ 0 \text{ otherwise} \end{cases}$$

In order to measure the hours wage and non-labor income elasticities, the reported hours worked in the previous week are used as dependent variables. Once the coefficients for each year are estimated, elasticities are calculated in the same procedure as before.

Figure 12 presents the predicted hours wage and non-labor income elasticities under this specification. Like previous results, the estimated elasticities have remained relatively constant in the last decade. Under this specification, the predicted hours wage elasticities are smaller than the ones predicted by the previous specifications. On the other hand, the hours non-labor income elasticities calculated using the Tobit model, are much more similar in magnitude to the ones calculated before. Table 6 presents the estimated coefficients of this specification for each year.

Finally, it can be argued that this study is focusing on single women whose labor supply decisions may be affected by income from labor and non-labor income of other members of their household. Specifically, parents or grandparents as a significant amount of women live under these circumstances. In this sense, as an additional robustness check, the base specification was conducted considering only those single women who identified themselves as household heads.

Figure 13 presents the estimated elasticities from this analysis. Despite the reduction in the number of observations, results from this specification parallel the ones obtained in the previous specifications. In terms of magnitude, hours wage and participation wage elasticities are slightly smaller than the estimated elasticities from the base specification. While the hours non-labor income and participation non-labor income elasticities are much more similar in terms of magnitude to the results obtained before. In this sense, all the estimated elasticities remain relatively constant.

Lastly, Tables 7 and 8 show the estimated coefficients from this procedure.

3.7 Discussion

The results obtained in the previous two specifications suggest that labor supply elasticities for Ecuadorian single women are larger than the ones obtained in other countries, but are smaller than the estimated elasticities for Ecuadorian married women. And also, that the estimated elasticities for single women have remained relatively constant in the period under analysis.

In terms of magnitude, one possible explanation for smaller elasticities compared to married women's labor supply elasticities is that single women work in more stable jobs than married women. On average, between 2007 and 2017, 15% of single women were private employees and only 26% had an informal job. In this sense, job stability will make single women's labor supply less responsive.

Also, it could be argued that as on average, single women are more educated than married women, single women will have a higher reservation wage than married women, which will imply that married women's labor supply is much more responsive than single women's. Nevertheless, given other factors related to the household composition like the number of children, married women's reservation wage will be greater than the one of single women. In this sense, in order to test this possible explanation, it will be required to have a measure of reservations wages of married and single women in Ecuador.

With regards to the change of the estimated elasticities across the decade, it could be that there may be a sample selection bias arising from married and single women changing their marital status. In this regard, the composition of married, separated and divorced women in Ecuador has remained constant in the last decade. Nonetheless, during the last part of the decade, the proportion of single women decreased and the one of those in a consensual union increased. Therefore, it is likely that a proportion of single women changed their marital status to a consensual union in the last decade. Therefore, in order to check the sample selection bias, it will be required to analyze the labor supply responsiveness of women in a consensual union and compare it with the ones estimated for single women. This is somewhat problematic as living arrangements of women in a consensual union are different to the ones of single and married women, which complicates the

estimation as there is no method to estimate the labor supply of women in a consensual union.[11]

Finally, there could be personal and social attitudes toward women that still prevail and that affect Ecuadorian single women's decision to supply more labor. This explanation is speculative at best, given the lack of other studies that would help to deepen the analysis in this area.

3.8 Conclusion

This study analyzes the extent of change in Ecuadorian single women's labor supply and labor force participation elasticities during the period 2007-2017. This research exploits micro-level data from the *Encuesta Nacional de Empleo, Desempleo y Subempleo* (ENEMDU), with controls for individual characteristics, household composition variables and job characteristics.

Overall results show that in the past decade labor supply responsiveness of Ecuadorian single women has remained relatively constant. Hour wage elasticities increased on average 0.9%, while hour income elasticities increased on average by 12.59%. On the other hand, participation wage elasticities decreased on average by 0.27%, and participation income elasticities have increased on average by 13.19%. Despite these results, the magnitude of these elasticities are large compared with the estimates of other countries, but still smaller than the elasticities of Ecuadorian married women.

Possible explanations for these results are that Ecuadorian single women have more stable jobs and are better educated than Ecuadorian married women, which makes married women's labor supply much more responsive than single women's.

Also, there could be a sample selection bias that may have affected these results. Nevertheless, given the likelihood that single women changed their marital status to a consensual union, it will be required to estimate the labor supply elasticities of this group of women. This turns out to be problematic, as the living arrangements of women in a consensual union are different than the ones of single and married women, which complicates the calibration of a labor supply model.

[11] A possible way to estimate the labor supply of women in a consensual union is to follow a model of family bargaining, where the income from labor and non-labor income of the partner is not pooled, but entered separately into the labor supply equation.

Finally, these results could be explained by personal and social attitudes toward women that still prevail in Ecuador and that affect single women's decision to supply more labor.

The contribution of this study to the literature is that it analyzes the labor supply behavior of single women in Ecuador. And, it also estimates the behavior of Ecuadorian single women's labor supply in the last decade at the intensive and extensive margin.

These results are important for policymakers, as it could help in the development of policies regarding income and in the inclusion of more women into the labor force. Nonetheless, single women's labor supply can change if there exists an integrated multi-dimensional approach focused to improve women's preferences and work circumstances.

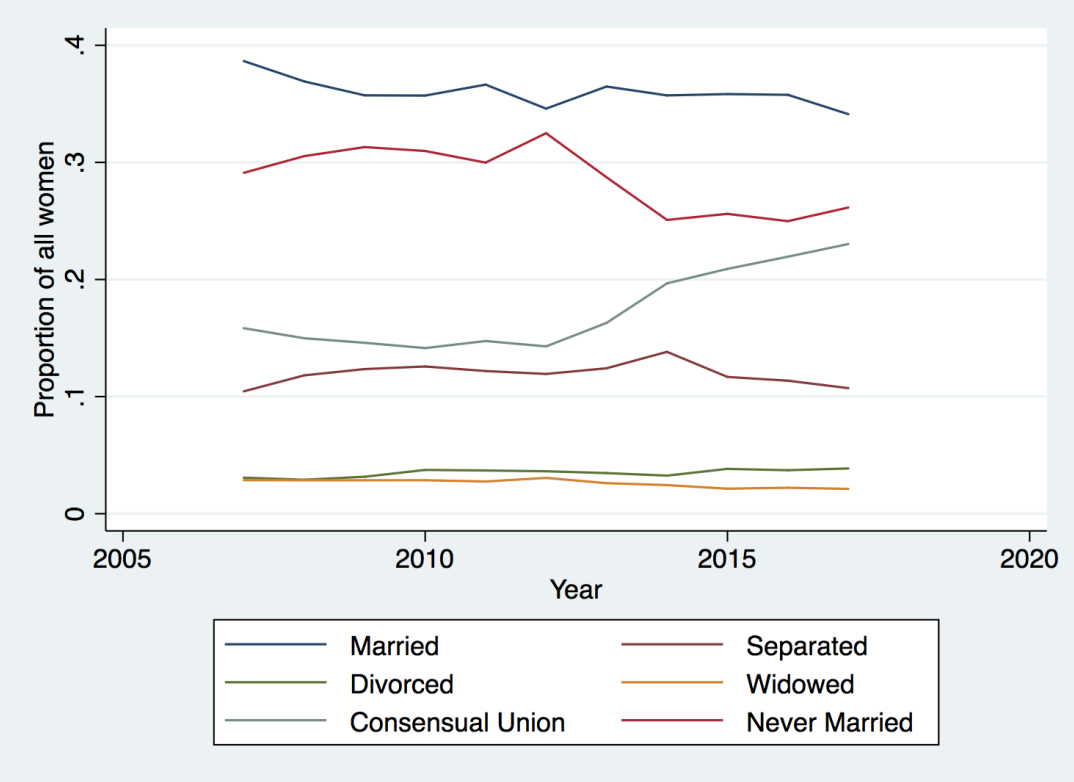

Figure 3.1: Composition of women by marital status.

Source: Author's calculations using data from INEC: *Encuesta Nacional de Empleo, Desempleo y Subempleo.* (2007 - 2017).

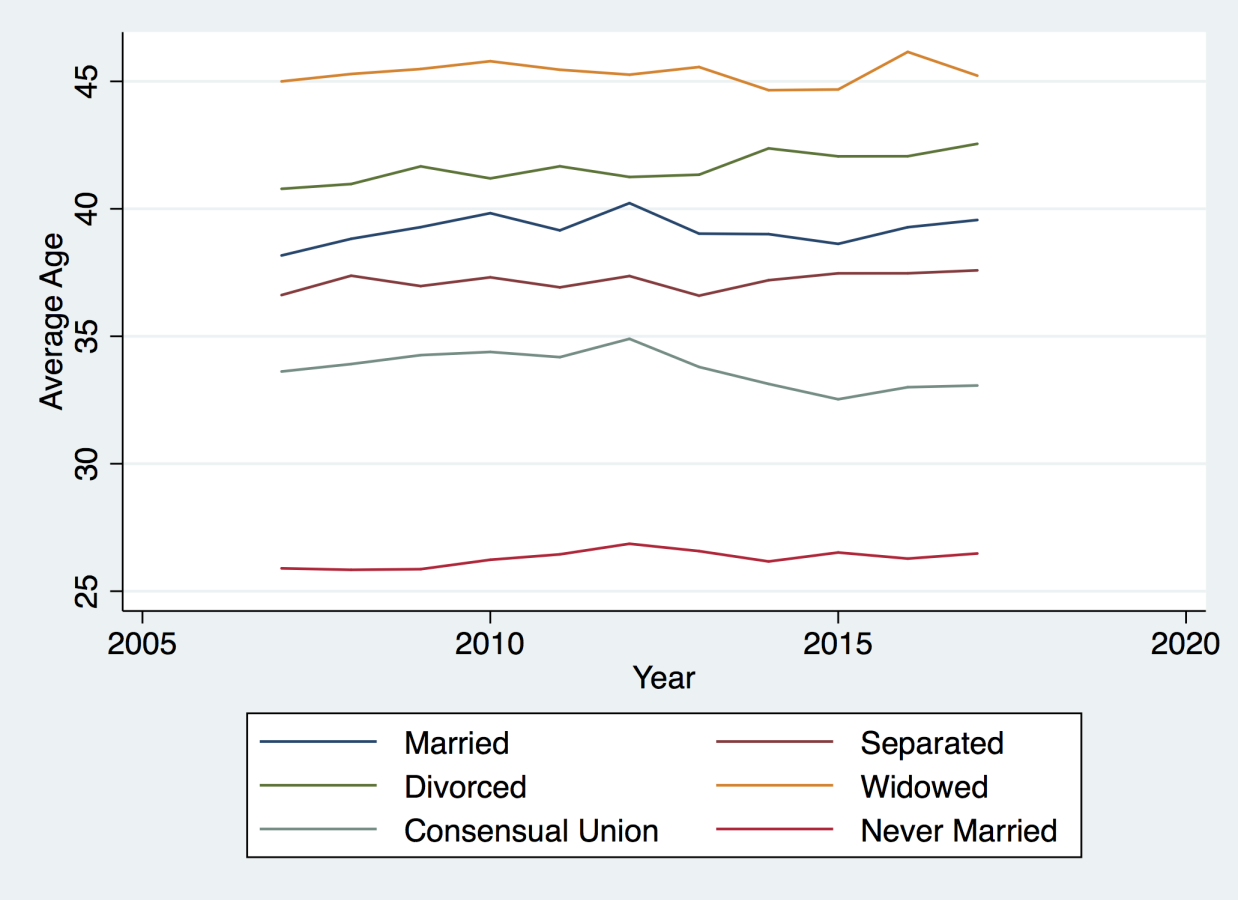

Figure 3.2: Average age of women by marital status.

Source: Author's calculations using data from INEC: *Encuesta Nacional de Empleo, Desempleo y Subempleo.* (2007 - 2017).

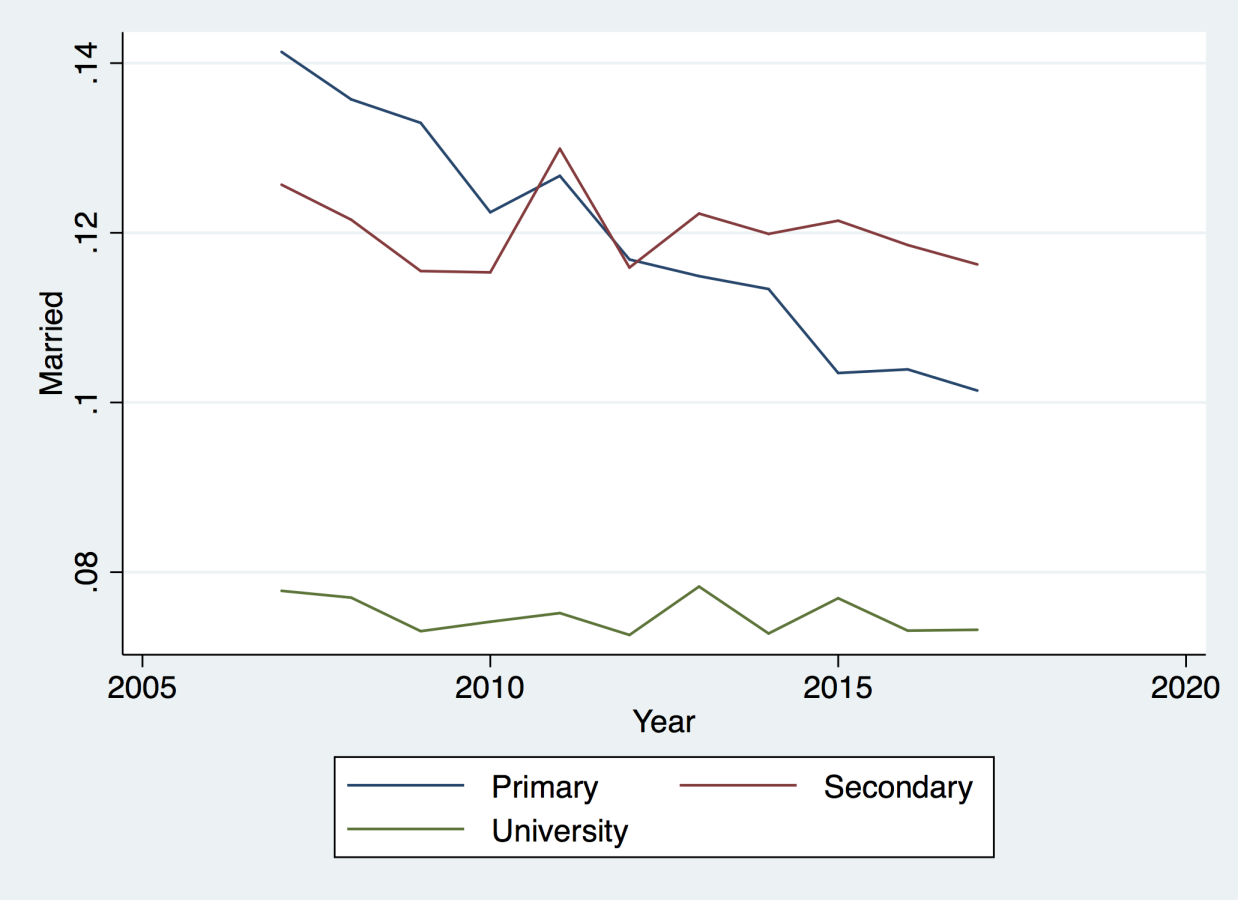

Figure 3.3: Educational attainment of married women.

Source: Author's calculations using data from INEC: *Encuesta Nacional de Empleo, Desempleo y Subempleo.* (2007 - 2017).

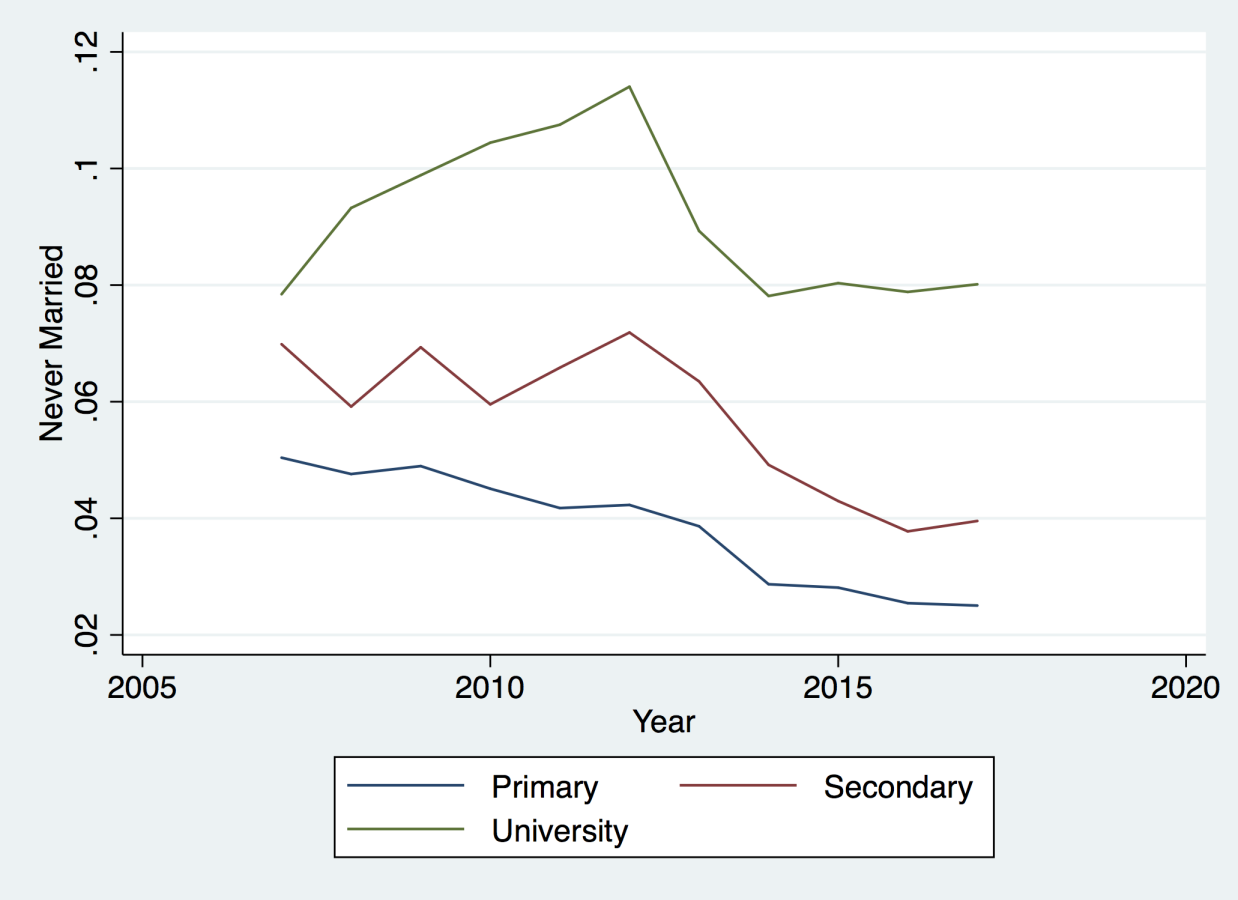

Figure 3.4: Educational attainment of single women.

Source: Author's calculations using data from INEC: *Encuesta Nacional de Empleo, Desempleo y Subempleo.* (2007 - 2017).

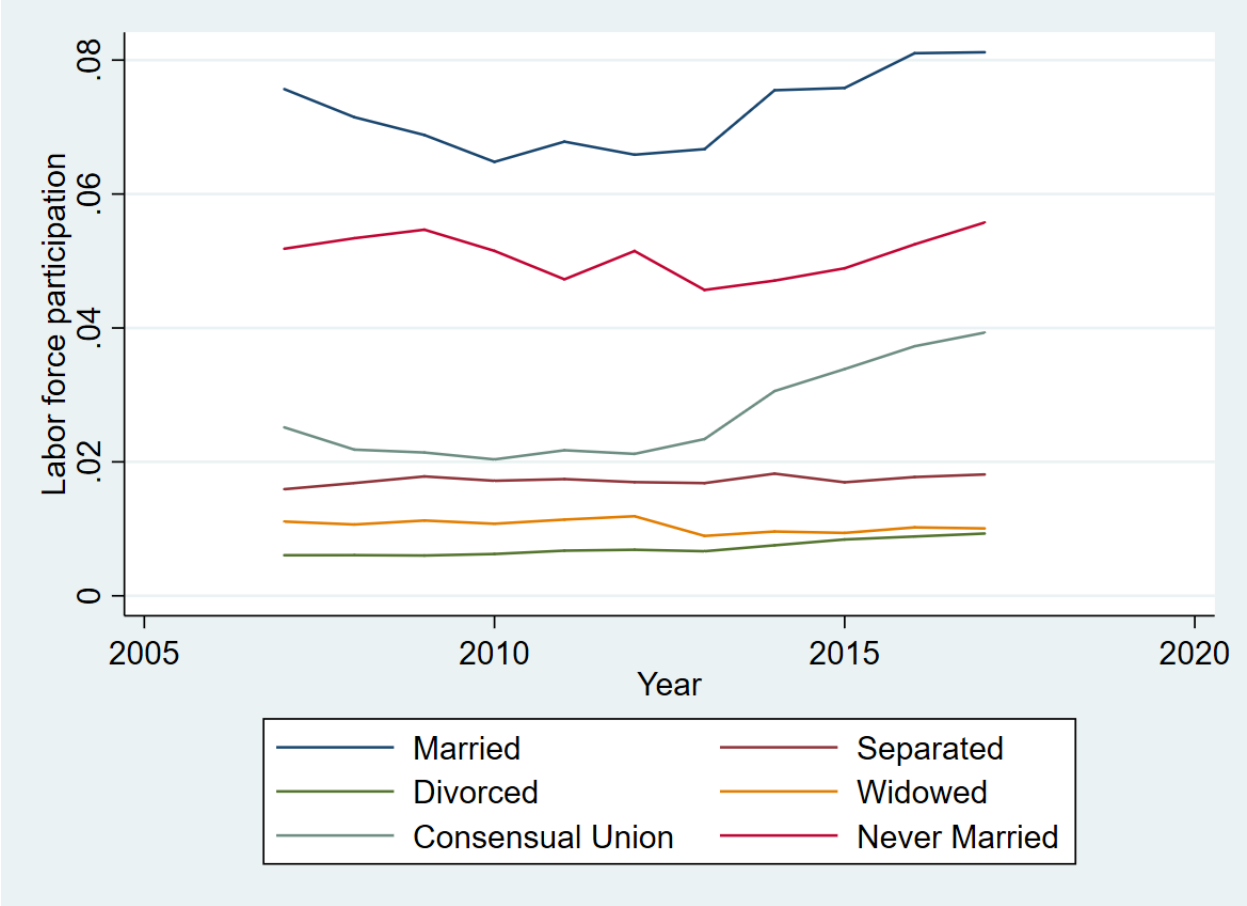

Figure 3.5: Labor force participation rate of women by marital status.

Source: Author's calculations using data from INEC: *Encuesta Nacional de Empleo, Desempleo y Subempleo.* (2007 - 2017).

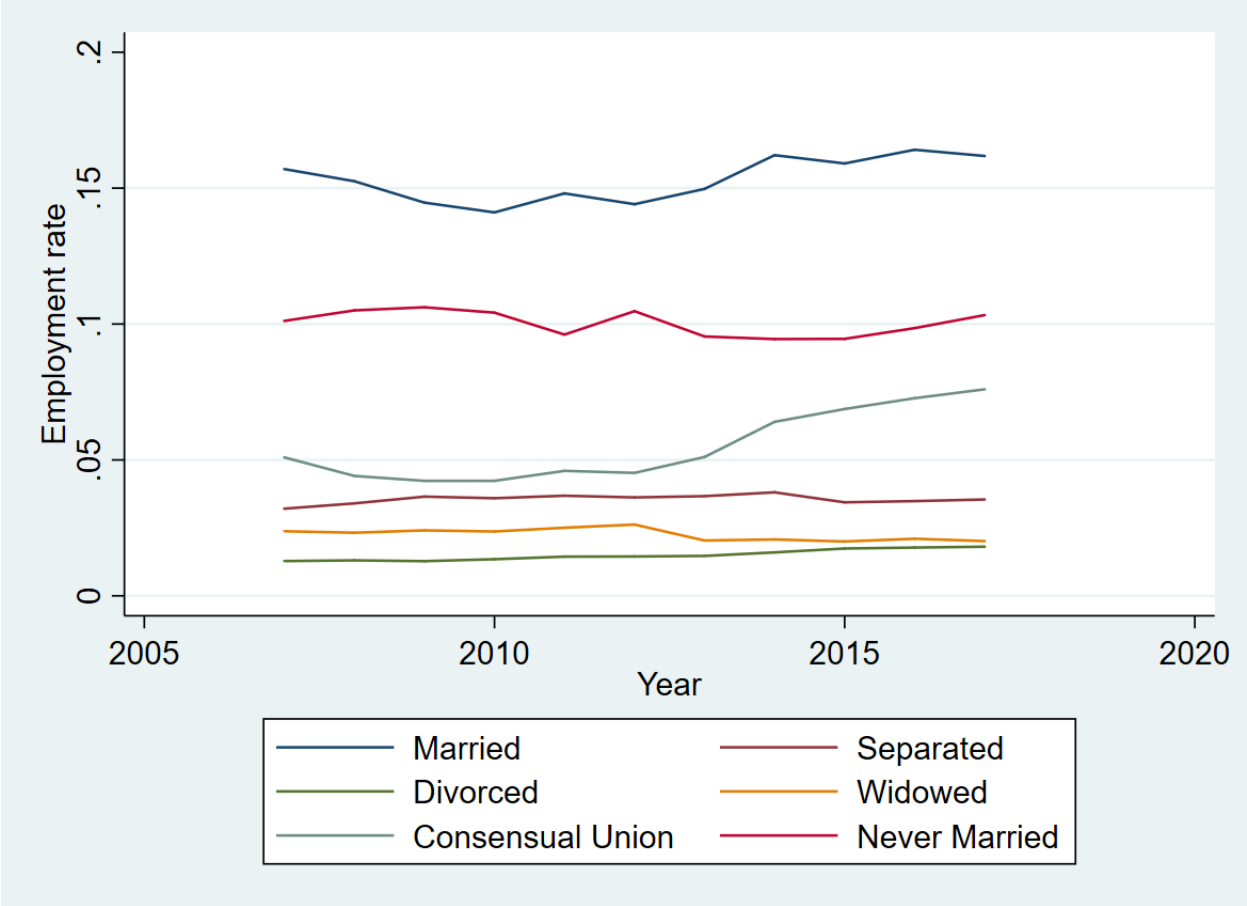

Figure 3.6: Employment rate of women by marital status.

Source: Author's calculations using data from INEC: *Encuesta Nacional de Empleo, Desempleo y Subempleo.* (2007 - 2017).

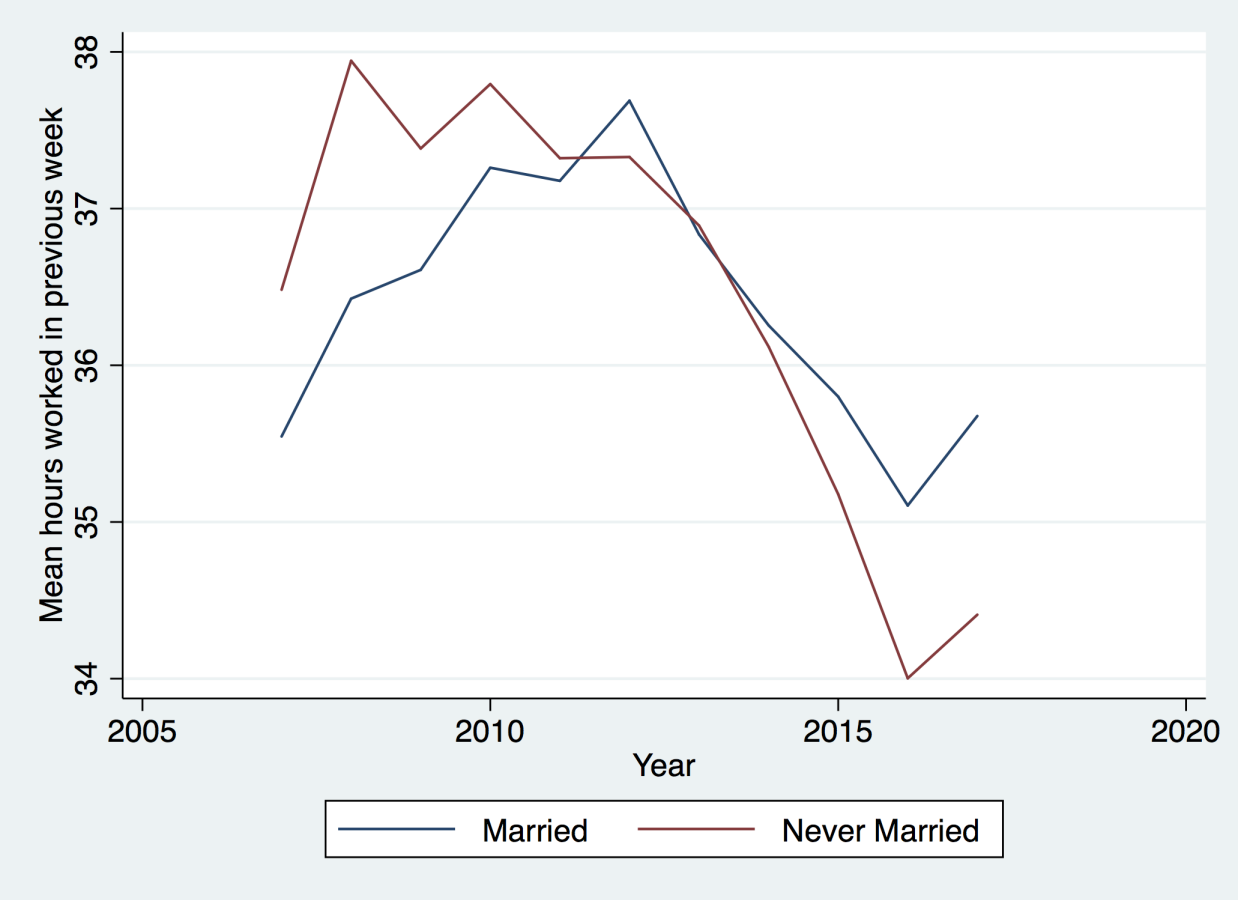

Figure 3.7: Average hours worked in the previous week of married and single women.

Source: Author's calculations using data from INEC: *Encuesta Nacional de Empleo, Desempleo y Subempleo.* (2007 - 2017).

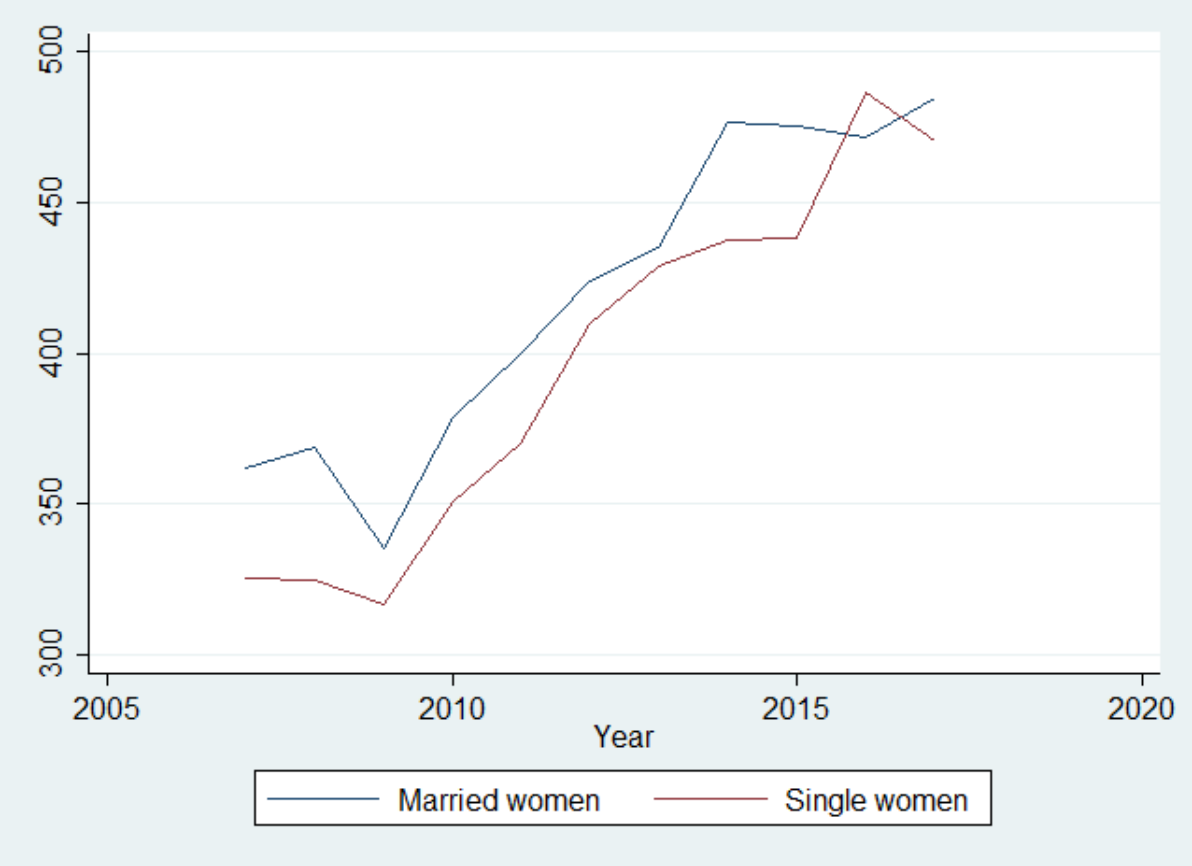

Figure 3.8: Real average monthly income from labor of married and single women.

Source: Author's calculations using data from INEC: *Encuesta Nacional de Empleo, Desempleo y Subempleo.* (2007 - 2017).

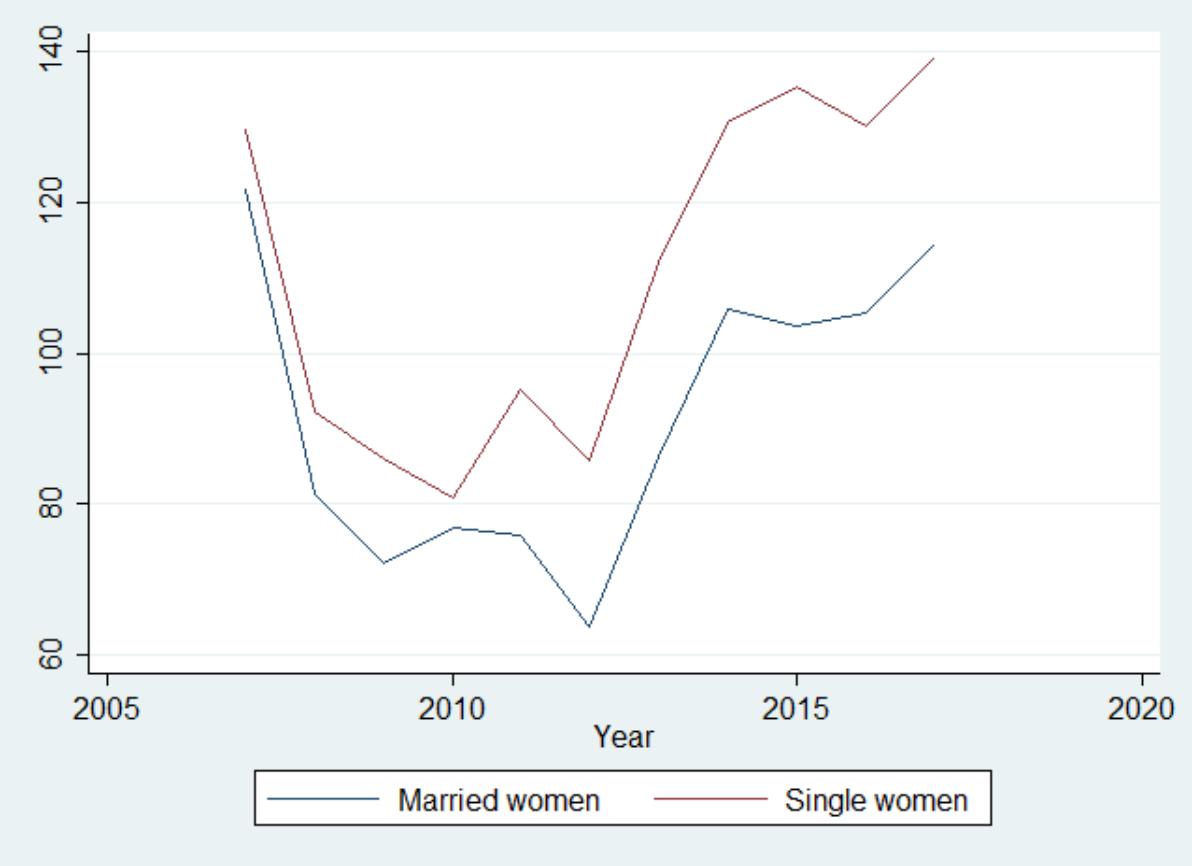

Figure 3.9: Real average monthly non-labor income of married and single women.

Source: Author's calculations using data from INEC: *Encuesta Nacional de Empleo, Desempleo y Subempleo.* (2007 - 2017).

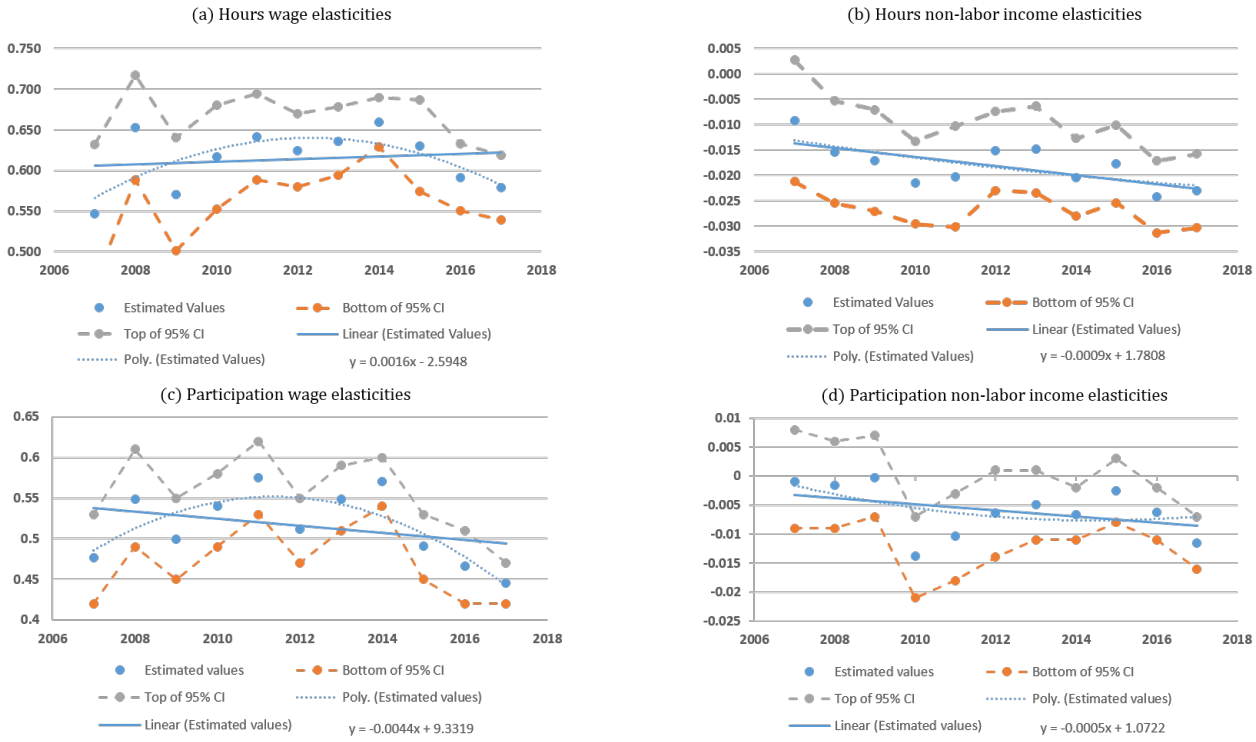

Figure 3.10: Estimated single female labor supply elasticities, 2007-2017.

Source: Author's calculations using data from INEC: *Encuesta Nacional de Empleo, Desempleo y Subempleo.* (2007 - 2017).

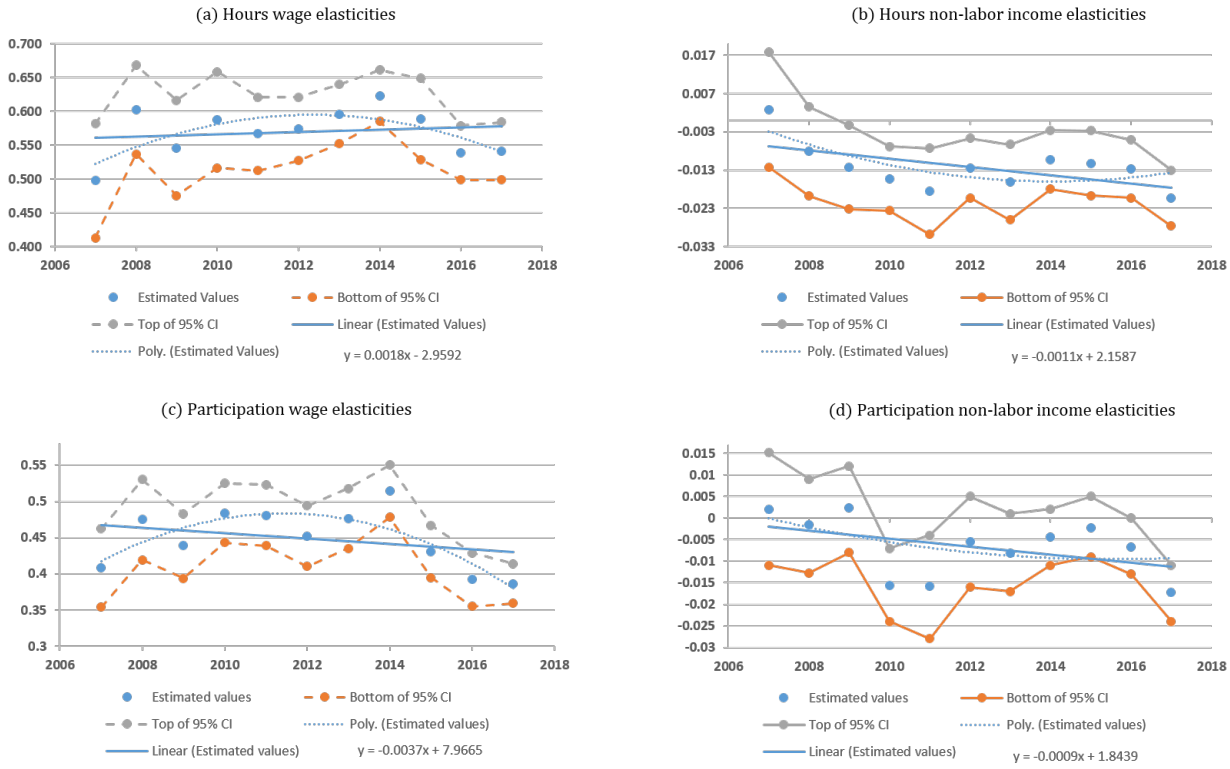

Figure 3.11: Estimated single female labor supply elasticities (Heckman), 2007-2017.

Source: Author's calculations using data from INEC: *Encuesta Nacional de Empleo, Desempleo y Subempleo.* (2007 - 2017).

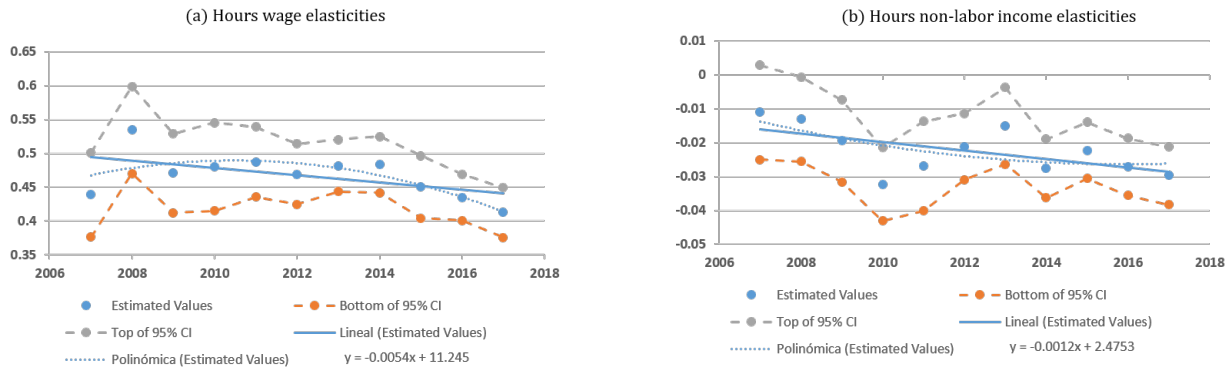

Figure 3.12: Estimated single female labor supply elasticities (Tobit), 2007-2017.

Source: Author's calculations using data from INEC: *Encuesta Nacional de Empleo, Desempleo y Subempleo.* (2007 - 2017).

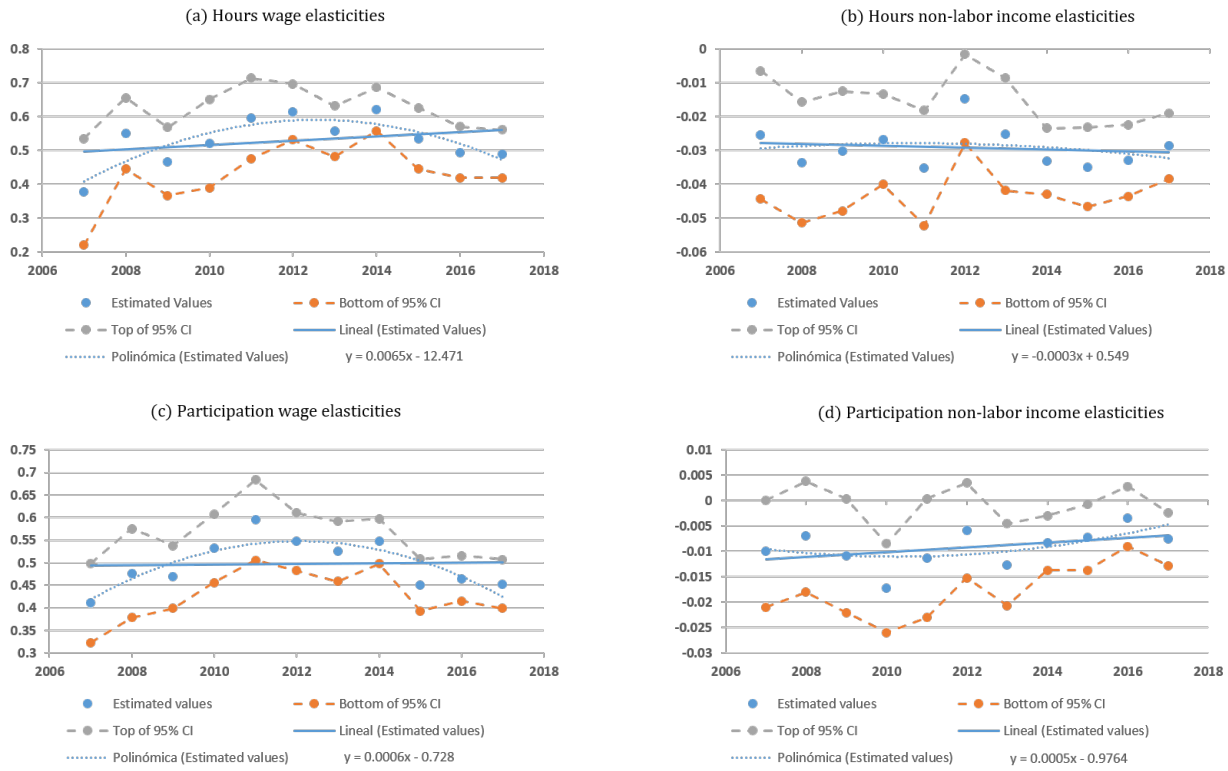

Figure 3.13: Estimated single female labor supply elasticities (Household heads), 2007-2017.

Source: Author's calculations using data from INEC: *Encuesta Nacional de Empleo, Desempleo y Subempleo.* (2007 - 2017).

Table 3.1: Summary statistics.

	(1) Observations	(2) Mean	(3) Sd. Dev	(4) Min	(5) Max
Age	29,379	35.14	8.67	25	55
Minority	29,379	0.15	0.35	0	1
Years of education	29,379	11.09	5.49	0	21
Household head	29,379	0.25	0.43	0	1
Children under 16	29,379	0.27	0.76	0	9
Presence of children under 6	29,379	0.32	0.46	0	1
Hours worked in the previous week	29,379	25.47	19.93	0	60
Monthly real income from labor	22,682	257.37	234.36	0	899.19
Monthly real non-labor income	29,379	25.86	53.99	0	304.76
Labor force	29,379	0.77	0.42	0	1
Informal job	29,379	0.26	0.44	0	1
Unstable job	29,379	0.79	0.41	0	1
Housemaid	29,379	0.06	0.23	0	1
Agriculture	29,379	0.01	0.109	0	1
Poor	29,379	0.28	0.45	0	1
Rural	29,379	0.36	0.48	0	1
Unemployment rate at zone of residence	29,379	0.05	0.05	0	0.64

Source: Author's calculations using data from INEC: *Encuesta Nacional de Empleo, Desempleo y Subempleo* (2007-2017).

Table 3.2: Estimated coefficients hours equation

	(1) 2007	(2) 2008	(3) 2009	(4) 2010	(5) 2011	(6) 2012	(7) 2013	(8) 2014	(9) 2015	(10) 2016	(11) 2017
	Hours worked in the previous week										
Wage	20.63***	25.40***	21.76***	23.18***	24.49***	23.70***	23.86***	24.73***	23.08***	21.21***	20.84***
	(1.647)	(1.280)	(1.349)	(1.231)	(1.032)	(0.868)	(0.799)	(0.576)	(1.046)	(0.748)	(0.730)
Non-labor income	-0.349	-0.597***	-0.651***	-0.806***	-0.773***	-0.575***	-0.557***	-0.763***	-0.647***	-0.866***	-0.829***
	(0.230)	(0.200)	(0.194)	(0.156)	(0.193)	(0.150)	(0.163)	(0.145)	(0.143)	(0.129)	(0.134)
Observations	1,957	2,195	2,380	2,563	2,127	2,427	2,407	3,162	3,193	3,246	3,363
R-squared	0.476	0.561	0.541	0.589	0.592	0.615	0.596	0.607	0.598	0.560	0.545

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Source: Author's calculations using data from INEC: *Encuesta Nacional de Empleo, Desempleo y Subempleo* (2007-2017).

Table 3.3: Estimated coefficients participation equation

	(1) 2007	(2) 2008	(3) 2009	(4) 2010	(5) 2011	(6) 2012	(7) 2013	(8) 2014	(9) 2015	(10) 2016	(11) 2017
	Participation in the labor force										
Wage	0.477***	0.549***	0.499***	0.540***	0.575***	0.512***	0.549***	0.570***	0.491***	0.466***	0.445***
	(0.0291)	(0.0297)	(0.0251)	(0.0222)	(0.0207)	(0.0210)	(0.0224)	(0.0175)	(0.0186)	(0.0223)	(0.0149)
Non-labor income	-0.000875	-0.00159	-0.000224	-0.0138***	-0.0103***	-0.00643*	-0.00487	-0.00661***	-0.00248	-0.00618***	-0.0116***
	(0.00440)	(0.00409)	(0.00363)	(0.00342)	(0.00394)	(0.00381)	(0.00317)	(0.00239)	(0.00268)	(0.00224)	(0.00223)
Observations	1,957	2,195	2,380	2,563	2,127	2,427	2,407	3,162	3,193	3,246	3,363
R-squared	0.573	0.607	0.582	0.631	0.671	0.637	0.686	0.689	0.618	0.591	0.579

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Source: Author's calculations using data from INEC: *Encuesta Nacional de Empleo, Desempleo y Subempleo* (2007-2017).

Table 3.4: Estimated coefficients hours equation (Heckman)

	(1) 2007	(2) 2008	(3) 2009	(4) 2010	(5) 2011	(6) 2012	(7) 2013	(8) 2014	(9) 2015	(10) 2016	(11) 2017
	Hours worked in the previous week										
Wage	18.78***	23.44***	20.81***	22.09***	21.65***	21.79***	22.35***	23.36***	21.56***	19.32***	19.49***
	(1.620)	(1.299)	(1.365)	(1.361)	(1.057)	(0.908)	(0.831)	(0.727)	(1.113)	(0.725)	(0.780)
Non-labor income	0.108	-0.315	-0.466**	-0.572***	-0.708***	-0.472***	-0.606***	-0.384***	-0.410***	-0.454***	-0.731***
	(0.289)	(0.230)	(0.213)	(0.161)	(0.218)	(0.150)	(0.188)	(0.146)	(0.158)	(0.139)	(0.134)
Observations	1,407	1,633	1,780	1,907	1,524	1,766	1,725	2,199	2,249	2,191	2,264
R-squared	0.569	0.646	0.642	0.691	0.714	0.722	0.709	0.727	0.735	0.709	0.693

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Source: Author's calculations using data from INEC: *Encuesta Nacional de Empleo, Desempleo y Subempleo* (2007-2017).

Table 3.5: Estimated coefficients participation equation (Heckman)

	(1) 2007	(2) 2008	(3) 2009	(4) 2010	(5) 2011	(6) 2012	(7) 2013	(8) 2014	(9) 2015	(10) 2016	(11) 2017
	Participation in the labor force										
Wage	0.408***	0.475***	0.439***	0.484***	0.481***	0.452***	0.476***	0.514***	0.431***	0.392***	0.386***
	(0.0275)	(0.0282)	(0.0227)	(0.0210)	(0.0213)	(0.0215)	(0.0212)	(0.0183)	(0.0182)	(0.0190)	(0.0140)
Non-labor income	0.00208	-0.00161	0.00235	-0.0156***	-0.0159***	-0.00549	-0.00809*	-0.00445	-0.00227	-0.00674*	-0.0173***
	(0.00660)	(0.00566)	(0.00511)	(0.00416)	(0.00595)	(0.00518)	(0.00478)	(0.00339)	(0.00384) (0.00343)	(0.00343)	
Observations	1,407	1,633	1,780	1,907	1,524	1,766	1,725	2,199	2,249	2,191	2,264
R-squared	0.563	0.594	0.581	0.628	0.659	0.623	0.669	0.685	0.611	0.592	0.579

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Source: Author's calculations using data from INEC: *Encuesta Nacional de Empleo, Desempleo y Subempleo* (2007-2017).

Table 3.6: Estimated coefficients hours equation (Tobit)

	(1) 2007	(2) 2008	(3) 2009	(4) 2010	(5) 2011	(6) 2012	(7) 2013	(8) 2014	(9) 2015	(10) 2016	(11) 2017
	Hours worked in the previous week										
Wage	21.70***	27.57***	24.09***	24.71***	25.12***	23.53***	24.42***	23.84***	21.87***	20.86***	19.80***
	(1.567)	(1.691)	(1.521)	(1.711)	(1.360)	(1.144)	(0.988)	(1.039)	(1.140)	(0.830)	(0.898)
Non-labor income	-0.549	-0.679**	-0.999***	-1.667***	-1.389***	-1.062***	-0.766***	-1.361***	-1.088***	-1.306***	-1.426***
	(0.350)	(0.327)	(0.316)	(0.282)	(0.349)	(0.250)	(0.294)	(0.216)	(0.208)	(0.206)	(0.210)
$P(H>0\|X)$	0.576	0.5519	0.5607	0.5523	0.5489	0.5575	0.5692	0.5897	0.5998	0.613	0.6261
Observations	1,957	2,195	2,380	2,563	2,127	2,427	2,407	3,162	3,193	3,246	3,363

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Source: Author's calculations using data from INEC: *Encuesta Nacional de Empleo, Desempleo y Subempleo* (2007-2017).

Table 3.7: Estimated coefficients hours equation (Household heads)

	(1) 2007	(2) 2008	(3) 2009	(4) 2010	(5) 2011	(6) 2012	(7) 2013	(8) 2014	(9) 2015	(10) 2016	(11) 2017
	Hours worked in the previous week										
Wage	14.18***	21.19***	17.46***	18.84***	22.34***	22.74***	20.63***	23.04***	19.67***	17.63***	17.45***
	(3.003)	(2.053)	(1.901)	(2.403)	(2.259)	(1.548)	(1.406)	(1.206)	(1.687)	(1.364)	(1.293)
Non-labor income	-0.955***	-1.290***	-1.128***	-0.966***	-1.320***	-0.543**	-0.935***	-1.230***	-1.283***	-1.176***	-1.021***
	(0.362)	(0.349)	(0.335)	(0.245)	(0.323)	(0.246)	(0.313)	(0.183)	(0.219)	(0.192)	(0.176)
Observations	656	730	720	801	716	820	911	1,271	1,411	1,345	1,454

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Source: Author's calculations using data from INEC: *Encuesta Nacional de Empleo, Desempleo y Subempleo* (2007-2017).

Table 3.8: Estimated coefficients participation equation (Household heads)

	(1) 2007	(2) 2008	(3) 2009	(4) 2010	(5) 2011	(6) 2012	(7) 2013	(8) 2014	(9) 2015	(10) 2016	(11) 2017
	Participation in the labor force										
Wage	0.411***	0.477***	0.469***	0.532***	0.595***	0.547***	0.525***	0.548***	0.450***	0.465***	0.453***
	(0.0448)	(0.0500)	(0.0352)	(0.0387)	(0.0451)	(0.0323)	(0.0337)	(0.0253)	(0.0293)	(0.0257)	(0.0275)
Non-labor income	-0.00991*	-0.00691	-0.0108*	-0.0172***	-0.0113*	-0.00583	-0.0126***	-0.00831***	-0.00724**	-0.00338	-0.00759***
	(0.00538)	(0.00547)	(0.00568)	(0.00445)	(0.00593)	(0.00474)	(0.00411)	(0.00275)	(0.00331)	(0.00317)	(0.00267)
Observations	656	730	720	801	716	820	911	1,271	1,411	1,345	1,454

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Source: Author's calculations using data from INEC: *Encuesta Nacional de Empleo, Desempleo y Subempleo* (2007-2017).

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