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Abstract

This document provides recent evidence about the persistency of wage gaps between formal and informal workers in Colombia. The methodology is based on a non-parametric procedure proposed by Ñopo (2008a) that allows us to compare labor incomes using matching on variables over a Nationwide Household Survey during 2008-2012. It is found that formal workers earn between 30 to 60 percent more, on average, than informal workers according to the definition of formality adopted and small variations occurs along this period. This is new evidence about the true differences in labor compensation from workers with distinct formality levels in Colombia. These results are important inputs for labor policy in a country with high income inequality levels.

Keywords: Wage gaps, non-parametric, Colombia, informality

JEL Classification: J31,C14, O17

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1. Introduction

The persistence of the informal sector in developing countries is still unexplained since belonging to a formal employment provides substantial benefits (pension and health coverage, vacations) than informal workers do not perceive. Informality is characterized by low productivity jobs, low levels of social protection and a continuous risk of facing poverty. The OECD estimates that informal workers are between 50 and 60% of total employment in Latin America and Southeast Asia. This feature reduces the efficiency of policies designed for delivering social benefits to the population and brings consequences for income distribution in many low-income countries. Several works discuss the choice of informality instead of formality (Maloney, 1999; Maloney, 2004; Fiess et al., 2010; Niels-Hugo et al., 2001).

The purpose of this document is to show that the labor income gaps between formal and informal workers in Colombia are highly stable in the recent years (2008-2012). Colombia is characterized by high and persistent level of informality and in a country where politicians have promoted labor and tax reforms in order to incentive the creation of formal jobs and formalize those who belong to informal activities without success (*Act 1607, December 26 of 2012*). However, most of the benefits from economic growth in Colombia have not contributed to reduce unemployment or informality at the same rate during the last decade. The reform is focused in increasing equity in the contributions and to increase labor formality. In this way the reform simplified the value added tax structure and the income tax, ensuring progressive taxation. Additionally, the reform seek to reduce the non-wage labor costs (in Colombia known as "*parafiscales*") in order to reduce the relative importance of labor cost on the total cost and incentive formal job creation. The structure of the formal sector includes the existence of a minimum wage which is established at the beginning of each year. This minimum wage is higher than in

other countries with similar economic development.¹ As a result, the government expects to reduce non-wage labor cost in 13.5% (generate between 400 thousand and 1 million formal jobs) and increase the participation into the formal sector size between 10% and 15% with this new tax structure. The effect of this reform is still unclear, but most of the recent events suggest that the evolution of informality depends on more factors than the cost of being formal and the meaning of informality.

The recent literature has been concerned about obtaining a more accurate definition about what does informality means. Since 1986, the National Department of Statistics (DANE) has measured the informality in Colombia by implementing one chapter on informality in the different household surveys. From 1986 to 2000 this chapter was applied on June in the ENH Survey (*Encuesta Nacional de Hogares* in Spanish) with biannual frequency in the seven main metropolitan areas.² The ECH survey (*Encuesta Continua de Hogares* in Spanish) replaced the ENH survey in 2001, applied the chapter on informality in the second quarter of each year (April to June) in the 13 main metropolitan areas and more than 240 municipalities, which means about 44,400 households. Finally, in the third quarter of 2006, the ECH survey was replaced by the GEIH (*Gran Encuesta Integrada de Hogares* in Spanish). In summary, the main changes were sample size, coverage and the frequency. Nevertheless, between ECH and GEIH also changed due to the use of mobile devices and the increase in coverage to 24 cities (13 main metropolitan areas plus 11 capital cities), which means a sample size increment of 17,600 households.

From the conceptual point of view, to classify one worker as an informal, the DANE starts with the International Labor Organization (ILO) criterion in 1986. That is, informal workers are: *i)* the employees or employers working in firms with less than 10 workers, *ii)* unpaid family workers, *iii)* unpaid workers on firms of other houses, *iv)* domestic household

¹ For those who are in favor of this reform, the easy way to create new employment is to reduce the price of labor. Following this argument, the set of labor payments carried out by the firm affects competitiveness in some economic sectors by generating an increase in the relative price of labor/ capital in the formal sector.

² In June 1990 the ENH changed the chapter on informality which caused some imprecisions in informality measure. This information was not comparable with those of previous periods, so the initial format was revived.

workers, v) self-employed individuals who are not professionals or technicians, -DANE-I, hereafter (DANE, 2009). Since 2009, it was adopted a new definition for measuring informal employment by DANE. In this case, the new firm size threshold was reduced from 10 to 5 employers taking into account the United Nations criteria (*Fundamental Principles of Official Statistics*, -UN principle-). This is the international standard use, adopted in *15th International Conference of Labor Statisticians* and the *DELHI Group recommendations*, DANE-II, hereafter. It is clear that wage gaps might differ according to the definition employed. Through the document, additional measures are included in order to obtain different gaps according to conceptual views.

The document is divided in 5 sections. Section 2 summarizes the recent literature about wage gaps between formal and informal workers. Section 3 shows the data and the methodology used in the paper. Section 4 is dedicated to present the main results. Section 5 discusses the implications of the findings.

2. Recent Literature

Traditionally, wage gaps have been commonly measured by means of a multi-step procedure. First, the estimation of earning equations is done using Mincer equations (Mincer, 1974) and Heckman corrections. Second, these estimations have been accompanied with a decomposition *a la* Blinder-Oaxaca (1973) between an observable and an unobservable components. The main concern with this decomposition is that it is only informative about the average unexplained differences in earnings but not about their distribution. In developing countries, when the characteristics of employees are diverse, this approach does not provide an accurate measure of the gaps.

In order to deal with this drawback, techniques such as quantile regression, generalized Lorenz Curves, and non-parametric techniques have been proposed. Ñopo (2008a, 2008b) and Ñopo et al. (2012) highlights an additional drawback of the Blinder-Oaxaca (BO) approach: there exist differences in the support of a probability distribution. Then, If there are considerable differences in the supports of the distributions of characteristics for

formal and informal workers, there will be combinations of individual' characteristics for which it is possible to find only individuals from one group but not from the other. As a result, the estimations might be biased.

The recent evidence about the formal-informal wage gaps is considerable but inconclusive: Mazumdar (1976) for Malaysia, Roberts (1989) for Mexico, Pradhan and Van Soest (1995) for Bolivia, Tansel (1999, 2000) and Baskaya and Hulagu (2011) for Turkey and Gong and Van Soest (2001) for Mexico. Along this literature, the gap depends on the size of the formal employment.

In the specific case of Colombia, there are two groups of works. In the first group, García (2009), Bernal (2009), Guataquí et al. (2010) and Galvis (2012) study the informality under structuralist (DANE, ILO) and institutionalist approaches (Legal1 and Legal2).³ By using different definitions, García (2009) finds that informal sector is between 49.02% and 60.7% in the 10 main metropolitan areas in 2006.

While Bernal (2009) reports a national informal sector of about 67.5% using DANE measure and 74% in institucionalist definition in 2006 (it is 62% for 13 main metropolitan areas, 69% for urban areas and around 90% for rural areas). Guataquí et al. (2010) find that informal sector is between 26% and 63% in the 13 main metropolitan areas in 2010 employing three different definitions: DANE, Strong⁴ and weak⁵. Galvis (2012) finds an informal sector size of 56.15% of total employment for urban areas (using DANE) and 62.32% in *institucionalist* measures (from April 2010 to March 2011) like Bernal (2009). In

³ The structuralist is related with the firm size and occupational position and institutionalist relates with labor legislation, - social security, minimum wage or taxes

⁴ The formal workers are: i) the employees and domestic household workers that: belong to contributive or special health regimen as contributors and not like beneficiaries, pay contribution to pension fund or are pensioners, have formal written contract and receive more than 95% of the minimum wage. ii) self-employed individuals who belong to contributive or special health regimen as contributors and not like beneficiaries and pay contribution to pension fund or are pensioners,

⁵ An employee, domestic household worker or self-employ will be formal if belong to social security system in health (as contributors and not like beneficiaries) either contributive or subsidized system or belong to a special regimen.

general, authors agree about the higher incidence of informality among young workers, females, uneducated or poor individuals.

Within the second group of studies,-about wage gaps- is the contribution made by Arango et al. (2004), Fernández (2006) , Hoyos et al. (2010) and, Badel and Peña (2010). Arango et al. (2004), analyze the economic sector importance (public, private) and gender gaps in employees' wages between 1984 and 2000 finding a high wage gap between qualified and no qualified employees by gender and economic sector. While Fernandez (2006), using the "*Encuesta de Calidad de Vida (ECV)*" survey (urban samples from 1997 and 2003) and employing quantile regression methodology reports gender wages gap in 2003 of 17% and 22% in 75 and 90 percentile respectively, where the principal determinant is the number of working hours. With the same methodology, Badel and Peña (2010) measure the gender wage gap for individuals between 25 and 55 years of age using seven main metropolitan areas subsamples of the June 2006 ECH survey, finding a gender wage gap around 35% in the lower end of the distribution and 30% in the upper end, which is largely explained by gender differences in the rewards to labor market characteristics and not by differences in the distribution of characteristics. Recently, Hoyos et al. (2010) survey gender wage gap from 1994 to 2006, using matching comparisons. They considered three sub-periods: 1994-1998, 2000-2001 and 2002-2006. They found that the gaps remained almost unchanged over the period. The gender wage gap ranges between 13 and 23 percent of average female wages, and it remains largely unexplained after controlling for different combinations of socio-demographics and job-related characteristics.

Mesa et al. (2008) find significant wage differences between cities and sectors in the unexplained human capital wage gap. The wages are highest in larger firms, the women in less qualified work receive less wage than men, the sectors with higher mean labor productivity have higher wages and the wage gap can be explained by characteristics different to type of employment or worker characteristics. Iregui et al. (2009) find that Agriculture sector is the only one that has negative gap respect to economy average wage.

Posso (2008) employs a quintile regression methodology to analyze wage differences between education levels for seven main metropolitan areas (1984 to 2005) and concludes that employees with post-secondary education have higher wages than rest of employees and there is high inequality within employees because of the post-secondary heterogeneity quality education. Finally, Uribe et al. (2007), use ENH to measure the differences in wage between formal and informal workers by Mincer equations estimations for individuals in urban areas in June of 2000, finding a meaningful wage gap and a positive influence of the firm size in wage level. In their approach, informal worker is measure as DANE does.

Since most of this literature does not include differences into the common support of the population being compared in terms of wage, we propose Ñopo's non parametric approach that it is well known in the literature.

3. Data and Methodology

3.1 Data

The empirical measurement of the wage gap is carried out by employing the *GEIH Survey* over 2008 - 2012. This is a nationwide survey carried out quarterly in 24 cities (13 metropolitan areas quarterly and 11 cities biannually) and more than 240 municipalities with a coverage about 62,000 households. This survey provides information about labor conditions, family structure, earnings and health conditions since 2007 and is collected by a probabilistic multi-stage and stratified sample design. (See www.dane.gov.co, for technical details). However, due to statistical problems, the data obtained during 2007 is not included into the analysis. Then, this short period limits the analysis to the short run and it is not possible to make inferences about long run trends. As it was mentioned before, the ECH differs in the sample design, the coverage and the collecting-data method from GEIH. Additionally, the chapter on informality is applied just in the second quarter while in GEIH survey it is applied monthly. In order to obtain more accurate results, some observations were excluded from the data. The observations into the database were

restricted to workers between 12 and 70 years old, we also restrict our calculations to those who work between 80 and 320 hours per month.⁶ Our final database is about 1,275,472 observations (more than 13 million of people per year after using sample weights) that represent more than the 80% out of the total employment.

The set of variables included into the empirical strategy includes the following characteristics. Population is classified in two type of regions according to their economic development (high and low), nine economic sectors, three types of labor participation (employer, employee and self-employed), seven schooling-levels and six age ranges. It is also included a set of dummies representing socioeconomic variables: marital status, level of qualification, place of residence (rural or urban), presence of children under five, presence of older people at home, and additional workers at home.

Once the control variables are defined, the challenge is to obtain an accurate measure of informality. The definition of informality has been widely discussed over time. Some of the concerns are about the advantages or drawbacks of using highly restrictive or simpler conditions for being classified as informal.

The choice of participating into the labor markets depends on many aspects such as the price of work, the menu of contracts, the tax structure, and the flexibility of the labor demand among other aspects. In developing countries, some institutional features allow the growing of underground and informal activities that are frequently associated to low productivity activities. The informal *economy* includes activities that are partially or fully outside government regulation, taxation, and observation. Under this approach, the incentive to belong to it is to increase their take-home earnings, to manage their time-constraint and reduce their costs by evading taxation and social contributions. The reasons that induce policies intended to reduce informality are sustained in the negative effects on growth and other indirect effects such as low coverage of formal social programs, and fiscal losses as a consequence of high evasion. Then, belonging to the

⁶ In Colombia, labor laws states that nobody might work more than 8 hours per day. This is equivalent to 160 hours per month.

fraction of activities with high incidence of informality increases the likelihood to be poor and generate problems in the long run. However, this risk is not an option for those who are excluded from the formal activities or for those who change their participation from employee to be owner of small-firms.

In order to provide a wider picture about wage gaps, three alternative measures of informality are used along the empirical section (See Diagram 1). First we adopt DANE-II definition. The DANE adopted the International Labor Organization criterion which states that: *i)* the employees or employers working in firms with less than 5 workers, *ii)* unpaid family workers, *iii)* unpaid workers in firms of other houses, *iv)* domestic household workers, *v)* self-employed individuals who are not professionals or technicians could be considered as informal. Secondly, we also propose one measure in which all workers who are covered by the social security system in health are classified as formal workers. Previous definitions (Legal1 and Legal2, García; 2009; Weak, Guataquí et al., 2010) are very rigorous, since they also require that they were covered by the pension system. We call this one as Weak-I (The differences between weak and Weak-I is that the former does not includes beneficiaries and the later does).

Thirdly, we construct an additional measure of informality based on the idea that human capital is crucial in the choice of going to the formal or informal sector. Then, we adapt DANE-II but the schooling level used as a threshold among self-employed and employed in small firms is reduced to up to secondary education (DANE-Modified). Obviously, these definitions imply differently populations (compositions and sizes). According to our database, the 49.23% out of the workers are informal in the case of DANE-Modified definition while this figure is 50.77% and 12,9% for DANE-II and Weak-I definitions, respectively. The requirements for each definition imply sample sizes.

Compared to other Latin American countries, Colombia exhibits higher incidence of informality (Mexico, 54.2%; Brazil, 42.1%; Chile⁷, 36.8%; and Uruguay, 37.7%).⁸

⁷ Data: CASEN Survey 2009.

⁸ Sources: IMF WEO October 2012, International Labor Organization 2011, Minister of Labor of each country and World Bank.

Diagram 1. Informality definitions

García (2009)	Guataquí et al. (2010)	Daza & Gamboa (2013)
DANE	DANE	DANE-II
<p>i) the employees or employers working in firms with less than 10 workers, ii) unpaid family workers, iii) unpaid workers in firms of other houses, iv) domestic household workers, v) self-employed individuals who are not professionals or technicians</p>	<p>i) the employees or employers working in firms with less than 10 workers, ii) unpaid family workers, iii) unpaid workers in firms of other houses, iv) domestic household workers, v) self-employed individuals who are not professionals or technicians</p>	<p>i) the employees or employers working in firms with less than 5 workers, ii) unpaid family workers, iii) unpaid workers in firms of other houses, iv) domestic household workers, v) self-employed individuals who are not professionals or technicians</p>
OIT	Strong	DANE-modified
<p>The formal workers are: i) the employees and domestic household workers that: belong to contributive or special health regimen as contributors and not like beneficiaries, pay contribution to pension fund or are pensioners, have formal written contract and receive more than 95% of the minimum wage. ii) self-employed individuals who belong to contributive or special health regimen as contributors and not like beneficiaries and pay contribution to pension fund or are pensioners.</p>	<p>The formal workers are: i) the employees and domestic household workers that: belong to contributive or special health regimen as contributors and not like beneficiaries, pay contribution to pension fund or are pensioners, have formal written contract and receive more than 95% of the minimum wage. ii) self-employed individuals who belong to contributive or special health regimen as contributors and not like beneficiaries and pay contribution to pension fund or are pensioners.</p>	<p>i) employees working on firms with less than five workers who have at most secondary education, ii) unpaid family workers, iii) unpaid workers on other houses firms, iv) domestic household workers, v) self-employed individuals who are not professionals or technicians</p>
Legal1	Weak	Weak-I
<p>An employee, domestic household worker or self-employment will be formal if belong to social security system in health (as contributors and not like beneficiaries) either contributive or subsidized system or belong to a special regimen.</p>	<p>An employee, domestic household worker or self-employment will be formal if belong to social security system in health (as contributors and not like beneficiaries) either contributive or subsidized system or belong to a special regimen.</p>	<p>Workers who are covered by the social security system in health.</p>
Legal2		
<p>Workers than don't pay social security contributions (pension and health) or receive less than minimum wage.</p>	<p>Workers than don't pay social security contributions (pension and health) or receive less than minimum wage.</p>	

According to each one, there are some movements of the people through the definitions. For example, we know that all the employees working on firms with less than 5 workers who have more than secondary education and the employer that are informal in DANE-II definition will move to DANE-Modified as formal workers, which implies that the informality level in DANE-Modified definition is less than DANE-II. With respect to Weak-I it's unclear the direction of the movement.

The variable employed for measuring the gap is the hourly labor income which is defined as the sum of wage, working overtime income, incomes in kind, subsidy and bonus for salaried and labor profits for self-employed and employers. For comparability purpose, these magnitudes are in 2008 constant prices.

The use of different measures allows us to disentangle some differences around the population belonging to each way of participation. By using DANE-II's definition (See Table 1), it is found that 54% out of the total labor employment is informal along the period. From this subset, 64% are men and 72% live in urban areas, 95% of the population only has basic education and a half of the people are between 25-44 years old. From a demographic point of view, 77% of the occupied live with children under 5 years and 15% have people older than 65 years old. According to job characteristics, 63% of informal workers are self-employed and about 30% are employees (with a notorious presence of domestic servants), while 83% of formal workers are employees and 11 % are self-employed with higher human capital than informal ones. The set of economic sectors where informality incidence is over the mean are Agriculture (74%), Hotels and Restaurants (65%), Transport y Communications (64%) and Construction (62%), (see, table 1 and A1).

Since a different perspective, the average informality rate fluctuates around 11% during 2008-2012 under Weak-I definition. From this fraction, 72% are men and 73% live in urban areas. As in the case of DANE II definition, a half of the population is between 25 - 44 years old. However, more than the 88% only have basic education. The criteria chosen

for this definition imply that 55% are self-employed while 40% are employees. In the other side, 56% out of the formal workers are employees and 38% are self-employed. Having social coverage as a main feature of formality implies that Construction (16%), Agriculture (13%), Hotels and Restaurants (13%), and Transport and Communications (12%) have higher incidence of informality, on average, than the rest of the sample. But these figures are much lower than Dane-II. Finally, we obtain the DANE-Modified's measure. In this case, informality is still around the 50% of the total employment with higher incidence among men (64%) and people from urban areas (69%).

<Table 1 about here>

As it is expected, about 90% out of the population do not have more than basic education. Most of them are self-employed (69%). It is important to highlight that under DANE-Modified all the employers will be formal. Under this definition, Agriculture (71%), and Transport and Communications (61%) are highly informal sectors.

For simplicity reasons, hourly labor earnings have been normalized such that the average of formals' earnings in each year is set equal to 100. In terms of labor compensation, some interesting facts appear (Table 2 and A2). The lowest unconditional disparities appear under Weak-I. In contrast, DANE-II and DANE-Modified exhibit considerably differences before controlling by formal-informal differences in observables characteristics yet. Females perceive higher (lower) incomes using DANE-II and DANE-Modified (Weak-I) than males. There are no differences on income over the life cycle for the three definitions. When getting close to retirement age (older than 55) informal workers labor incomes decrease faster than those of formal workers.

<Table 2 about here>

Those formal workers with no elderly presence at home and no children under 5 years tend to have higher labor incomes on average than their counterparts with at least one elderly or one child at home. Regarding of the type of employment, employers earn more than employees and self-employed. Finance and Business Services and Communal Services are sectors where workers tend to have higher earning than those at other sectors, while

for the informal workers are Finance and Business Services and Estate Activity. Regarding region, it is not surprising that those formal workers in development regions earn more than the rest of workers.

3.1 Methodology

Traditional methods in the study of wage gaps rely on parametric techniques such as Blinder (1973) and Oaxaca (1973) -BO- that decompose the gap between observable and unobservable factors. However, this decomposition does not include differences in the support of the empirical distributions of individual characteristics of groups compared. The existence of differences in the supports of the distributions of characteristics for one group or other group implies that there will be combinations of individual characteristics for which it is possible to find only individuals from one group. Then, the BO approach neglects these differences in the supports. (See, Gamboa and Zuluaga (2013) for a discussion). Recently, Ñopo (2008) proposes a non-parametric method based on a matching procedure. In contrast to propensity score matching, their approach makes the match using characteristics instead of scores. Its main advantage with respect to BO is the use of the common support in the estimation of the gaps. We adopt Ñopo's method and apply it to the informal-formal wage gaps.⁹ Briefly, this method starts from the following expression:

$$\Delta = E[Y|I] - E[Y|F] \quad (1)$$

The wage gaps is equal to the difference between the expected income given that is an informal worker minus the expected income given that is a formal worker. Recognizing the fact that the support of the distribution of characteristic for informal workers could be different than the support of the distribution of characteristics for formal workers, Ñopo (2008) decomposes the total gap into four additive terms as follows:

⁹ For technical details See Ñopo (2008)

$$\Delta = \Delta F + \Delta I + \Delta x + \Delta 0 \quad (2)$$

According to eq. 2, the value of ΔF corresponds to the part of the gap which is explained by differences between formal workers that can be matched to informal workers and those who cannot be matched. That is, the part of the gap that can be explained by the differences in characteristics between two groups of formal workers, those who are in and out of the common support. The term ΔI represents the fraction of the wage gap between informal workers (those who can be matched and those who cannot). Third, the Δx accounts for the gap explained over the common support by differences in the characteristics of formal and informal workers. Lastly, $\Delta 0$ is the unexplained part of the wage gap. Each one allows to have an intuition about the importance of recognizing the comparison among people with similar characteristics. In terms of Ñopo (2008), that is what explains the difference between his approach and Blinder-Oaxaca ones.

The method proposed by Ñopo is an iterative process consisting in four steps. In the first step, one formal worker is chosen from the sample. Next, from the informal set, a group of individuals that share the same characteristics as the worker chosen in the previous stage are picked. In the third step a “synthetic individual” is constructed with the characteristics of the average of all the informal workers from the previous step. The following step consists in the use of the new pair of individuals as a matched sample. This new sample is composed by four subsets (“matched formals”, “matched informal”, “unmatched formals” and “unmatched informal”). The estimation of eq. 1 is carried out following Ñopo (2008a). These sets allow us to compare people with similar characteristics who belong to the database.

As a result, we obtain the total gap as the difference between averages in the income earned by the comparing groups, expressed as a percentage of the average of income for

the formal workers. This methodology has been used previously in racial, gender and family spaces.

4 Results

The number of characteristics employed to construct the “*synthetic individuals*” into the matching process determines how the gap is decomposed. The procedure followed along the document to obtain the wage gaps was, as in the standard literature, structured in two steps. In the first steps, the gap was calculated adding one-by one the demographic variables. That is, first we only include gender and create the “individual”, with this one we proceed to match the sample and estimate the gap. Secondly, we use gender and age and repeat the process and so on. Through this step the variables included are gender, age, place of residence, schooling, marital status, presence of children under five years at home, presence of people older than 65 at home and a dummy of the existence of multiple workers at home.¹⁰

¹⁰ For robustness of our results, they were used different orderings and the results remain.

In the second step, labor variables were added with replacement to the complete set of the socioeconomic variables. This last part of the algorithm allows us to check the importance of each variable to the explanation of the wage gaps. Finally, we use the complete set of variables (socioeconomic and labor) to assess the gap in the last line of each panel.

The results for this process are summarized in Table 3 (and appendix A3). Due to the length of the period, the size of the gap remains stable within each informality definition and varies between them. This is evidence about the persistence of better conditions, on average, for formal workers. The gap is considerably higher in DANE-Modified than in the other ones. It ranges between 0.63 and 0.38 according to the measure employed. This implies that an informal worker earns on average between 38 and 63 percent less than a typical formal worker. When informality is measured as the set of workers who do not belong to the social security system, (Weak-I) the gap between informal workers and their counterparts is the smallest. The size of the gap is in the expected range in comparison with previous studies. Pratap and Quintin (2006) reported a gap range of 23% -37% for Argentina. Tansel (1999) found gaps higher than the 68% for Turkey. Baskaya and Hulagu (2011) find a gap between 15% -25% according to their method in Turkey. Most of these differences could come from the recognition of the differences in the common support and the methodologies used to solve the bias.

Once the gap is estimated, the next step consist on assess the importance of each variable (demographic or labor) to reduce the unexplained part of the wage gap. The addition of socioeconomic variables reduces the unexplained part in a similar way for all the definitions. The size of each component differs according to the measure. For DANE-II approach, the part of the gap that can be explained by the differences in characteristics between informal workers '*in*' and informal workers '*out*' of the common support (ΔI) is stable as well as ΔF the fraction of the gap explained by the differences between formal workers (who are in and out of the common support). Some of these 'demographic'

variables could be related and could be the source of the up and down changes in each one of the components.

<Table 3 about here>

Having included socioeconomic variables, the next step is to include labor variables, but in contrast to the algorithm used before this time each variable replaces other labor variable. For our set of labor variables, we can extract some interesting findings. First of all, the type of worker allows us to explain one fraction of the gap in two of the three definitions (in the case of DANE-Modified all the employers are formal workers). Second, the variable *qualified worker* does not explain the gap as a consequence of having introduced schooling in a previous step. Third, the existence of different capital-labor structures over the economy explains that the economic sector helps to reduce the unexplained part of the gap. Lastly, it seems that region does not provide additional information to the gap sources.

The criteria employed to define the conditions needed to be allocated as an informal worker have consequences on the structure of the sample. Labor supply composition depends on them because in some cases one formal worker might be classified as an informal in other cases. Then, the analysis of the unexplained wage-gap component obtained some findings that can be as contradictory, nonetheless correspond to the characteristics of each population used into the matching process.

For all the informality measures employed, the set of variables included into the matching process reduce half of the unexplained fraction gap. As an example, under DANE-II's definition the gap goes from 56.35% to 32%, while in Weak-I it is reduced from 37.82% to 17% for 2012. In DANE-Modified, this fraction is 23% as a consequence of the fact that those with high human capital who work in small firms belong to the formal sector under DANE-Modified.

There seems to be no considerable differences arising from gender on the explanation of wage gap for each definition used during the reference period. In all the cases, women

exhibit a higher unexplained fraction of the gap as a consequence of being a more heterogeneous population among the informal workers (education, age, type of worker conditions). Through time, the unexplained component raises with differences on human capital and experience accumulated by formal and informal workers.

Regarding the schooling level, there is not a specific trend on the unexplained component in all the measures of informality employed. From DANE-II perspective, this component is very short among high educated workers, while using Weak-I (definition based on social security contributions) the fraction of the gap coming from aspects out of the matching process is growing over the period. Last but not least, the existence of additional workers at home plays different roles according to the informality measure. (See Figures A1-A13 into the appendix 2).

5 Discussion

The existence of an informal sector reduces the benefits originating from economic growth through different channels. Thus, government might design targeted policies intended to reduce the size of informality avoiding the creation of perverse incentives. However, it is not easy to understand why informality is still growing when its average income is under the formal sector one. Our findings suggest that the differences between formal and informal labor income are important because of their implications on aspects such as social security coverage, poverty and income distribution.

Furthermore, after controlling for an extensive set of variables and using different perspectives of informality an important fraction of the gap remains unexplained. This is evidence of the importance of unobservable factors such as institutional arrangements, individual preferences, gender and other discriminations on the choice of participate into the labor market.

Our strategy of using multiple definitions allows us to control for particular cases. For example, those cases where someone works in a small firm with 3 employees. Under DANE-II will be informal, but under DANE-Modified will be formal. This transition is due to the importance of human capital in the probability of choosing between being a formal or

informal worker. Since workers endowed with basic education face higher barriers to participate into the formal labor market, which also implies perceiving less income, one important concern emerges. Low educated people in a country characterized by high inequality levels might be constrained to improve the quality of living.

Our findings report that the gap is very stable over the period for all the measures used into the analysis. Then, it is necessary to continue monitoring the effects of the policies designed to reduce it or work on new schemes to provide more information about the consequences of belonging to informality.

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Table 1. Descriptive Statistics by year

	DANE-II				WEAK-I				DANE-Modified			
	2008		2012		2008		2012		2008		2012	
	Formal	Informal	Formal	Informal	Formal	Informal	Formal	Informal	Formal	Informal	Formal	Informal
All	44.98	55.02	46.00	54.00	87.11	12.89	90.03	9.97	49.23	50.77	50.50	49.50
Gender												
Female	39.10	35.08	39.74	36.59	38.33	27.16	39.16	27.95	38.78	35.05	39.51	36.54
Male	60.90	64.92	60.26	63.41	61.67	72.84	60.84	72.05	61.22	64.95	60.49	63.46
Urban												
No	13.93	27.76	13.06	27.98	20.47	28.78	20.66	25.29	12.73	30.08	11.90	30.53
Yes	86.07	72.24	86.94	72.02	79.53	71.22	79.34	74.71	87.27	69.92	88.10	69.47
Age												
10-18	1.76	4.43	1.85	4.43	2.93	5.27	3.02	5.27	1.68	4.73	1.77	4.75
19-24	14.69	11.91	15.09	12.14	12.43	18.06	12.81	19.70	14.19	12.15	14.77	12.20
25-34	32.19	23.03	33.58	21.91	27.10	27.46	27.20	27.96	31.63	22.81	32.69	21.76
35-44	26.38	26.14	24.65	23.46	26.57	24.12	24.28	21.60	26.60	25.91	24.80	23.20
45-54	18.41	20.87	17.44	22.16	20.19	16.89	20.36	16.64	18.90	20.60	18.00	22.02
> 55	6.56	13.63	7.39	15.88	10.78	8.20	12.32	8.83	7.00	13.79	7.97	16.07
Education												
None or Primary Incomplete	8.71	28.68	7.25	27.61	18.68	26.57	17.74	22.84	8.61	30.44	7.27	29.44
Primary Complete	8.60	21.21	7.52	19.97	15.19	17.90	14.07	15.76	8.78	22.09	7.79	20.83
Secondary Incomplete	11.72	22.56	11.01	22.61	16.88	23.13	16.67	22.77	11.83	23.36	11.27	23.41
Secondary Complete	25.10	23.48	25.64	25.18	24.49	22.29	25.35	25.72	24.56	23.86	24.91	25.88
Tertiary Incomplete	21.29	2.59	25.94	3.25	11.65	6.65	14.18	9.22	22.11	0.23	26.72	0.39
Tertiary Complete and Post Tertiary	24.59	1.49	22.63	1.39	13.12	3.44	11.99	3.69	24.10	0.03	22.04	0.05
Marital Status												
Married or Live together	42.25	40.36	42.33	40.57	40.10	48.67	40.27	51.39	41.82	40.62	41.87	40.87
Divorced/Separated/Widow/er/Single	57.75	59.64	57.67	59.43	59.90	51.33	59.73	48.61	58.18	59.38	58.13	59.13
Head of Household												
No	49.93	45.67	50.68	46.68	47.48	48.30	48.25	50.97	49.09	46.13	50.01	47.00
Yes	50.07	54.33	49.32	53.32	52.52	51.70	51.75	49.03	50.91	53.87	49.99	53.00
Presence of children younger than 5 years in the household												
No	78.56	77.45	79.66	79.91	78.22	76.16	79.86	79.16	78.79	77.14	79.89	79.69
One	17.39	17.06	16.96	15.62	17.21	17.19	16.33	15.40	17.21	17.20	16.84	15.62
More than one	4.04	5.49	3.38	4.47	4.57	6.64	3.81	5.44	3.99	5.66	3.27	4.69
Presence of older in the household												
No	85.87	83.51	85.90	83.41	84.53	84.86	84.45	85.48	85.89	83.30	85.81	83.28
Yes	14.13	16.49	14.10	16.59	15.47	15.14	15.55	14.52	14.11	16.70	14.19	16.72
Presence of other member with labor income												
No	32.79	36.71	29.51	32.14	34.42	38.51	30.66	33.33	32.78	37.05	29.33	32.55
Yes	67.21	63.29	70.49	67.86	65.58	61.49	69.34	66.67	67.22	62.95	70.67	67.45
Qualified Worker												
No	57.30	96.43	56.01	96.07	76.95	91.53	76.35	89.36	57.18	99.82	56.05	99.68
Yes	42.70	3.57	43.99	3.93	23.05	8.47	23.65	10.64	42.82	0.18	43.95	0.32
Type of Employment												
Employee	84.57	31.69	83.08	30.37	57.83	39.54	56.18	40.49	79.94	31.75	78.51	30.23
Employer	3.69	5.34	3.79	5.68	4.50	5.21	4.84	4.54	9.33	0.00	9.53	0.00
Self-Employed	11.74	62.98	13.13	63.95	37.66	55.25	38.98	54.97	10.72	68.25	11.96	69.77
Public Employee												
No	87.06	100.00	89.92	100.00	93.35	99.79	94.85	100.00	88.18	100.00	90.82	100.00
Yes	12.94	0.00	10.08	0.00	6.65	0.21	5.15	0.00	11.82	0.00	9.18	0.00
Economic Sector												
Trade, Hotels and Restaurants	17.30	28.58	18.89	27.97	22.86	27.87	23.25	28.65	19.47	27.42	20.96	26.68
Communal Services	27.85	14.85	26.32	14.74	21.87	12.72	20.99	11.72	26.29	15.27	24.68	15.37
Industry	17.96	10.38	17.01	10.33	14.10	11.71	13.61	11.59	17.76	9.93	16.96	9.78
Transport and Communications	6.29	9.73	6.60	9.77	8.02	9.26	8.15	9.82	6.31	10.00	6.55	10.11
Estate Activity	9.18	4.35	9.80	4.61	6.78	4.78	7.21	5.07	9.22	3.90	9.66	4.28
Construction	4.57	6.81	6.13	7.93	5.48	7.96	6.68	10.88	4.88	6.69	6.76	7.45
Finance and Business Services	2.95	0.26	3.00	0.27	1.64	0.33	1.64	0.48	2.76	0.21	2.81	0.21
Agriculture	10.94	23.93	9.37	23.20	17.20	24.13	16.45	20.33	10.56	25.40	9.00	24.84
Others	2.97	1.11	2.87	1.18	2.05	1.24	2.02	1.46	2.74	1.18	2.63	1.28
Development Region												
No	43.87	64.2	43.75	64.63	53.96	62.35	54.83	56.81	44.11	65.64	43.89	66.39
Yes	56.13	35.8	56.25	35.37	46.04	37.65	45.17	43.19	55.89	34.36	56.11	33.61

Source: Authors' calculations using Household Surveys (GEIH)

Table 2. Earnings distribution by year

	DANE-II				WEAK-I				DANE-Modified			
	2008		2012		2008		2012		2008		2012	
	Formal	Informal	Formal	Informal	Formal	Informal	Formal	Informal	Formal	Informal	Formal	Informal
All	100.00	40.67	100.00	40.75	100.00	56.35	100.00	61.86	100.00	35.33	100.00	35.90
Gender												
Female	102.51	36.48	101.54	36.74	99.79	51.67	99.05	57.70	100.93	32.19	100.31	32.67
Male	98.38	42.94	98.99	43.06	100.13	58.10	100.61	63.48	99.41	37.02	99.80	37.77
Urban												
No	51.77	27.81	56.63	28.63	50.23	41.53	52.53	46.18	51.62	27.73	56.85	28.74
Yes	107.81	45.61	106.52	45.46	112.81	62.34	112.36	67.17	107.06	38.59	105.83	39.05
Age												
10-18	33.85	24.43	36.23	25.66	37.50	37.34	39.54	43.73	33.94	24.15	36.36	25.57
19-24	56.96	31.41	58.23	34.03	64.96	48.13	67.51	55.31	56.61	29.96	58.23	32.36
25-34	87.74	40.84	90.80	41.16	97.60	56.71	101.75	64.86	87.55	36.25	90.80	36.96
35-44	111.04	43.55	111.91	44.32	109.30	62.55	111.76	68.08	109.78	38.09	111.47	38.44
45-54	131.15	45.57	123.33	43.60	120.35	63.47	110.72	65.17	130.38	37.43	121.50	37.85
>55	142.53	40.76	148.28	40.30	102.42	52.59	103.85	56.33	141.00	34.03	145.05	33.87
Education												
None or Primary Incomplete	41.99	29.10	46.64	29.70	44.87	41.94	46.61	44.94	44.17	28.12	47.99	29.14
Primary Complete	50.71	35.81	54.10	36.91	56.75	47.46	58.50	54.96	54.97	33.40	57.54	35.03
Secondary Incomplete	54.34	39.31	57.20	39.81	62.82	54.14	64.42	57.59	56.80	37.22	60.14	37.69
Secondary Complete	66.54	48.53	66.78	45.67	82.42	60.10	80.20	63.10	69.31	44.26	69.25	42.39
Tertiary Incomplete	87.49	71.19	83.44	70.97	123.14	78.06	118.27	80.89	85.55	46.18	82.65	47.77
Tertiary Complete and Post Tertiary	216.96	202.09	216.08	184.30	306.37	162.02	306.25	186.30	215.34	145.32	215.19	106.18
Marital Status												
Married or Live together	90.15	36.93	89.49	36.99	91.75	54.84	91.17	59.66	89.92	32.72	88.87	33.78
Divorced/Separated/Widow/er/Single	107.20	43.20	107.72	43.32	105.52	57.79	105.95	64.19	107.24	37.11	108.01	37.37
Head of Household												
No	86.69	35.07	89.02	36.40	88.15	50.83	90.79	57.05	85.76	31.91	88.65	32.91
Yes	113.27	45.39	111.28	44.56	110.72	61.51	108.59	66.86	113.73	38.25	111.36	38.55
Presence of children younger than 5 years in the household												
No	102.22	41.05	101.71	40.69	101.98	57.44	100.94	62.99	102.13	35.36	101.46	35.76
One	93.29	40.57	94.07	42.63	95.50	56.04	99.00	59.50	93.27	36.29	95.05	37.41
More than one	85.69	35.65	89.56	35.35	83.11	44.66	84.47	52.16	87.06	31.89	89.82	33.36
Presence of older in the household												
No	101.27	41.37	99.77	41.34	102.16	56.76	101.04	62.00	101.37	35.69	99.86	36.39
One	92.31	37.15	101.37	37.77	88.20	54.09	94.33	61.04	91.65	33.53	100.86	33.46
Presence of other member with labor income												
No	103.45	41.72	104.27	41.39	100.75	59.94	101.59	64.36	103.97	36.36	104.52	36.85
Yes	98.32	40.07	98.21	40.45	99.61	54.11	99.30	60.61	98.07	34.72	98.13	35.45
Qualified Worker												
No	58.00	37.81	60.57	37.96	64.20	51.03	65.41	55.81	60.49	35.28	62.73	35.84
Yes	156.35	118.02	150.22	108.94	219.54	113.89	211.64	112.63	152.76	59.64	147.53	55.65
Type of Employment												
Employee	94.37	39.00	97.22	41.34	113.52	51.70	118.02	60.73	93.24	36.50	96.40	39.30
Employer	155.59	118.98	128.80	110.29	197.12	115.70	169.89	123.26	131.82	0.00	117.46	0.00
Self-Employed	123.08	34.88	109.29	34.30	67.62	54.09	65.35	57.62	122.73	34.78	109.72	34.43
Public Employee												
No	90.03	40.67	89.73	40.75	90.40	56.30	90.71	61.86	91.07	35.33	90.66	35.90
Yes	167.06	0.00	191.56	0.00	234.77	84.53	270.97	0.00	166.59	0.00	192.32	0.00
Economic Sector												
Trade, Hotels and Restaurants	77.77	45.22	75.06	43.37	81.78	60.04	79.62	63.82	81.08	38.45	77.26	37.45
Communal Services	133.51	39.63	138.61	41.89	141.82	57.45	146.76	61.49	132.61	35.33	138.69	38.29
Industry	88.00	43.05	82.19	42.07	101.90	59.05	95.25	64.91	88.23	36.16	82.94	35.33
Transport and Communications	81.96	40.62	85.23	41.74	81.05	52.88	84.82	56.85	83.64	37.07	87.23	38.45
Estate Activity	123.44	63.62	114.15	55.95	147.16	94.87	134.97	96.28	125.28	46.13	116.59	41.38
Construction	73.08	41.81	71.65	47.28	77.29	59.24	83.26	65.57	72.47	38.76	73.34	42.21
Finance and Business Services	164.26	80.07	175.82	91.00	222.33	96.02	239.25	181.22	162.30	70.56	176.33	63.01
Agriculture	49.20	30.15	52.31	30.55	50.96	42.49	51.60	47.42	52.36	28.33	55.46	29.17
Others	118.45	36.72	138.41	30.68	136.64	55.13	153.74	50.36	120.30	30.12	138.69	30.47
Development Region												
No	81.63	34.01	85.69	34.76	75.53	48.42	78.13	52.78	81.66	30.92	85.69	31.95
Yes	114.36	52.60	111.13	51.70	128.68	69.48	126.55	73.80	114.48	43.74	111.20	43.71

Source: Authors' calculations using Household Surveys (GEIH)

Table 3. Formal-informal earnings gaps decomposition by year

<i>DANE-II</i>								
	2008				2012			
	Delta O	Delta F	Delta I	Delta X	Delta O	Delta F	Delta I	Delta X
<i>Demographic set</i>								
Male	-0,58			0,00	-0,58			0,00
+ Age	-0,58			0,00	-0,57			0,00
+ Place of Residence	-0,55			-0,03	-0,54			-0,03
+ Schooling	-0,21		0,00	-0,37	-0,22	0,00	0,00	-0,36
+ Marital Status	-0,21		0,00	-0,37	-0,22	0,00	0,00	-0,36
+ Children under 5	-0,21	0,00	0,00	-0,37	-0,22	0,00	0,00	-0,36
+ Older than 65	-0,21	0,00	0,00	-0,37	-0,22	0,00	0,00	-0,36
+ Dummy another worker	-0,21	0,00	0,00	-0,36	-0,22	0,00	0,00	-0,36
<i>Job-related variables</i>								
& Qualified worker	-0,21	0,00	0,00	-0,37	-0,21	0,00	0,00	-0,36
& Type of worker	-0,38	-0,11	-0,01	-0,08	-0,39	-0,13	0,00	-0,05
& Economic Sector	-0,19	-0,01	-0,01	-0,37	-0,17	-0,01	-0,02	-0,38
& Region	-0,20	0,00	0,00	-0,38	-0,19	0,00	0,00	-0,38
All variables	-0,32	-0,07	-0,07	-0,11	-0,33	-0,10	-0,08	-0,07
<i>WEAK-I</i>								
	2008				2012			
	Delta O	Delta F	Delta I	Delta X	Delta O	Delta F	Delta I	Delta X
<i>Demographic set</i>								
Male	-0,43			0,01	-0,38			0,01
+ Age	-0,42			0,00	-0,37			0,01
+ Place of Residence	-0,41			-0,01	-0,36			0,00
+ Schooling	-0,30		0,00	-0,11	-0,28		0,00	-0,08
+ Marital Status	-0,30		0,00	-0,12	-0,26		0,00	-0,10
+ Children under 5	-0,30	0,00	0,00	-0,12	-0,27	0,00	0,00	-0,09
+ Older than 65	-0,30	0,00	0,00	-0,11	-0,27	0,00	0,00	-0,09
+ Dummy another worker	-0,31	0,00	0,00	-0,11	-0,27	0,00	0,00	-0,09
<i>Job-related variables</i>								
& Qualified worker	-0,31	0,00	0,00	-0,11	-0,27	0,00	0,00	-0,09
& Type of worker	-0,31	0,00	-0,02	-0,09	-0,25	0,00	-0,02	-0,09
& Economic Sector	-0,29	0,00	-0,03	-0,09	-0,25	0,00	-0,03	-0,08
& Region	-0,30	0,00	-0,01	-0,11	-0,27	0,00	-0,01	-0,09
All variables	-0,17	0,00	-0,19	-0,06	-0,17	0,00	-0,18	-0,01
<i>DANE-Modified</i>								
	2008				2012			
	Delta O	Delta F	Delta I	Delta X	Delta O	Delta F	Delta I	Delta X
<i>Demographic set</i>								
Male	-0,64			0,00	-0,63			0,00
+ Age	-0,63			0,00	-0,62			-0,01
+ Place of Residence	-0,61			-0,03	-0,60			-0,03
+ Schooling	-0,33		-0,03	-0,28	-0,46	0,00	0,00	-0,16
+ Marital Status	-0,31		-0,05	-0,27	-0,44	0,00	-0,07	-0,13
+ Children under 5	-0,28	0,00	-0,09	-0,27	-0,36	0,00	-0,16	-0,12
+ Older than 65	-0,35	0,00	-0,14	-0,15	-0,37	0,00	-0,16	-0,10
+ Dummy another worker	-0,31	0,00	-0,19	-0,13	-0,35	0,00	-0,19	-0,09
<i>Job-related variables</i>								
& Qualified worker	-0,32	0,00	-0,19	-0,12	-0,35	0,00	-0,19	-0,09
& Type of worker	-0,26	-0,03	-0,24	-0,10	-0,30	-0,06	-0,21	-0,06
& Economic Sector	-0,29	-0,01	-0,26	-0,08	-0,32	-0,01	-0,24	-0,07
& Region	-0,28	0,00	-0,24	-0,11	-0,30	0,00	-0,24	-0,09
All variables	-0,20	-0,03	-0,33	-0,08	-0,23	-0,06	-0,29	-0,05

Source: Authors' calculations using Household Surveys (GEIH).

Appendix 1

Table A1. Descriptive Statistics by year 2009-2011

	DANE-II						WCAKI						DANE/Modified					
	2009		2010		2011		2009		2010		2011		2009		2010		2011	
	Formal	Informal	Formal	Informal	Formal	Informal	Formal	Informal	Formal	Informal	Formal	Informal	Formal	Informal	Formal	Informal	Formal	Informal
All	43.69	56.31	44.45	55.55	44.70	55.30	88.36	11.64	89.32	10.68	89.78	10.22	47.92	50.08	48.81	51.19	49.20	50.80
Gender																		
Female	39.22	35.36	39.70	35.63	39.80	35.81	38.31	27.47	38.64	27.39	38.82	26.78	38.85	35.40	39.34	35.62	39.37	35.87
Male	60.78	64.64	60.30	64.37	60.20	64.19	61.69	72.53	61.36	72.61	61.18	73.22	61.15	64.60	60.66	64.38	60.63	64.13
Urban																		
No	13.81	28.15	13.52	28.14	13.00	27.91	21.23	26.82	21.04	26.71	20.69	26.07	12.59	30.43	12.31	30.54	11.81	30.38
Yes	86.19	71.85	86.48	71.86	87.00	72.09	78.77	73.18	78.96	73.29	79.31	73.93	87.41	69.57	87.69	69.46	88.19	69.62
Age																		
10-18	1.81	4.37	1.74	4.46	1.62	4.41	2.94	5.62	2.97	5.57	2.90	5.49	1.71	4.67	1.62	4.80	1.55	4.73
19-24	14.49	12.14	14.33	12.02	14.76	12.12	12.54	17.95	12.41	18.37	12.60	19.46	14.04	12.36	13.98	12.16	14.39	12.24
25-34	33.08	22.93	33.37	22.68	33.50	22.48	27.18	28.82	27.31	28.43	27.35	27.94	32.42	22.71	32.61	22.49	32.64	22.34
35-44	25.76	25.33	25.69	24.59	25.19	23.55	25.81	23.34	25.34	22.91	24.51	22.29	26.04	25.04	25.73	24.47	25.33	23.27
45-54	17.87	20.75	17.73	21.37	17.57	22.10	20.02	15.51	20.17	16.30	20.49	16.44	18.26	20.63	18.35	21.09	18.20	21.90
>55	6.98	14.47	7.14	14.87	7.35	15.33	11.52	8.76	11.80	8.43	12.15	8.37	7.52	14.58	7.71	14.99	7.89	15.51
Education																		
None or Primary incomplete	8.35	29.92	7.81	29.64	7.38	28.24	19.73	26.35	19.26	25.56	18.34	23.96	8.34	31.68	7.96	31.36	7.45	30.02
Primary Complete	9.01	20.93	8.35	20.17	8.02	20.01	15.51	17.31	14.78	16.06	14.44	16.51	9.22	21.70	8.53	21.01	8.32	20.78
Secondary incomplete	11.67	22.29	11.23	22.28	10.81	22.63	16.91	23.26	16.65	23.38	16.71	22.93	11.81	23.02	11.55	22.92	11.04	23.45
Tertiary Complete	25.89	23.01	25.36	23.85	25.49	24.85	24.45	22.90	24.60	23.87	25.25	24.16	25.28	23.34	24.63	24.42	24.87	25.39
Tertiary incomplete	22.16	2.44	23.39	2.72	24.50	2.91	11.60	6.99	12.41	7.67	12.98	8.85	22.83	0.23	24.10	0.28	25.21	0.32
Tertiary Complete and PostTertiary	22.92	1.41	23.86	1.35	23.80	1.36	11.81	3.20	12.30	3.46	12.28	3.60	22.52	0.02	23.24	0.02	23.11	0.05
Marital Status																		
Married or Live together	41.48	39.73	41.86	40.71	42.52	40.23	39.45	48.45	40.14	50.29	41.39	48.61	40.78	40.23	41.36	41.09	41.91	40.62
Divorced/Separated/Widow/er/Single	58.52	60.27	58.14	59.29	57.48	59.77	60.55	51.55	59.86	49.71	59.90	58.31	59.22	59.77	58.64	58.91	58.09	59.38
Head of Household																		
No	49.82	45.62	49.85	45.86	50.92	46.44	47.13	49.92	47.39	49.66	48.18	50.82	49.07	45.97	49.14	46.20	50.18	46.76
Yes	50.18	54.38	50.15	54.14	49.08	53.56	52.87	50.08	52.61	50.34	51.82	49.18	50.93	54.03	50.86	53.80	49.82	53.24
Presence of children younger than 5 years in the household																		
No	78.38	77.70	78.62	78.50	79.72	78.99	78.24	76.14	78.75	76.98	79.50	77.74	78.47	77.56	78.82	78.31	79.88	78.77
One	17.63	16.31	17.75	16.31	16.78	16.12	17.16	17.02	16.95	16.92	16.39	16.39	17.61	16.71	17.58	16.34	16.68	16.16
More than one	4.00	5.54	3.63	5.19	3.50	4.89	4.60	6.84	4.30	6.10	4.11	5.65	3.92	5.73	3.60	5.35	3.45	5.06
Presence of older in the household																		
No	86.41	83.67	86.26	83.65	85.49	83.41	84.88	84.76	84.73	85.48	84.22	85.41	86.31	83.53	86.18	83.50	85.41	83.31
Yes	13.59	16.33	13.74	16.35	14.51	16.59	15.12	15.24	15.27	14.52	15.78	14.59	13.69	16.47	13.82	16.50	14.59	16.69
Presence of other member with labor income																		
No	32.23	35.22	31.15	34.40	30.10	32.75	33.58	36.46	32.57	36.20	31.14	35.33	31.93	35.75	31.04	34.78	29.91	33.17
Yes	67.77	64.78	68.85	65.60	69.90	67.25	66.42	63.54	67.43	63.80	68.86	64.67	68.07	64.25	68.96	65.22	70.09	66.83
Qualified Worker																		
No	58.26	96.69	56.54	96.48	55.56	96.29	78.39	91.31	77.30	90.69	76.80	89.33	58.26	99.80	56.67	99.77	55.75	99.71
Yes	41.74	3.31	43.46	3.52	44.44	3.71	21.61	8.69	22.70	9.31	23.20	10.67	41.74	0.20	43.33	0.23	44.25	0.29
Type of Employment																		
Employee	83.97	30.63	82.87	30.07	82.64	29.74	55.75	40.17	55.15	40.08	54.89	40.13	79.06	30.81	78.12	30.10	77.80	29.74
Employer	4.17	5.38	4.23	5.52	3.86	5.71	4.81	5.19	4.98	4.68	4.90	4.75	10.12	0.00	10.13	0.00	9.93	0.00
Self-Employed	11.86	63.99	12.90	64.41	13.51	64.55	39.44	54.64	39.87	55.24	40.21	55.12	10.81	69.19	11.74	69.90	12.27	70.26
Public Employee																		
No	88.35	100.00	89.27	100.00	89.71	100.00	94.25	99.88	94.68	99.87	94.88	99.98	89.38	100.00	90.23	100.00	90.65	100.00
Yes	11.65	0.00	10.73	0.00	10.29	0.00	5.75	0.12	5.32	0.13	5.12	0.02	10.62	0.00	9.77	0.00	9.35	0.00
Economic Sector																		
Trade, Hotels and Restaurants	18.15	27.40	18.25	27.52	18.22	28.00	22.77	27.77	22.86	27.92	23.07	28.53	20.22	26.24	20.33	26.33	20.46	26.70
Communal Services	27.94	14.88	27.68	14.76	27.17	14.27	21.68	12.25	21.49	12.25	20.98	11.73	26.27	15.36	25.97	15.28	25.43	14.82
Industry	17.73	10.23	17.09	10.10	17.38	10.40	13.68	12.16	13.37	11.89	13.66	12.30	17.60	9.74	17.02	9.58	17.18	9.97
Transport and Communications	6.65	9.57	6.77	9.78	6.70	9.71	8.12	9.59	8.28	9.82	8.22	9.58	6.54	9.91	6.68	10.12	6.63	10.04
Estate Activity	9.08	4.83	9.05	4.61	9.22	4.73	6.94	4.73	6.81	4.73	6.93	5.04	9.08	4.48	8.94	4.34	9.17	4.39
Construction	4.76	7.08	5.04	7.37	5.81	7.52	5.73	8.63	5.98	9.29	6.37	10.15	5.31	6.77	5.80	6.84	6.44	7.06
Finance and Business Services	2.91	0.21	3.08	0.22	2.93	0.22	1.53	0.34	1.64	0.26	1.55	0.22	2.74	0.15	2.89	0.16	2.73	0.17
Agriculture	10.28	24.72	10.23	24.40	9.40	23.96	17.75	23.42	17.58	22.49	17.03	21.21	9.94	26.20	9.79	26.02	9.05	25.60
Others	2.49	1.10	2.82	1.23	3.18	1.18	1.79	1.10	2.01	1.35	2.19	1.08	2.31	1.15	2.57	1.33	2.92	1.26
Development Region																		
No	43.53	64.30	43.06	64.85	86.23	91.66	54.68	59.33	54.56	60.23	89.16	89.91	43.84	65.70	43.45	66.34	86.38	91.99
Yes	56.47	35.70	56.94	35.15	13.77	8.34	45.32	40.67	45.44	39.77	10.84	10.09	56.16	34.30	56.55	33.66	13.62	8.01

Source: Authors' calculations using Household Surveys (GEIH)

Table A2. Earnings distribution by year

	DANEII				WEAK-I				DANE-Modified					
	2009		2010		2009		2010		2009		2010		2011	
	Formal	Informal	Formal	Informal	Formal	Informal	Formal	Informal	Formal	Informal	Formal	Informal	Formal	Informal
All	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Gender														
Female	104.47	36.43	101.65	35.30	102.83	35.63	99.89	52.75	100.39	52.34	102.89	32.31	100.52	31.21
Male	97.12	42.05	98.91	40.82	98.13	41.94	99.04	58.82	99.75	60.75	98.16	36.41	99.66	35.55
Urban	56.08	27.80	53.05	27.67	54.76	28.41	52.06	45.79	51.31	42.66	55.98	27.75	53.20	27.75
No	107.04	44.87	107.34	43.23	106.76	44.05	112.93	63.56	112.97	63.20	106.34	38.12	106.57	36.76
Age														
10-18	38.95	25.07	34.57	23.45	34.76	24.67	41.35	38.97	37.15	40.21	38.71	24.92	34.69	23.42
19-24	59.30	32.44	58.97	31.38	56.70	32.74	67.66	52.01	67.15	51.62	58.82	31.11	58.47	30.19
25-34	90.03	40.50	90.49	38.27	91.36	40.04	100.71	60.62	100.90	57.62	89.99	35.74	90.41	33.89
35-44	111.73	43.71	107.79	42.49	111.17	43.22	110.84	64.65	109.08	60.83	111.28	37.48	108.06	36.70
45-54	127.09	43.17	130.52	41.61	125.62	43.29	115.26	62.12	116.11	62.58	125.18	37.42	127.53	35.62
> 55	134.88	39.47	138.94	40.40	141.21	38.32	97.68	57.90	101.27	58.38	133.75	32.86	137.18	33.99
Education														
None or Primary incomplete	45.30	28.85	43.76	29.34	44.94	29.24	45.77	45.05	46.48	43.20	47.20	27.97	45.95	28.55
Primary Complete	53.00	35.93	51.58	33.91	51.85	35.41	58.63	51.97	55.96	50.74	56.10	33.89	54.44	32.21
Secondary/Incomplete	56.24	39.14	54.77	36.86	56.45	38.04	65.00	54.19	62.04	52.81	58.87	36.98	57.02	34.98
Secondary Complete	69.00	47.15	64.49	44.66	64.21	45.36	84.98	61.30	79.73	60.38	71.17	43.32	66.87	41.49
Tertiary/Incomplete	87.32	73.50	84.76	73.96	81.32	70.57	126.07	84.40	123.46	80.52	85.85	48.06	84.08	45.89
Tertiary Complete and Post Tertiary	220.68	196.23	218.35	200.82	218.08	184.20	319.13	167.85	318.38	161.30	219.01	62.07	217.95	72.25
Marital Status														
Married or Live together	89.47	35.73	88.92	34.71	88.34	35.52	90.73	56.14	90.19	54.36	89.26	32.07	88.65	31.23
Divorced/Separated/Widow(er)/Single	107.46	42.92	107.98	41.69	108.62	42.49	106.04	61.28	106.57	59.99	107.39	36.91	108.01	35.95
Head of Household														
No	89.62	35.60	87.85	34.11	88.16	34.95	91.45	53.23	89.65	51.65	89.18	31.88	87.27	30.89
Yes	110.30	43.81	112.08	42.87	112.29	43.78	107.62	64.33	109.32	62.59	110.43	37.59	112.30	36.68
Presence of children younger than 5 years in the household														
No	101.29	40.04	101.89	38.93	101.52	39.63	100.83	59.87	101.30	57.65	101.21	34.78	101.56	34.08
One	96.15	41.86	93.82	39.37	94.92	40.36	100.11	57.64	97.92	56.63	96.44	36.75	94.57	34.45
More than one	91.64	35.01	89.20	36.09	89.70	38.23	85.40	49.61	84.31	52.43	91.84	32.22	92.35	31.57
Presence of older in the household														
No	100.79	40.80	101.02	39.60	100.57	40.47	101.89	59.66	102.14	57.69	100.72	35.65	101.01	34.64
One	94.96	36.31	93.60	35.05	96.63	35.74	89.41	53.95	88.15	54.06	95.47	31.49	93.72	30.82
Presence of other member with labor income														
No	101.30	40.73	102.60	39.48	104.31	40.21	99.49	60.99	100.03	60.35	101.82	36.13	102.92	34.93
Yes	99.38	39.70	98.82	38.53	98.15	39.42	100.26	57.53	99.98	55.35	99.15	34.31	98.69	33.51
Qualified Worker														
No	60.56	37.26	58.37	36.02	58.39	36.91	65.88	53.29	63.80	52.15	62.59	34.93	60.46	33.97
Yes	155.05	122.04	154.16	116.52	152.02	111.61	223.79	116.62	223.27	105.97	152.22	51.43	151.71	48.22
Type of Employment														
Employee	96.17	38.81	96.55	37.75	96.59	39.15	117.16	55.83	118.11	54.32	94.97	36.89	95.63	35.84
Employer	128.28	117.35	127.92	111.70	129.68	112.61	181.07	128.51	175.71	122.54	121.23	0.00	118.21	0.00
Self-Employed	117.14	34.17	113.02	33.12	112.39	33.47	65.87	54.35	65.49	53.68	116.93	34.11	113.35	33.22
Public Employee														
No	90.37	40.07	90.39	38.85	90.87	39.68	90.92	58.73	90.98	57.05	91.36	34.96	91.29	34.01
Yes	173.04	0.00	179.98	0.00	179.62	0.00	249.03	111.48	260.45	138.84	172.72	0.00	180.49	0.00
Economic Sector														
Trade, Hotels and Restaurants	78.26	44.28	75.42	42.86	73.13	42.83	83.00	62.86	80.74	61.20	80.33	38.26	78.86	36.22
Commutal Services	135.35	39.93	133.23	39.65	131.48	40.29	144.67	58.64	143.83	59.43	134.74	35.92	132.86	36.46
Industry	84.44	43.14	82.80	41.63	86.12	42.41	100.07	61.54	98.00	60.23	85.25	35.90	83.89	34.29
Transport and Communications	88.21	40.22	90.08	38.22	88.84	39.70	86.78	50.96	85.88	54.24	85.20	36.71	90.45	35.74
Estate Activity	120.57	56.97	125.65	55.08	121.75	53.91	139.24	101.01	146.46	86.69	123.46	40.68	128.87	38.73
Construction	70.11	43.38	72.28	42.22	73.83	43.64	78.64	59.67	79.76	58.18	70.97	39.08	70.81	38.60
Finance and Business Services	154.39	100.56	161.26	103.43	176.60	114.60	219.02	87.07	228.65	93.38	153.90	73.51	161.85	72.00
Agriculture	50.92	29.69	51.82	28.72	51.31	30.08	50.77	46.29	50.88	43.42	54.10	28.07	54.40	27.52
Others	125.35	33.12	136.16	30.23	142.53	32.56	137.69	64.73	149.50	58.69	125.31	29.79	136.36	30.05
Development Region														
No	84.96	33.81	81.27	32.15	97.68	38.81	76.96	52.43	74.03	48.77	84.97	30.67	81.03	29.53
Yes	111.60	51.34	114.16	51.22	114.52	49.23	127.80	68.07	131.18	69.86	111.73	43.19	114.57	42.83

Source: Authors' calculations using Household Surveys (GEIH)

Table A3. Wage Gap decomposition (2009-2011)

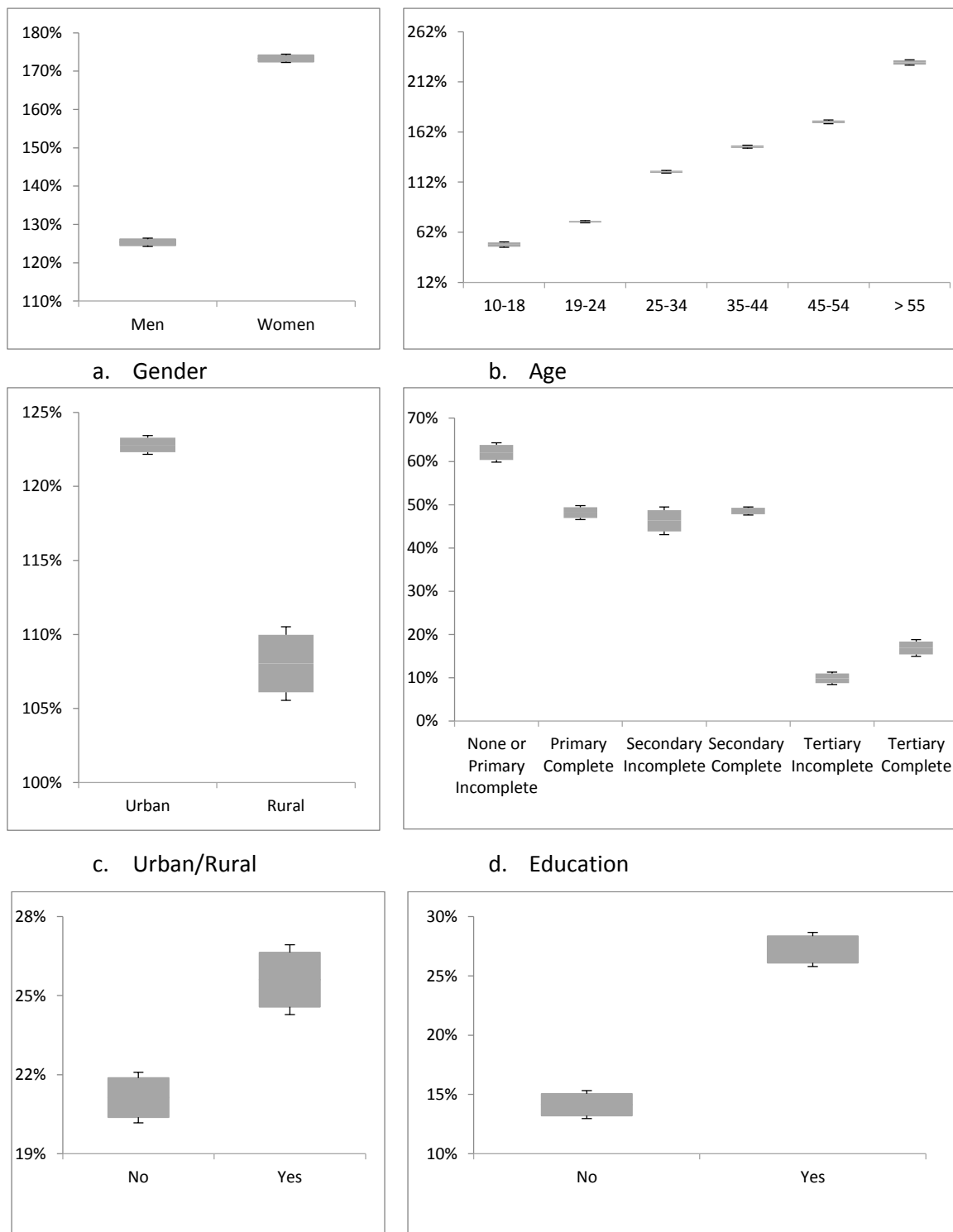
	DANE-II																	
	2009						2010						2011					
	Delta O	Delta F	Delta I	Delta X	CSF	CSI	Delta O	Delta F	Delta I	Delta X	CSF	CSI	Delta O	Delta F	Delta I	Delta X	CSF	CSI
	Delta= -58,5%						Delta= -59,7%						Delta= -58,5%					
<i>Demographic set</i>																		
Male	-0,59			0,00	1,00	1,00	-0,60			0,00	1,00	1,00	-0,59			0,00	1,00	1,00
+ Age	-0,58			0,00	1,00	1,00	-0,60			0,00	1,00	1,00	-0,58			0,00	1,00	1,00
+ Place of Residence	-0,56			-0,03	1,00	1,00	-0,57			-0,03	1,00	1,00	-0,55			-0,03	1,00	1,00
+ Schooling	-0,22		0,00	-0,37	1,00	0,99	-0,19		0,00	-0,41	1,00	0,99	-0,17	0,00	0,00	-0,41	1,00	0,99
+ Marital Status	-0,21	0,00	0,00	-0,37	1,00	0,99	-0,19	0,00	0,00	-0,41	1,00	0,99	-0,17	0,00	0,00	-0,41	1,00	0,99
+ Children under 5	-0,21	0,00	0,00	-0,37	1,00	0,99	-0,19	0,00	0,00	-0,41	1,00	0,99	-0,19	0,00	0,00	-0,40	1,00	0,99
+ Older than 65	-0,21	0,00	0,00	-0,37	0,99	0,98	-0,19	0,00	0,00	-0,41	0,99	0,99	-0,19	0,00	0,00	-0,40	0,99	0,99
Dummy another																		
+ worker	-0,21	0,00	0,00	-0,37	0,99	0,98	-0,19	0,00	0,00	-0,40	0,99	0,98	-0,19	0,00	0,00	-0,39	0,99	0,98
<i>Job-related variables</i>																		
& Qualified worker	-0,21	0,00	0,00	-0,37	0,99	0,98	-0,19	0,00	0,00	-0,40	0,99	0,98	-0,20	0,00	0,00	-0,39	0,99	0,98
& Type of worker	-0,43	-0,11	-0,01	-0,03	0,35	0,83	-0,43	-0,12	0,00	-0,05	0,34	0,82	-0,39	-0,13	0,00	-0,06	0,34	0,82
& Economic Sector	-0,19	-0,01	-0,01	-0,37	0,93	0,92	-0,21	-0,01	-0,02	-0,36	0,93	0,92	-0,18	-0,01	-0,03	-0,37	0,93	0,92
& Region	-0,21	0,00	0,00	-0,37	0,98	0,97	-0,17	0,00	0,00	-0,42	0,98	0,97	-0,19	0,00	0,00	-0,39	0,98	0,97
All variables	-0,36	-0,07	-0,08	-0,07	0,30	0,62	-0,38	-0,09	-0,07	-0,05	0,30	0,62	-0,37	-0,10	-0,06	-0,05	0,30	0,64

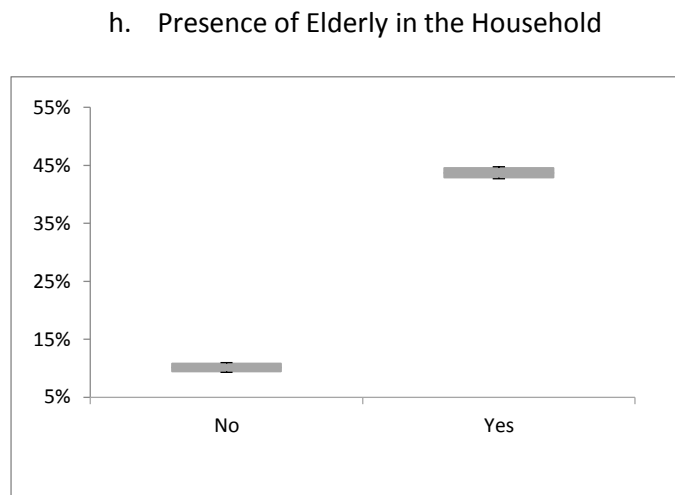
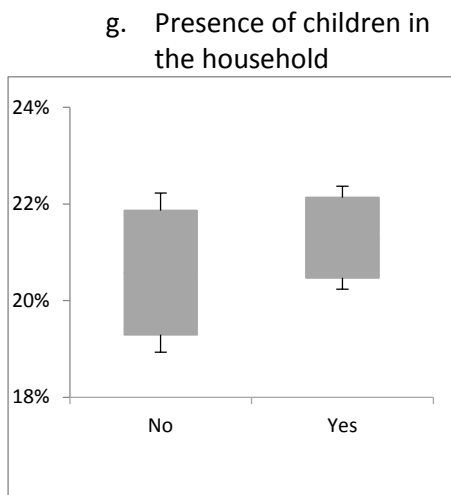
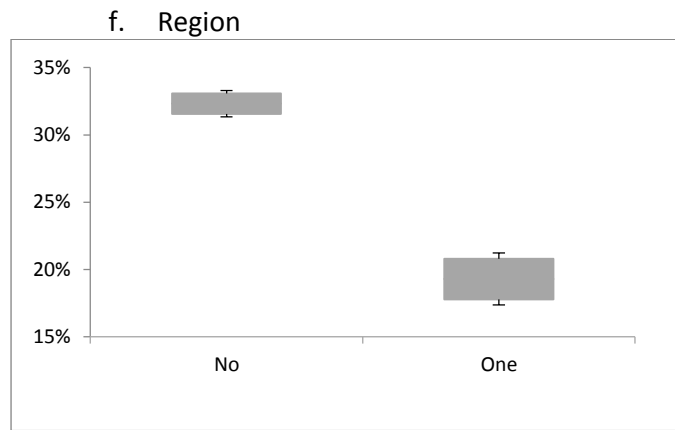
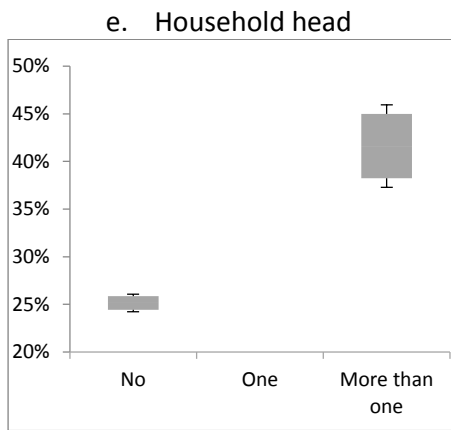
	WEAK-I																	
	2009						2010						2011					
	Delta O	Delta F	Delta I	Delta X	CSF	CSI	Delta O	Delta F	Delta I	Delta X	CSF	CSI	Delta O	Delta F	Delta I	Delta X	CSF	CSI
	Delta= -39,7%						Delta= -41,0%						Delta= -39,2%					
<i>Demographic set</i>																		
Male	-0,41			0,01	1,00	1,00	-0,42			0,01	1,00	1,00	-0,41			0,02	1,00	1,00
+ Age	-0,40			0,00	1,00	1,00	-0,41			0,00	1,00	1,00	-0,40			0,01	1,00	1,00
+ Place of Residence	-0,39			-0,01	1,00	1,00	-0,40			-0,01	1,00	1,00	-0,39			0,00	1,00	1,00
+ Schooling	-0,29		0,00	-0,10	1,00	1,00	-0,33		0,00	-0,08	1,00	1,00	-0,30		0,00	-0,09	1,00	1,00
+ Marital Status	-0,27		0,00	-0,12	1,00	1,00	-0,31		0,00	-0,10	1,00	1,00	-0,29		-0,01	-0,10	1,00	1,00
+ Children under 5	-0,28	0,00	0,00	-0,12	1,00	0,99	-0,31	0,00	0,00	-0,10	1,00	0,99	-0,29	0,00	-0,01	-0,09	1,00	0,99
+ Older than 65	-0,28	0,00	0,00	-0,12	1,00	0,99	-0,31	0,00	0,00	-0,09	1,00	0,99	-0,29	0,00	-0,01	-0,09	1,00	0,99
Dummy another																		
+ worker	-0,28	0,00	0,00	-0,12	1,00	0,98	-0,31	0,00	0,00	-0,10	1,00	0,98	-0,30	0,00	-0,01	-0,09	1,00	0,98
<i>Job-related variables</i>																		
& Qualified worker	-0,28	0,00	0,00	-0,12	1,00	0,98	-0,31	0,00	0,00	-0,09	1,00	0,97	-0,30	0,00	-0,01	-0,09	1,00	0,98
& Type of worker	-0,26	0,00	-0,02	-0,11	0,99	0,95	-0,31	0,00	-0,03	-0,08	0,99	0,94	-0,28	0,00	-0,03	-0,09	0,99	0,94
& Economic Sector	-0,28	0,00	-0,02	-0,09	0,98	0,89	-0,31	0,00	-0,04	-0,06	0,98	0,88	-0,29	0,00	-0,04	-0,06	0,98	0,88
& Region	-0,28	0,00	-0,01	-0,11	0,99	0,97	-0,30	0,00	-0,01	-0,10	0,99	0,96	-0,29	0,00	-0,01	-0,08	0,99	0,96
All variables	-0,18	0,00	-0,18	-0,04	0,93	0,70	-0,20	0,01	-0,20	-0,02	0,93	0,69	-0,20	0,00	-0,17	-0,02	0,94	0,71

	DANE-Modified																	
	2009						2010						2011					
	Delta O	Delta F	Delta I	Delta X	CSF	CSI	Delta O	Delta F	Delta I	Delta X	CSF	CSI	Delta O	Delta F	Delta I	Delta X	CSF	CSI
	Delta= -64,0%						Delta= -65,1%						Delta= -64,3%					
<i>Demographic set</i>																		
Male	-0,64			0,00	1,00	1,00	-0,65			0,00	1,00	1,00	-0,65			0,00	1,00	1,00
+ Age	-0,64			-0,01	1,00	1,00	-0,65			0,00	1,00	1,00	-0,64			-0,01	1,00	1,00
+ Place of Residence	-0,61			-0,03	1,00	1,00	-0,62			-0,03	1,00	1,00	-0,61			-0,03	1,00	1,00
+ Schooling	-0,39		-0,11	-0,15	1,00	0,89	-0,52		-0,03	-0,10	1,00	0,97	-0,48	0,00	-0,07	-0,09	1,00	0,95
+ Marital Status	-0,39	0,00	-0,12	-0,13	1,00	0,87	-0,50	0,00	-0,06	-0,09	1,00	0,91	-0,44	0,00	-0,11	-0,10	1,00	0,89
+ Children under 5	-0,37	0,00	-0,15	-0,12	1,00	0,84	-0,46	0,00	-0,12	-0,07	1,00	0,85	-0,41	0,00	-0,13	-0,10	1,00	0,87
+ Older than 65	-0,38	0,00	-0,17	-0,09	0,99	0,82	-0,45	0,00	-0,13	-0,07	0,99	0,83	-0,39	0,00	-0,14	-0,11	0,99	0,85
Dummy another																		
+ worker	-0,35	0,00	-0,20	-0,09	0,99	0,77	-0,40	0,00	-0,18	-0,06	0,99	0,77	-0,37	0,00	-0,17	-0,09	0,99	0,81
<i>Job-related variables</i>																		
& Qualified worker	-0,36	0,00	-0,20	-0,09	0,99	0,75	-0,41	0,00	-0,18	-0,06	0,99	0,76	-0,37	0,00	-0,18	-0,09	0,99	0,79
& Type of worker	-0,30	-0,04	-0,24	-0,07	0,30	0,64	-0,35	-0,04	-0,21	-0,05	0,30	0,62	-0,31	-0,05	-0,22	-0,06	0,29	0,65
& Economic Sector	-0,32	-0,01	-0,25	-0,06	0,93	0,61	-0,34	-0,01	-0,25	-0,05	0,93	0,60	-0,33	-0,01	-0,24	-0,07	0,93	0,60
& Region	-0,30	0,00	-0,25	-0,09	0,98	0,70	-0,32	0,00	-0,26	-0,07	0,98	0,72	-0,35	0,00	-0,20	-0,09	0,98	0,77
All variables	-0,23	-0,04	-0,31	-0,07	0,28	0,41	-0,25	-0,04	-0,32	-0,04	0,27	0,41	-0,26	-0,05	-0,28	-0,05	0,27	0,42

Appendix 2

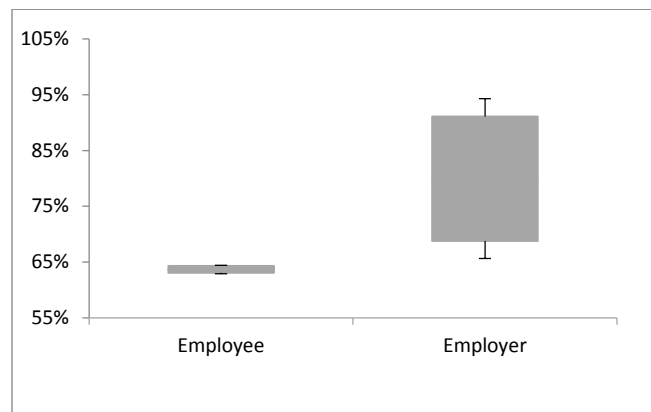
Figure A1. DANE-II. Confidence interval for the unexplained formal earnings gap (after controlling for demographic and job related characteristics) by different characteristics - year 2012.



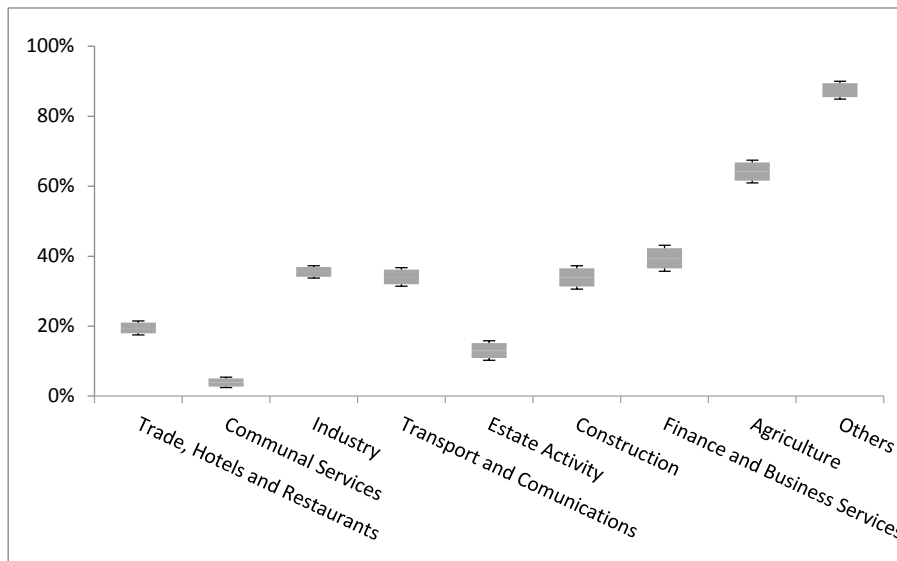


i. Aportant

j. Qualified



k. Type of employment



I. Economic sector



m. Marital status

Source: Authors' calculations using Household Surveys (GEIH)