Essays on informal labor markets

Adriana Patricia Vega Núñez

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PhD in Economics | Adriana Patricia Vega Núñez

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Adriana Patricia Vega Núñez

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OMNIA LVCE

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BARC

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PhD student:

Adriana Patricia Vega Núñez

Advisors:

Raúl Ramos
Antonio Di Paolo

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Para mis padres y esposo,
Ángel, Patricia y Stephan

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Chapter 1: Introduction

1.1 Introduction

The present dissertation deals with the analysis of informality in developing countries considering both the worker's and the firm's perspective. Within a context of a strong presence of this phenomenon in the majority of South and Central America countries, the main goal of this research is to explore the factors that may influence the prevalence and the consequences of informality in this region. The analysis focuses in two dimensions of the informal labor market: the firms and the workforce, divided in three main topics. Firstly, we set up the determinants of firm informality; secondly, we study the informal labor selection process considering both the employees and workers' decisions; and thirdly we describe the dynamics of labor market across the informal and formal sectors considering workers' characteristics. While the first analysis considers a wide sample of South and Central America countries, the rest of the thesis refers to Ecuador, one of the countries with higher rates of informality in Latin America.

Informal economic activities are usually not taxed and operate outside the legal and regulatory boundaries of the government. Frequently, these activities take place in markets surrounded by onerous regulations and taxation and weakness of the legal system (Dabla-Norris et al., 2008). From the workforce and firm points of view, informality not only allows production avoiding a regulatory framework and, hence, facilitates tax evasion, but also does not provide access to social services, as typically found in a formal economy. Moreover, informal economy composes a growing and persistent phenomenon in many developing countries. In fact, although there is marked heterogeneity regarding informality in South and Central America countries, this fact is persistent in the majority of them (Perry et al., 2007; and Bacheta et al., 2009). A great number of workers in these countries are self-employed or salaried workers in small (informal or formal) firms without complying with the respective labor regulations and without enjoying the benefits and protection levels of formal workers.

As just mentioned, informality in most cases is related to negative conditions at the individual level, but from an aggregate perspective, informal firms result to be small and show lower levels of productivity compared to those firms in

the formal economy (Loayza et al., 2009; and Maurizio, 2012), limiting economic growth. Moreover, this negative relationship between informality and economic growth can be revealed to restrictions to informal firms and workers to public service access (La Porta & Schleifer, 2014).

The widespread discussion of labor informality, its determinants, implications, and suitable policy recommendations grew largely during the last decades. In fact, despite informality is a well-researched topic in different areas of analysis, the recent availability of firm-level data covering formal and informal firms has provided a new perspective on the phenomenon. In this field, and as the first topic of this dissertation, we begin discussing the choice of firms to operate in the formal or informal sector and its different explanations. Thus, on the side of the owners of informal firms we can find two points of view regarding their decision to be informal or run their business with the necessary formal requirements. On the one hand, the owners of informal firms do not formalize them because of the barriers they face to do so, such as costly regulations that may reduce the productivity of these firms (de Soto, 1989). On the other hand, it is observed that firms in which their benefits (access to credit, less risk of fines, market information) are greater than their costs (time, taxes and accounting costs) they formalize their firms. However, there are also smaller and less productive businesses that discard the formal sector because they perceive low benefits from becoming formal (Maloney, 2004). So, from the employees' side, firms' choice between formal and informal sector is reduced to a cost-benefit analysis associated with informality. And as a result, when the costs of operating a business formally surpass the benefits then entrepreneurs may shelter in the informal economy.

There are regulations like the registration costs, permits and licenses, payroll taxes and employer's contribution to social security that influence the decision to formalize a business (Chen, 2012). Additionally, in more general terms burdensome regulatory regimes in trade, finance and labor market are associated with higher rates of informality (Loayza et al., 2005; Djankov & Ramalho, 2008; and Loayza et al., 2009). These regulations can restrict formal activities and incentive them to avoid taxation, license payments or labor requirements (Webb et al., 2009). In this sense, the regulatory environment plays an important role in the informal economy and clearly an over-regulation or the other extreme a lack of regulation are not the ideal points for this market. There is a need to recognize what are the appropriate regulations to be established in the labor market, considering the specific characteristics of each

formal and informal sector and also the specific realities, needs and constraints among the different segments of the informal sector (self-employed and wage employed) (Chen, 2006).

Likewise, there is also a relationship between informality and some factors that allow firms' operations. Among these factors we find that informal firms may exhibit limited access to bank financing or more credit limitations compared to formal firms, due to the lack of pertinent documentation of the firm such as business registration and licensing, tax certificates or reported financial accounts (Fatoki & Asah 2011; Aga & Reilly, 2011; and Nirosha & Stuart, 2016). Another important point is the relationship between trade and informality. A significant fraction of world's trade take place in the informal economy (Godfrey, 2011) and at the same time trade generates competition among firms. Informal activities are characterized by situations outside the normal conditions of commerce, such as unauthorized payments, clandestine sales and gift giving, as means of influencing competition. Since formal and informal firms are not under the same commerce conditions, the behavior of informal firms within the limits of trade could be an obstacle for their counterparts in the formal sector (Mathias et al., 2014).

Within this framework the governance also affects the choice of firms among formality and informality. Hereof, the enrichment in quality of governance can improve formal entrepreneurship and therefore promote economic development (Thai & Turkina, 2014). When we refer to quality of governance, it comprehends diverse measures of government performance like the process of government selection and citizens' participation, government efficiency when managing resources, formulating and implementing policies and regulations, and finally citizens' respect to government institutions (Kaufman et al., 2000).

In this context, national and international authorities have emphasized on reforms in order to facilitate the process of firms' formalization and to integrate the shadow economy into the formal one. The reforms have reduced the average time to start a business from 50 to 30 days, and reduced the cost of starting it by two-thirds (World Bank, 2013). But despite these efforts, most of these businesses in developing countries remain informal.

After stating that informality is a relevant problem in most developing countries, it seems worth analyzing this puzzling subject from a firm perspective. Thereby, Chapter 2 **"Determinants of firm informality:**

Evidence for Central and South America countries" provides evidence on the determinants of being an informal firm and its differences across South and Central America countries. In particular, it addresses the cross-national variations in the prevalence of informality with the objective of identifying the factors motivating entrepreneurs' decisions to operate a business in the norms of the formal or informal sector. The resulting outcomes suggest a relationship between informality and some specific characteristic of the firm. Moreover, business' obstacles, economic and regulation environment in terms of business operation are the main factors that affect firm's choice whether to choose informality or formality. Another key factor for the decision of being formal entrepreneurs is the quality of governance, which is measured by citizens' participation in selecting their government and citizens' freedom in terms of association, media and expression. As an essential part of the analysis is focused on the environment in which the company develops its core business, we put a special emphasis on this issue. Therefore, chapter 2 broadens our understanding of the importance of the rigorousness of policies based on the institutionalization of informality in the labor market.

Once analyzed informality as an outstanding concern to deal with in developing countries, due to its incidence and persistence, it would be also noteworthy to analyze this challenging issue from a closer perspective. In this line, we explore and underline one particular country, Ecuador, where informality has been an outstanding piece in the labor market. We have a particular interest in the Ecuadorian labor market because in first place there is little evidence about this country, and secondly because its informality rates are among the highest in Latin America, showing levels around 40 percent during the last decades. In order to explore more deeply and obtain a broader knowledge about informality, the third and fourth chapters focus on an individual analysis considering workers' information. We investigate the determinants of informality from workers' perspective where we contemplate the static and dynamic viewpoints.

Referring to workers' perspective, there are two streams in the literature regarding the reasons why workers become informal. The first one highlights workers who are marginalized from the formal sector due to lack of jobs, and the second one stands out that workers voluntarily choose to be part of the informal sector. With respect to the former, early literature links informality to lower working conditions, lack of protection for employees, illegal activities, low productivity, unfair competition, corruption and vulnerability in public

services, regulation and institutions of the government (Günther & Launov, 2012). Thus, informality costs can be observed in different dimensions: at a national level as just outlined since there is a close relationship between countries' growth and the level of informality, at an enterprises level where there are trade and finance barriers limiting access to certain markets, and finally, at an employee level who can be stripped of labor rights. In this light, informal workers' preferences lie in the search of employment in the formal economy since higher wages are paid and labor protection is offered. However, the failure of the established economic system to create enough regular employment do not allow all workers to enter the formal job market and their only viable option is to find employment in the informal labor market (de Soto, 1989; Fields 2004; and Tokman 2007). Along this line, Bennet and Estrin (2007) show that entrepreneurs initially carry out their economic activities in the informal sector since the entry costs are lower compared to those in the formal sector. Once the entrepreneurs gain experience and learn how to work with their product, they decide between expanding their business and, hence, moving to the formal sector. In this position, we find that informality is shown as a step before formality.

Nevertheless, and as an opposite point of view, the emerging conceptualization of informality contemplates both the costs and benefits of informality where both the formal and informal sectors are coexisting in the labor market. These benefits among others are workers' autonomy and independence, entrepreneurial abilities and skills, and diverse alternatives of informal employment such as part time and homework agreements (Maloney, 1999). Therefore, the informal market offers desirable characteristics in terms of employment that may compensate its costs and what is considered by the labor supply at the time of selecting a job (Bosch & Maloney, 2010). In this context, the existence of mandatory employment benefits such as social insurance benefits for unemployment, pensions and health care among workers can affect labor force participation, employment and earnings (Betcherman, 2014). Concerning the first point, for instance the existence of an unemployment insurance can influence the time to make a decision to participate in the formal labor market. Regarding the second point, in the case of the type of employment and specifically formal or informal, a worker has the option of deciding a sector based on the benefits that each of them offers, whether in terms of wages, employment protection, flexibility or autonomy. Finally, the fact of obtaining one of these labor advantages may negatively affect the wage that a worker earns monthly. In this way, in many occasions,

informal workers may prefer to receive higher incomes instead of having access to this type of service, and might also take into account their quality and efficiency in order to make a decision.

The third chapter "**Where to be employed: Formal and informal labor selection processes"** addresses the issue of how the job placement process, understood as job opportunities in formal and informal sector, operates in Ecuador. Thereby, there are two main actors relevant in labor market decision-making: the demand (workforce) and the supply (employers). From one side, the former decides among the employment options in order to maximize his/her utility and according to their specific characteristics they decide among the sector options offered in the labor market. On the other side, employers based on workers' characteristics minimize their costs at the moment of hiring an individual. In this sense, we can question if the decisions of these two market participants always coincide in the labor market. These two agents interact in the market and each other choices affect them mutually. Thus, it may result in a limited number of formal jobs due to the particular requirements demand in this sector (Perry et al., 2007). Then workers must consider the limiting formal job options and their preferences to choose between the formal and informal sector. Or in other words, whether choosing the formal and informal sector, workers consider both elements: the availability of jobs and their sector preferences.

One of our major results is that in the Ecuadorian labor market there is a formal job rationing, and at the same time there are some workers that do not search for a job in the formal sector. Thus, in the informal market there may exist two types of workers: those who could not find employment in the formal sector due to formal job restrictions and those who value the benefits and gains of the informal sector over the formal sector and voluntary prefer to work as informal. Furthermore, a particular outcome is that two specific workers' characteristics, human capital and commitment, are the key elements for workers to find employment in the formal or informal sector.

An emerging question of this employment decision-making process is how the transitions or movements among the different sectors of the labor market operate. Therefore, Chapter 4 **"Analysis of formal - informal transitions in the Ecuadorian labor market"** is trying to shed light on the dynamics of the labor market across the labor status and distinguish workers' characteristics that influence the transitions across formal and informal sectors. With respect to the formal sector target, there is a large proportion of workers that remain

in this sector and in the case of the outflows it is observed two marked streams. Firstly, the flows to wage informal employment corroborate the rationing of formal jobs in the market and, secondly, the flows to self-employed indorse the existence of workers that voluntary choose this sector. Additionally, salaried informal workers prefer to search job opportunities in both formal and self-employed sectors rather than remain in this sector. With respect to workers' characteristics, the level of education, years of experience and earnings differentials across sectors have a significant effect on employment decisions and therefore on job transitions.

The present dissertation concerning the widespread of informality in developing countries follows a precise and pithy narrative, where we first introduce this topic from a regional standpoint regarding the analysis of firms from South and Central America countries and thereby we consider the case of Ecuador as a country where informal economy is a notable challenge and we add an additional perspective which is the analysis of informal workers. Every sequential chapter reports upcoming research questions arising from former chapters' analyses, having as initial subject the behavior of formal and informal firms in the labor market. The rest chapters are organized as follows. Chapters 2, 3, and 4 contain the detailed explanations of the three main research questions addressed in this dissertation, the review of the relevant literature and the results from the empirical analyses. Ultimately, Chapter 5 closes the discussion with the main results and main policy recommendations in order to capture policy weaknesses in the informal sector.

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Chapter 2: Determinants of firm informality: Evidence for Central and South America countries

2.1 Introduction and objectives

For most developing countries, informality is among the policy makers' priorities as it has relevant economic and social implications (Ferreira & Robalino, 2010; Levy & Schady, 2013; Frölich et al., 2014; and ILO, 2014). By informality we define that situation where firms, workers and/or activities operate outside a legal and regulatory framework in the economy. From an individual or firm point of view, on the one hand, informality allows production avoiding a regulatory framework and, hence, facilitates tax evasion. On the other hand, it also takes protection and social services away, as typically found in a formal economy. The prevalent informality phenomena in the majority of Latin America countries has increased since the 1980s, reaching levels of sometimes over 50% of the affected labor force (Perry et al., 2007; and Tockman 2008). Furthermore, a typical developing country produces around 35% of its GDP by employees working in the informal sector (Loayza, 2016).

Although, informality is a well-researched subject in different areas of analysis, works with firm-level data are limited since this type of data covering both formal and informal firms is recently available. This literature has so far only evaluated the determinants of entrepreneurial informal activity focusing on individual characteristics and on countries' regulatory and environmental differences (Friedman et al., 2000; Ardagna & Lusardi, 2008; Elbadawi & Loayza, 2008; Rand & Tarp, 2010; Hendy & Zaki, 2013; and Williams, 2014) or the cost and consequences of transition from informal to formal firms (Djankov, et al., 2002; Jaramillo 2009; Bruhn, 2011; De Giorgi & Rahman, 2013; De Mel et al., 2013; and Bruhn & McKenzie, 2014). However, to my knowledge, no study so far has intended to explain the reasons for the cross-national variations in the prevalence of informality and describe why businesses are found in the informal sector instead of the formal one from a regional perspective in Central and South America countries using firm-level data. In order to fill this gap in the literature, the aim of this chapter is to identify the factors influencing the decision of firms to remain informal, or why firms decided to register or operate in the boundaries of the formal sector considering cross-country differences after having controlled for different firm characteristics. In order to analyze firm-level surveys of 16 Central and South

America countries covering 25.754 firms operating in three sectors (namely, the manufacturing, retail and service sectors) we employ a multivariate logistic regression approach. It is important to emphasize that the estimated coefficients of the logistic regressions do not have to coincide with causal effects, since with the available data we cannot solve endogeneity and selection problems. The countries analyzed in this chapter are: Argentina, Bolivia, Chile, Colombia, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay and Venezuela. We chose these countries in order to represent an important part of South and Central America countries and for which we have available at least two years of firms' information. The main results of the analysis remark that there are some specific firms' characteristics and firms' obstacles in operation that increase the probability of operating informally. Moreover, a cross-country difference in terms of governance quality is a main factor that influences the likelihood of running a business formally. As previously mentioned, the importance of this topic and specifically in these countries is due to the presence and prevalence of an important share of informal employment and as well because this subject remains in the call of multinational organisms and national authorities to design policies that seek to facilitate formalization and move undeclared work into declared field (European Commission, 2007; ILO, 2014; and OECD, 2015). Despite of the attempts to start a process of formalization among informal firms, it is necessary to clarify why entrepreneurs, willingly or not, choose the path of informality. By achieving this, policy makers would be able to implement the necessary changes to legislation and economic policies to institutionalize or to abolish informality; as well as to identify the extent of the phenomena in the mostly affected regions.

The rest of the Chapter is organized as follows. Section 2.2 provides the reader with a brief literature review focusing on the prevalence of informal firms and the characteristics and regulatory environment related to informality from a regional perspective. Section 2.3 describes the data and the empirical methodology. Section 2.4 contains the discussion of the results obtained in the analysis. Finally, the conclusions of the Chapter are reported in Section 2.5.

2.2 Literature review

The traditional literature on informal economy drives in a context of poverty, gender inequality, and precarious work. Informal jobs do not require high

levels of education, skills, knowledge and capital as the formal economy may demand. However, evidence from developing countries suggests that informal employment can also show a heterogeneous structure, where individuals could choose informality because of their preferences, but in most of the cases people enter the informal economy because it is the only available opportunity to have access to income (Cunningham & Maloney, 2001; Pratap & Quintin, 2006; Packard, 2007; Arias & Khamis, 2008; Bucheli & Cena, 2010; Bosch & Maloney, 2010; Günther & Launov, 2012; García & Badillo, 2017; and García, 2017).

A possible definition of informal economy is the economic activities performed by a set of units of production not covered or insufficiently covered by formal arrangements. Their activities operate outside the formal institutional boundaries. Usually, informal sector companies operate on small scale with an elementary organization. Labor relations are based mostly on occasional employment and family or personal and social relations rather than contractual arrangements with labor rights. Additionally, informal employment suffers from lack of protection such as non-payment of wages, obligation to overtime, dismissals without notice or compensation, and unsafe working conditions (ILO, 2002; and ILO, 2013). Although, there is not a commonly exact definition of the term informality, there is a wide consensus about the fact that it affects workers, firms and activities with very particular characteristics. They are involved in a context of specific disadvantages such as inadequate and unsafe labor conditions, less regular and lower incomes than those in the formal economy, longer working hours, absence of social security and other labor protection legislation, and physically and financially more vulnerable (ILO, 2002; and ILO, 2009). Despite, the definition of the informal economy is still debated in some units and labor force statistics; the one above is the usual conceptualization of informality.

As just mentioned, the majority of workers and their families do not have access to social security and become a vulnerable segment of the society. Apparently, informal economy differs between countries in terms of income, status in employment, sector, size of firm, location and social protection (Lund & Nicholson, 2003; Chen, 2009; and Gasparini & Tornarolli, 2009). In this sense, and taking into account the heterogeneity among countries, it is widely important to consider these particular characteristics in order to use specific tools at the moment of using policy instruments. On the other side, a formal worker is the one who receives benefits from social security programs

financed by a percentage of his/her salary, usually distributed between the employer and the worker. Commonly, the benefits that workers perceive are medical and disability insurance and retirement pension. However, among the countries of the region there is a high heterogeneity regarding the advantages of these programs. In particular, these differences between countries are mainly observed in the nature of pension system (distribution or capitalization), the quality and assurance of the services and the replacement rates (Levy & Székely, 2016).

It is also important to highlight that, by its own nature, informality is associated with negative aspects. Firstly, from a country perspective, evidence suggests that there is a negative relationship between informality and economic growth (Loayza et al., 2009; and Maurizio, 2012). This issue can be explained in terms of the size of the informal sector and the linkage with the production of the country. In this sense, an informal firm tends to be small and present lower levels of productivity compared to those that are part of the formal economy. Thus, the differences in the size of the informal sector explain to some extent the disparities between developed and developing countries (Prado 2011; and La Porta & Schleifer, 2014). In general terms, formal economies are more profitable and have higher output per worker (Medvedev & Oviedo, 2013).

It seems that there is also a relationship between informality and some elements that allow firms' operation. For instance, informality can take an important role at the moment to get access to credits in formal institutions. Consequently, informal firms may exhibit limited access to bank financing or more credit constraint compared to formal firms, due to the lack of pertinent documentation of the firm such as business registration and licensing, tax certificates or reported financial accounts. It is important to consider that reporting requirements and promoting information about a business allow financial institutions to perform a more detail evaluation and identify collaterals when applying for credit facilities (Fatoki & Asah 2011; Aga & Reilly, 2011; and Nirosha & Stuart, 2016). Additionally, informal firms may be discouraged to demand loans due to high taxation systems and low quality of legal environment (Perry et al., 2007; Gatti & Honorati, 2007; and Koeda & Dabla-Norris, 2008). At the same time, the linkage between informality and bank credits can be related to other important issues such as the performance, productivity, growth and innovation of the firm (Kappler et al., 2006; Aiyagari et al., 2007; D'Erasmo & Moscoso, 2009; and Beck & Mohammad, 2014). In

this line, firms may do not considered formal finance and they give rise informal credit by choice (Safavian & Wimpey, 2007; and Farazi, 2014).

In this context, there are two main elements regarding the relationship between informality and linkages among firms. On one hand, an important share of world's trade takes place in an informal mode trough unregulated economic activities (Godfrey, 2011). On the other hand, trade generates competition among firms that can be seen as a mechanism that increases the productivity growth rates of the firm and as well a power unit of economic growth (González & Lamanna, 2007). As it is well known, informal activities are characterized by behaviors outside the normal scope of commerce, such unsanctioned payments, clandestine sales and gift giving, as means of influencing competition. In this sense, competition between formal and informal firms is not essentially fair. Since in many cases both sides do not compete under the same conditions or rules, where the rewards could be for the informal activities instead of beneficiating formal performance. This means that at some point, informal activities could become an obstacle to formal business achievement (Mathias et al., 2014).

There is also evidence that firms' incentives to work informally could be related to the opportunity of diminishing or avoiding tax payments and avoiding difficult administrative processes. Therefore, tax reduction and regulatory compliance simplification lead to a significant increase in formality (Dabla-Norris et al., 2008; and Fajnzylber et al., 2011). This issue can also be related to the scale of production or the size of the firms, since avoiding taxes and regulatory compliance in the case of small informal firms could make them able to compete with their larger formal counterparts (Farrell, 2004). Additionally, small informal firms may manage just small contracts, which can be usually associated to require high fixed costs, and limiting parties or clients meaning that informal firms achieve a minor share in the market.

The environment of firms is also relevant to explain cross-country differences in the incidence of informality. Economic regulation is the nation's economy framework that includes laws and policies focusing on different economic markets, such as product, trade, fiscal, finance and labor. These regulations follow a process in order to achieve specific goals on the overall economy. In this line, some authors analyze the relationship between burdensome regulatory regimes and the level of informality. There is evidence that rigid employment laws and policies increase informality (Loayza et al., 2005; Djankov & Ramalho, 2008; and Loayza et al., 2009). That is, economic

regulation stimulates tax evasion of the firms, since entrepreneurs take advantages of the imperfect laws and regulations and participates in informal activities to avoid taxes, license payments or labor requirements (Webb et al., 2009). Additionally, economic regulation by nature can constrain the formal activities of the firms and provide disincentives for entrepreneurs to join the formal economy, thereby heightening the desirability of avoidance schemes and forming opportunities for informal activities (Mathias et al., 2014).

Having considered economic regulations, it is also reasonable to look at the quality of governance. Thus, governance is defined as the traditions and institutions that determine authority performance in a particular country (Kaufmann et al., 2000). The improvement of governance quality can reduce informal entrepreneurship and this component can also stimulate economic development (Thai & Turkina, 2014). Moreover, the lack of intervention of the government (better information, facilities in business formalization, etc.) results in informal entrepreneurship (Williams & Martinez, 2014), and as well lower quality of state institutions drives individuals to work in the informal sector (Schneider, 2010). Therefore, governance and indeed quality of government usually includes (1) the process of government selection, held accountable, monitored and replaced and citizen participation in this process; (2) the capacity of government to efficiently manage resources and formulate, implement and enforce policies and regulations; and (3) the respect of citizens and the state for the institutions that govern economic and social interactions among them (Kaufmann et al., 2000). Additionally, Rothstein and Teorell (2008) mention that a state manages its citizens' relations in two dimensions: the access to public authority and the way in which that authority is exercise. Thus, quality of governance might consider both elements and be based on a political equality in order to legitimize democracy according to the different processes of government selection of the countries and as well complemented with the political system and public authority.

It is well known that corruption is also present in these countries. Thus, we should also consider the potential link between corruption and informality. In this sense, it exists evidence that corruption positively affects the size and composition of the informal sector (Dreher & Schneider, 2010; and Mishra & Ray, 2013). As we have already discussed, when a firm chooses to be in the formal sector it sacrifices the advantages of being informal, but at the same time evades the costs mentioned above risking itself to get penalties. At the same time, these costs and benefits of informality may also be influenced by

the presence of corruption. For example, if law supervisors can be persuaded by firms in order no hide non-compliance; it can directly affect the profitability or performance of the firm. Since, developing economies present imperfections in the formal institutions, then informal firms can compensate these imperfections by making bribe payments (Williams & Martinez, 2016).

2.3 Data and empirical setup

2.3.1 Data

The study uses data from three World Bank datasets: Enterprise Surveys, World Bank Indicators and the Worldwide Governance Indicators.

The World's Bank Enterprise Survey collects data from firms of the main manufacturing and service sectors across the world. For the present analysis, we focus on firms in 16 Central and South American countries. The Enterprise Survey was done during four different years (2006, 2010, 2016 and 2017) using the same survey implementation and sampling strategy.[1] However, the surveys are not available for all the Central and South American countries in all these periods (see Table A2.1.1 in the appendix for a list of the countries with each specific year used in the analysis). The countries were chosen to represent an important share of this region for which at least there are two years of the surveys information. Although the data is partly longitudinal, this dimension is not fully exploited in the analysis because we have a reduced sample in terms of number of years for each country, which prevents the use of firm fixed effects. We replaced the missing values with the mean of each variable value. The final resulting sample consists of 25,754 firms. The surveys include standardized survey instruments and a uniform sampling methodology in order to make them comparable across countries. Additionally, the questionnaire contains two types of questions: objective and subjective variables regarding the environment of the firm. The former kind of questions state quantitative measures of firms' characteristics such as: sales, number of workers, firm registration, etc. On the other hand, the subjective questions suggest the perceptions of the surveyed firms concerning some elements that influence their operations, such as financial or tax rates obstacles.

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[1] The surveys include standardized survey instruments and a uniform sampling methodology in order to make them comparable across nations.

The second database source comes from the World Bank Economy and Growth Indicators. In particular, GDP growth data for the considered countries and years has been obtained from this source in order to capture their economic dynamics during the period of analysis.

Last, the Worldwide Governance Indicators dataset reports six dimensions of governance indicators for over 200 countries over the world: voice and accountability, political stability and absence of violence, government effectiveness, regulatory quality, rule of law and control of corruption. These indicators are constructed based on different variables evaluating perception of governance from over 30 data sources composed by different institutions and higher values correspond to better outcomes.

2.3.2 Empirical setup

Since the endogenous variable, being or not a formal firm, has a binary nature, we apply logistic regression analysis in order to determine which firms' and environment characteristics affect the probability of an entrepreneur choosing the formal sector relative to the probability of choosing the informal sector. The binary formal/informal dependent variable is constructed using a specific question of the World Bank Enterprise Survey. In particular, a formal establishment is the one registered with the authorities at start-up according on a country specific basis. It is reported that ten percent of the firms of the total sample are informal firms (see Table A2.1.1).

The setup of the empirical model is based on the above literature review about the characteristics of informal firms, as well as other determinants of informality at the country level. The logit equation predicts the probability of the occurrence of running business formally. To interpret the main results of the logistic regressions, we report the average marginal effects on the predicted probabilities of the determinants of informality of firms in Central and South American countries, which allows us to identify the relevance of the main factors driving informality.

The following analyses are based on three logistic regressions; in which we progressively include different sets of explanatory variables. First, we estimate a baseline model that only includes characteristics of the firm, second, we add the variables referring to the perceptions of the surveyed firm regarding the main obstacles to carry out firms' operation, and third, we control for variables related to the country and governance environment. This stepwise

inclusion of explanatory variables enables identifying the individual and net contribution of these factors to informality in Central and South America countries.

As stated before, the empirical models follow the broader literature review, in model 1 we included the characteristics of the establishment. Consequently, among these firms' characteristics we consider the size, the productivity, the age[2], the top managers experience, the number of employees at start up, and the percentage own by the main owner. Likewise, there are some categorical variables included in the model that characterize the firms, such as the legal status of the firm, if the firm exports, the firm's sector, if the establishment is part of a larger firm, if the firm operates using email or web page and if there is formal training for the employees. In all model, we also include dummies for the country and the year of the survey (table A2.1.2 in the appendix provides variables definitions).

In model 2, we add a set of dummy variables collecting the self-reported obstacles given by the firm interviewed for its operation to investigate the principal limitations according to their own perception. We collect 9 different indicators that focus on wide-ranging themes such as electricity; competitors in the informal sector; finance; tax rates; tax administration; business licensing and permits; political instability; corruption and crime, theft and disorder. All of them are included as dummy variables with value 1 if the response in any of these topics is that they are considered as an obstacle in the operation of the firm and value 0 otherwise.

Finally, in model 3 we add five variables that seek to calculate the impact of the political, regulatory and development environment of each country regarding informality. The first variable is the average economic growth of the previous 6 years of each economy for 2006, 2010, 2016 and 2017, as an indicator of development of the country. The second, third, fourth and fifth variables are the governance indicators: voice and accountability, political stability, regulatory quality and rule of law which ranges are in between -2,5 (weak) and 2,5 (strong) governance performance. In order to avoid multicollinearity problems and since we want to observe the specific effect and meaning of each indicator on firms' formality, we are able to use just four governance measures (see table A2.1.3 in the appendix for the correlation matrix of the governance indicators and table A2.1.4 for the variance inflation

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[2] We employed the variable age and squared age.

factor of model 3). The former one measures perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media. The second measures perceptions of the likelihood of political instability and/or politically motivated violence, including terrorism, while the third indicator reflects perceptions of the ability of the government to formulate and implement policies and regulations. The last indicator captures the extent to which agents have confidence in and abide by the rules of society. We used one lag period of these variables in order to avoid a potential endogeneity problem in the model. Additionally, in order to identify if the different obstacles of the firm and environment indicators present an excessive correlation, we calculate the VIF measure, which is detailed for all the variables (see table A2.1.4). In general terms this measure indicates that multicollinearity is not a problem in this case.

2.3.3 Descriptive statistics

Figure 2.1 shows the percentage of each sector over the total number of firms by each country. On average informal firms make up for around 10% in the South and Central America countries. When taking a closer look at each country, this share of informal firms is comparatively low in Panama, Venezuela, Chile, Paraguay, Uruguay, Peru and Mexico showing an average rate of 4.9%. Ecuador, Guatemala, Honduras and Colombia show mid-levels of informal corresponding to around 14%. The most outstanding countries with respect to informality are Nicaragua, Dominican Republic and El Salvador with rates over 21% (see table A2.1.1 in the appendix for a list of the number of formal and informal firms for each country and year).

Table 2.1 provides a description of the characteristics of formal, informal and total sample of the firms. The first part of the table shows the mean value of the quantitative characteristics of the firm. The second part shows the percentage of the categorical characteristics according to sector of employment. The table shows the mean value of the quantitative characteristics of the firm. With respect to the size of the firm, formal establishments have more than the double of employees than their informal equivalents, exhibiting on average 151 and 74 employees respectively. The logarithm of the productivity of formal firms displays on average one more point compared to informal firms. Turning our attention to the age variable, informal establishments present more years of operation (29) than the formal

ones (24). Another notable point is that in both sectors, formal and informal firms, the top manager experience is very similar: 22 and 24, respectively. However, there is a remarkable difference in the number of employees at start-up of the business, in the formal case on average firms start with 29 employees while the informal ones with 12 workers (see Table A2.1.5 in the appendix for complete overview of the descriptive statistics of the quantitative variables of the total sample).

Figure 2.1: Percentage of formal and informal firms by country
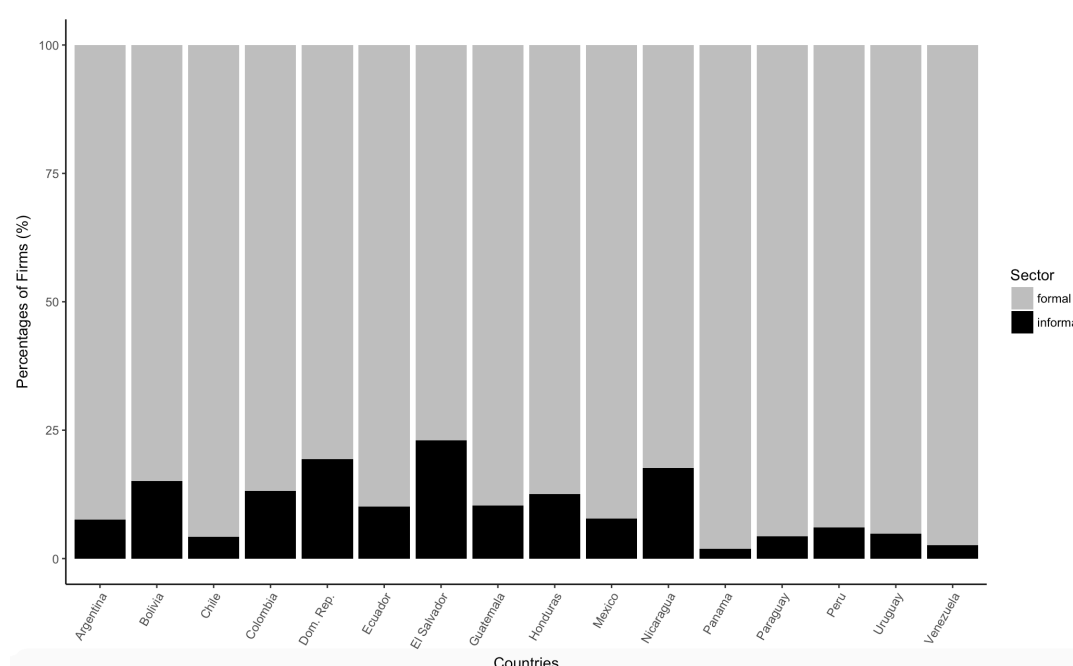
Regarding the percentage of the categorical characteristics according to sector of employment, it appears that both types of establishments have more than 71% owned by the main owner of the firm, meaning that on average the company has a senior partner. Moreover, in both cases there is more than one proprietor in the firm. Furthermore, the majority of formal and informal establishments only operate at a national level rather than internationally. Formal and informal firms of the sample are highly present in the manufacturing sector: 57% and 67%, correspondingly.

Table 2.1: Descriptive statistics of enterprise characteristics

	Informal	Formal	Total
Size	73.9	151.3	143.9
	(249.5)	(897.7)	(857.2)
Log productivity	11.7	12.2	12.2
	(2.1)	(2.2)	(2.2)
Age	28.6	23.5	24
	(22.5)	(18.7)	(19.2)
Top manager experience	23.7	22.4	22.4
	(12.1)	(12)	(12)
Num. Employees at start up	12.4	29.1	27.5
	(78.6)	(194.3)	(186.4)
Percentage own by larger owner	75.4	70.9	71.3
	(25.6)	(25.7)	(25.7)
Legal status of the firm			
Non-only proprietor	69	88	86
Only proprietor	31	12	14
Exports			
Does not export	78	74	74
Exports	22	26	26
Sectors			
Manufacturing	67	57	58
Retail	12	12	12
Services	21	31	30
Establishment is part of larger firm			
It is not part	88	81	82
It is part	12	19	18
E mail to contact clients			
Does not use e mail	26	13	14
Uses e mail	74	87	86
Web page			
Does not have web page	59	42	43
Has web page	41	58	57
Training for employees			
Do not receive	61	54	55
Receive	39	46	45

Source: Author's calculations based on World Bank Enterprise Survey (2006, 2010, 2016 and 2017).

In second place, we have the service sector, where 31% are formal firms and 21% are informal firms. And the third place is the retail sector with 12% of formal and informal firms. According to these percentages there is a difference of ten points between formal and informal firms in both the manufacturing and service sector, showing that informal firms relatively would be more concentrated in the manufacturing sector while formal firms in the service sector. Most of the firms of both kinds of establishments are not part of a larger company and as well their employees do not receive formal training. Finally, two interesting characteristics are the use of technology in the firm's operations. On one hand, the vast majority of the firms use email to communicate with their clients or suppliers. However, regarding whether the company has a web page, a 58% of the formal firms and a 41% of the informal firms have one. In this sense, it is observed that being part either of the formal or informal sectors, an important share of the firms is involved with technology in order to perform their operations.

Table 2.2 reveals the percentage of formal, informal and total sample firms that experience obstacles in the nine different aspects regarding their operations. In general terms, it is observed that more than 65% of the firms, either formal or informal, encounter difficulties on these areas. Around 78% of the formal firms report that there are four main obstacles that face the firms: presence of competitors in the informal sector, meaning that there is a large competition among informality in the different markets; tax rates, political instability and corruption and crime, theft and disorder obstacles.

Table 2.2: Percentage of firms experiencing obstacles in their operation

	Informal	Formal	Total
Electricity for operations obstacle	72.6	70.7	70.8
Competitors in the informal sector obstacle	86.4	78.3	79.1
Financial obstacle	74.5	70.3	70.7
Tax rates obstacle	81.7	80.3	80.5
Tax administration obstacle	77.8	76.5	76.7
Business licensing and permits obstacle	65.4	65.8	65.8
Political instability obstacle	77.4	79.7	79.4
Corruption obstacle	79.9	79.2	79.3
Crime, theft and disorder obstacle	78.6	75.7	75.9

Source: Author's calculations based on World Bank Enterprise Survey (2006, 2010, 2016 and 2017).

Concerning the descriptive statistics of the countries' environment for the total sample, the average economic growth of the 16 Central and South American countries is 3.7%. Moving to the mean values of the political and regulatory environment of the region in analysis, it is observed that voice and accountability is on average 0.1, political stability indicator is -0.4, regulatory quality is -0.1 and rule of law is –0.4. The numbers revels that the region perception is closer to a weak governance performance in terms of citizen participation, stability, regulations, policies implementation and confidence in the rules of society (see table A2.1.6 for descriptive statistics of the governance indicators by country).

2.4 Results

To examine and understand the factors that drive firms to operate informally, table 2.3 reports the average marginal effects of the logistic regressions[3] which explores the relationship between informality and the characteristics of the firms, the self-reported obstacles given by the firm interviewed for its operation and the institutional compliance environment and development of each country. The strategy of sequentially introducing the different groups of potential determinants of informality allows us to analyze if there are changes in the specific contribution of each of them on informality. Additionally, in the three models we introduce the country and year control variables.

Model 1 reports the results for the relationship between the characteristics of the firms and informality. The size and productivity coefficients are positive, which suggest that bigger and more productive firms are more likely to operate formally. Operating in the retail or the service sector increases the probability of operating formally, relative to firms in the manufacturing sector. In addition, sole proprietors of a business are likely to operate informally. Older firms are more likely to operate informally, although the effect is non-linear (U-shaped)[4]. Being part of a larger firm is associated with a higher likelihood of operating formally.

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[3] The models have been also estimated by OLS, which provided qualitatively similar results (see Table A7).

[4] Since variable age is included in a quadratic form, Table 4 shows the average effect of this variable.

Table 2.3: Average marginal effects of doing business formally of Model 3

	Dependent variable: formal/informal firms		
	Model 1	**Model 2**	**Model 3**
Firms characteristics			
Size (number of employees)	0.0001***	0.0001***	0.0001***
	(0.00002)	(0.00002)	(0.00002)
Log productivity	0.006***	0.006***	0.007***
	(0.001)	(0.001)	(0.001)
Manufacturing sector (reference category)			
Retail sector	0.036***	0.035***	0.035***
	(0.005)	(0.005)	(0.005)
Service sector	0.036***	0.034***	0.034***
	(0.004)	(0.004)	(0.004)
Only proprietor	-0.046***	-0.045***	-0.046***
	(0.007)	(0.007)	(0.007)
Age	-0.002***	-0.002***	-0.002***
	(0.0001)	(0.0001)	(0.0001)
Top manager experience	0,000001	-0,00001	0,0000003
	(0.0001)	(0.0001)	(0.0001)
Num. Employees at start up	0,0003	0,0003	0,0003
	(0.0002)	(0.0002)	(0.0002)
Establishment is part of larger firm	0.012**	0.012**	0.012**
	(0.005)	(0.005)	(0.005)
E mail to contact clients	0.041***	0.042***	0.043***
	(0.006)	(0.006)	(0.006)
Web page	0.031***	0.030***	0.029***
	(0.004)	(0.004)	(0.004)
Training for employees	0.015***	0.014***	0.014***
	(0.004)	(0.004)	(0.004)
Percentage own by main owner	-0.0002***	-0.0003***	-0.0003***
	(0.0001)	(0.0001)	(0.0001)
Exports	0,001	-0,001	-0,001
	(0.005)	(0.005)	(0.005)
Obstacles in the operation of the firms (Answer by the firm)			
Electricity for operations obstacle		-0,005	-0,005
		(0.004)	(0.004)
Competitors in the informal sector obstacle		-0.028***	-0.028***
		(0.004)	(0.004)
Financial obstacle		-0.007*	-0.007*
		(0.004)	(0.004)

Table 2.3: Average marginal effects of doing business formally of Model 3 (continued)

	Model 1	Model 2	Model 3
	Dependent variable: formal/informal firms		
Tax rates obstacle		0,0003	-0,0035
		(0.006)	(0.006)
Tax administration obstacle		-0.011**	-0.011**
		(0.005)	(0.006)
Business licensing and permits obstacle		0,003	0,0036
		(0.004)	(0.005)
Political instability obstacle		0.021***	0.022***
		(0.006)	(0.006)
Corruption obstacle		0,003	0,0026
		(0.006)	(0.006)
Crime, theft and disorder obstacle		-0,006	-0,0058
		(0.004)	(0.004)
Environment of the firm (World Bank indicators)			
Average GDP growth			0.0058***
			(0.002)
Voice and Accountability lag1			0.046*
			(0.027)
Political Stability and Absence of Violence and Terrorism lag1			0,021
			(0.015)
Regulatory Quality lag1			-0,007
			(0.017)
Rule of Law lag1			0,02
			(0.019)
Country control	x	x	x
Year control	x	x	x
	25,754	25,754	25,754
Observations			
Pseudo R²	0,08	0,09	0,13

Source: Author's calculations based on World Bank Enterprise Survey and Worldwide Governance Indicators (2006, 2010, 2016 and 2017).

Note: Significant at *p<0.1, **p<0.05, ***p<0.01, Robust standard errors used.

Turning the analysis to the technological variables, both the usage of email and the existence of a web page have a positive relationship with formality. The presence of training for employees in a firm is associated with a higher probability of operating formally. Finally, an interesting result is that if a firm

has one main owner there is a higher probability to work informally. This can be explained because small companies are generally operated on more informal basis than large companies (Gillman et al., 2002; Marlow et al., 2004; and Barrett & Sexton, 2006). Additionally, within small companies, this is more likely to be the administrative procedure because the company is usually supervise by the owner or a general manager with few formalized systems (Wilkinson, 1999; and Harney & Dundon, 2006).

Model 2 adds the set of dummy variables collecting the perceived obstacles faced by the interviewed firm in performing its operation. It is observed that not all the obstacles regarding the different aspects that involve the operation of a firm included in the analysis are associated with firms' informality. Thus, only the presence of informal competitors, financial obstacles and tax administration obstacles are significantly associated with a lower likelihood of doing business formally. Firms' perception of political instability obstacle presents a positive relationship with formality. In this context, if the political situation were affecting directly to the business, firms would prefer to work formally since the political issues would be taking place in their direct operations and it would be better to operate according to law and regulations in order to avoid any problem. No significant relationship is found for electricity, tax rates, business licensing and permits, corruption and crime, theft and disorder obstacles.

Finally, in order to explain the cross-national variations to register an informal firm, model 3 presents the complete specification including variables related to the economic and institutional environment of each country. The average GDP growth of the country is associated with an increase on firms' formality. Thus, economic development of a country is related with a lower incidence of informality, confirming that the prevalence of informal sector entrepreneurship is developed in economies with low development in terms of GDP growth. As seen in the literature, in general terms the governance performance has a positive correlation on firm's formality and as well its quality can be measured as citizens' participation in how they select their government and the degree of protection of civil rights such as freedom of expression, freedom of association, and a free media. Thus, an improvement in the voice and accountability indicator increases the likelihood of doing business formally, which is directly related to the above governance characteristic. In this sense, the cross-national variations in informal entrepreneurship are associated with the quality of governance of the country.

However, the political stability and absence of terrorism, regulatory quality and rule of law indicators do not show a significant relationship with firms' formality.

The average marginal effects of model 3 reveal the quantitative effects of the explanatory variables. Following the characteristics of the firms, the size and productivity of the firm have a small positive impact on the probability of running business formally by around 0.01 and 0.7 percentage points (p.p.), respectively. Whether the firm belongs to the retail sector or service sector increase the probability of being formal by around 3.4 p.p. in both cases. Sole proprietors of a business and older firms decrease the probability of being formal by 4.6 and 0.2 p.p., respectively. However, being part of a larger firm and offering training for employees increase the probability of formality by 1.2 and 1.4 p.p. Likewise, if the firm uses email and has a web page increases the probability of being formal by 4.3 and 2.9 p.p., respectively. Finally, if a firm has one main owner there is a small higher probability to work informally in 0.03 p.p. compared to firms that have more than one main owner.

Regarding the self-reported obstacles to operate either in the formal or informal sector, the perception of the existence of political instability increases the probability of doing formal business by 2.2 p.p. Oppositely, the presence of informal competitors, financial obstacles and tax administration obstacles reduces the probability of operating formally by 2.8, 0.7 and 1.1 p.p., respectively. As mentioned and supported by the related literature there are two important points to remark. Firstly, the presence of informal activities and specifically informal competitors can become an obstacle to formal entrepreneur (Mathias et al., 2014). Secondly, difficult administrative processes and regulatory compliance drive to informal activities (Dabla-Norris et al., 2008; and Fajnzylber et al., 2011).

Turning to the influence of the general perception of the framework and environment of each country regarding informality, economic growth and voice and accountability increase the probability of doing business formally by 0.6 and 4.6 p.p., respectively. In line with the evidence from the related literature, we observe that lower level of quality of governance, specifically in terms of lower levels of countries' citizen participation at selecting their government and lower degree of protection of civil rights, is correlated with informally entrepreneurs.

2.5 Conclusions

Informality plays an important role in developing countries and therefore the existence of informal firms is as frequently observed characteristics in those countries. Firms will choose whether or not to do business formally according to firms' characteristics, firms' specific environment and obstacles and countries' framework. Using survey data from 25.754 firms in 16 South and Central America countries, this study is aimed at analyzing the factors that influence firms to operate on an informal basis paying special attention to cross-national differences in the economic and institutional environment.

This chapter has shown three main results on firms' informality. Firstly, it sheds light on the association between informality and the characteristics of firms. In this sense, small firms, less productive firms, older firms, one proprietor firms, less technological firms and manufacturing firms are more likely to operate informally. As second result, it reveals that entrepreneurs face obstacles in their operations, such as the presence of informal competitors, financial and tax administration obstacles, which positively influence informality. Thirdly, it analyses the effect of cross-country determinants of the likelihood of being informal firm. These factors are associated with the average GDP growth and the governance performance of the country, since the results indicate that greater citizens' participation in selecting their government and greater freedom of citizens are positively related to the likelihood of running business formally. The results of the logistic regressions do not necessarily coincide with a causal effect, since with the available data we cannot solve endogeneity and selection problems.

Lastly, the results of this chapter suggest different policy recommendations regarding informal firms. On one side, the identification of a specific relationship between firms' characteristics and firms' formality, suggests that addressing the informality phenomena in the region requires special emphasis in certain aspects, such as: the use of schemes of productive and old companies as models for new entrepreneurs, the stimulation of the use of information and communication technologies in companies, and the incentive of firms start-ups with more than one partner where a larger partner is avoided. From the other side, considering the relationship between companies' and countries' environment and informality, it is evident that in terms of policy, two important points must be taken into account. The first one refers to internal obstacles that companies face, where the encouragement of more flexible economic regulations such as simplified registration procedures and

also the possibility of receiving benefits of operating formally like access to finance and market information, access to government subsidies and incentives, and efforts to strength organizations of informal workers and to promote their representation would incentive formal activities. The second one suggests that governments should proactively engage with informality and lead the way to formality by "good" governance i.e. by providing guidance and facilities at the moment of becoming formal.

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Appendix 2.1

Table A2.1.1: Number of formal and informal firms by year

	2006		2010		2016		2017		Total		
	Informal	Formal	Informal	Formal	Informal	Formal	Informal	Formal	Informal	Formal	% Informal
Argentina	74	977	84	958	0	0	63	913	221	2848	7,8
Bolivia	87	522	48	309	0	0	65	295	200	1126	17,8
Chile	20	987	66	963	0	0	0	0	86	1950	4,4
Colombia	107	888	148	791	0	0	0	0	255	1679	15,2
Dom. Rep.	0	0	59	298	79	277	0	0	138	575	24,0
Ecuador	55	597	47	318	0	0	38	322	140	1237	11,3
El Salvador	152	531	82	275	171	545	0	0	405	1351	30,0
Guatemala	49	462	64	523	0	0	0	0	113	985	11,5
Honduras	45	379	47	313	48	284	0	0	140	976	14,3
Mexico	73	1366	154	1316	0	0	0	0	227	2682	8,5
Nicaragua	92	382	72	264	38	295	0	0	202	941	21,5
Panama	13	588	5	353	0	0	0	0	18	941	1,9
Paraguay	34	574	8	351	0	0	15	349	57	1274	4,5
Peru	20	610	79	917	0	0	86	911	185	2438	7,6
Uruguay	15	592	33	569	0	0	27	313	75	1474	5,1
Venezuela	12	487	9	307	0	0	0	0	21	794	2,6
Total	848	9942	1005	8825	336	1401	294	3103	2483	23271	10,7

Source: Author's calculations based on World Bank Enterprise Survey (2006, 2010, 2016 and 2017).

Table A2.1.2: Definition and source of variables

Variable	Definition and construction
Size	Business size calculated on the number of permanent plus temporary employees of the firm.
Log productivity	Logarithm of business productivity, which is calculated as the size of the firm over the sales of the firm.
Retail sector	Dummy variable that takes on the value 1 if firm operates in the retail sector, zero otherwise.
Service sector	Dummy variable that takes on the value 1 if firm operates in the service sector, zero otherwise.
D. Only proprietor	Dummy variable that takes on the value 1 if firm is organized as sole proprietorship, and zero if the firm is organized as a corporation, cooperative, partnership, or some other legal form.
Age	Business age calculated as the difference between the years of the survey minus the year when the firm started operations.
Top manager experience	Years of the top manager experience.
Num. Employees at start up	Number of employees at start-up of the business
Establishment is part of larger firm	Dummy variable that takes on the value 1 if firm is part of a larger firm, zero otherwise.
E mail to contact clients	Dummy variable that takes on the value 1 if firm uses e-mail to contact clients, zero otherwise.
Web page	Dummy variable that takes on the value 1 if firm has web page, zero otherwise.
Training for employees	Dummy variable that takes on the value 1 if firm offers training for employees, zero otherwise.
Percentage own by larger owner	Percentage own by larger owner of the business.
Exports	Dummy variable that takes on the value 1 if firm exports, zero otherwise.
Electricity for operations obstacle	Dummy variable that takes on the value 1 if firm has electricity obstacles for the operation and growth of the business, zero otherwise.
Competitors in the informal sector obstacle	Dummy variable that takes on the value 1 if firm has competitors in the informal sector obstacles for the operation and growth of the business, zero otherwise.
Financial obstacle	Dummy variable that takes on the value 1 if firm has financial obstacles for the operation and growth of the business, zero otherwise.
Tax rates obstacle	Dummy variable that takes on the value 1 if firm has tax rates obstacles for the operation and growth of the business, zero otherwise.
Tax administration obstacle	Dummy variable that takes on the value 1 if firm has tax administration obstacles for the operation and growth of the business, zero otherwise.
Business licensing and permits obstacle	Dummy variable that takes on the value 1 if firm has business licensing and permits obstacles for the operation and growth of the business, zero otherwise.

Table A2.1.2: Definition and source of variables (continued)

Variable	Definition and construction
Political instability obstacle	Dummy variable that takes on the value 1 if firm has political instability obstacles for the operation and growth of the business, zero otherwise.
Corruption obstacle	Dummy variable that takes on the value 1 if firm has corruption obstacles for the operation and growth of the business, zero otherwise.
Crime, theft and disorder obstacle	Dummy variable that takes on the value 1 if firm has crime, theft and disorder obstacles for the operation and growth of the business, zero otherwise.
Average GDP growth	Shows the average economic growth of the previous 6 years of each economy for 2006, 2010, 2016 and 2017, as an indicator of development of the country.
Voice and Accountability	Reflects perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media.
Political Stability and Absence of Violence and Terrorism	Measures perceptions of the likelihood of political instability and/or politically-motivated violence, including terrorism.
Regulatory Quality	Reflects perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development.
Rule of Law	Reflects perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence.

Source: World Bank Enterprise Survey and World Bank Indicators

Table A2.1.3: Pearson correlations between the Worldwide Governance Indicators

	Voice and Accountability	Political Stability and Absence of Violence and Terrorism	Government Effectiveness	Regulatory Quality	Rule of Law	Control of Corruption
Voice and Accountability	1					
Political Stability and Absence of Violence and Terrorism	0.75	1				
Government Effectiveness	0.91	0.58	1			
Regulatory Quality	0.76	0.41	0.86	1		
Rule of Law	0.91	0.65	0.93	0.86	1	
Control of Corruption	0.9	0.59	0.92	0.83	0.95	1

Source: Author's calculations based on World Bank Worldwide Governance Indicators (2005, 2009, 2015 and 2016).

Table A2.1.4: Variance inflation factor of the Worldwide Governance Indicators (Model 3)

	VIF
Size (number of employees)	1.32
Log productivity	1.61
Sector	1.36
Only proprietor	1.64
Age	6.9
Age 2	6.22
Top manager experience	1.22
Num. Employees at start up	1.08
Establishment is part of larger firm	1.12
E mail to contact clients	1.45
Web page	1.46
Training for employees	1.27
Percentage own by main owner	1.28
Exports	1.26
Electricity for operations obstacle	1.12
Competitors in the informal sector obstacle	1.11
Financial obstacle	1.17
Tax rates obstacle	1.85
Tax administration obstacle	1.94
Business licensing and permits obstacle	1.43
Political instability obstacle	1.66
Corruption obstacle	1.63
Crime, theft and disorder obstacle	1.18
Voice and Accountability	3.8
Political Stability and Absence of Violence and Terrorism	3.4
Regulatory Quality	2.8
Rule of Law	2.8

Source: Author's calculations based on World Bank Enterprise Survey (2006, 2010, 2016 and 2017) and Worldwide Governance Indicators.

Table A2.1.5: Descriptive statistics of the quantitative variables for the total sample

Statistic	N	Mean	St. Dev.	Min	Max
Firms characteristics					
Size	25,754	143.9	857.2	1	96,176
Log productivity	25,754	12.2	2.2	3.5	20
Age	25,754	24	19.2	0	210
Top manager experience	25,754	22.4	12	0	74
Num. Employees at start up	25,754	27.5	186.4	1	21,000
Percentage own by main owner	25,754	71.3	25.7	1	100
Environment of the firm					
Average GDP growth	25,754	3.7	1.7	-0.04	8.2
Voice and Accountability	25,754	0.1	0.5	-0.9	1.3
Political Stability and Absence of Violence and Terrorism	25,754	-0.4	0.7	-2.1	1.1
Regulatory Quality	25,754	-0.1	0.7	-1.6	1.5
Rule of Law	25,754	-0.4	0.6	-1.6	1.3

Source: Author's calculations based on World Bank Enterprise Survey (2006, 2010, 2016 and 2017) and Worldwide Governance Indicators.

Table A2.1.6: Descriptive statistics of the Worldwide Governance Indicators by country

	N	Average GDP growth				Voice and Accountability				Political Stability and Absence of Violence and Terrorism				Regulatory Quality				Rule of Law			
		Mean	SD	Min	Max	Mean	SD	Min	Max	Mean	SD	Min	Max	Mean	SD	Min	Max	Mean	SD	Min	Max
Argentina	3,069	2.8	2	0.9	5.5	0.4	0.1	0,3	0.5	-0.02	0.2	-0.2	0.2	-0.6	0.1	-0.8	-0.5	-0.5	0.1	-0.7	-0.3
Bolivia	1,326	4	1	3	5.3	-0.1	0.1	-0,2	0.01	-0.6	0.3	-1	-0.2	-0.8	0.1	-0.9	-0.7	-1	0.2	-1.2	-0.8
Chile	2,036	4.6	0.2	4.4	4.8	1.2	0.1	1	1.3	0.7	0.1	0.6	0.8	1.4	0.1	1.4	1.5	1.3	0.004	1.3	1.3
Colombia	1,934	4.3	0.5	3.8	4.8	-0.2	0.1	-0,3	-0.1	-1.9	0.1	-2.1	-1.8	0.1	0.1	0.01	0.1	-0.5	0.1	-0.6	-0.4
Dom. Rep.	713	5.6	0.04	5.6	5.7	0.1	0.03	0,1	0.2	0.1	0.1	-0.001	0.2	-0.1	0.1	-0.2	-0.04	-0.6	0.1	-0.8	-0.5
Ecuador	1,377	4.1	0.4	3.5	4.5	-0.3	0.1	-0,4	-0.2	-0.6	0.3	-0.8	-0.1	-1	0.2	-1.3	-0.8	-0.9	0.2	-1.3	-0.7
El Salvador	1,756	2	0.2	1.8	2.3	0.04	0.1	-0,1	0.2	-0.02	0.01	-0.03	-0.01	0.1	0.2	-0.2	0.3	-0.6	0.1	-0.7	-0.5
Guatemala	1,098	3.4	0.3	3.1	3.7	-0.3	0.1	-0,4	-0.3	-0.9	0.04	-0.9	-0.8	-0.3	0.1	-0.4	-0.2	-1	0.02	-1.1	-1
Honduras	1,116	4.3	0.5	3.5	4.8	-0.4	0.1	-0,5	-0.3	-0.5	0.1	-0.6	-0.3	-0.5	0.1	-0.6	-0.3	-0.9	0.1	-0.9	-0.8
Mexico	2,909	2.1	0.1	2	2.3	0.2	0.001	0,2	0.2	-0.6	0.1	-0.7	-0.4	0.2	0.02	0.2	0.2	-0.5	0.1	-0.6	-0.3
Nicaragua	1,143	3.8	0.9	3.1	5.3	-0.4	0.1	-0,4	-0.2	-0.3	0.1	-0.3	-0.1	-0.4	0.02	-0.4	-0.4	-0.7	0.1	-0.8	-0.6
Panama	959	5.4	1.7	4.1	7.6	0.5	0.1	0,4	0.6	-0.1	0.1	-0.2	0.1	0.2	0.1	0.2	0.4	-0.1	0	-0.1	-0.1
Paraguay	1,331	2.7	1.5	1.2	4.8	-0.2	0.2	-0,4	-0.04	-0.5	0.4	-0.9	0.2	-0.6	0.2	-0.8	-0.3	-0.9	0.1	-1	-0.7
Peru	2,623	5.1	0.9	4	6.3	0.1	0.1	-0,01	0.3	-0.7	0.5	-1.2	-0.2	0.3	0.2	0.03	0.5	-0.6	0.1	-0.7	-0.5
Uruguay	1,549	2.9	2.6	-0.04	5.8	1	0.1	0,9	1.2	0.9	0.1	0.8	1.1	0.4	0.04	0.4	0.5	0.6	0.1	0.5	0.7
Venezuela	815	5.1	2.5	3.2	8.2	-0.7	0.1	-0,9	-0.6	-1.3	0.01	-1.3	-1.2	-1.3	0.2	-1.6	-1.1	-1.4	0.2	-1.6	-1.2
Total	25,754	3.6	1.6	-0.04	7.3	0.1	0.5	-0,9	1.3	-0.4	0.7	-2.1	1.1	-0.1	0.7	-1.6	1.5	-0.4	0.6	-1.6	1.3

Source: Author's calculations based on World Bank Worldwide Governance Indicators (2005, 2009, 2015 and 2016).

Table A2.1.7: OLS regression models of formal/ informal LAC firms
(2006-2010-2016-2017)

	Dependent variable: formal/ informal firms		
	Model 1	**Model 2**	**Model 3**
Constant	0.860***	0.887***	0.889***
	(0.016)	(0.018)	(0.023)
Firms characteristics			
Size (number of employees)	0.000006*	0.000006*	0.000006*
	(0.000003)	(0.000003)	(0.000003)
Log productivity	0.005***	0.005***	0.005***
	(0.001)	(0.001)	(0.001)
Manufacturing sector (reference category)			
Retail sector	0.040***	0.040***	0.040***
	(0.006)	(0.006)	(0.006)
Service sector	0.035***	0.035***	0.035***
	(0.004)	(0.004)	(0.004)
Only proprietor	-0.082***	-0.081***	-0.081***
	(0.008)	(0.008)	(0.008)
Age	-0.002***	-0.002***	-0.002***
	(0.0003)	(0.0003)	(0.0003)
Age2	0.0000003	0.0000003	0.0000003
	(0.000003)	(0.000003)	(0.000003)
Top manager experience	-0.0002	-0.0002	-0.0002
	(0.0002)	(0.0002)	(0.0002)
Num. Employees at start up	0.00002	0.00002	0.00002
	(0.00001)	(0.00001)	(0.00001)
Establishment is part of larger firm	0.015***	0.014***	0.015***
	(0.004)	(0.004)	(0.004)
E mail to contact clients	0.053***	0.054***	0.054***
	(0.007)	(0.007)	(0.007)
Web page	0.031***	0030***	0.029***
	(0.004)	(0.004)	(0.004)
Training for employees	0.021***	0.021***	0.021***
	(0.004)	(0.004)	(0.004)
Percentage own by main owner	-0.0002***	-0.0002***	-0.0002***
	(0.00007)	(0.00007)	(0.00007)
Exports	0.007	0.007	0.007
	(0.004)	(0.004)	(0.004)

Table A2.1.7: OLS regression models of formal/ informal LAC firms
(2006-2010-2016-2017) (continued)

	Dependent variable: formal/ informal firms		
	Model 1	**Model 2**	**Model 3**
Obstacles in the operation of the firms (Answer by the firm)			
Electricity for operations obstacle		-0.004	-0.004
		(0.004)	(0.004)
Competitors in the informal sector obstacle		-0.027***	-0.027***
		(0.004)	(0.004)
Financial obstacle		-0.009**	-0.009**
		(0.004)	(0.004)
Tax rates obstacle		-0.003	-0.003
		(0.006)	(0.006)
Tax administration obstacle		-0.010*	-0.010*
		(0.006)	(0.006)
Business licensing and permits obstacle		0.004	0.004
		(0.005)	(0.005)
Political instability obstacle		0.019***	0.020***
		(0.006)	(0.006)
Corruption obstacle		0.004	0.004
		(0.006)	(0.006)
Crime, theft and disorder obstacle		-0.005	-0.004
		(0.004)	(0.004)
Environment of the firm (World Bank indicators)			
Average GDP growth			0.006***
			(0.002)
Voice and Accountability lag1			-0.028
			(0.0028)
Political Stability and Absence of Violence and Terrorism lag1			0.002
			(0.015)
Regulatory Quality lag1			-0.011
			(0.018)
Rule of Law lag1			0.041
			(0.025)
Country control	x	x	x
Year control	x	x	x
Observations	25,754	25,754	25,754
R^2	0.08	0.08	0.08

Source: Author's calculations based on World Bank Enterprise Survey and Worldwide Governance Indicators (2006, 2010, 2016 and 2017). *Note:* Significant at *$p<0.1$, **$p<0.05$, ***$p<0.01$, Robust standard errors used.

Chapter 3: Where to be employed: Formal and informal labor selection processes

3.1 Introduction

One of the main characteristics of developing and transition countries is that more than half of the labor force belongs to the informal economy (Jütting et al, 2008; and Loayza, 2016). This phenomenon has been persistent and includes a wide range of activities of small firms, the self-employed, and salary workers constituting informal sector. The early literature relates informality to unprotected workers, corruption, tax evasion, illegal activities, low productivity, low investment rates, etc. In contrast, formal employment offers higher wages and social protection benefits (Günther & Launov, 2006). However, the emerging conceptualization of informality shows different advantages in terms of workers´ autonomy, entrepreneurial abilities and skills, and protection against unemployment (Maloney, 1999; and Mandelman & Montes-Rojas, 2009). In this sense, Ecuador is a country where informality has been a remarkable feature of the labor market. The analysis of decision-making about formal or informal labor force participation is important with respect to the development of the labor market employment process of such a developing country. No studies have so far sought to explain this labor placement process for Ecuador applying the most appropriate methodology. In this sense, the inclusion of both preferences of the demand and the supply side of the labor market differentiated and overcome the disadvantages of previous work carried out by Canelas (2015), where there were not considered these preferences. In her study, she uses a simultaneous equation probit model to study the determinants of poverty and informality in the country and concludes that informal work is both a demand-led and as well a voluntary supply-led form of work.

There are two main actors relevant in labor market decision-making. On one hand, there is the supply part of the market, namely the workforce. Jobs' and workers' characteristics, such as the human capital stock, time availability, salaries, and specific conditions of each individual influence the options available to maximize their welfare. Workers must decide among the options offered in the labor market, such as participation or inactivity, and among the kinds of work available. The second actor is the demand side, namely employers, who select their workforce taking into account elements such as

productivity level and the cost of hiring a specific worker, limiting the job options in the labor market (Archibald, 1977).

Matching these two market participants leads us to doubt that demand and supply coincide in all occasions. Furthermore, it is important to take the presence of an excess supply of workers into account. Workers are competing for scarce formal employment opportunities. According to the traditional view, formal jobs present specific characteristics such as minimum working conditions stated in contracts, including hours of work, stability, wages, and formality, in contrast to the informal sector, which does not guarantee such protections (Fields 1975, Dickens & Lang 1985, and Tansel & Oznur Kan 2012). However, formal jobs impose several restrictions on workers, such as education, ability, and work experience requirements; as a result, not all workers are eligible to enter this sector (Perry et al, 2007). The goal of this analysis is to identify whether, in choosing between the formal or informal sector, workers consider both elements: the limitations to the availability of jobs and informal or formal sector preferences.

With this purpose in mind, we model the relationship between worker preferences and employer hiring decisions to identify the determinants of individual decisions. This model is created in a context in which the only available information is the outcome: whether the worker is employed in the formal or informal sector. Hence, the decision of the two actors, workers and employers, can be modeled as a bivariate probit model with partial observability (Poirier, 1980). Using this model, we are able to estimate the proportion of workers whose sector selection is restricted and the extent to which a rationing of formal sector opportunities takes place.

Models analyzing such settings can be found on diverse topics and have been proposed by many authors. Abowd & Faber (1982) develop a bivariate model with partial observability to determine the allocation of workers with respect to union and non-union sectors. Gaag & Vijverberg (1988), Mengistae (1999) and Hartog & Oosterbeek (1993) examine the selection process between the public and private sector and consider both decisions, namely, the desire of an individual to obtain public employment and whether they get selected for that position. The authors find that job rationing of public sector positions exists due to expectations of wage premiums associated with this segment of the labor market. There are also studies regarding the rationing of formal jobs and the relationship of this phenomenon to informality. Using an endogenous switching regression framework, Huguet (1996) tests if the Spanish labor

market behaves as an integrated market, or whether, by contrast, it consists of two segments with different mechanisms of wage formation and where access is rationed for more desirable jobs. Using the same approach, Veras (2004) investigates the existence of a job queue for formal employment in the Brazilian labor market. García & Badillo (2017) provide evidence of rationing employment in the formal sector for Colombian labor market. The results show that the informal sector is composed of two segments; from one side, there is a segmentation in the market that discourage workers from entering the desired sector, and from the other side, a share of employees are part of the informal sector because of the desirable characteristics that this sector can offer them. As highlighted by the above-mentioned articles, these types of models have wide-ranging application in contexts where the most important aspect is the ability to identify individual choices from joint decisions, bearing in mind that this partial observability brings a loss of asymptotic efficiency of the estimates relative to the full observability case (Chun-Lo & Schmidt, 1985). However, there are several studies with different methodologies analyzing if there exists a rationing in the formal sector employment and workers must go to informal jobs as their only alternative. The results support a heterogeneous informal market view, where informal occupation could be both a desire employment and as well the only accessible option in the market (Maloney, 1999; Cunningham & Maloney, 2001; Pratap & Quintin, 2006; Lehmann & Pignatti, 2007; Packard, 2007; Arias & Khamis, 2008; Bosch & Maloney, 2010; Bucheli & Cena, 2010; Günther & Launov, 2012; Rawaa, 2013; and García, 2017).

Considering these facts, it seems reasonable that employment decisions regarding formality depend on the worker's aspiration to belong to the formal sector and the employer's decision to hire the individual into this sector. With this in mind, we take a closer look at these two decisions, which directly affect the resulting market wage of a worker. For instance, by analyzing the hiring decision, a worker with less than five years of experience may receive a lower wage compared to an identical worker with more than five years of experience. Analogously, considering an individual's preferences, a worker may receive a lower wage if he/she decides to work part time instead of full time. Therefore, estimating wage equations without including the participation of both worker and employer preferences may generate biased estimates. Lee (1978) and Heckman (1979) first explored the relationship of these two main actors to avoid selectivity bias in the estimation of wages. These authors developed a single selection process and then moved to a double selection approach. Since

then, several authors have advanced and developed extensions of the Heckman procedure to correct the problem of sample selection on wage equations estimations (Fishe, et al, 1981; Catsiapis & Robinson, 1982; Tunali, 1986; Pradhan & Soest, 1995; Mohanty, 2001; and Lee, 2009).

As already mentioned, the main objective of this article is to match the characteristics of workers in the formal sector with workers in the informal sector and to examine the determinants of the job placement process in these two areas of the labor market. Since we can only observe the joint decision, i.e. workers' preferences and employers' hiring decisions, we model a bivariate binomial probit model with partial observability to determine whether individuals voluntarily exit the formal sector or are omitted from it. Thus, based on previous studies, we seek to evaluate these movements for a labor market of a developing country such as Ecuador, where the proportion of informality is around 44 percent in 2015, and determine if workers' employment decisions correspond to voluntary or involuntary pronouncements.

The next section reviews the theoretical model concerning the estimation procedure. In section 3.3, the data is presented along with the description of the main variables used in the analysis. Section 3.4 presents the empirical results and robustness checks. The final remarks and conclusions are presented in the section 3.5.

3.2 The model (Two decisions with partial observability)

3.2.1 Specification

To set the model up, we need to consider the two outlined choices: the one arising from the worker's side and the one originating from the employers with respect to formal or informal sector employment. First, we examine the worker's decision concerning her/his willingness to take up a formal job, which is determined by the wage premium gained in a specific sector: W_{1i} is the hourly wage earned by a randomly selected individual i in the formal sector *1* and W_{2i} is the hourly wage earned in the informal sector *2*. Let U_{1i} be the maximum utility the individual *i* would acquire in the formal sector, and let U_{2i} be the associated maximum utility of the informal sector. A worker will prefer formal sector employment to informal sector employment if $V_{1i} = U_{1i} - U_{2i} > 0$. Following this expression, V_{1i} is linear in the wage premium of

the formal segment $(W_{1i} - W_{2i})$ and a set of characteristics of the workers and of his/her environment (family) Z_{1i}. According to Abowd and Farver (1982), this expression corresponds to individuals who have a desire to achieve a formal job. Formally, this decision can be expressed by the following equation:

$$V_{1i} = \alpha_1(W_{1i} - W_{2i}) + Z_{1i}\beta_1 + u_{1i} \tag{3.1}$$

where α_1 is a constant, β_1 is a vector of coefficients, and u_{1i} is the error term with mean zero and variance σ_{u1}^2.

Once V_{1i} is defined, and since it cannot be observed for any individual, an indicator variable I_{1i} is created with the following characteristics:

$$I_{1i} = 1 \quad iff \quad V_{1i} = \alpha_1(W_{1i} - W_{2i}) + Z_{1i}\beta_1 + u_{1i} \geq 0$$

$$I_{1i} = 0 \quad iff \quad V_{1i} = \alpha_1(W_{1i} - W_{2i}) + Z_{1i}\beta_1 + u_{1i} < 0 \tag{3.2}$$

I_{1i} equals 1, if the worker joins the formal sector and 0 if the worker chooses not to be part of the formal sector.

The next decision is the one taken by the hiring firm V_{2i}, regarding individual i. To select its employees, firms behave in a cost-minimizing manner. Thus, an employer from the formal sector will hire an individual $(V_{2i} > 0)$ considering all factors in order to minimize costs. The first factor analyzed corresponds to the worker's productivity Z_{2i} observed by the employee, and the second factor corresponds to the expected cost that the firm has to incur upon employing the individual i given that he/she wants to join the formal sector $E(W_{1i}|V_{1i} > 0)$. This decision can be expressed as:

$$V_{2i} = \alpha_2 E(W_{1i}|V_{1i} > 0) + Z_{2i}\beta_2 + u_{2i} \tag{3.3}$$

where α_2 is a constant, β_2 is a vector of coefficients, and u_{2i} is a random term with mean zero and variance σ_{u2}^2.

Let us now define a second binary variable, I_{2i}, which follows the employer's selection process in choosing a worker who is willing to join the formal sector. The variable is defined as:

$$I_{2i} = 1 \quad iff \quad V_{2i} = \alpha_2 E(W_{1i}|V_{1i} > 0) + Z_{2i}\beta_2 + u_{2i} \geq 0$$

$$I_{2i} = 0 \quad iff \quad V_{2i} = \alpha_2 E(W_{1i}|V_{1i} > 0) + Z_{2i}\beta_2 + u_{2i} < 0 \qquad (3.4)$$

Hence I_{2i} is equal to 1, if a worker is selected to join the formal sector given his/ her desire to be part of this sector, and 0 if the worker is not chosen.

In this sense, equations (3.1) and (3.3) divide the population into three mutually exclusive groups. If we observe that workers are in the formal sector, then we know that (a) $I_{1i} = 1$ and $I_{2i} = 1$. However, if workers are part of the informal sector, we do not know whether this is because (b) $I_{1i} = 1$ and $I_{2i} = 0$ (workers would like to belong to the formal sector, but they were not chosen to fill the vacancy) or (c) $I_{1i} = 0$ and $I_{2i} = 0$ (workers prefer to be part of the informal sector). The classification of the population between the formal and informal sectors can be labeled with a probit model with an observable dichotomous variable I_i; taking a value of 1 if a worker is in the formal sector and 0 if a worker is in the informal sector. However, this model has a classification problem: if we find an individual in the formal sector we can infer that $I_{1i} = 1$ and $I_{2i} = 1$, but we cannot draw conclusions in the same way for an individual in the informal sector. Therefore, we make use of Poirier's probit model, which overcomes this lack of observation by developing the idea that an individual is observed in the formal sector if this is his/her preference and he/she fulfills employers' standards.

Consequently, an additional system of equations together with equation (3.1), (3.3), and the sectorial wage equation for the formal and informal segments are expressed as:

$$W_{1i} = X_{1i}\gamma_1 + v_{1i} \quad iff \quad V_{1i} > 0 \text{ and } V_{2i} > 0 \qquad (3.5)$$

$$W_{2i} = X_{2i}\gamma_2 + v_{2i} \quad otherwise \qquad (3.6)$$

where X_{1i} and X_{2i} are the individual and industry characteristics, γ_1 and γ_2 are vectors of the respective coefficients, and v_{1i} and v_{2i} are *idd* normal errors with mean zero and variance $\sigma_{v_1}^2$ and $\sigma_{v_2}^2$, respectively (Mengistae, 1999).

W_{1i} is observed only if the individual is employed in the formal sector, and W_{2i} is observed for workers of the informal sector. However, employment depends on two decisions: the decision of the worker to participate in the formal sector and the employer's decision to hire that worker from the group

of job applicants. These decisions may influence the wage that workers receive. In this sense, the OLS estimation of the wage equations that does not take the two previous roles of workers and employers into account may result in biased estimates. The omission of selection decisions in the wage estimations yields to sample selection bias (Lee, 1978; and Heckman, 1979). Therefore, wage estimations are derived from a double selection approach, which eliminates the omitted variable problem and allows simultaneous estimation of both decisions.

3.2.2 Estimation procedure

We follow three main steps to estimate the model. First, we estimate the reduced form of the bivariate model, where the wage differential between the two sectors is not included. From this estimation, the residuals are taken in order to obtain the expectations of v_1 and v_2, which are the inverse Mills ratios. In the second step, we introduce these expectations in the wage equations of the formal and informal sector to avoid selection bias. In the last step, we include the wage estimations in the bivariate model. Hence, the differential in wages between the two sectors enters the equation where workers would like to belong to the formal sector, and the estimated wage a worker would earn in the formal sector is incorporated in the second equation, which accounts for the participation decision in the formal sector and the hiring decision.

There are two aspects to bear in mind regarding the bivariate model. First, it is important to determine the appropriate variables for the two main equations of the bivariate model. Thus, as shown by Poirer (1980), we need to introduce characteristics that have an effect on the first equation but not on the latter, and vice versa. In this specific case, the family background variable influences the first decision, i.e., whether a worker participates in the formal or informal sector, but it does not impact the employer's hiring decision. Furthermore, to identify the coefficients of both wage equations we need to include at least one variable that does not have a direct influence on the probability of the equations that matches the two decisions of the bivariate model. Thus, in the last step estimation of the bivariate model we exclude one variable each time. The second concern is about the partial observability of the data. In this sense, we do not have individual information about the decision process of workers or employers. We only have the current working status, i.e., if an individual is working in the formal or informal sector. In other words, we unable to

observe the different natures of the decision process for informal workers. The data only provides us with the outcomes of the two decisions processes.

Let us analyze in detail the first stage of the procedure. Abowd-Farber´s model of participation and hiring decisions assumes that these decisions are made sequentially, thus, they are independent from one another. The error of the selection equations (u_1 and u_2) follows a bivariate normal distribution where the covariance between them is zero.

Moving to the second step, we estimate the wage equations using Maddala's (1983) method to correct for selection bias. This methodology is an extension of the studies of Heckman (1976), Heckman (1979), and Lee (1978, 1979). To obtain consistent estimates of γ_1 of the employee's wage equation of the formal sector, the following expression is estimated:

$$W_{1i} = X_{1i}\gamma_1 + \sigma_{1_{v1}}\lambda_{1i} + \sigma_{2_{v1}}\lambda_{2i} + \varepsilon_{1i} \qquad (3.7)$$

where λ_{1i} and λ_{2i} are equivalent to the inverse Mills ratios in the univariate analysis. These ratios are defined as follows:

$$\lambda_{1i} = \frac{\phi(Z_{1i}\beta_1)}{\Phi(Z_{1i}\beta_1)} \qquad (3.8)$$

$$\lambda_{2i} = \frac{\phi(Z_{2i}\beta_2)}{\Phi(Z_{2i}\beta_2)} \qquad (3.9)$$

Once λ_{1i} and λ_{2i} are estimated from the bivariate probit, they are included in the subsequent OLS estimation:

$$W_{1i} = X_{1i}\gamma_1 + \sigma_{1_{v1}}\hat{\lambda}_{1i} + \sigma_{2_{v1}}\hat{\lambda}_{2i} + \eta_{1i} \qquad (3.10)$$

where $\eta_{1i} = \varepsilon_{1i} + \sigma_{1_{v1}}(\lambda_{1i} - \hat{\lambda}_{1i}) + \sigma_{2_{v1}}(\lambda_{2i} - \hat{\lambda}_{2i})$.

In the case of the informal workers' wage equation, there is an additional problem regarding sample selection, which makes it difficult to identify the kind of informal worker. Mengistae (1999) solves this problem by dividing workers of the informal sector into two groups. The first group is made up of workers of the informal sector who did not want to be part of the formal sector ($I_1 = 0$). The resulting wage equation is

$$W_{2i}^{(1)} = X_{2i}\gamma_2 + \sigma_{1_{v2}}\lambda_{3i} + \varepsilon_{2i}^{(1)} \tag{3.11}$$

where $\lambda_{3i} = \frac{-\phi(Z_{1i}\beta_1)}{1-\Phi(Z_{1i}\beta_1)}$. The second group corresponds to individuals who are part of the informal sector, because they were not hired in the formal sector despite their wiliness to join ($I_1 = 1 \; and \; I_2 = 0$). Their corresponding wage equation is

$$W_{2i}^{(2)} = X_{2i}\gamma_2 + \sigma_{1_{v2}}\lambda_{1i} + \sigma_{2_{v2}}\lambda_{4i} + \varepsilon_{2i}^{(2)} \tag{3.12}$$

where $\lambda_{4i} = \frac{-\phi(Z_{2i}\beta_2)}{1-\Phi(Z_{2i}\beta_2)}$. Since in the Heckman-Lee procedure it is not required to know the distribution of the informal sector between groups one and two, we assume that the proportion of workers of the informal sector who were not chosen for work in the formal sector is π. In contrast, $(1 - \pi)$ is the proportion of informal workers who wanted to be part of this segment of the labor market. Formerly, the expected wage of a random worker of the subsample of the private sector is $(1 - \pi)E\left(W_{2i}^{(1)}\right) + \pi E\left(W_{2i}^{(2)}\right)$. The whole informal sector conditional wage equation is:

$$W_{2i} = X_{2i}\gamma_2 + \sigma_{1_{v2}}\lambda_{3i} + \delta_1\lambda_{1i}^* + \delta_2\lambda_{4i} + \varepsilon_{2i} \tag{3.13}$$

where $\varepsilon_{2i} = (1 - \pi)\varepsilon_{2i}^{(1)} + \pi\varepsilon_{2i}^{(2)}$, $\lambda_{1i}^* = \lambda_{1i} - \lambda_{3i}$, $\delta_1 = \pi\sigma_{1_{v2}}$ and $\delta_1 = \pi\sigma_{2_{v2}}$. Again, after obtaining the inverse Mills ratio by estimating the bivariate probit and in order to obtain consistent estimates of $\gamma_2, \sigma_{1_{v2}}, \delta_1$ and δ_2, we apply Ordinary Least Squares to

$$W_{2i} = X_{2i}\gamma_2 + \sigma_{1_{v2}}\hat{\lambda}_{3i} + \delta_1\hat{\lambda}_{1i}^* + \delta_2\hat{\lambda}_{4i} + \eta_{2i} \tag{3.14}$$

where $\eta_{2i} = \varepsilon_{2i} + \sigma_{1_{v2}}\left(\lambda_{3i} - \hat{\lambda}_{3i}\right) + \delta_1\left(\lambda_{1i}^* - \hat{\lambda}_{1i}^*\right) + \delta_2\left(\lambda_{4i} - \hat{\lambda}_{4i}\right)$.

Applying the Heckman-Lee technique in this second step of the overall methodology provides consistent estimates of the coefficients of the wage equation.

Analyzing the third step of the model, the two former equations are considering participation in the formal sector. The hiring decision is estimated with a bivariate probit model including the wage estimations of the two sectors. As previously stated, the difference in wages between the two sectors enters the equation where workers would like to belong to the formal sector. The estimated wage that a worker would earn in the formal sector is included in the second equation.

3.2.3 Robustness of the model

There are two possible scenarios that can be proven. The first refers to the absence of formal sector job restrictions in the sense of the number of jobs available. The opposite case is the existence of a universal job market where there are no restrictions in jobs in any of the two sectors. In order to prove the existence of formal sector rationing, it is important to calculate the proportion of informal sector workers who have been rationed out of the formal sector. This proportion is $\pi = \delta_1/\sigma_{1_{v2}}$ [5]. With this in mind, the first hypothesis to be tested is if $\pi = 0$, while the universal hypothesis implies that $\pi = 1$. In other words, the hypotheses are corroborated applying an F test of join significance: in the former test the restriction is $\delta_1 = \delta_2 = 0$ and in the latter, we have $\sigma_{1_{v2}} = \delta_1$ (Mengistae, 1999). Rejecting the non-existence of formal job rationing and the universal job market would suggest a situation of partial job rationing, in which some informal workers are searching for work in the formal sector.

Turning back to the computations of the length of formal sector rationing, Farber (1983) and Venti (1987) present another method. The length *(q)* corresponds to the inverse of the average probability of being chosen to work in the formal sector given that the preference for this worker is the formal sector $(P(Eq2))$. Similarly, other important probabilities are $P(Eq1)$ and $P(formal)$. The former is the probability of workers that would like to join the formal sector and the latter is the probability of working in the formal sector. Table 3.1 describes these measures.

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[5] The proportion of the informal workers rationed out come from the estimates of the conditional wage equation (13) of informal workers.

3.3 Data

The data source used in this analysis is the national survey (ENEMDU) for 2015, conducted by the Ecuadorian National Institute for Statistics and Census (INEC). The cross-section survey contains information on the labor force covering the entire country including both urban and rural populations. The study considers workers who are 15 years of age or older and for which information on their formal or informal condition and wages[6] are available. We replaced the missing values of the rest of variables with the mean of each variable value. Thus, the final sample of the analysis contains 37,108 individuals.[7]

Table 3.1: Calculus of probabilities and length of formal sector rationing

$P(Eq1) = Prob(V_{1i} > 0)$
$P(Eq2) = Prob\big((V_{1i} > 0)\big|V_{2i} > 0\big)$
$P(formal) = Prob(V_{1i} > 0 \text{ and } V_{2i} > 0)$
$q = 1 \Big/ \dfrac{1}{n} \displaystyle\sum_{i=1}^{n} P(Eq2)$

Source: Farber (1983) and Venti (1987).

It is important to define the informal sector as a set of units of production that is involved in the production of goods or the provision of services. Its principal goal is to create jobs and produce income for all involved in this activity. Usually, informal sector companies operate on small scale with an elementary organization. Labor relations are based mostly on occasional employment and family or personal and social relations rather than contractual arrangements with labor rights (ILO, 2013). Considering the available information in the national survey, we define informal workers those salaried workers who are employed by small companies with less than ten employees who are not registered plus all independent and self-employed workers. Correspondingly, we identify, that from the total individuals that are currently active in the labor market, 55.6% are formal workers and 44.4% are informal workers.

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[6] We are using the logarithm of the monthly hourly wages.

[7] We are using the weights specified by the INEC as the expansion factors.

To determine workers' labor sector preferences, personal and demographic characteristics, human capital qualities, family characteristics, and employment factors are included. The personal characteristics are gender, if the worker is the head of the household, marital status, region of residence, and area of residence. Human capital qualities are workers' level of education[8], age[9], and the tenure of existing work.[10] The family characteristics information available for the analysis of individuals' preferences for formal and informal sector is the size of the household. Employment characteristics include the individuals' working sector. The hiring decision of the employer is influenced by personal characteristics, workers' human capital qualities (not including age and tenure of existing work), and employment factors mentioned above. In this way, age and tenure variables are used as exclusion restrictions in the wage equation, while marital status is the exclusion restriction in the selection equation of the final bivariate models.

Table 3.2 is presented to start the examination of personal and employment characteristics of both formal and informal workers. The first part of table 3.2 shows the percentage of the personal and job characteristics according to sector of employment. The second part shows the mean value of relevant individual characteristics of the workforce. With respect to education, formal workers are better educated than their informal equivalents, exhibiting on average 1.82 more years of schooling in the first case. Most of the individuals who belong to the formal segment have a secondary level of education (44%), while (37%) completed tertiary education. Correspondingly, most informal employers have finished primary school (49%), and a significant share of this segment has completed secondary school as well (38%). Turning our attention to the gender analysis, the majority of formal and informal workers are men, 64% and 63%, respectively. Another remarkable point is that in both cases most of workers are heads of households.

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[8] The level of education is a categorical variable where the first category corresponds to individuals with no education; the second category corresponds to primary level, the third to secondary level, and the fourth to tertiary level education.

[9] The age variable is entered as a quadratic form in both workers' decision and wage equations.

[10] The tenure variable is entered as a quadratic form in both workers' decision and wage equations.

Table 3.2: Descriptive statistics of personal and employment characteristics

	Informal %	Formal %	Total %
Education			
No education	5.92	0.58	2.73
Primary	48.78	18.49	30.69
Secondary	38.27	44.27	41.86
Tertiary	7.03	36.66	24.72
Gender			
Female	36.06	37.01	36.63
Male	63.94	62.99	63.37
Head of household			
Non-head	39.09	47.09	43.87
Head	60.91	52.91	56.13
Marital status			
Unmarried	34.39	34.67	34.56
Married	65.61	65.33	65.44
Region			
Sierra	40.79	50.06	46.33
Cost	53.78	45.64	48.92
Amazon	5.34	3.92	4.49
Insular	0.09	0.38	0.26
Area			
Rural	41.46	18.06	27.48
Urban	58.54	81.94	72.52
Sector			
Primary	35.25	10.72	20.60
Industry	20.49	19.77	20.06
Service	44.26	69.51	59.34
Mean			
Age (years)	43.53	37.96	41.24
	(15.46)	(12.34)	(14.44)
Education (years)	4.92	6.74	5.90
	(1.74)	(1.94)	(2.11)
Tenure (years)	14.13	8.35	11.95
	(14.55)	(9.10)	(13.19)
Home size	4.36	4.23	4.30
	(2.20)	(1.86)	(2.06)
Hourly wage (dollars)	1.99	4.36	3.32
	(1.97)	(6.75)	(4.93)

Source: Author's calculations based on the ENEMDU, 2015.

Note: The informal sector is formed by salaried workers employed by small establishments with less than ten employees and are unregistered plus all independent and self-employed workers. It uses the weights of the sample available in the database.

The table shows that formal workers are concentrated in the service sector (70%), specifically in the commerce, hotel, and building sector (30%) and in the financial and education sector (27%). In contrast, the informal segment is concentrated in the primary sector (35%) and in services (44%), where most are employed in the commerce, hotel, and building sector. Regarding age and the size of the home, there are no notable differences between formal and informal workers. In the case of acquired experience in the current job, there is a major difference between the two groups analyzed. Formal workers have 8.4 years of tenure and informal workers have, on average, 14.1 years. Finally, a meaningful difference is present in the earned hourly wage. In the case of formal workers, their average hourly wage is 2.37 dollars higher than the wage of their counterparts in the informal sector.

A typical informal sector worker is a married man around 44 years old with a primary school education. He is the head of an average household of 4.3 individuals. The most common place of work is the primary or service sector with average hourly earnings of 1.99 dollars.

3.4 Empirical results

Before turning to the estimation results described in section 3.2, we first test the effects of the explanatory variables included in the model on the likelihood of being part of the formal sector using a univariate probit model for the total sample and for males and females separately. We do not comment on these results (Table 3.3), since these models simply serve as a point of reference for the following models. Additionally, as explained, job placement in the formal or informal sector results from a joint decision, and the univariate probit model is inadequate, because it omits worker preferences and the selection mechanism of employers. Hence, a bivariate model with partial observability including both aspects is more appropriate.

Table 3.4 presents the estimates of the reduced bivariate probit model for the three cases: total sample, male, and female. The results show interesting patterns in equations (1) and (2) for each situation. With respect to the human capital characteristics of workers, we first examine the education variable. A higher level of education increases the likelihood that people will prefer to join the formal sector, and it is also an important characteristic influencing selection for a formal sector job when we consider the entire sample. But there is a remarkable difference with respect to the male sample, where higher

level of education decreases the probability of being chosen to work in the formal sector. However, in the next steps we cannot confirm this difference among the groups analyzed.

Table 3.3: Estimates of the univariate probit model
Y= 1 formal, 0 informal

	Total		Male		Female	
	Coefficients	Marginal effects	Coefficients	Marginal effects	Coefficients	Marginal effects
Personal characteristics						
Primary	0.514***	0.174***	0.409***	0.143***	0.671***	0.204***
	(0.005)	(0.001)	(0.006)	(0.002)	(0.008)	(0.002)
Secondary	0.989***	0.347***	0.826***	0.292***	1.243***	0.415***
	(0.005)	(0.001)	(0.006)	(0.002)	(0.008)	(0.002)
Tertiary	1.783***	0.583***	1.505***	0.494***	2.117***	0.675***
	(0.005)	(0.001)	(0.006)	(0.002)	(0.008)	(0.002)
Age	0.014***	-0.001***	0.029***	-0.0001***	-0.006***	-0.003***
	(0.0003)	(0.00002)	(0.0003)	(0.00003)	(0.0005)	(0.00003)
Age2	-0.0002***		-0.0004***		-4.37e-05***	
	(3.03e-06)		(3.72e-06)		(5.38e-06)	
Tenure	-0.006***	-0.003***	-0.023***	-0.006***	0.020***	0.003***
	(0.0002)	(0.00003)	(0.0002)	(0.00003)	(0.0003)	(0.00005)
Tenure2	-0.0001***		0.0001***		-0.0006***	
	(3.91e-06)		(4.55e-06)		(7.75e-06)	
Male	0.238***	0.073***				
	(0.001)	(0.0004)				
Head Household	-0.003**	-0,00091	0.079***	0.024***	-0.213***	-0.061***
	(0.001)	(0.0005)	(0.002)	(0.0007)	(0.003)	(0.0008)
Married	0.120***	0.0370***	0.122***	0.038***	-0.045***	-0.013***
	(0.001)	(0.0004)	(0.002)	(0.0006)	(0.002)	(0.0007)
Coast	-0.361***	-0.110***	-0.284***	-0.089***	-0.466***	-0.134***
	(0.001)	(0.0004)	(0.002)	(0.0005)	(0.002)	(0.0006)
Amazon	-0.196***	-0.059***	-0.211***	-0.065***	-0.128***	-0.035***
	(0.003)	(0.001)	(0.004)	(0.001)	(0.005)	(0.001)
Insular	0.619***	0.157***	0.729***	0.186***	0.523***	0.125***
	(0.015)	(0.003)	(0.020)	(0.004)	(0.023)	(0.005)
Urban	0.352***	0.107***	0.343***	0.107***	0.384***	0.110***
	(0.002)	(0.0005)	(0.002)	(0.0006)	(0.003)	(0.0008)

Table 3.3: Estimates of the univariate probit model (continued)
Y= 1 formal, 0 informal

	Total		Male		Female	
	Coefficients	Marginal effects	Coefficients	Marginal effects	Coefficients	Marginal effects
Household characteristics						
Home size	-0.017***	-0.005***	-0.010***	-0.003***	-0.028***	-0.008***
	(0.0003)	(0.0001)	(0.0004)	(0.0001)	(0.0006)	(0.0002)
Sector						
Industry	0.227***	0.074***	0.196***	0.066***	0.384***	0.116***
	(0.002)	(0.0007)	(0.002)	(0.0008)	(0.004)	(0.001)
Service	0.410***	0.132***	0.447***	0.147***	0.389***	0.118***
	(0.002)	(0.0006)	(0.002)	(0.0008)	(0.004)	(0.001)
Constant	-1.289***		-1.247***		-0.967***	
	(0.007)		(0.009)		(0.012)	
N	37108		23342		13766	
Log L	-3003261.4		-1936464.6		-1037964.4	
Pseudo R2	0.2		0.19		0.24	
AIC	6006559		3872963		2075963	
BIC	6006712		3873100		2076091	

Source: Author's calculations based on the ENEMDU, 2015.

Note: The informal sector is formed by salaried workers employed by small establishments with less than ten employees and are unregistered, plus all independent and self-employed workers. It uses the weights of the sample available in the database. *$p<0.1$, **$p<0.05$, ***$p<0.01$. Dummy variables, default categories are: less than primary education, sierra region, and primary sector.

Regarding the other human capital characteristics such as age and tenure, it is shown that the former has a positive and decreasing effect on the probability of joining the formal sector for the total and male sample, while for the female sample we find the contrary effect. The tenure variable has a negative effect that is increasing in the full model and male group, while for the female case there is a positive and decreasing effect. In the case of the gender variable, females are less likely to be chosen to join the formal sector. Concerning the head of household variable, contrary effects are reported in the full sample. Workers' decisions to seek formal employment are influenced positively, while the employers' selection processes show a negative impact of this variable. These two effects are explained when we analyze the gender specific models; in the case of the model only using the male subsample, both equations

present positive effects, while in the female case both are negative. This finding could be related to the evidence that in the estimation sample, males are most often the head of the household. The data demonstrates that a male married worker has a higher likelihood of seeking formal work and of being selected to perform formal work than a single worker.

Table 3.4: Estimates of reduced bivariate probit model
Y= 1 formal, 0 informal; j: (1), (2)

	Workers who would like to work in the formal sector. (1)			Workers who would like to work and are chosen to work in the formal sector (2)		
	Total	Male	Female	Total	Male	Female
Personal characteristics						
Primary	0.379***	0.420***	0.630***	0.620***	-0.194	0.0876
	(0.123)	(0.145)	(0.212)	(0.128)	(0.202)	(0.676)
Secondary	0.513***	0.911***	1.261***	1.268***	-0.437**	0.0904
	(0.142)	(0.146)	(0.214)	(0.127)	(0.212)	(0.868)
Tertiary	1.121***	1.569***	2.145***	2.047***	-0.0266	0.24
	(0.167)	(0.151)	(0.218)	(0.131)	(0.261)	(0.967)
Age	0.075***	0.021***	-0,0119			
	(0.0115)	(0.00617)	(0.0105)			
Age2	-0.001***	-0.0003***	7.62e-07			
	(0.000125)	(6.53e-05)	(0.000113)			
Tenure	-0.076***	-0.024***	0.030***			
	(0.00682)	(0.00317)	(0.0116)			
Tenure2	0.0009***	0.0002***	-0.001***			
	(0.0001)	(6.00e-05)	(0.0002)			
Male	-0,0564			0.290***		
	(0.0582)			(0.0334)		
Head of Household	0.186***	0.0519	-0.225***	-0.085***	0.160*	-0.01
	(0.0592)	(0.0513)	(0.0602)	(0.0322)	(0.0908)	(0.147)
Married	0.114**	0.154***	-0.0469	0.0870***	-0.158*	0.00141
	(0.0505)	(0.0476)	(0.0527)	(0.0305)	(0.0860)	(0.108)
Coast	0.259***	-0.468***	-0.588***	-0.568***	0.699***	1.003***
	(0.0701)	(0.0461)	(0.0544)	(0.0321)	(0.0929)	(0.206)
Amazon	-0.486***	0.201***	0.256	0.192***	-0.51***	-0.84***
	(0.0528)	(0.0517)	(0.202)	(0.0463)	(0.0631)	(0.123)
Insular	1.180***	0.716***	0.419***	0.465***	0,276	1.046**
	(0.242)	(0.247)	(0.160)	(0.111)	(0.444)	(0.432)
Urban	0.561***	0.129***	0.227***	0.114***	0.617***	0.651***
	(0.0524)	(0.0489)	(0.0846)	(0.0420)	(0.113)	(0.177)

Table 3.4: Estimates of reduced bivariate probit model (continued)
Y= 1 formal, 0 informal; j: (1), (2)

	Workers who would like to work in the formal sector. (1)			Workers who would like to work and are chosen to work in the formal sector (2)		
	Total	Male	Female	Total	Male	Female
Household characteristics						
Home size	-0.0146	-0.00424	-0.0241**			
	(0.0100)	(0.00729)	(0.0111)			
Sector						
Industry	0.756***	-0.213***	-0.983***	-1.292***	0.730***	1.661***
	(0.103)	(0.0767)	(0.341)	(0.431)	(0.127)	(0.402)
Service	3.439	-0.126*	-1.056***	-1.512***	9.266***	2.694***
	-2.530	(0.0711)	(0.330)	(0.465)	(0.0964)	(0.753)
Constant	-1.959***	-0.346*	0,763	0.766	0.483**	-0.482
	(0.232)	(0.206)	(0.587)	(0.496)	(0.229)	(0.989)
Rho	0.207	-1.962	-0.826			
	(0.199)	(0.011)	(0.235)			
N	37108	23342	13766	37108	23342	13766
Log L	-2896348.3	-1901093.9	-1011663.6	-2896348.3	-1901093.9	-1011663.6
AIC	5792761	3802248	2023387	5792761	3802248	2023387
BIC	5793033	3802489	2023613	5793033	3802489	2023613

Source: Author's calculations based on the ENEMDU, 2015.

Note: The informal sector is formed by salaried workers employed by small establishments with less than ten employees and are unregistered, plus all independent and self-employed workers. It is used the weights of the sample available in the database and robust standard errors. *$p<0.1$, **$p<0.05$, ***$p<0.01$. Dummy variables, default categories are: less than primary education, sierra region, and primary sector.

In contrast, female married workers present a lower probability in the first equation. In this sense, Tijdens (2002) presents a gender roles model, arguing that women work part time because they have children at home or are secondary earners. Thus, according to the results of this analysis, a married woman who considers the possibility of having children takes into account that within the informal sector, particularly in self-employment, there could be greater flexibility regarding time allocation compared to the formal sector. Finally, referring to the place where workers live, workers are more likely to prefer and be selected for formal employment if they live in urban areas.

Moving the analysis to the variables that are only included in the first equation, namely, the characteristics of a worker's household the main results do not vary greatly compared to the results of the univariate model. Home size has a negative effect: if there are more members in a household, there is greater pressure to find any type of employment in the female sample. Thus, individuals tend to rapidly accept informal employment, since they are worried about the time required for a lengthy formal selection process.

Finally, considering the different sectors in the full sample, being part of the industrial sector increases the likelihood of joining the formal sector compared to the primary sector. There is a contrary effect on the probability of being selected to work in the formal sector for both industrial and service sectors.

The least square estimates of the wage equations for both formal and informal workers for the total, male, and female samples are reported in table 3.5. It is important to highlight that all coefficients of selection bias correction are statically significant. The main implication of the significant effect of the estimated coefficients ($\sigma_{1_{v1}}, \sigma_{2_{v1}} \sigma_{1_{v2}}, \delta_1, \delta_2$) associated with the selection bias reported in both wage equations estimation is the difference found in the education variables; therefore, it is important to correct for such bias. We find that there is a statistically significant and positive effect of education on workers' earnings in formal and informal jobs. However, these coefficients are overestimated in the OLS estimation without correction (See table A3.1.1 in the appendix). The corrected coefficients of the human capital variables have the expected signs and present a concave effect in the case of age and job tenure on logged monthly earnings in the formal and informal sectors.

On average, women earn less than men with similar characteristics in the formal and informal sectors. The results confirm that the commitment of a head of the family increases the average wage in both the formal and informal sectors. Importantly, a female head of household, on average, receives a lower wage in the informal sector. Again, a female married worker earns a lower salary in the informal sector. There is a wage difference across occupational sector. In general, industry and service sector workers earn lower wages compared to workers of similar characteristics in the formal primary sector. On the other hand, in the informal group and for the entire sample, the industry and service sector present a higher wage compared to primary sector jobs.

Table 3.5: Wage equations for formal and informal workers correcting for selection bias

Y= Log hourly wage (formal/informal)

	Formal wage equation			Informal wage equation		
	Total	Male	Female	Total	Male	Female
Primary	0.115***	0.115***	0.0962***	0.123***	0.326***	0.207***
	(0.00493)	(0.00634)	(0.00895)	(0.00253)	(0.00769)	(0.00723)
Secondary	0.339***	0.323***	0.278***	0.178***	0.455***	0.378***
	(0.00570)	(0.00817)	(0.0106)	(0.00313)	(0.0159)	(0.0128)
Tertiary	0.870***	0.824***	0.748***	0.348***	0.687***	0.585***
	(0.00670)	(0.0103)	(0.0128)	(0.00477)	(0.0251)	(0.0209)
Age	0.0202***	0.0194***	0.0272***	0.0222***	0.018***	0.034***
	(0.000181)	(0.000254)	(0.000299)	(0.000227)	(0.00047)	(0.00042)
Age2	-0.000***	-0.000***	-0.000***	-0.000***	-0.00***	-0.00***
	(2.10e-06)	(3.01e-06)	(3.55e-06)	(2.40e-06)	(5.23e-06)	(4.40e-06)
Tenure	0.0210***	0.0205***	0.0165***	0.0031***	0.007***	0.003***
	(0.000111)	(0.000171)	(0.000226)	(0.000135)	(0.00043)	(0.00036)
Tenure2	-0.000***	-0.000***	-0.000***	-8.31e-05***	-0.00***	-0.00***
	(3.12e-06)	(3.77e-06)	(6.47e-06)	(2.40e-06)	(4.33e-06)	(8.47e-06)
Male	0.146***			0.282***		
	(0.000978)			(0.00137)		
Head of Household	0.0893***	0.0942***	0.0554***	0.0757***	0.045***	-0.02***
	(0.000846)	(0.00124)	(0.00163)	(0.00129)	(0.00207)	(0.00321)
Married	0.0741***	0.0855***	0.0320***	0.0475***	0.115***	-0.04***
	(0.000783)	(0.00136)	(0.00127)	(0.00117)	(0.00294)	(0.00255)
Coast	-0.089***	-0.058***	-0.066***	0.104***	-0.034***	-0.13***
	(0.00131)	(0.00244)	(0.00237)	(0.00160)	(0.00796)	(0.00614)
Amazon	0.0114***	0.0363***	-0.048***	-0.231***	-0.17***	-0.18***
	(0.00179)	(0.00241)	(0.00298)	(0.00264)	(0.00437)	(0.00578)
Insular	0.617***	0.634***	0.562***	0.837***	0.760***	0.779***
	(0.00554)	(0.00737)	(0.00882)	(0.0177)	(0.0237)	(0.0304)
Urban	-0.014***	-0.049***	0.0657***	0.0264***	-0.11***	0.100***
	(0.00104)	(0.00145)	(0.00186)	(0.00162)	(0.00305)	(0.00354)
Industry	-0.114***	-0.042***	-0.035***	0.314***	0.068***	-0.20***
	(0.00253)	(0.00208)	(0.00589)	(0.00379)	(0.00421)	(0.0120)
Service	-0.132***	-0.055***	0.0521***	0.406***	-0.19***	0.068***
	(0.00304)	(0.00226)	(0.00609)	(0.00531)	(0.00369)	(0.0128)
Constant	0.143***	0.268***	-0.00537	-0.718***	0.0555	-0.82***
	(0.00758)	(0.0139)	(0.0129)	(0.00794)	(0.0342)	(0.0171)

Table 3.5: Wage equations for formal and informal workers correcting for selection bias (continued)
Y= Log hourly wage (formal/informal)

	Formal wage equation			Informal wage equation		
	Total	Male	Female	Total	Male	Female
$\sigma_{1_{v1}}$	-0.160***	-0.0724***	-0.156***			
	(0.00249)	(0.0108)	(0.00836)			
$\sigma_{2_{v1}}$	0.0292***	-0.228***	0.0317***			
	(0.00499)	(0.00529)	(0.00649)			
$\sigma_{1_{v2}}$				-0.310***	0.680***	0.0975***
				(0.00450)	(0.0183)	(0.0109)
δ_1				0.00486*	0.229***	0.170***
				(0.00272)	(0.0257)	(0.0150)
δ_2				0.258***	1.018***	0.341***
				(0.00882)	(0.00998)	(0.0169)
Observations	3325122	2094344	1230778	2242892	1434103	808788
	0.4	0.23	0.26	0.11	0.1	0.1

Source: Author's calculations based on the ENEMDU, 2015.

Note: The informal sector is formed by salaried workers employed by small establishments with less than ten employees and are unregistered, plus all independent and self-employed workers. It is used the weights of the sample available in the database. *p<0.1, **p<0.05, ***p<0.01. Dummy variables, default categories are: less than primary education, sierra region, and primary sector.

To verify if it is correct to apply a bivariate model, we present two tests used by Mengistae (1999). The first hypothesis suggests that there is no job rationing in the formal sector, which is tested by the statement that π equals zero. The second hypothesis tests the presence of a universal labor market, expressed by π as equal to one. Both are F tests of joint statistical significance of the parameters that correct the problem of selection bias associated to the conditional informal wage equation (13). The first test is verified with $\delta_1 = \delta_2 = 0$ and the second with $\sigma_{1_{v2}} = \delta_1$ as presented in Table 3.6.

The results show that both null hypotheses are rejected at a 1% level of significance in three cases, supporting the application of the bivariate model compared to the univarite specification to define the procedure of obtaining formal or informal employment considering worker and employer preferences.

Table 3.6: Test of the existence of non-rationing in the formal sector and universal labor market hypothesis

Ho	F test		Prob>F
Total			
Non-rationing in the formal sector	F(2, 2242872)	428.38	0.000
Universal labor market	F(1, 2242872)	4323.2	0.000
Male			
Non-rationing in the formal sector	F(2, 1434084)	5475.75	0.000
Universal labor market	F(1, 1434084)	901.78	0.000
Female			
Non-rationing in the formal sector	F(2, 808769)	273.15	0.000
Universal labor market	F(1, 808769)	37.36	0.000

Source: Author's calculations based on the ENEMDU, 2015.

A second implication regarding the existence of formal job rationing is that for workers who want to work in the formal sector, job restrictions in this sector mean this is not always an option. Finally, another important finding supporting the rejection of the universal labor market is that not all the individuals search for a job in the formal sector. This result may imply that informal workers choose to join this sector due to advantages found there (Carneiro & Henley 2002). For these three analyses, it is important to state that in the informal market there may exist two types of workers: those who could not find employment in the formal sector and those who value the benefits and gains of the informal sector over the formal sector. According to Renooy (1990), informal activities take place both within and outside formal environments and they interact with each other. Some of the advantages of the informal sector are a higher degree of flexibility, lower entrance restrictions, lower prices of goods and services and capital intensity, and the presence of social and family networks.

Following the procedure described in the previous section, table 3.7 shows the length of formal sector rationing and the probabilities associated with the reduced bivariate model of the total, male, and female samples. The first three rows are the mean values of the probabilities presented for the different samples. In this sense, the mean probability of workers who seek to work in the formal sector is around 75%, 70%, and 68% for the entire, male, and female cases respectively. Whereas those workers who prefer to join the formal sector and are chosen by the employer to fill a vacancy represent 81%, 82%, and 79%, respectively. The conditional probability of being a formal

worker is 58% for the full sample; for the male subsample the likelihood is 6 points higher compared to the female sample. Next, the length of formal sector rationing has a value of 1.24, meaning that for each 100 workers in the formal sector there are 124 workers wishing to find a formal job. For the female case, the rationing linked to the formal sector is 1.27, while for the male sample for every 100 workers we find 123 workers who wish to be part of the formal sector.

Table 3.7: Probabilities and length of the formal sector rationing from the bivariate model

	Total sample	Male	Female
P (eq1)	0.75	0.70	0.68
P (Eq2)	0.81	0.82	0.79
P (formal)	0.58	0.60	0.54
q	1.24	1.23	1.27

Source: Author's calculations based on the ENEMDU, 2015.

Note: Eq1: workers who would like to work in the formal sector; Eq2: workers who would like to work and are chosen to work in the formal sector; formal: formal workers; q: length of the formal sector rationing.

Estimates of the final bivariate probit models with partial observability are shown in table 3.8, excluding the married variable. As explained, we consider the wage equation estimators with the inverse Mills rations to correct for selection bias. Equation (3.1) proposes that workers' preferences for formal employment are influenced by the wage premium increase in this sector $(W_f - W_i)$. According to the results for the full sample, the difference in wages has a positive effect on the probability of joining a formal job. This effect is due to the fact that if there is a meaningful difference between the formal wage and the informal wage, there is a higher likelihood of joining formal employment. Conversely, referring to the estimates of the bivariate models by gender, there is evidence that the wage premium has a negative impact on the likelihood of working in the formal sector. Different levels of education can explain this negative effect. An individual with a lower level of education would have lower aspirations for a formal job. Therefore, the wage gap between the two sectors would have a negative impact; since less educated individuals do not expect to earn a formal wage. The preceding discussion corroborates the asymmetric effects in the decision to join the formal sector due to differences in formal and informal wages.

Table 3.8: Estimates of the bivariate probit model
Y= 1 formal, 0 informal; j: (1), (2)

	Workers who would like to work in the formal sector. (1)			Workers who would like to work and are chosen to work in the formal sector (2)		
	Total	Male	Female	Total	Male	Female
Expected wages of the formal or informal sector						
$\ln W_f - \ln W_i$	3.150***	-0.799**	-0.381***			
	(0.284)	(0.335)	(0.619)			
$\ln W_f$				-1.448***	-1.763***	-3.046***
				(0.226)	(0.281)	(0.378)
Personal characteristics						
Primary	0.511***	0.348**	0.689***	0.111	0.0645	0.434
	(0.112)	(0.154)	(0.187)	(0.158)	(0.226)	(0.402)
Secondary	0.667***	0.958***	1.383***	0.001	0.087	0.804*
	(0.118)	(0.151)	(0.217)	(0.178)	(0.247)	(0.454)
Tertiary	0.516***	1.801***	2.406***	0.817***	1.455***	2.528***
	(0.168)	(0.184)	(0.405)	(0.281)	(0.387)	(0.559)
Age	0.0163***	0.0380***	-0.00339			
	(0.005)	(0.007)	(0.011)			
Age2	-0.0003***	-0.0004***	-0.0001			
	(5.72e-05)	(6.83e-05)	(0.0001)			
Tenure	-0.0456***	9.19e-05	0.0442***			
	(0.005)	(0.005)	(0.013)			
Tenure2	0.0004***	-0.0003***	-0.0008***			
	(7.83e-05)	(9.01e-05)	(0.0002)			
Male	0.750***			-0.0104		
	(0.0517)			(0.0689)		
Head of Household	-0.104***	0.104**	-0.211***	0.316***	0.536***	0.16
	(0.0326)	(0.0509)	(0.0486)	(0.0738)	(0.110)	(0.105)
Coast	-0,0709	-0.508***	-0.606***	0.658***	0.487***	0.548***
	(0.050)	(0.044)	(0.055)	(0.065)	(0.095)	(0.181)
Amazon	-0.538***	0.397***	0,213	-0.528***	-0.599***	-0.891***
	(0.0717)	(0.0896)	(0.140)	(0.0518)	(0.0742)	(0.118)
Insular	1.337***	0.575**	0.361*	1.262***	1.542***	2.759***
	(0.133)	(0.284)	(0.184)	(0.300)	(0.579)	(0.498)
Urban	0.241***	0.126***	0.242***	0.560***	0.611***	0.837***
	(0.033)	(0.049)	(0.056)	(0.083)	(0.107)	(0.144)

Table 3.8: Estimates of the bivariate probit model (continued)
Y= 1 formal, 0 informal; j: (1), (2)

	Workers who would like to work in the formal sector. (1)			Workers who would like to work and are chosen to work in the formal sector (2)		
	Total	Male	Female	Total	Male	Female
Household characteristics						
Home size	-0.005	0.005	-0.026**			
	(0.00556)	(0.00722)	(0.0114)			
Sector						
Industry	0.208**	-0.510***	-0.901***	1.378***	0.874***	1.094***
	(0.0852)	(0.108)	(0.207)	(0.150)	(0.144)	(0.224)
Service	0.133*	-0.270***	-1.102***	7.055***	8.763***	7.141***
	(0.0737)	(0.102)	(0.295)	(0.0985)	(0.142)	(0.388)
Constant	-2.286***	-0.325	0.645	1.315***	1.494***	1.675***
	(0.221)	(0.223)	(0.605)	(0.207)	(0.329)	(0.526)
Rho	-0.979	-0.941	-0.819			
	(0.00525)	(0.017)	(0.106)			
N	37108	23342	13766			
Log L	-2919846.7	-1895426.6	-1001865,.			
AIC	5839757	3790913	2003790			
BIC	5840030	3791155	2004016			

Source: Author's calculations based on the ENEMDU, 2015.

Note: The informal sector is formed by salaried workers employed by small establishments with less than ten employees and are unregistered, plus all independent and self-employed workers. It is used the weights of the sample available in the database. *p<0.1, **p<0.05, ***p<0.01. Dummy variables, default categories are: less than primary education, sierra region, and primary sector.

However, formal sector wages decrease the possibility of being chosen for a formal vacancy as presented in equation (2). This can be explained by the principle of cost minimization, in the sense that workers' wages represent a cost to the employer.

Once we control for sectorial wage differentials, we can identify that there are small differences compared to the reduced-form models. In general, it is observed that higher levels of education positively influence outcomes in the two decision processes. Another feature worth mentioning is the result regarding the head of household variable. Being the head of the household decreases the likelihood of preferring the formal sector, since preferences may

be affected by the necessity to find a job in a timely fashion. However, this characteristic is an important element for workers in being chosen for formal jobs, as being a head of household is linked with a high degree of worker commitment. Employers take this circumstance as a positive characteristic at the moment of hiring. Annex A3.1.2A and A3.1.2B present the marginal effects of the joint probabilities for the four possible outcomes for the total, male and female subsamples. In this sense, the first effects are workers who would like to work and are chosen to work in the formal sector. The second one shows workers who would like to work but are not chosen to work. The third are workers who would not like to work in the formal sector but they are actually working in this sector. And the fourth group is workers who would not like to work in the formal sector and they are not working there.

All in all, the results confirm the existence of rationing in the formal labor market. For instance, labor market restrictions are generated because of the reduced ability to create enough vacancies to cope with the preferences of workers. On the other hand, the features that allow workers to find a better job in terms of formality are, in principle, human capital characteristics, especially education. Moreover, workers' commitment, concern, and responsibility are principal factors that determine whether a worker will find employment in the formal sector. The household characteristics considered in this study (home size) show a negative effect on the probability of seeking a formal job. The financial difficulties and necessity of various resources reduce opportunities to find formal jobs, and workers prefer to receive income from any type of employment in a timely way.

3.5 Conclusions

The main objective of this chapter is to determine the factors that influence the decision of workers and employers to enter the formal or informal sector in Ecuador. For this reason and taking into account the highly informal workforce participation in the country, we have analyzed whether being part of an informal job is a worker's voluntary decision, or if it is because there are restrictions on the number of job placements in the formal sector.

The starting point of this chapter was that although there has been a burgeoning literature on the rationing of the formal sector employment, the results of this study corroborate the restriction of the number of jobs in the formal economy. Complementary, individuals' personal characteristics—i.e.,

level of education and level of commitment related to their economic role in their household—influence their preferences for formal sector jobs. Another piece is the asymmetric effect in workers' decisions to join the formal sector due to the wage differential between the two options for work specified in the analysis. Additionally, once individuals select their affinities for formal employment, they have to fit into a position offer. It is also shown that job offers depend on the costs that workers represent to the firm regarding their human capital characteristics, and employers take into account the responsibility and commitment of the individuals in the household when selecting employees for a formal job. The main contribution regarding previous studies of the country is that in this analysis it is considered the preferences of both the demand and the supply side of the market.

Lastly, the validation of the existence of the segmentation on the selection mechanism on finding employment in the labor market reflects the scarcity of formal jobs in Ecuador. Policy implications can be drawn from these results. First, if there is a rationing of the formal sector and a desire among people to obtain a formal job that is likely to be related to job characteristics offered by the formal sector that cannot be found in informal occupations. Since the informal economy is a major provider of employment, it could be reasonable to try to institutionalize informal jobs and show that they are linked in different ways to the formal economy. The linkages can be seen in the production, trade, and distribution of goods and services between these two sectors. Assuming that informality has a significant presence in the economy and it is closely related to the formal sector, policy makers should encourage more equitable acquaintances between formal and informal employment options and try to equilibrate the costs and benefits of working either in one sector or another. Secondly, decision makers should take into account the increase and the wide range of informal occupations, such as temporary, part-time, and homework arrangements. Thus, the policy response could focus on reducing barriers to registration or costs regarding informality and increasing benefits of regulation or formal work.

3.6 References

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Annex A3.1.1: Wage equations for formal and informal workers without correcting selection bias

Y= Log hourly wage (formal/informal)

	Formal wage equation			Informal wage equation		
	Total	Male	Female	Total	Male	Female
Primary	0.134***	0.125***	0.168***	0.165***	0.179***	0.136***
	(0.005)	(0.005)	(0.008)	(0.002)	(0.003)	(0.004)
Secondary	0.359***	0.346***	0.407***	0.249***	0.268***	0.241***
	(0.005)	(0.005)	(0.008)	(0.003)	(0.003)	(0.004)
Tertiary	0.888***	0.870***	0.932***	0.463***	0.565***	0.363***
	(0.005)	(0.005)	(0.008)	(0.003)	(0.004)	(0.005)
Age	0.0218***	0.021***	0.027***	0.0217***	0.0148***	0.0348***
	(0.0002)	(0.0002)	(0.0003)	(0.0002)	(0.0003)	(0.0004)
Age2	-0.0002***	-0.0002***	-0.0003***	-0.0003***	-0.0001***	-0.0004***
	(2.09e-06)	(2.59e-06)	(3.54e-06)	(2.30e-06)	(2.66e-06)	(4.31e-06)
Tenure	0.0197***	0.0198***	0.019***	0.004***	0.007***	-6.05e-05
	(0.0001)	(0.0001)	(0.0002)	(0.0001)	(0.0001)	(0.0002)
Tenure2	-0.0003***	-0.0004***	-0.0002***	-0.0001***	-0.0002***	-5.52e-05***
	(3.12e-06)	(3.76e-06)	(5.72e-06)	(2.29e-06)	(2.67e-06)	(4.24e-06)
Male	0.142***			0.301***		
	(0.0008)			(0.001)		
Head of Household	0.0947***	0.098***	0.0422***	0.0721***	0.075***	0,002
	(0.0008)	(0.001)	(0.001)	(0.001)	(0.002)	(0.003)

Annex A3.1.1: Wage equations for formal and informal workers without correcting selection bias (continued)

Y= Log hourly wage (formal/informal)

	Formal wage equation			Informal wage equation		
	Total	Male	Female	Total	Male	Female
Married	0.0762***	0.088***	0.029***	0.048***	0.080***	-0.034***
	(0.0008)	(0.001)	(0.001)	(0.001)	(0.002)	(0.003)
Coast	-0.077***	-0.0591***	-0.106***	0.071***	0.107***	-0.044***
	(0.0007)	(0.0009)	(0.001)	(0.001)	(0.001)	(0.002)
Amazon	0,003	0.023***	-0.0331***	-0.251***	-0.301***	-0.151***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.005)
Insular	0.623***	0.654***	0.582***	0.847***	0.837***	0.766***
	(0.006)	(0.007)	(0.009)	(0.018)	(0.021)	(0.030)
Urban	0.008***	-0.021***	0.076***	0.022***	-0.009***	0.091***
	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)	(0.003)
Industry	-0.03***	-0.001	-0.122***	0.216***	0.260***	0.044***
	(0.001)	(0.002)	(0.003)	(0.002)	(0.002)	(0.004)
Service	0,002	0.016***	-0.040***	0.186***	0.0918***	0.334***
	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.003)
Constant	-0.046***	0.095***	-0.101***	-0.652***	-0.255***	-0.889***
	(0.006)	(0.007)	(0.010)	(0.005)	(0.006)	(0.009)
Observations	3325122	2094344	1230778	2242892	1434103	808788
	0.24	0.23	0.26	0.11	0.1	0.1

Source: Author's calculations based on the ENEMDU, 2015

Annex A3.1.2A: Marginal effects of final bivariate probit model
Y= 1 formal, 0 informal; j: (1), (2)

	Workers who would like to work and are chosen to work in the formal sector.			Workers who would like to work and are not chosen to work in the formal sector.		
	Total	Male	Female	Total	Male	Female
Expected wages of the formal or informal sector						
$\ln W_f - \ln W_i$	0.941***	-0.242**	-0.1	0.012***	-0.007**	-0.005
	(0.084)	(0.103)	(0.163)	(0.002)	(0.003)	(0.008)
$\ln W_i$	-0.093***	-0.155***	-0.127***	0.093***	0.155***	0.127***
	(0.014)	(0.030)	(0.015)	(0.014)	(0.030)	(0.015)
Personal characteristics						
Primary	0.168***	0.125***	0.196***	-0.001	0.004	0.014
	(0.028)	(0.037)	(0.036)	(0.010)	(0.021)	(0.016)
Secondary	0.207***	0.342***	0.450***	0.007	0.007	0.002
	(0.032)	(0.036)	(0.036)	(0.012)	(0.022)	(0.018)
Tertiary	0.206***	0.626***	0.767***	-0.038***	-0.074***	-0.063***
	(0.052)	(0.039)	(0.068)	(0.014)	(0.028)	(0.021)
Age	-0.003***	0.001*	-0.004***	-0.00009***	-0.00008**	-0.0002***
	(0.0004)	(0.0007)	(0.0007)	(0.00002)	(0.00003)	(0.00005)
Tenure	-0.011***	-0.002*	0.008***	-0.00005***	-0.0001***	-0.0001
	(0.001)	(0.001)	(0.003)	(0.00002)	(0.00003)	(0.0001)
Male	0.215***			0.008**		
	(0.013)			(0.004)		
Head of Household	-0.01	0.0789***	-0.050***	-0.021***	-0.045***	-0.009**
	(0.008)	(0.011)	(0.013)	(0.005)	(0.013)	(0.005)

Annex A3.1.2A: Marginal effects of final bivariate probit model (continued)
Y= 1 formal, 0 informal; j: (1), (2)

	Workers who would like to work and are chosen to work in the formal sector.			Workers who would like to work and are not chosen to work in the formal sector.		
	Total	Male	Female	Total	Male	Female
Coast	0.021	-0.112***	-0.142***	-0.042***	-0.047***	-0.031***
	(0.013)	(0.014)	(0.016)	(0.005)	(0.012)	(0.006)
Amazon	-0.187***	0.018	0.003	0.017***	0.079***	0.047***
	(0.018)	(0.020)	(0.027)	(0.006)	(0.009)	(0.007)
Insular	0.330***	0.221***	0.154***	-0.063***	-0.091***	-0.073***
	(0.014)	(0.048)	(0.038)	(0.007)	(0.017)	(0.008)
Urban	0.111***	0.097***	0.108***	-0.036***	-0.057***	-0.040***
	(0.009)	(0.011)	(0.015)	(0.005)	(0.009)	(0.007)
Household characteristics						
Home size	-0.002	0.002	-0.007**	-0.00002	0.00005	-0.0003*
	(0.002)	(0.002)	(0.003)	(0.00002)	(0.00006)	(0.0002)
Sector						
Industry	0.260***	0.0002**	0,0013**	-0.197***	-0.154***	-0.196***
	(0.023)	(0.029)	(0.027)	(0.018)	(0.024)	(0.038)
Service	0.264***	0.139	0.016	-0.223***	-0.217***	-0.267***
	(0.012)	(0.017)	(0.045)	(0.019)	(0.034)	(0.035)

Source: Author's calculations based on the ENEMDU, 2015.

Annex A3.1.2B: Marginal effects of final bivariate probit model
Y= 1 formal, 0 informal; j: (1), (2)

	Workers who would not like to work and are chosen to work in the formal sector.			Workers who would not like to work and are not chosen to work in the formal sector.		
	Total	Male	Female	Total	Male	Female
Expected wages of the formal or informal sector						
$\ln W_f - \ln W_i$	-0.941***	0.242**	0.1	-0.012***	0.007*	0.005
	(0.084)	(0.103)	(0.163)	(0.002)	(0.003)	(0.008)
$\ln W_i$	-0.006***	-0.016***	-0.033***	0.006***	0.016***	0.033***
	(0.001)	(0.005)	(0.008)	(0.001)	(0.005)	(0.008)
Personal characteristics						
Primary	-0.159***	-0.118**	-0.169***	-0.007**	-0.012**	-0.041***
	(0.038)	(0.058)	(0.053)	(0.002)	(0.006)	(0.015)
Secondary	-0.207***	-0.333***	-0.400***	-0.007***	-0.017**	-0.052***
	(0.041)	(0.057)	(0.054)	(0.002)	(0.007)	(0.019)
Tertiary	-0.161***	-0.53***	-0.650***	-0.007***	-0.018**	-0.053***
	(0.057)	(0.061)	(0.080)	(0.002)	(0.007)	(0.019)
Age	0.003***	-0.001*	0.004***	0.00009***	0.00008**	0.0002***
	(0.0004)	(0.0007)	(.0007)	(0.00002)	(0.00003)	(0.00005)
Tenure	0.011***	0.002*	-0.008***	0.00005***	0.0001***	0.0001
	(0.001)	(0.001)	(.003)	(0.00002)	(0.00003)	(0.0001)
Male	-0.216***			-0.007***		
	(0.014)			(0.001)		

Annex A3.1.2B: Marginal effects of final bivariate probit model (continued)
Y= 1 formal, 0 informal; j: (1), (2)

	Workers who would not like to work and are chosen to work in the formal sector.			Workers who would not like to work and are not chosen to work in the formal sector.		
	Total	Male	Female	Total	Male	Female
Head of Household	0.033***	-0,021	0.059***	-0.001**	-0.012***	0.001
	(0.010)	(0.017)	(0.014)	(0.0005)	(0.003)	(0.001)
Coast	0,023	0.160***	0.172***	-0.002***	-0,0003	0,001
	(0.015)	(0.013)	(0.015)	(0.0005)	(0.0007)	(0.003)
Amazon	0.136***	-0.099***	-0.057**	0.034***	0.002**	0.007**
	(0.020)	(0.020)	(0.028)	(0.004)	(0.001)	(0.003)
Insular	-0.265***	-0.128***	-0.073**	-0.002***	-0.002***	-0.008**
	(0.017)	(0.048)	(0.037)	(0.0005)	(0.0008)	(0.004)
Urban	-0.074***	-0.037**	-0.060***	-0.001***	-0.003***	-0.008***
	(0.010)	(0.016)	(0.016)	(0.0003)	(0.0008)	(0.003)
Household characteristics						
Home size	0.002	-0.002	0.007**	0.00002	-0.00005	0.0003*
	(0.002)	(0.002)	(0.003)	(0.00002)	(0.00006)	(0.0002)
Sector						
Industry	-0.059**	0.156***	0.198***	-0.004***	-0.002***	-0.003
	(0.026)	(0.032)	(0.032)	(0.0008)	(0.0007)	(0.003)
Service	-0,037	0.081***	0.260***	-0.004***	-0.0023***	-0.009**
	(0.023)	(0.028)	(0.049)	(0.0008)	(0.0009)	(0.004)

Source: Author's calculations based on the ENEMDU, 2015.

Chapter 4: Analysis of formal informal transitions in the Ecuadorian labor market[11]

4.1 Introduction

The widespread informality is a characteristic of developing and transition economies. The informal economic activities include a diverse range of people in these countries and have a variety of effects on them. This phenomenon has been persistent and remains as a major challenge in many countries seeking to reduce it. Charmes (2009) shows that informal employment has existed since it was firstly defined in the middle 1970s. From the middle 1970s to 2000s, informal employment has presented an upward oriented trend in diverse regions around the world[12]. On average, in these last 30 years, informal employment had accounted for more than 47% of total non-agricultural employment in developing regions and around 24% in transition economies. Specifically, Latin America presented on average more than 50% of informality.

The meaning of the term informality varies among researchers, but most of the time it is associated with negative things: unprotected workers, tax evasion, illegal activities, low productivity, low investment rates, etc. However, in the literature different schools of thoughts dealing with the causes of informal employment have emerged. The main question regarding this issue is whether individuals or firms voluntary exit the formal sector or are omitted from it. In this sense, Perry et al (2007) discussed about two dominant schools of thoughts.

The first one is the exclusion view, which coincides with the traditional way of thinking, points to a segmented market where people end up in informal jobs since it is their only available option of occupation (de Soto, 1989). In the same sense, informal workers would prefer a formal job because higher wages are paid and labor protection is offered.

In contrast, the voluntary view of the informal labor market follows the opposite direction, where the labor market offers jobs with various

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[11] This chapter has been published in CEPAL Review for the edition 123 in December 2017.
[12] Regardless of the way of measuring informality, the incidence of this phenomenon is high in Latin America, Sub-Saharan Africa and Asia and has persisted and increased over the time (Perry et al, 2007; Jütting et al, 2008; Bacheta et al, 2009; and Charmes, 2009).

characteristics from where workers can choose voluntary to join into informal work. In this line, Maloney (2004) gives evidence for Latina America and settles that the informal sector is an unregulated micro-entrepreneurial sector, which does not correspond to a disadvantaged segment of labor market. Furthermore, Bosch and Maloney (2005) suggest that a considerable part of the informal sector, particularly the self-employed, correspond to voluntary entry to this segment of the labor market. Accordingly, there are diverse alternatives of informal employment that can offer desired qualities, such as independence or possibilities for training.

The aim of this study is to examine the dynamics in the labor market across the different labor status and observe the characteristics that determine the probability of staying or moving across the formal and informal sectors in Ecuador. The empirical analysis is based on the Ecuadorian National Survey of Employment and Unemployment (ENEMDU) for the period of 2011-2012. The investigation consists in examining the flows among the labor sectors: formal, informal, unemployed and out of the labor force. The investigation contributes to the existing literature in two aspects. First, we use a panel that follows both formal and informal workers during two consecutive years, allowing us to differentiate changes in the labor force over time. The second way is the enrichment of the scarce evidence that exists for Ecuador. For this purpose, a transition matrix is constructed to schematize the dynamics of the market and interactions among the sectors. Third, since the transition matrix does not consider observable characteristics of the workers, a multinomial logit analysis was implemented to identify these characteristics and determine the probabilities of choosing the different labor sectors.

The rest of the study is organized as follows. The next section discusses a brief summary of empirical the literature on the dynamics in the formal and informal labor market. Section 4.3 describes the data and definition of informality and other main variables used in the study as well this section presents the econometric methodology and models. The results are reported in section 4.4. Finally, section 4.5 discusses the main findings and remarks.

4.2 Literature Review

As previously mentioned, there are two perspectives used to explain informality regarding segmentation in the labor market. The first alternative

implies that workers would prefer formal wage employments, but there is a restriction that makes not always possible to find a formal job, so the only option would be to enter in the informal sector. In this sense, Harris and Todaro (1970) set in their model a minimum wage above the equilibrium wage resulting in a limitation of formal jobs leading us to segmentation in the labor market.

In the second stream, Maloney (1999) perceives the formal and informal sector as an integrated market. In other words, workers choose among the different job offers their occupations according to their preferences, abilities and needs. Thus, workers who prefer informal employment to the formal one are due to desirable characteristics that this part of the labor market offers.

These two schools of thoughts examine in different ways the diverse flows in the labor market and the involving sectorial wage differentials. If we consider a segmented market, flows from informal to formal jobs should be larger than the opposite movement. Comparing with an integrated market, the flows between formal and informal jobs should be in both directions and of a similar volume (Fields, 2009).

Recent evidence suggests that emerging countries show important dynamics in the labor market. Moving of workers across jobs, or changes from unemployment to employment, and even the entering and exiting the labor market indicates the mobility of the sector. In this scope, Maloney (1999) analyzed the workers transitions between sectors using panel data from Mexico, finding that patterns of mobility in the labor market implied that an important part of workers considers the informal sector as a desirable destination and that the different types of works, formal and informal, are well integrated. Duryea et al, (2006) examined evidence on workers' flows across the sectors in the labor market of three Latin American countries: Argentina, Mexico and Venezuela. The authors found a high mobility not only in and out of the labor market but also through different types of jobs. Another finding is that workers who moved from formal wage to informal wage experienced on average a decline in wages, while the inverse movement produced the opposite effect. The study by Cea et al, (2008) provides panel data evidence for Chile. On the one hand, the results revealed that the labor status of the individuals have an important degree of persistence. On the other hand, the study suggests that age, schooling, and non-labor income are significant characteristics that determine the probability of being in a certain labor status. In another study for Argentina, Jimenez (2011) found evidence for the

segmentation of the formal sector of the labor market. It is important to remark that workers from this group were confronted with unfavorable job conditions.

Lehman and Pignatti (2007) in their panel data analysis in Ukraine found the presence of segmentation in the labor market where informal salaried employees are associated with involuntary moves. Slonimczyk and Gimpelson (2013) used a multinomial logit model that allows for individual heterogeneity in preferences, revealing the existence of an integrated labor market in Russia.

In general, informality is a prominent feature of transition and emerging economies, as is the mobility of workers across sectors in the labor market. These topics have been studied in many countries and over many years and the evidence provide us with diverse results. Nevertheless, the evidence for Ecuador is limited, previous studies of the Ecuadorian labor market are mainly focused on wage distribution and not in employment effects or transitions of the formal and informal sector. A recent study from Canelas (2014) investigates if changes in the minimum wage have an impact on the formality and informality rates, as well as on wage level in Ecuador. The results suggest that alterations in the minimum wage do not affect the employment rates and wages.

4.3 Data and Methodology

The source of the data used in this study is the national survey (ENEMDU), conducted by the Ecuadorian National Institute of Statistics and Census (INEC). The ENEMDU is a household rotating panel survey. The panel does not follow individuals continuously, but it is constructed from four reports, spread over two consecutive years. Households are interviewed for two consecutive quarters then, in the next two consecutive quarters the interviewed households are substituted by a new sample, and finally the first group of households returns to the sample for the two last quarters. This national survey integrates both urban and rural population.

The analyzed panel is 2011:4-2012:4. We are considering only one year in the analysis since we performed separated transition tables for previous years and the results obtained were quite similar to those in the panel evaluated in this work (table A4.1.1 and A4.1.2). The weights used are the expansion factors specified by the INEC. In the analysis we consider workers who are aged 15 years or older.

In order to identify the different labor status that are used in the analysis, we can split the labor force into three major categories employment, unemployment and out of the labor force. Additionally and with respect to the employment category we divide this category into two more subdivisions: individuals who belong to the formal sector and individuals who belong to the informal sector and respectively. Moreover, in the last subdivision, informal workers of private companies or households were classified as wage employees and independent workers as self-employees. In this sense, we considered five different status in the labor market: (1) formal sector, (2) wage employment sector, (3) self-employment, (4) unemployed and (5) out of the labor force. This division corresponds to working age population and these categories are mutually exclusive. Individuals are classified as unemployed if they did not work in the reference week but had searched for a job. Out of the labor force individuals are those who do not work, nor seek some type of employment.

We can find diverse definitions of informality. There are various criteria regarding the level of production units or firms, or the level of workers with respect to the employment relationship. ILO (2013) defines the informal sector as a set of units engaged in the production of goods or the provision of services with the main objective of creating jobs and generating income for people involved in this activity. Typically the enterprises operate on small scale, with a rudimentary organization where, the labor relations are based mostly on occasional employment, family or personal and social relations rather than contractual arrangements with labor rights. In this sense and given the available information from the national survey (ENEMDU), two definitions for the informal sector are used in this study. The first one focuses on the firm characteristics: salaried workers employed by small establishments with less than ten employees and which are not registered, plus all independent and self-employed workers. The second definition focuses on social security coverage. Workers are considered as informal if they are not covered by social security.

Figure 4.1 plots the informality rates based on the two above stated definitions during the observation period 2011 and 2012. As can be seen, the country presents a share of informal workers between 32% and 38%, respectively, of the labor force in this period. In general, in Ecuador the percentage of informality can be considered high, but it is among the common fraction of workers that belong to this segment of the labor market in most of Latin

American countries.[13]

Figure 4.1: Share of informal employment in Ecuador 2011-2012
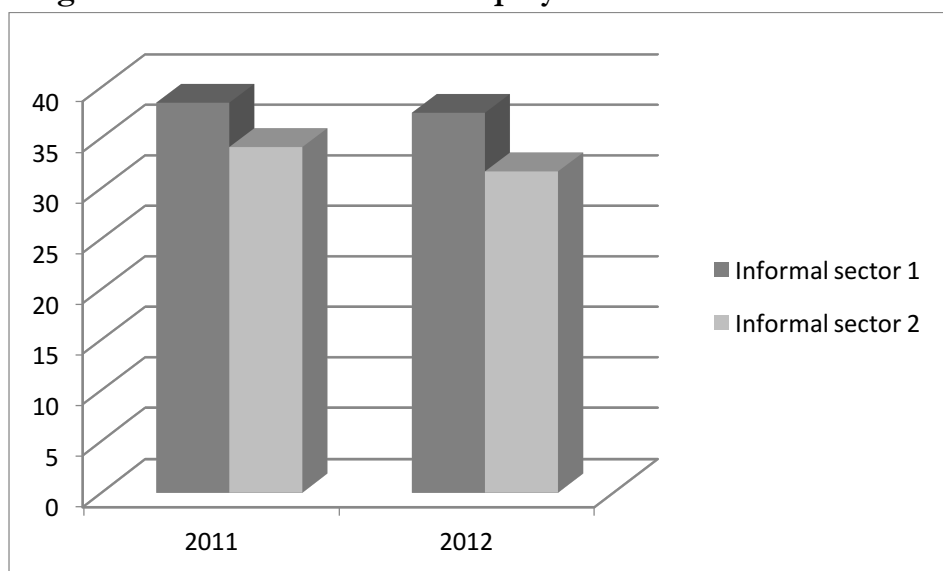
Source: Own calculations based on the ENEMDU, 2011-2012.

Note: Informal sector 1 is formed by salaried workers employed by small establishments with less than ten employees and are not registered, plus all independent and self-employed workers. Workers who are not covered by social security form informal sector 2.

Since we divided the informal sector into two specific branches (self-employment and wage employment) and since the first definition is the most appropriated for the subdivision we used this characterization of informality for the rest of the analysis i.e., salaried workers employed by small establishments with less than ten employees and are not registered, plus all independent and self-employed workers.

Given the five-labor status, we defined twenty different transitions, which represent the flow in the labor market between sectors during the analyzed period. Additionally, we included five stages of persistence, which characterize

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[13] Between 1970s and 2000s, on average, informal employment accounts for more than 47 percent of total non-agricultural employment in West Asia and in North Africa, and more than 70 percent in sub-Saharan Africa, more than 50 percent in Latin America, nearly 70 percent in South and Southeast Asia and 24 percent in transition economies (Charmes, 2009).

the permanency of labor status compared to the previous period. The analysis concentrates primarily on the movements from the formal and informal sector (wage employment and self-employment) to each of the other labor status, in order to identify the workers' characteristics of these types of transitions. Table A4.1.3 in the appendix presents the mean values for the sample using the first informality definitions across the different transitions and permanencies, respectively, for age, level of schooling, work experience, and the initial real wage. The initial and final real wage denotes the monthly real wage of workers during December 2011 and December 2012, respectively. Thus, to construct this variable we considered exclusively the earnings of the main job as the only source of labor income. Finally, the differential in earnings corresponds to the difference between the final and initial real wage whether the worker experienced a transition or permanency among the labor sectors.

In the second part of this section we describe the econometric techniques implemented in the study in order to provide empirical evidence of the patterns of mobility between the mentioned sectors of the Ecuadorian labor market.

To identify the directions and volume of the diverse flows in the labor market, we used two methods: transition matrices and a multinomial logit analysis of movements between labor sectors.

4.3.1 Transition matrices

The transition matrices allow us to determine the flows of workers between the considered labor sectors by calculating the conditional probability of finding a worker in sector j at the end of the period, given that the worker began in sector i, P_{ij}. The sum of each row of the transition matrix is equal to 100% and the totals at the end of the columns and rows represent the share of workers in each category at the end of the period P_i and P_j. The components in the main diagonal reveal the share of workers who remained in the same labor category at the end of the period. The information of the transition matrices gives us a first intuition of the different movements of workers among the established sectors.

4.3.2 Multinomial Logit Analysis of transitions between labor sectors

Since the previous methodology is only descriptive, we will also implement a multinomial logit analysis in order to determine which workers' characteristics affect the probability of a worker *i* chooses sector *j* rather than the other sectors. The multinomial logit model is a probabilistic discrete model, which can explain transitions and permanencies in the different sectors of the labor market. We can find the effect for each worker's characteristics on the probability of fluctuating a sector. We model flows among five different labor market states: formal sector (*j*=1), wage employment (*j*=2), self-employment (*j*=3), unemployment (*j*=4), and out of the labor force (*j*=5).

We use the standard exponential form for the multinomial logit analysis:

$$P_{ij} = \frac{\exp(X_i \beta_j)}{\sum_{l=1}^{m} \exp(X_i \beta_l)} \qquad (4.1)$$

where the vector β_j measures the degree to which an increase in worker characteristics X_i increase the probability of a worker going to sector *j*. The workers' characteristics are age, gender, marital status, level of education, years of experience, regions, and the logarithms of the differential in earnings. We can calculate the predicted probabilities of making a transition and show how the explanatory variables affect these probabilities.

4.4 Results

4.4.1 Transition matrices

In this first exploration with transition matrices we describe labor mobility by calculating the probabilities of finding a worker in status *j*, at the end of the period, conditional on the labor status at the beginning of the period. This yields to a five by five-annual matrix for the analyzed period December 2011 to December 2012 (table 4.1). Since the purpose of this investigation is to identify the patterns of workers' transitions that moved from and to the formal and informal sector, we are going to focus mainly on the transition from the formal sector to each of the other labor status and from the informal sector both (wage employment and self-employment) to the other sectors.

Table 4.1. Worker mobility among sectors of the labor market in Ecuador. 2011-2012

Initial status	Final status					Total	Pi
	Formal sector	Informal sector wage employment	Informal sector self-employment	Unemployed	Out of labor force		
Formal sector	79	6	6	2	6	100	25
Informal sector wage employment	21	46	18	4	12	100	10
Informal sector self-employment	8	7	67	1	16	100	25
Unemployed	23	11	25	19	22	100	4
Out of labor force	4	4	8	3	81	100	36
Pj	26	10	24	3	37		

Source: Own calculations based on the ENEMDU, 2011-2012.

Note: P_i is the relative size of a sector at the initial period; Pj is the relative size of a sector at the final period.

Regarding the movements from the employees of the formal sector, we found a 79% of permanency in this sector. An interesting result is that the largest outflow of this sector is into the informal category (12% in total). In this last movement we need to differentiate two streams. The first one is related to the displacement into wage employment of the informal sector (6%). This kind of flows reveals a decrease of job conditions for workers, in terms of formality. This particular situation of labor transition could be explained by the rationed out of formal employment opportunities (Fields, 1972; and Perry et al, 2007). The second displacement regards movements into the self-employment (6%), this fact may us associate with voluntary decisions of individuals seeking to find more autonomy or due to inefficiencies in formal sector protections, and low levels of labor productivity (Maloney, 1999). Moreover, workers of formal firms who left their jobs could move to unemployment (2%) or leave the labor activity (6%).

Turning to the movements from informal wage employees, we see a different picture compared to transitions from the formal relationship. First, the probability of staying as a wageworker is around 46% meaning that these individuals prefer to search other opportunities rather than remaining in this kind of jobs. If we look at the outflows from this segment of the informal sector, we find that 21% of workers raised their job quality by changing to the formal sector. This sort of moves can be understood as workers' improvements in job conditions and furthermore informal wageworkers are typically subject to lower remuneration than similar workers in the formal sector (Günther & Launov, 2006). The outflows to the other subdivision of the informal part of the labor force are around 18%, marking out that wage employees of the informal sector no only try to find a job in the formal sector, but also in the self-employment segment. Both the formal sector and self-employment exhibit in some way more desirable characteristics than wage employment of the informal sector, such as in the first case formal labor conditions and in the second one independence. As well, the probability of moving from wage employment either to a formal or self-employment is higher than the probability of moving to unemployment. The flow from wage employment led out of the labor force corresponds to 12%.

The third row of the table analyses the transitions from self-employment. If we evaluate the permanencies of this division, we arise that a significant proportion of individuals remain as self-employees. Another essential citation is that the courses from self-employment to both formal sector and wage

employment are quite similar, 8% and 7%, respectively. While the moves to unemployment is 1%.

Mandelman and Montes-Rojas (2009) remark that the choice of the self-employed sector can be motivated by two reasons: it attracts individuals with outstanding entrepreneurial abilities, or that the self-employed sector operates as a protection for unemployment. The two explanations named above could support the substantial permanency in this labor sector and also the similar flows to the formal sector and wage employment.

Concerning the movements from unemployment, we observed a high mobility, since 19% of individuals remained unemployed during the observation period. In this sense, most of unemployed migrated to the self-employment sector, followed by the formal sector and finally wage employment in the informal sector, respectively 25%, 23%, and 11%.

Most of people who found a job were in the informal sector (wage and self-employment); this result can be attributed to an insufficient human capital or other individual characteristics and preferences of the workers. Traditionally, if we consider unemployment as the lowest state in the labor market, people from this segment who had restrictions and difficulties in getting into formal employments, will probably be induced to rapidly accept employments with lower labor conditions and earnings. Jütting, et al. (2008) argue that it can also be the case that working in the informal sector gives some extra advantages to individuals compared to the formal sector. After all, informality cannot be considered the last resort of a worker. Workers may voluntary choose to work in the informal sector because they would have the chance to accumulate experience or training and preparation in the case of being a low skilled young worker or unskilled older individual, and also they would find greater flexibility and autonomy. The World Bank (2012) highlights that the owners of small companies value the independence and flexibility of having their own business and the main reason to have small business is because they want to achieve autonomy.

When we refer to people out of the labor force we observe a high permanency in this state. On the other hand just, 8%, 4%, 4% and 3%, respectively, moved into self-employment, formal sector, wage employment and into unemployed. Again, the flows of people pointed to the informal sector in total are higher than the ones to the formal sector. In this context, we can see that there are some attractive characteristics that the informal sector offers to the workers.

4.4.2 Multinomial Logit Analysis

The main objective of this section is to obtain an overview of the labor force dynamics in Ecuador. Thus, the informal sector both wage employment and self-employment comprises the largest source of employment. As mentioned before, this segment of the labor force not necessarily corresponds to a lower job status compared to the formal sector, since it is observed that workers' transitions from formal employment into informal one are significant in the labor market.

The multinomial logit analysis of movements between labor sectors allows to determine in statistically terms, if workers are more or less likely to move to another sector compared to the initial sector, according to their specific characteristics (table 4.2A and 4.2B). The obtained results show that workers become less likely to leave formal status for informal status, as their level of education increases. On average a worker who did the transition to wage employment and self-employment is 6 and 7 years of studies respectively. Concerning the experience of the worker, the probability of moving into informal sector specifically to self-employment decreases as the experience increases. It is important to stress that the mean of the years of experience is 8, so this is a considerable number of years of training. This figure can be related to people who started a business. Aroca and Maloney (1998) found that the informal self-employment sector is a desirable destination for workers, but it requires accumulating financial and human capital. Thus, the mean number of years of experience suggests that workers first work for some years accumulating savings and knowledge, which afterwards can be used to start a business. The characteristics of each sector of the labor market and as well the specificities of a work determine different wages among workers. Tansel and Oznur (2012) test if informal workers get lower remunerations compared to similar workers in the formal sector. The authors found that unobserved fixed effects joint to observable workers characteristics explained the differentials in payments between formal and informal employment. Thus, the unobserved characteristics such as personal abilities of production, character traits and quality of management could affect the workers' productivity and therefore the differential in wages.

Table 4.2A. Multinomial logit analysis of transitions between sectors, Ecuador, 2011-2012

Transitions Variables	From the formal sector to			
	Informal sector wage employment	Informal sector self-employment	Unemployed	Out of the labor force
Constant	1.391)***	-2.305***	-3.387***	-1.548**
	(3.15)	(5.07)	(2.90)	(2.48)
Age	-0.022**	0.026***	-0.018	0.006
	(2.56)	(3.52)	(0.90)	(0.52)
Male (d)	-0.144	0.026	-0.014	0.811***
	(0.78)	(0.15)	(0.04)	(3.42)
Married (d)	-0.365*	0.206	-1.003**	-0.469*
	(1.93)	(1.20)	(1.89)	(1.72)
Schooling	-0.397***	-0.153***	-0.277***	-0.441***
	(8.93)	(3.69)	(2.66)	(7.02)
Experience	-0,005	-0.042***	-0.077**	-0.008
	(0.40)	(4.11)	(1.93)	(0.56)
Coast	-0.05	0.204	1.522***	-0.436
	(0.23)	(0.86)	(1.97)	(1.42)
Centre	-0.069	0.388	1.503**	-0.618
	(0.22)	(1.34)	(1.68)	(1.51)
South	-0.257	0.318	1.221	0.227
	(0.87)	(1.13)	(1.33)	(0.59)
Log. Diff. earnings	-0.017	-0.176***	-0.778***	-0.887***
	(0.30)	(4.13)	(10.17)	(17.91)

Source: Own calculations based on the ENEMDU, 2011-2012.

Note: The coefficients reflect how the different worker characteristics and the percentage change in the real wage affect the probability of moving from the initial sector to the final sector relative to the probability of staying in the initial sector. The informal sector is formed by salaried workers employed by small establishments with less than ten employees and are not registered, plus all independent and self-employed workers. Z statistics are in parenthesis; *p<0.1, **p<0.05, ***p<0.01. (d) Dummy variables; default categories are: male, other civil status except married and north region.

Table 4.2B. Multinomial Logit Analysis of transitions between sectors, Ecuador, 2011-2012

Transitions / Variables	From the informal sector wage employment to				From the informal sector self-employment to			
	Formal sector	Informal sector self-employment	Unemployed	Out of the labor force	Formal sector	Informal sector wage employment	Unemployed	Out of the labor force
Constant	-1.774***	-3.022***	-5.078***	-5.392***	-3.084***	0.404	-3.691***	-2.908***
	(3.50)	(5.65)	(4.21)	(5.37)	(6.61)	(0.88)	(3.17)	(6.04)
Age	-0.004	0.034	0.004	0.024	-0.016**	-0.027***	-0.061***	0.004
	(0.43)	(4.13)***	(0.23)	(1.63)	(2.15)	(3.95)	(3.21)	(0.62)
Male (d)	-0.334**	-0.154	-0.594	0.744**	-0.436***	-0.589***	-0.346	1.078***
	(1.68)	(0.77)	(1.28)	(2.07)	(2.67)	(3.52)	(0.87)	(6.44)
Married (d)	0.063	0.022	-0.848	-0.932**	0.464***	-0.411**	-0.984**	-0.391**
	(0.29)	(0.11)	(1.58)	(2.30)	(2.70)	(2.40)	(1.95)	(2.45)
Schooling	0.295***	0.157***	0.246**	0.168	0.303***	-0.15***	0.319***	-0.064
	(5.21)	(2.73)	(1.91)	(1.63)	(7.35)	(3.23)	(2.92)	(1.49)
Experience	-0.018	-0.005	0.004	-0.011	-0.005	-0.001	-0.104**	-0.017**
	(1.47)	(0.48)	(0.19)	(0.59)	(0.53)	(0.15)	(02.48)	(2.41)
Coast	-0.565**	0.187	0.135	-0.037	-0.332**	-0.165	0.577	0.43**
	(2.39)	(0.75)	(0.24)	(0.08)	(1.52)	(0.75)	(0.87)	(1.93)

Table 4.2B. Multinomial Logit Analysis of transitions between sectors, Ecuador, 2011-2012 (continued)

Transitions / Variables	From the informal sector wage employment to				From the informal sector self-employment to			
	Formal sector	Informal sector self - employment	Unemployed	Out of the labor force	Formal sector	Informal sector wage employment	Unemployed	Out of the labor force
Centre	0.095	-0.086	0.334	-0.27	-0.04	-0.168	0.325	-0.164
	(0.32)	(0.26)	(0.47)	(0.47)	(0.15)	(0.59)	(0.37)	(0.56)
South	-0.499	-0.466	0.167	0,099	-0.132	-0,11	1.318	0.406
	(1.64)	(1.33)	(0.22)	(0.16)	(0.50)	(0.39)	(1.74)**	(1.45)
Log. Diff. earnings	0.034	-0.283***	-0.942***	-1.146***	0.126***	0.174***	-0.636***	-0.661***
	(0.44)	(4.28)	(9.89)	(13.22)	(3.42)	(4.38)	(7.69)	(19.63)

Source: Own calculations based on the ENEMDU, 2011-2012.

Note: The coefficients reflect how the different worker characteristics and the percentage change in the real wage affect the probability of moving from the initial sector to the final sector relative to the probability of staying in the initial sector. The informal sector is formed by salaried workers employed by small establishments with less than ten employees and are not registered, plus all independent and self-employed workers. Z statistics are in parenthesis; *p<0.1, **p<0.05, ***p<0.01. (d) Dummy variables; default categories are: male, other civil status except married and north region.

As expected, the logit results show that the probability of moving from the formal sector to self-employment declines as the percentage difference of the real wage between the initial and final sector rises. The sample mean difference in real earnings of the individuals who moved in this direction had a reduction in their remuneration. Therefore, if this difference increases workers would be less likely to move into the informal employment.

In a similar way, we follow the transitions between the formal employment and the two sectors in which people are not engaging in the labor market: unemployment and out of the labor force. In both cases, the probability of making these transitions decreases as the level of education increases. Another important remark is that the probability of workers who move from the formal sector to unemployment decreases, as the year of experience is greater.

Moving to the second multinomial logit analysis, the flows from wage employment to the formal sector present an interesting pattern. We can consider that better educated workers push up the mean years of schooling in the formal sector, so comparing the mean years of schooling of individuals who persisted as wage employees and individuals who moved to the formal status is 5 and 6, respectively (see table A4.1.3). The results suggest that better educated people are more likely to enter the formal sector employment. This association points out that while workers are increasing their level of education they start in the informal sector as an option of employment and after raising their level of instruction and skills they will try to get better labor conditions.

Another finding is related to the transitions from wage employment directed to self-employment, in different words movements across the same informal sector. In this sense, education has a positive effect on this flow, while the percentage difference of the real wage between the initial and final sector has a negative impact.

The third column represents the changes from self-employment to the other labor sectors. The probability of moving from self-employment to the formal sector is associated with to variables: education and the percentage difference in the real wage. Referring to the first one, people with higher education tend to move to a better work in terms of formality. The mean differences in the real wage of the workers who moved to the formal sector is positive and significant, thus if these differences increases the probability of moving to this sector will also increase.

The results propose that better educated people are less likely to move from self-employment to wage employment, pointing out that workers prefer in this case to have autonomy or independence that probably the second option would not offer them. The difference in real wage in this instance has a positive relationship.

Finally, the main finding regarding the transition from the informal sector both wage employment and self-employment directed to unemployment and out of the labor force are related with the percentage difference of real wage, which influences in a negative way these two transitions.

Using the two multinomial logit models and in order to have a better idea of the economic significance of the effect of observable characteristics of the workers in the different transitions across the labor sectors, we run simulation exercises assigning specific workers' characteristics. We first analyze the effect of years of experience in the probabilities of moving from the formal sector to the other segments and the probability of permanency in the same sector. For this exploration we fixed the age to 38 years and high school education and we then compare the transition or permanency probabilities for both men and women (figures A4.1.1 to A4.1.5). Both for females and males, more years of experience led to a significant increase in the probabilities of retention in formal employment. The transition probabilities show that more years of experience reduce exit rates to the informal and unemployed sectors.

We also analyzed the effect of the different levels of education, for the second and third logit models. In this case we again fixed the age to 38 years and assigned 10 years of experience (figures A4.1.6 to A4.1.15). The results indicate that when the level of education increases, the probability of passing from the informal sector (both wage employment and self-employment) to the formal sector increases as well. If we analyze the probability of permanency as wage employee of the informal sector, it decreases with the level of education. With the same workers characteristics considered before, the probability of changing from wage employment to self-employment, unemployment and out of the labor force increases as the years of schooling upturns. Given the previous characteristics of the workers the behavior of the probabilities of staying in the self-employment sector is interesting. This probability increases as workers reach the secondary level of education afterwards this probability declines. Finally, the probability of fluctuating from a self-employment to wage employment or out of the labor force decreases as the individuals acquire more years of instruction.

4.5 Final Remarks

Informality is an important phenomenon, which comprises a significant share of the labor force employment in many developing and transition economies. The study provides an overview of the dynamics of the formal and informal sectors and some specific patterns of the transitions within the labor sectors. We specify a transition matrix and a multinomial logit model to identify the movements across the sectors and the effect of each worker's characteristics on the probability of moving to a given a sector.

The results observed in the transition matrix suggest an important dynamics not only in and out of the labor market but also across the sectors. Nonetheless, these results can be considered in the normal percent range of movements found in similar analysis of labor mobility in Latin America. The flows in the labor sectors regarding employed people suggest that individuals are searching for job opportunities in both formal and informal sectors; as seen in the transitions matrix, movements from the different labor status pointed to the formal, wage and self-employment.

The multinomial logit analysis was applied since the transition matrices do not consider observable characteristics of the workers that can affect their choice in which sector to work. This approach indicated that education, years of experience, and other characteristics influence the selection of employment and therefore the transitions or permanencies in the different sectors.

The findings presented in the study sustain a significant interaction between the formal and informal sectors. The patterns of mobility imply that informal employment should be viewed as a desirable destination as it is the formal sector, since this type of employments may present some characteristics and advantages that can attract many workers.

Finally, changes from formal to wage and self-employment that the labor market might present leads to important policy implications and the nature of policies oriented to people in formal and informal employment should vary as well. Accordingly, it might be questioned the importance and effectiveness of the existing labor market, productivity and social protection policies. In this sense, if informal workers are part of this segment involuntary, then policy makers have to focus on aspects such as the rigidities of wages and be aware of the formality of the enterprises in terms of social protection. Another important fact is the impact of informal employment on the economy, since from an individual standpoint could be more favorable to remain informal,

but from the society perspective it is need a certain formalization of the economy. Being part of the informal sector in most of the cases corresponds to an individual´s optimal decision regarding their own preferences, their level of education and inclusively the restrictions or limitations of the formal sector. In contrast, having a big proportion of informal workers it is not necessarily the best option for the society as a whole, since it is evident that a certain level of formalization is the easiest way to organize the labor force and the associated legal activities.

In the other case, individuals who choose voluntary to become informal, policy makers need to be aware of the heterogeneity and complexities of jobs and working conditions within the informal sector, as well to take into account the inefficiencies in the labor codes and the low levels of formal sector productivity (Maloney, 2004). In this regard, workers in the informal sector on a voluntary basis would find ways to substitute the protection offered by the formal institutions and we would have to think deeply in the quality of the different jobs rather than the legal protections. In many occasions, it seems evident that individuals that belong to the informal sector have low levels of human capital, which lead us to think that improvements in the accessibility and quality of education is likely to rise workers' productivity and the related remunerations in the formal sector. However, when individuals are choosing the sector in which they prefer to work, they not only take their earnings into account, but also all other components and advantages linked with each potential job/sector.

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Appendix 4.1

Table A4.1.1. Worker mobility among sectors of the labor market in Ecuador. 2007-2008

	Final sector						
Initial sector	Formal sector	Informal sector wage employment	Informal sector self-employment	Unemployed	Out of labor force	Total	Pi
Formal sector	79	6	6	2	6	100	27
Informal sector wage employment	21	46	18	4	12	100	13
Informal sector self-employment	8	7	67	1	16	100	22
Unemployed	23	11	25	19	22	100	4
Out of labor force	4	4	8	3	81	100	34
Pj	26	10	24	3	37	500	

Source: Own calculations based on the ENEMDU, 2011-2012.

Note: P_i is the relative size of a sector at the initial period; Pj is the relative size of a sector at the final period.

Table A4.1.2. Worker mobility among sectors of the labor market in Ecuador. 2009-2010

| | Final sector | | | | | | |
Initial sector	Formal sector	Informal sector wage employment	Informal sector self-employment	Unemployed	Out of labor force	Total	Pi
Formal sector	75	8	8	2	6	100	25
Informal sector wage employment	19	47	17	4	13	100	12
Informal sector self-employment	10	9	61	3	18	100	23
Unemployed	24	14	16	16	30	100	5
Out of labor force	5	4	7	3	81	100	35
Pj	27	12	21	4	37		

Source: Own calculations based on the ENEMDU, 2011-2012.

Note: P_i is the relative size of a sector at the initial period; Pj is the relative size of a sector at the final period.

Table A4.1.3. Summary statistics using the second definition of the informal sector, Ecuador, 2011-2012

Workers transitions between sectors	Number of observations	Mean			
		Age (years)	Schooling (years)	Experience (years)	Initial real wage (USD)
From the informal sector (self-employment) to					
Formal sector	200	42.6	6.8	11.3	290.8
		(14.06)	(1.97)	(11.08)	(394.28)
Informal sector wage employment	191	42.1	5.32	11.4	180.7
		(14.94)	(1.86)	(12.91)	(324.39)
Informal sector self-employment	1,591	48	5,5	13.6	215
		(13.53)	(1.90)	(12.03)	(302.08)
Unemployed	34	30.4	7.2	4	107.9
		(10.62)	(1.65)	(4.12)	(164.50)
Out of the labor force	350	48	5.4	10.7	90.7
		(19.53)	(1.90)	(13.73)	(137.73)

Source: Own calculations based on the ENEMDU, 2011-2012.

Note: The informal sector is formed by salaried workers employed by small establishments with less than ten employees and are not registered, plus all independent and self-employed workers. Standard errors in parenthesis.

Figure A4.1.1 Effect of years of experience (Formal to formal)
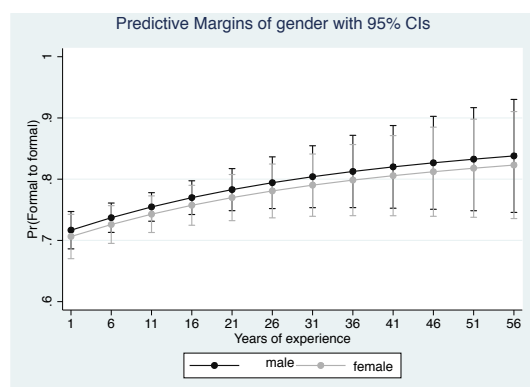
Source: Own calculations based on estimation results.

Figure A4.1.2 Effect of years of experience (Formal to wage employment)
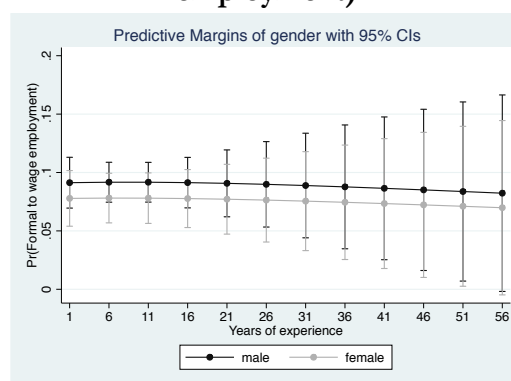
Source: Own calculations based on estimation results.

Figure A4.1.3 Effect of years of experience (Formal to self-employment)
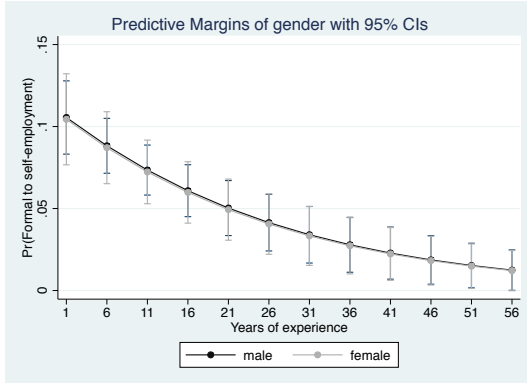
Source: Own calculations based on estimation results.

Figure A4.1.4 Effect of years of experience (Formal to unemployment)
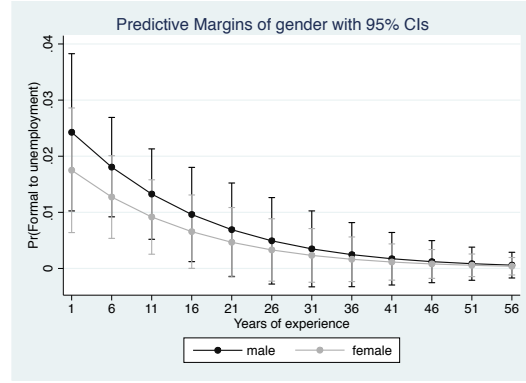
Source: Own calculations based on estimation results.

Figure A4.1.5 Effect of years of experience (Formal to out of labor force)
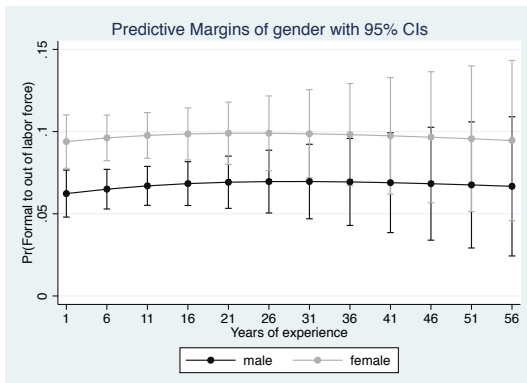
Source: Own calculations based on estimation results.

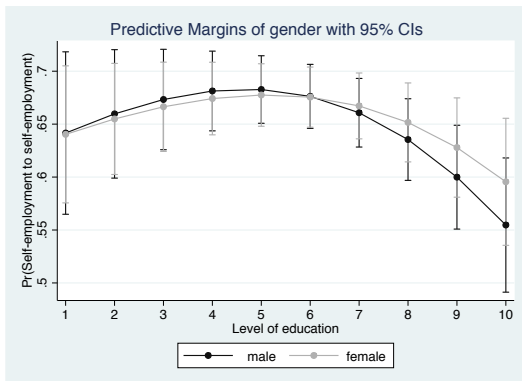**Figure A4.1.6 Effect of level of education (Wage employment to formal)**
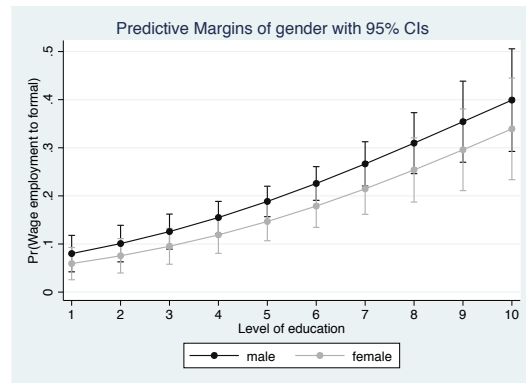
Source: Own calculations based on estimation results.

Figure A4.1.7 Effect of level of education (Wage employment to wage employment)
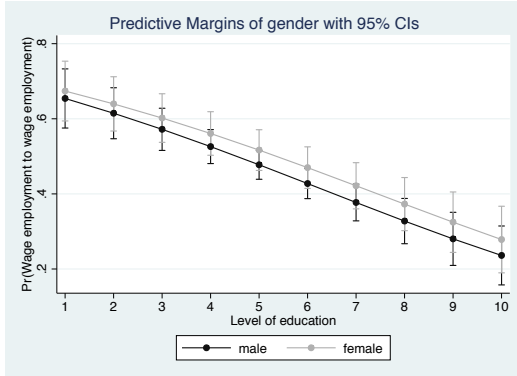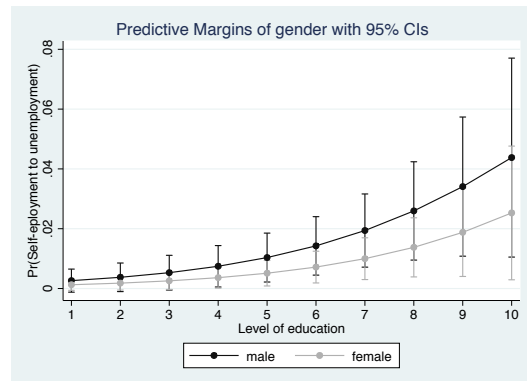

Source: Own calculations based on estimation results.

## Figure A4.1.8 Effect of level of education (Wage employment to self-employment)
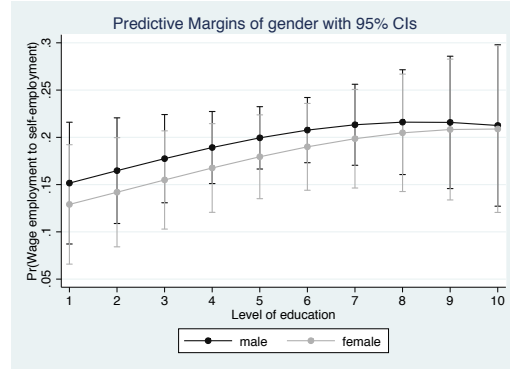
Source: Own calculations based on estimation results.

Figure A4.1.9 Effect of level of education (Wage employment to unemployment)
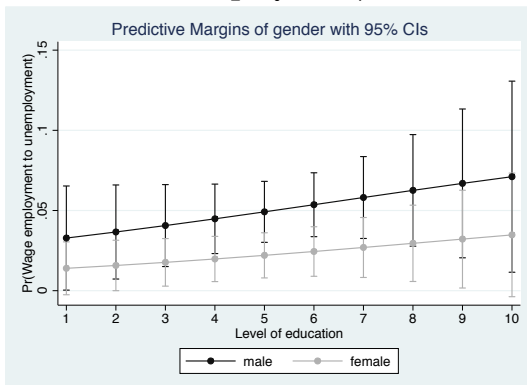
Source: Own calculations based on estimation results.

Figure A4.1.10 Effect of level of education (Wage employment to out of labor force)
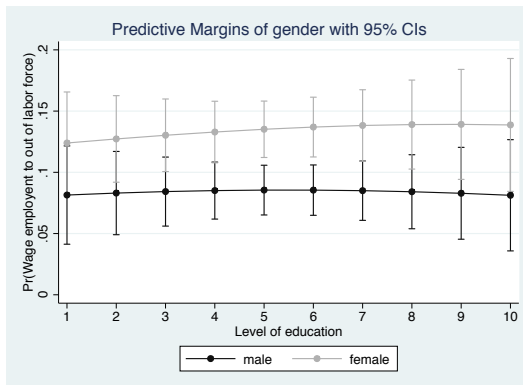
Source: Own calculations based on estimation results.

Figure A4.1.11 Effect of level of education (Self-employment to formal)
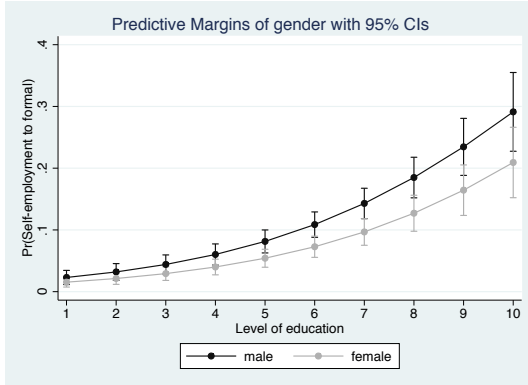
Source: Own calculations based on estimation results.

Figure A4.1.12 Effect of level of education (Self-employment to wage employment)
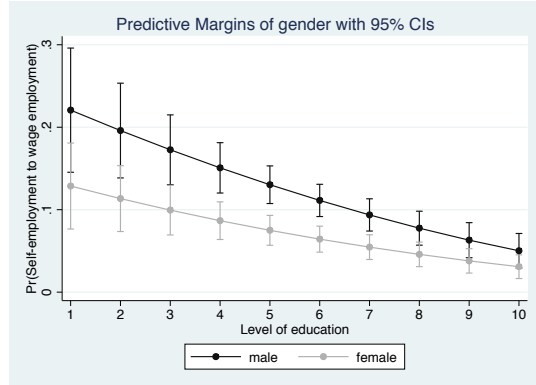
Source: Own calculations based on estimation results.

Figure A4.1.13 Effect of level of education (Self-employment to self-employment)

Source: Own calculations based on estimation results.

Figure A4.1.14 Effect of level of education (Self-employment to unemployment)

Source: Own calculations based on estimation results.

Figure A4.1.15 Effect of level of education (Self-employment to out of labor force)
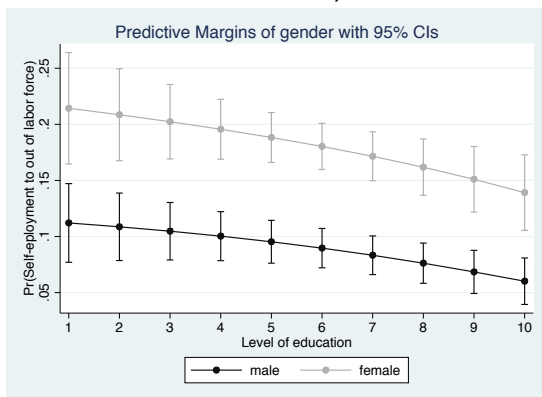
Source: Own calculations based on estimation results.

Chapter 5: Conclusions

The objective of this thesis is to analyze the existence and prevalence of the informal economy in developing countries. With this aim, we first evaluate the conditioning factors of this phenomenon in a cross-country analysis, concerning South and Central America countries. We start our research from a firm's perspective emphasizing the role of firm's characteristics and their corresponding influences on entrepreneurs' decision to work formally or informally. Next, we focus on the Ecuadorian context and we analyze the topic by a combined view of firms and workers' preferences to uncover the mechanics of the formal and informal labor market selection process. Lastly, we analyze how workers' characteristics explain transitions between informal and formal labor markets.

Thereby, the initial point of analysis intends to provide evidence of the presence of informal firms and its differences between the South and Central America countries. Thus, Chapter 2 seeks to evaluate which are the cross-national factors that account for the prevalence of informality and identify the reason influencing the decision to run a business in the borderlines of the formal or informal sector in this region. It is worth mentioning that with these objectives in mind, this study is the first analysis using firm-level data covering a wide sample of South and Central America countries. The obtained results suggest the existence of a relationship between informality and firms' characteristics, where small firms, less productive firms, older firms, one proprietor firms, less technological firms and manufacturing firms are more likely to operate informally. With respect to firms' obstacles that they normally face to operate, it turns out that the presence of informal competitors, financial and tax administration obstacles have clear positive impact on informality. In this sense, we confirm that rigid regulation in trade, finance and labor market, as well as some administrations procedures such as costs, permits and licenses and payroll taxes are associated with higher rates of informality. After controlling for firm's characteristics that may influence formalization, we find evidence that governance quality measured as citizens' participation in how they select their government and the degree of protection of civil rights in each country, affect the likelihood that a firm's chooses whether to operate informally or formally. Another evident finding is that there is a closer and direct relationship between economic growth and formality of the firms. Additionally, the cross-national differences in the

economic and institutional environment affect the way a business run its operations in terms of formalization. A certain limitation of this analysis is that the data is not always longitudinal, where we have a reduced sample in terms of number of years, which prevent the use of firm fix effects. Future studies could conduct a longitudinal comparative analysis of the determinants of formal and informal entrepreneurship. Another interesting field of further research is to consider other macro-level determinants like cultural characteristics and economic opportunities that may affect formal and informal entrepreneurship in a regional perspective.

While the previous chapter addresses informality as a challenge issue to deal with in developing countries, the next two analyses focus their attention in Ecuador. Chapter 3 explains the determinants of the job placement process in the Ecuadorian formal and informal labor market. In this regard, it seeks to answer weather being part of an informal job is a worker's voluntary decision, or it is because there are restrictions on the number of job placements in the formal sector. In order to consider both workers' preferences and employers' hiring decisions, we apply a bivariate binomial probit model with partial observability since we can only observe the joint decision of both actors of the market. The methodology follows previous literature from where we only have one final output variable of the two decisions arising from the demand side (employers) and the one originating from the supply side (workforce) with respect to formal or informal sector employment. The study supports the presence of a restriction in the number of formal jobs in the economy and therefore existence of both, voluntary and involuntary informal employment. This fact, consequently, led us to think that labor market restrictions are generated from a reduced ability to create enough vacancies to cope with the preferences of workers. Additionally, we find that human capital characteristics and workers' commitment are the main factors defining whether a worker finds employment in the formal or informal sector.

From one side, these results highlight the existence of limited formal jobs, which leads to a segmented Ecuadorian labor market. From the other side, there are workers who prefer informal employment to formal, due to desirable characteristics that this part of the labor market offers. Nonetheless, these results lead directly to a next question, explicitly, how are the dynamics of the formal and informal sectors and which patterns affected the transitions within the labor sectors.

In order to shed light on this question, Chapter 4 draws a picture of the movements across five different labor status defined as: formal sector, wage employment, self-employment, unemployed and out of the labor force. However, our interest lies in the specific inquiry of the dynamics of the formal and informal employment, where the latest one is divided in two sub sectors: wage employment and self-employment. In order to identify and examine the directions and volume of the diverse flows across the formal and informal sectors in the Ecuadorian labor market we use panel data, which follows both formal and informal workers during two consecutive years. For the empirical exercise, we apply two different approaches: the first one is the transition matrix to outline the dynamics of the market and interactions among the sectors and the second approach is the multinomial logit analysis which determine the probability of staying or moving across the formal and informal sectors.

Thereby, in the formal sector we observe that an important fraction of workers (79%) persists in this sector of employment, however there are movements as well to the informal sector. As just mentioned and given the availability of our data, we have divided the informal sector into two sub-groups. Thus, the movements are presented to wage informal employments and second to self-employment. The first flow suggests a restriction in the number of formal employment and the second flow, which is consistent with the existence of workers that voluntary choose informality. Conversely, the movements from informal wage employees present a different picture. The probability of staying in this sector is around 46%, meaning that these workers search for job opportunities in other sectors. At the same time, the transitions to formal and self-employment, 21%, 18% respectively, confirm that informal wage workers search for job opportunities in both formal and self-employed sectors rather than remain in this sector. For its part, self-employment stage shows a noteworthy share of permanency. Concerning the results of the multinomial logit approach, education, years of experience, as well as other workers' characteristics influence the selection of employment and therefore the transitions or permanencies in the different sectors. Moreover, better educated people become less likely to leave formal status for informal status and on the opposite side are more likely to enter to formal employment. On the other hand, the logit results show that if the wage difference between the formal and informal sector increases, workers would be less likely to move into informal employment. Chapter 4 analyzes the transitions between the sectors of the labor market, where the time period analyzed is limited. A future

research project and if longitudinal data were available it would be interesting to do a more long-term study.

The obtained results, certainly, lead to notice some policy recommendations in two main directions: first, resettling the existing labor policies regarding informality employment and, second, furthering the development and appliance of flexible economic regulations and institutions in terms of firms' formalization in South and Central America countries. With respect to the former, the existence of segmentation on the selection process on finding employment in the Ecuadorian labor market exposes the insufficiency and inadequacy of formal jobs in the country. The supply labor market frequently follows the traditional way of behaving meaning that a considerable amount of the workforce prefers to work protected by regulated labor conditions. In this sense, this behavior addresses the problem of excess supply in the formal sector and consequently more formal jobs need to be created.

Moreover, it can also be argued that there should be a transformation in the overall structure of employment. Hence, both formal and informal employments must offer these workers' desired conditions such as social protection and legal rights; thus, the two sectors would not present overwhelming differences in these aspects. In terms of legal protection, it can be considered the property rights, labor rights and business rights among the labor market. In this sense, property rights facilitate economic transactions, allowing for the evolution of effective credit markets, and improving business climate and investment opportunities. The absence of labor rights leads us to have workers without social protection rights, income protection, workplace safety, decent working conditions and lack of participation in workers' organizations. Finally, the absence of business rights may limit the access to credit or markets, enforce contracts or insure business against bankrupt. Since most informal workers are not protected by existing labor regulations and most informal firms are not protected by existing business laws, a reform would be necessary in the current regulations in order to extend these social protection and legal rights in the informal economy.

It should be considered that informal economy offers convenient characteristics and advantages such as autonomy and independence, which assure workers' willingness to work in this sector. Moreover, the increasingly wide range of informal occupations, such as temporary, part-time, and homework arrangements also attract workers' attention. Thereby, policy makers need to have in mind, when setting specific conditions for informal

employment, the heterogeneity and complexities of jobs and working conditions within the informal sector, as well as the inefficiencies in the labor codes.

With respect to the development and appliance of flexible economic regulations and institutions, the authorities of the region could provide additional incentives to register their business. Thus, policies could focus on reducing barriers of registration or costs regarding informality in order to avoid financial, administrative and political obstacles to run their firms. Moreover, policies should also target on the increase of benefits of regulation of informal work, such as special taxes rates according to the type and size of the business, access to finance and market information, and efforts to strengthen organizations of informal workers. Furthermore, government information and facilities could be a core element in order to incentivize business formalization under a market-based policy.

Finally, the conclusions of the different applied exercises and the subsequent policy recommendations of this dissertation not only provide policymakers with credible results and advice to develop and improve existing policies in the regions' labor market, but can be also considered as a starter parameter when analyzing other nations or regions with different realities that face the phenomenon of informality.

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