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Abstract - In this paper, we explore the connection between labor market segmentation in two sectors, a modern protected formal sector and a traditional-unprotected-informal sector, and overeducation in a developing country. Informality is thought to have negative consequences, primarily through poorer working conditions, lack of social security, as well as low levels of productivity throughout the economy. This paper considers an aspect that has not been previously addressed, namely the fact that informality might also affect the way workers match their actual education with that required performing their job. We use micro-data from Colombia to test the relationship between overeducation and informality. Empirical results suggest that, once the endogeneity of employment choice has been accounted for, formal male workers are less likely to be overeducated. Interestingly, the propensity of being overeducated among women does not seem to be closely related to the employment choice.

JEL classification*:* O15; J21; J24
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1. Introduction

A main feature of almost all developing countries is the presence of a large proportion of workers employed in the unregulated-unprotected-informal sector. According to the dualistic view, based on the Harris and Todaro (1970) model, jobs are rationed in the formal sector due to labor market rigidities of an institutional nature, such as labor unions and minimum wages legislation. As a result some workers are forced to accept informal sector jobs characterized by precarious working conditions, lack of social security and inferior earnings. Most studies of labor markets in developing countries find that some characteristics are better rewarded in formal jobs (Pradhan and Van Soest, 1995; Tansel, 1999; Gong and Van Soest, 2001). However it is possible that rigidities associated with formal jobs might also affect the way workers match their actual education with the one required to perform their job. In a segmented labor market of such characteristics, as long as the more highly educated workers tend to be more productive than their less skilled counterparts, education may not provide access to good jobs. A highly skilled worker who is unable to obtain a high-skill job in the formal sector may accept a low-skill job in the informal sector for which she is overeducated. An individual worker is said to be overeducated if she has acquired more education than what is required to perform her job. Overeducation is, thus, often taken to imply that resources are not efficiently used, since overeducated workers make lower returns on their investment relative to similarly educated individuals whose jobs match appropriately their level of education. Here, we assume that overeducation in a developing country is not independent of market segmentation into formal and informal jobs.

There is now a substantial body of literature addressing the phenomenon of overeducation in developed countries.[1] An increasing amount of this literature is concerned with providing an explanation for overeducation that is consistent with one of the theoretical frameworks of the labor market: human capital theory (Becker, 1964), the job competition model (Thurow, 1975) or the assignment models

[1]Duncan and Hoffman (1981), Verdugo and Verdugo (1989), Sicherman (1991), Tsang et al. (1991), McGoldrick and Robst (1996) studied the phenomenon for the United States; Alpin et al. (1998), Green et al. (2002), Dolton and Vignoles (2000) and Chevalier (2003) for the UK; Hartog and Oosterbeek (1998) and Groot and Massen van den Brink (2000) for Holland; Bauer (2002) and Buchel and van Ham (2003) for Germany; Kiker et al. (1997) and Mendes de Oliveira et al. (2000) for Portugal; Alba-Ramirez (1992) for Spain. For an extensive review of overeducation in developed countries see McGuinness (2006).

(Tinbergen, 1956). The majority of studies tend to support the assignment interpretation, arguing that earnings depend to some extent on both individual and job characteristics. These models also imply that there is no reason to expect wage rates to be correlated only to acquired schooling or other individual attributes (human capital theory), nor should it be expected that individual productivity and, hence, earnings will be determined solely by job characteristics (job competition model). In addition, a number of studies have also estimated the effects of overeducation on earnings. These studies show that overeducated workers tend to earn higher returns to their years of schooling than co-workers who are not overeducated, but lower returns than workers with a similar level of education who are employed in jobs that require the same level of education that they possess.

To the best of our knowledge, few studies have examined overeducation in developing countries. Quinn and Rubb (2006) study the phenomenon for Mexico, Abbas (2008) for Pakistan and Mehta et al. (2011) for India, Mexico, the Philippines and Thailand. One reason for this paucity of studies might be data limitations that hinder identification of the education levels required for specific jobs. Moreover, despite the increase in recent decades in average schooling attainment in developing countries, the average presented in these economies is lower than that presented in high-income countries. In Latin American and Caribbean Countries the average educational attainment for females and males between the ages of 21 and 24 are 9.6 and 9.3 years, respectively (Duryea et al., 2007). By comparison, the average for the OECD countries is 12.5 for males and 12.8 for females aged between 25 and 34 (OECD Education at a Glance, 2010). The fact that educational attainment remains low in developing countries means that the overeducation is a somewhat contradictory phenomenon for these economies. Nevertheless, previous studies find evidence of overeducation in developing countries (Quinn and Rubb, 2006 for Mexico; Abbas, 2008 for Pakistan and Mehta et al., 2011 for unskilled jobs in the Philippines) and report that the incidence of overeducation is similar to that present in developed economies.

Given the differences between the labor markets of developed and developing economies, it is plausible that the factors accounting for overeducation may differ. As has already been mentioned labors markets of developing economies are characterized

by a high degree of informality. In the specific case of Latin America, the informal sector employs between 30 and 70% of the urban work force (Maloney, 2004), embracing a variety of heterogeneous activities, such as self-employed entrepreneurs, salaried workers employed in large and small firms, and unpaid domestic workers. Besides the well-known negative implications of informality, primarily the result of poorer working conditions, a segmented labor market (divided between a formal and an informal jobs) might also affect the way workers match their acquired education with the education required to perform their job. As Berry and Sabot (1978) affirm, "one of the inefficiencies associated with segmentation, more difficult to document but possibly imposing greater resource costs on the economies of developing countries, involves the failure of the market to move the 'right' resources into high wage sectors, a failure commonly described by the term 'mismatch'". Building on this statement, here we assume that the study of overeducation in a developing economy with a large informal sector cannot fail to examine the role played by this segmentation.

Our assumption also builds on a model developed by Charlot and Decreuse (2005). This model show that self-selection in education is inefficient in presence of labor market segmentation. As workers do not internalize the impact of their education decision on the others wage and employment perspectives, too many workers are willing to acquire education and this leads to overeducation. In our opinion, this is a reasonable explanation for educational mismatch in the labor markets of developing countries that presents labor market segmentation into a formal and an informal sector. In contrast with (some) developed countries in which overeducation is clearly associated with large endowments of education, the population in developing economies presents low or moderate levels of education attainment. Formal and informal labor market segmentation is, thus, a phenomenon that could account for overeducation in these economies. However, this model it is not able to predict in which sector the incidence of overeducation will be highest; in this regard our empirical exercise tries to shed light on this issue.

Colombia is a good example of a developing country characterized by the high degree of informality in its labor market, and the country's informal employment makes an interesting case to study for several reasons. First, informality today is at the center of

economic debate in the country because of the high levels that prevail. Second, previous studies have found overeducation to exist in Colombia (Mora, 2005 and Castillo, 2007). Finally, studies of informality in Colombia and other developing countries focus primarily on the size of the informal sector and on the effects of labor market rigidities on employment, wages and their distribution, and on the probability of workers entering the informal sector.[2] However, little attention has been paid to the effects of a large informal sector on the way workers match their education with that required to perform their job. If labor market segmentation can lead to education-occupation mismatches, then it may also affect the allocation of resources in the educational system, one manifestation of which is the bias toward academic training (Berry and Sabot, 1978).

Summing up, in this paper we study the contribution of working in a formal or an informal job on the probability of being overeducated in a developing country with low or moderate educational attainment. We hypothesize that in developing countries with a large informal sector, educated workers that do not find a high skilled formal job may accept an unskilled informal job for which she is overeducated, i.e. informal workers are more likely to be overeducated than formal workers. We test the positive relationship between informality and overeducation by exploiting information in a micro-data set for Colombian workers. In so doing, two types of empirical models are used: firstly, a simple univariate probit model that assumes that the unobservable characteristics that affect an individual's chances of working in either formal or informal jobs are independent of those determining her propensity to be overeducated; and, secondly, a bivariate probit model that enables us to control for the likely endogeneity of the selection of the formal or informal job. Our results confirm that, conditional on other individual and family characteristics, formal workers present a significantly lower probability of being overeducated. This general result seems to be driven by the fact that male informal workers face a greater probability of being overeducated, whereas no significant differences are detected between informal and formal female workers.

[2] Magnac (1991), Nuñez (2002), Maloney and Nuñez (2004), Floréz (2002), Kugler and Kugler (2009) and Mondragón-Vélez et al. (2010) for Colombia; Pradhan and van Soest for Bolivia (1995); Pratap and Quintin for Argentina (2006); Tansel (1999) for Turkey and Gong and Van Soest (2002) for Mexico.

The rest of the paper is organized as follows. The next section gives the details concerning the data and some selected descriptors are given in section 2, while the empirical approach is presented in section 3. Section 4 summarizes the estimate results of the empirical models, section 5 presents some robustness checks and, finally, section 6 concludes.

2. Data and descriptive statistics

We use data from the 2008 wave of the Colombian Household Survey (CHS), a repeated cross-section conducted by the National Statistics Department (DANE). This survey gathers information about employment conditions for a population aged 12 years or more and includes data about income, occupation, industry, and firm size, in addition to the individual's general characteristics of sex, age, marital status and educational attainment. Certain household characteristics, such as the head of the household, the number of children, and the level of education of all its members, are also included. The CHS covers the thirteen major metropolitan areas of Colombia, which in 2008 accounted for 45% of the country's population. It should be noted that this survey has been used for various empirical studies analyzing labor market issues in Colombia (see, for example, Magnac, 1991; Attanasio et al., 2004 and Goldberg and Pavcnik, 2005).

The analysis conducted herein was limited to employed individuals between the ages of 15 and 60 that were not undertaking formal studies and who reported working between 16 and 84 hours per week. Government employees, household employees, the self-employed, bosses or employers, unpaid family workers, workers without pay in enterprises or other family businesses and day laborers were not included in the sample. The subsequent sample used in the analysis comprised 15,104 observations.

As a starting point in our analysis, we had to use a criterion to determine whether a worker in the sample is overeducated, and if that worker is employed in the formal or informal job. Four basic methods have been suggested in the literature for measuring the education required for a job and, consequently, for determining overeducation. The first 'subjective' approach uses self-assessment to define the job's educational requirements and then compares this with the worker's actual education (Battu et al.,

2000 and McGuinness, 2003). The second is a variation on the above and involves asking the worker directly whether he or she is overeducated (Devillanova, 2012). Overeducation can also be calculated objectively by using job analysts definitions of the educational requirement for each occupation, as available in the United States Dictionary of Occupational Titles, and comparing this with the workers educational level (Rumberger, 1987; Hartog and Oosterbeek, 1988; Kiker and Santos, 1991; Chevalier; 2003). An alternative objective measure is obtained by analyzing the distribution of education in each occupation; employees who depart from the mean (Verdugo and Verdugo 1989) or mode (Mendes de Oliviera et al. 2000) by more than one standard deviation are classified as being overeducated. This last approach is usually known as the 'statistical' method.

Since the CHS does not supply information to construct a subjective measure of overeducation, and taking into account that the requirements of education in the rather broad categories of occupations (two-digit ISCO classification) available in the CHS are likely to differ from those in the US economy, we decided to follow other studies in the literature in applying the 'statistical' approach based on the mean of the distribution of education within each two-digit occupation.[3] By using such an objective measure, the overall incidence of overeducation in the sample was found to be 15%, a figure similar to that reported for other developing economies (Quinn and Rubb, 2006) and lower than the incidence of overeducation in developed economies (McGuinness, 2006).

As regards informality, alternative definitions and corresponding ways of measuring it have been proposed in the literature. This lack of consensus largely reflects issues of data availability in each study. In the particular case of Colombia, according to DANE, informal workers are those who fall into at least one of these categories: (i) work in firms with five or fewer employees; (ii) are unpaid family workers and housekeepers; (iii) are self employed who work in places of up to five persons other than independent professionals and technicians; or (iv) are business owners of firms

[3] As stressed in Ramos and Sanromà (2011), a two-digit classification of occupations is not optimal for applying the mode criterion. In addition, Mehta et al. (2011) emphasized that the modal education is more prone to shift even when technology and the jobs-pool do not. In any case, we also computed the results of the following sections using the mode criterion, and the main conclusions remained the same as those derived from results using the mean criteria (results are available upon request).

with five or less employees. This definition, in line with that proposed by the International Labor Office, has been criticized in the literature because it does not take into account the benefits associated with formal employment, such as inclusion in the social security system (Flórez, 2000). Nevertheless, the data made available by the CHS allow us to determine whether the workers in the sample are covered or not by the social security system, and it even distinguishes between contributions to the retirement pension and to the health system. Using this information, we classified workers as formally or informally employed according to their degree of inclusion in the social security system. That is to say, an individual was classified as a formal worker if she contributed to both health and retirement pension systems. Applying this condition, as many as 33.3% of individuals in the entire sample worked in informal jobs.[4]

The incidence of overeducation in the entire sample and in the two jobs, and the percentage of Colombian workers in the formal and in the informal jobs are shown in the first set of rows in Table 1. This table also displays basic summary statistics concerning the distribution of the individual and job characteristics considered in the subsequent analysis, distinguishing in this regard between workers in the formal and informal jobs. In addition, to obtain some insights into differences by gender in the magnitudes under analysis, figures were computed for the entire sample and for men and women separately.

As mentioned above, 15% of Colombian urban workers were overeducated, this figure being higher in the case of formal workers (17%) than for those employed in informal jobs (11%). This gap of six percentage points is found for both male and female workers. As for the distribution of workers in each job, around one third had an informal job in 2008, this percentage being higher for men (35%) than for women (31%). Differences in overeducation between the two jobs, and by gender, might simply be caused by disparities in the distribution of the characteristics that are assumed to affect the incidence of overeducation. Actually, the comparison of the figures reported in Table 1 confirms that there are substantial differences in some of the observable worker and job characteristics of formal and informal workers. As a

[4] Self-employment in Latin America generally constitutes one of the principle sources of employment and a large proportion of the self-employed operate in the informal sector. If the sample is not restricted to exclude self-employees, the percentage of

matter of example, the number of years of schooling, as a measure of education, are not only useful as a proxy for general human capital but they are also likely to be correlated with unobserved individual ability. What the figures show is that informal workers are more likely to have education levels below those of formal workers: whereas 45% of informal workers in the entire sample have at most basic secondary education, the percentage of workers in formal jobs with secondary or tertiary education is as high as 81% (45% with tertiary education). If, as expected, there is a strong association between education and the likelihood of overeducation, such a gap in educational attainment could explain much of the difference observed in the overeducation figures between the two jobs.

There are significant differences in other characteristics as well. The percentage of female workers in formal jobs is higher than that in informal, perhaps due to the fact that our sample excludes self-employed individuals. A much larger proportion of the workforce in formal jobs is married, and workers in those jobs tend to accumulate much more tenure than informal workers, suggesting a higher stability of employment for formal workers. As for the occupational structure, the share of informal workers in unskilled manufacturing and agricultural occupations (42%), and the share in merchant, vendor and service jobs (36%) is larger than that in formal jobs, while administrative staff (24%) and professionals and technicians are more strongly represented in formal jobs. Finally, it is worth mentioning that more than two thirds of informal workers are employed in small firms, with 10 or less workers. This is in sharp contrast with figures of formal jobs, where more than half formal workers work in firms with more than 100 employees, and around two thirds in firms with at least 50 employees. In short, these figures indicate a close connection between informality and firm size in Colombia.

As for the gender component, Table 1 shows that male and female workers differ in some of the characteristics that are supposed to affect overeducation. Interestingly, the most remarkable differences affect the distribution of education levels and occupations. Broadly speaking, female workers are more highly educated than their male counterparts, and find themselves concentrated in occupations such as

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informal workers increases up to 59% for 2008.

administrative staff (24%), merchant and vendor jobs (22%) and service work (20%), while men are more highly concentrated in unskilled manufacturing and agricultural occupations (48%), which are associated with higher levels of informality.

This simple descriptive analysis suggests i) the presence of quite large levels of overeducation in Colombia, ii) apparently, affecting more intensively formal workers than in the informal workers, and iii) that formal and informal workers differ in their levels of educational attainment, occupational distribution, and other individual and job characteristics, which are thought to exert an influence on the individual's probability of being overeducated. Since the greater incidence of overeducation in formal jobs might well be caused by a composition effect (for example, associated with the higher education of workers in that jobs), in the section that follows we estimate the impact of informality on overeducation but in relation to the conditioning factors of observable worker and job characteristics.

3. Informality and overeducation. Empirical specification

A multivariate empirical model needs to be specified in order to assess the impact of formal or informal jobs on the probability of Colombian workers being overeducated, conditional on other observed individual, household and job characteristics. In so doing, we first assume that the allocation of a worker to a formal or informal job is exogenous to her chances of being overeducated. Under such an assumption, a univariate probabilistic specification provides consistent estimates of the effect of the job on the chances of the worker having more education than that required for her occupation. However, the endogeneity assumption can easily be questioned. Were this to be the case, the standard probabilistic specification with exogenous covariates would lack consistency. To address this issue, we estimate the effect of the sector by means of a bivariate specification in which this variable is instrumented.

Briefly, a simple way to identify the determinants of educational mismatch is to assume a latent continuous (unobserved) variable Y_i^* for the probability of overeducation of worker *i*, which is related to a linear index function and an additive error term, ε_i:

$$Y_i^* = \beta X_i + \alpha S_i + \varepsilon_i \qquad (1)$$

where X_i is a vector of individual and firm characteristics (including age, gender, marital status, head of household, education, tenure, occupation, industry sector, contract type and the unemployment rate of the metropolitan area), S_i is a dummy variable for the job (formal or informal), and ε_i is a normally distributed error with zero mean and unit variance.

The observed dichotomous realization Y_i of the latent variable Y_i^* is as follows:

$Y_i = 1$ if the individual is overeducated ($Y_i^* \geq 0$)

$Y_i = 0$ otherwise

Given the normality of the error term in (1) a probit specification can be used to estimate the effect of the job on the probability of being overeducated, conditional on the other characteristics in *X*:

$$prob[Y_i = 1] = prob[\beta X_i + \alpha S_i + \varepsilon_i > 0] = \Phi[\beta X_i + \alpha S_i] \qquad (2)$$

where Φ[] is the evaluation of the standard normal cdf.

Since the estimate of the coefficient α is only informative about the sign of the impact of *S*, its associated marginal effect is computed from the estimates of the probit model in (2) as:

$$\partial[P(Y=1)/S]_{\bar{X}} = \Phi(\beta \bar{X} + \alpha) - \Phi(\beta \bar{X}) \qquad (3)$$

where the bar over the X denotes the sample average.

As indicated above, the assumption made in the specification of the univariate probit in (2) is that the job (formal or informal) is exogenous to the probability of being

overeducated. However, if the assignment of workers to each of the sectors is not random and some unobservable factors (ability among others) that influence the probability of being assigned to a particular job are also affecting the probability of being overeducated, then the estimation of a univariate probit would suffer from selection bias.[5] This would have dramatic consequences on the inference since the estimates from the univariate probit would be inconsistent if this endogeneity was ignored.

To take account of this potential drawback properly, in a second step, we estimate the effect of the job in a bivariate probit model, in which the job is instrumented by family characteristics. In addition to the latent outcome equation in (1), the bivariate model is based on an additional equation for the latent model linking the probability of assignment to the formal or informal job to a set of characteristics:

$$S_i^* = \gamma Z_i + \mu_i \qquad (4)$$

where Z_i is a vector of observed individual and family characteristics, and μ_i is a normally distributed error term. Z_i includes the set of characteristics in X_i plus some additional variables used as instruments for the assignment to the job, S_i^*.

Since we can only observe the job for each individual, the link between the observed binary variable S_i and the latent variable S_i^* is assumed to be as follows:

$S_i = 1$ if the individual works in the formal sector ($S_i^* \geq 0$)

$S_i = 0$ otherwise

Therefore, the probit specification associated with the probability of working in a formal job, conditioned to the characteristics in *Z*, stands as:

[5] We have ignored another type of selection whereby an individual might not accept a job that does not match his or her level of education and chooses instead to be unemployed or to remain outside the labor force. We argue that this selection bias is irrelevant in the case of Colombia where there is no unemployment benefit system and the family protection network against unemployment is low or exclusive to a group of high-income individuals.

$$prob[S_i = 1] = prob[\gamma Z_i + \mu_i > 0] = \Phi[\gamma Z_i] \tag{5}$$

The bivariate probit thus consists of equations (2) and (5), where μ_i and ε_i are distributed bivariate normal, with E[μ_i] = E[ε_i] = 0, *var*[μ_i] = *var*[ε_i] = 1 and *cov*[μ_i, ε_i] = ρ. In other words, the empirical model allows for the likely correlation of the unobserved determinants of overeducation and the unobserved determinants of the sector. In such a framework, there are four possible states of the world (Y_i= 0 or 1 and S_i = 0 or 1), and the corresponding log-likelihood function associated to this set of events is (for further details see Wooldridge p.478, 2002):

$$\begin{aligned} L = & \sum_{Y_i=1, S_i=1} \ln \Phi_2[\beta X_i + \alpha S_i, \gamma Z_i, \rho] + \\ & \sum_{Y_i=1, S_i=0} \ln \Phi_2[\beta X_i, -\gamma Z_i, -\rho] + \\ & \sum_{Y_i=0, S_i=1} \ln \Phi_2[-\beta X_i - \alpha S_i, \gamma Z_i, -\rho] + \\ & \sum_{Y_i=0, S_i=0} \ln \Phi_2[-\beta X_i, -\gamma Z_i, \rho] \end{aligned} \tag{6}$$

The inference in the bivariate probit model is based on the maximization of the log-likelihood in eq. (6) with respect to the parameters β, α, γ and ρ. If ρ is statistically different from 0, estimates from the bivariate probit are preferable; otherwise conclusions regarding the impact of the sector could be based on the estimate of the univariate probit in eq. (2).[6] Marginal effects are computed from the estimates of the bivariate probit model using a similar formulation to that for the univariate probit model.

Two issues that usually result from the estimation of a bivariate probit model with an endogenous binary regressor are identification and the selection of valid instruments. Identification can be achieved by relying solely on the functional form and the distributional assumptions. However, the objective of forming a consistent estimator for α becomes manageable if we can construct at least one instrument for S_i. A

[6] A bivariate probit model with an endogenous binary regressor has been used in, for instance, Evans and Schwab (1995) to analyze the effect of catholic schools on finishing high school and starting college.

variable I_i would be a valid instrument for S_i if it were a determinant of the sector of employment and it were not correlated with the error term of the overeducation equation (outcome equation). The first condition is easy to check; we can verify whether Z_i is correlated with S_i, once the other variables have been controlled for. However, it is harder to test if the instrument is valid or not. In the context of the bivariate probit model, this condition relies on the economic or institutional knowledge related to the problem under study.

As in many other studies, finding suitable instrumental variables is far from straightforward, since almost any regressor that determines the probability of being overeducated could plausibly affect assignment into formal and informal jobs as well. Previews studies about informality, control for household characteristics that may affect a person's propensity to have an informal job such as the number of children in a household, number of inactive adults in a household, and earnings of other household members (Hill, 1983; Magnac, 1991, Marcouiller et al., 1997; Goldberg and Pavcnik, 2003; Maloney, 2004). To the best of our knowledge, in the over-education literature only Mavromaras and McGuinness (2012) use the presence of children as a control variable in probit estimations of overskilling. [7] The authors only report a marginal statistical significance for the coefficient of this variable, and only for the group of moderately overskilled workers. Thus, it could be the case that certain family characteristics influence an individual's choice regarding formal or informal employment but do not affect overeducation, such as the presence of children in the household and the earnings of other household members. One reason why such family characteristics may affect the sector of employment is because they are closely related to the households income needs. For instance, having more children means more expenses for the household and increase the need of finding a job, which is presumably more easily available in the informal sector. On the other side, informal sector is characterized by greater flexibility in the working hours, which aids combining working life with childcare. The assumption here is that the presence of children does not exert a significant effect on the propensity to be overeducated.

[7] The authors define overskilling as the situation where a worker reports that their skills (related to education and work experience) are not fully utilised in their job.

Another family characteristic that is thought to influence the choice of employment sector but not the individual's propensity to be overeducated is the social status, which we suggest is captured by the educational achievement of other members of the household. Accordingly, we construct the average number of years of schooling of other household members and use this as an additional instrument for the sector of employment.

4. Informality and overeducation. Results

The maximum likelihood estimates of the coefficients when running the univariate probit model are reported in Table 2 both for the entire sample and separately for male and female workers. The corresponding marginal effects for the average individual as defined in eq. (3) are also reported. Our results show that after controlling for other characteristics, formal workers are less likely to be overeducated than their informal counterparts. In other words, when we compare formal and informal workers with similar individual, household, and firm characteristics, those in the former group have a lower propensity to be overeducated. This contrasts sharply with the raw probabilities derived from the sample since, as the descriptive analysis in section 2 shows, the share of overeducated workers in formal jobs is greater than that in informal jobs. Thus, these results suggest that a sorting effect drives the gap in the raw propensities.

Yet, it should be mentioned that the marginal effect associated with working in formal jobs is of a moderate magnitude. The probability that a formal worker is overeducated is just 2.5 percentage points (pp) less than that for an otherwise similar informal worker. The impact on probability is even lower for men at 1.86 pp, and somewhat higher for women at 2.72 pp. Interestingly, the coefficient and the corresponding marginal effect are statistically significant only at the 5% confidence level in the separate samples for both genders. Thus, the results from the univariate probit model suggest a modest impact of formality on overeducation having first controlled for education and other observable characteristics.

In the case of the estimates of the coefficients for the control variables, the results shown in Table 2 are consistent with previous findings in the literature. For the sake

of brevity, we only comment on the results for the whole sample. As expected, the probability of being overeducated increases with educational attainment (Alba-Ramirez, 1993; Kiker et al., 1997 and Quinn and Rubb, 2006). Overeducated workers may substitute education for a lack of job experience, taking jobs that require less education than they actually possess in order to accumulate experience and improve their chances of finding a better job match (Rosen, 1972; Sicherman and Galor, 1990 and Mendes de Oliveira et al., 2000). As such, we expect overeducated workers to have less job experience. To test this hypothesis we use a variable that measures experience, specifically potential experience calculated as an individual's age minus five years of education. On the other hand, several studies report that overeducation may have a negative effect on job satisfaction (Tsang et al., 1991), if this is the case, then overeducated workers with more tenure in a firm can be expected to be more prone to turnover. Consequently we hypothesize that overeducated workers will have less tenure. The results for the estimated marginal effect of general experience confirm the expected negative effect of this variable on the probability of an average worker in the sample being overeducated. However, it should be pointed out that this marginal effect is only significantly different from zero at a 10% confidence level. The impact of tenure is also negative, though almost negligible and, not in fact statistically significant. Therefore, the results for Colombia are in conflict with the evidence on the substitutability between education and other forms of human capital postulated by the human capital theory, according to which overeducation might be seen as a transitory situation.

The results also indicate that females are less likely to be overeducated than males presenting similar characteristics, and that marital status does not have a statistically significant impact on the probability of being overeducated for both genders. Significant differences do exist however in terms of industry and firm size. Compared to individuals employed in Agriculture, mining, electricity, gas and water (our reference category), those employed in construction are more likely to be overeducated, while those working in transportation, financial intermediation and social services are less likely to be overeducated. As for firm size, the incidence of overeducation conditional on other characteristics is slightly lower for small (4 to 50 workers) and substantially lower for medium size firms (51 to 100 workers). Finally, it is worth mentioning that local labor market conditions do not seem to be relevant,

as the coefficient of the metropolitan unemployment rate, although positive, is not statistically significant.

However, it should be borne in mind that the specification used to obtain these results assumes the exogeneity of the employment and the absence of a simultaneous impact of the unobservable characteristics on the probability of overeducation and on the assignment of formal or informal jobs. The violation of these assumptions would invalidate the results.

Our estimates of the effect of the job, when relaxing the assumption of exogeneity and the lack of correlation between the unobservable variables that influence both overeducation and formality/informality, are summarized in Table 3. These results correspond to the maximum likelihood estimates obtained from the bivariate probit model described in section 3, using instruments for the employment sector and the same set of control variables as those employed in the univariate probit model. Here, the discussion focuses solely on the coefficients of the equation for the probability of being overeducated since the estimates obtained for the parameters in the formal/informal sector equation (see Table A1 in the appendix) are relatively standard, and largely conform to results reported elsewhere (Magnac, 1991 and Pradhan and van Soest, 1995). Below, we first examine the entire sample of Colombian workers, and then discuss the differences that emerge between the samples of male and female workers.

The coefficient of the formal job and the corresponding marginal effect are estimated to be negative and highly significant. In fact, the magnitude of the marginal effect of working in formal jobs estimated from the bivariate probit model is substantially higher than that estimated by the univariate probit model. The results suggest that, for otherwise similar workers, working in formal jobs reduces the probability of overeducation by 16.44 pp. This finding confirms that selection bias strongly affects the estimate of the effect of the employment sector on the probability of being overeducated and, hence, the need to account for it. On the other hand, it seems that, in addition to the benefits associated with receiving social security and higher wages, being a formal worker also ensures a better use of one's skills in the workplace. Or, alternatively, informal workers, in addition to receiving lower wages and no health

and pension cover, are less likely to make proper use of their acquired knowledge in the workplace. As discussed in the introduction, to the best of our knowledge this finding has not previously been recorded, and represents a novel contribution of this study.

Note that the estimate of ρ (correlation between the error terms of the overeducation and the employment sector equations) is positive and statistically significant, suggesting that non-observable characteristics that exert a positive effect on the probability of being formal employed also have a positive impact on the probability of being overeducated. This could be interpreted as evidence that in the case of formal workers overeducation is caused, to some extent, by the desire to form part of the formal sector (better employment opportunities, social system protection, etc.). A worker with a certain level of education might take a job for which less education is actually required, simply because that job is protected, for example, by the minimum wage.

An alternative interpretation of the positive effect of unobservable factors on the probability of being overeducated can be made from within an internal labor market framework (Doeringer and Piore, 1972). Internal labor markets are those in which workers are hired into entry-level jobs, while higher levels are filled from within. Certain rules differentiate the members of the internal labor market from outsiders and accord them rights and privileges that would not otherwise be available. Typically these internal rights include certain guarantees of job security and opportunities for career mobility. If an internal labor market exists, then there must be some jobs, presumably at high levels, that are filled almost exclusively through internal promotion and there must be other port-of-entry jobs, presumably at low levels, that are filled through external hiring. In this context, individuals in any given firm are hired into its lower or middle levels and subsequently succeed in advancing to higher levels. Workers that do not have the qualifications for particular entry-level jobs are thus excluded from accessing the entire job ladder. For this reason, workers may initially accept a job for which their actual education is higher than that actually required in exchange for the benefits of gaining access to an internal labor market. It

should be stressed that internal labor markets operate in the primary sector (formal) rather than in the secondary sector (informal).

As for the estimate of the coefficients, and the associated marginal effects of the other observable characteristics in the overeducation equation, they are, in general, roughly identical to those estimated with the univariate probit, with the exception of firm size. The estimates from the bivariate probit model indicate that compared to individuals working for micro-firms (those with less than 10 workers), workers in small, medium and large firms are more likely to be overeducated. This result can be interpreted as follows: large firms usually have better job opportunities (as well as paying higher wages), and workers have better chances of being promoted and of receiving more on-the-job training. These characteristics mean that job offers from large firms are valued highly by job seekers who might apply for vacancies in which the required level of education is less than the one they have acquired. Likewise, large firms in the formal sector are in a position to select the most highly skilled from the pool of available workers. Yet, it should be pointed out that the impact on overeducation is weaker in the case of medium size firms (between 50 and 100 workers), where the coefficient is not, in fact, statistically significant.

Finally, we should stress that the results by gender point to a substantial difference in the impact of the job on the probability of being overeducated. Whereas, for a male, having a formal job reduces the propensity of overeducation by 20.09 pp compared to a similar informal male worker, for females the effect is lower, 10.71 pp and its only statistical significance at the 5% confidence level. Interestingly, for the female workers we do not find a significant correlation between the errors of the two equations in contrast with the highly significant correlation coefficient for males.

6. Robustness checks. Validity of the instruments

The estimates of the bivariate probit presented in Table 3 are consistent and unbiased as long as the instruments are correlated with the probability of working in formal or informal jobs but not with the error term of the over-education equation in (2). In order to investigate if the selected instruments are valid we implement a procedure suggested by Cohen-Zadar and Elder (2009) and also implemented by Kim (2011).

This approach is based on the idea that the instruments, presence of children and average years of education of the other members of the household, exert an effect on the probability of over-education only through the job, if it is formal or informal, but not directly. If the instruments do not influence the probability of overeducation apart from its effect on the job, it should have no effect in the overeducation in a subsample of workers for whom the probability of working in informal or formal jobs is closely to zero. One can argue that public employees are a specific group of workers for whom the probability of working in informal jobs is approximately zero.[8] Then, for this subsample of workers, the instruments should have no effect in the probability of being overeducated. Table 4 reports the effects of the educational achievement of other members of the household and the presence of children estimated from a probit overeducation equation for public employees, conditioning on the other set of controls used for the estimates of the probit overeducation equation for private employees in Table 3. Results in Table 4, for the total sample and for women working in the public sector, confirm that the coefficients of the instruments are not statistically significant, which means that the instruments do not exert a direct effect on the probability of being overeducated. In the case of men the educational achievement of other members of the household is statistical significant only at 5% but its marginal effect is considerably low -0.0075. Although an insignificant estimate for the coefficient associated to this variable is not guarantee of exogeneity, it does provide some evidence that its use as an instrument is likely not to be problematic.

Last as a sensitive analysis for the IV estimates, we estimate the effect of the sector of employment on the probability of being overeducated using different set of the instruments. This sensitive analysis is presented in Table 5. The results of the biprobit when using only as an instrument the presence of children are summarized in column 2, whereas those using only the average years of education of the other members of the household as an instrument are shown in column 3. As it can be seen the results are fairly robust to the set of instrument chosen.

[8] As a matter of fact, only 3.9% of the public employees report that they don't make contribution to the health and old insurance system in contrast with the 33% of workers from private firms.

7. Conclusions

This study has sought to add to the overeducation literature examining developing countries by analyzing the connection between labor market segmentation (the modern, protected, formal sector, on the one hand, and the traditional, unprotected, informal sector, on the other) and overeducation in Colombia. To date, studies concerned with informality in developing countries have focused primarily on the size of this sector, on the effects of labor market rigidities on employment, wages and their distribution, and on the probability of a worker entering the informal sector. However, no attention has been paid to the effects that a large informal sector has on the way workers match their education with that required to perform their particular job. This study offers some new evidence in this respect.

Using micro-data for Colombia, we have estimated two types of empirical models in order to test the relationship between overeducation and informality: a simple univariate probit model for the probability of being overeducated that includes the job in which the individual is employed as an explanatory factor, formal or informal; and a bivariate probit model with an endogenous regressor that considers that the assignment of workers to each of the jobs is not random and some unobservable factors which influence the probability of choosing a particular job, could also affect the probability of being overeducated. The results of the univariate probit estimation indicate that formal workers are less likely to be overeducated than their informal counterparts. However, we have also shown that the assignment of workers to the formal or informal jobs is not random and that some unobservable characteristics that influence the probability of choosing a particular job also affect the probability of being overeducated, particularly as regards male workers.

The results obtained from the bivariate probit model for the probability of overeducation, once the potential endogeneity of sector choice and overeducation were taken into account, show that formal workers are less likely to be overeducated and that non-observable characteristics that exert a positive effect on the probability of being a formal worker have a positive impact on the probability of being overeducated, in the case of male workers only. This could be interpreted as evidence that for formal male workers, overeducation is caused, at least in part, by a desire to

have a formal job (better employment opportunities, social system protection, etc.). A worker with a good education may take a job for which less education is required, because that job is protected, for example, by the minimum wage.

Although we are aware that our results have some shortcomings, including the fact that better and more suitable instruments might have been used, we believe that they are conclusive in terms of the correlations reported and in providing an initial understanding of the importance of the effect of labor market segmentation on the probability of being overeducated. According to our results it seems that, in addition to the benefits associated with receiving social security and earning higher wages, being a formal worker also ensures a better use of acquired skills in the workplace. To the best of our knowledge, no study has presented evidence of this to date.

References

Abbas, Q. (2008). Over-education and under-education and their effects on earnings: Evidence from Pakistan,1998–2004. *SAARC Journal of Human Resource Development, 4*, 109–125.

Alba-Ramírez, A. (1993). Mismatch in the Spanish Labor Market: Overeducation? *The Journal of Human Resources, 28*(2), 259-278.

Alpin, C., Shackleton, J. R., & Walsh, S. (1998). Over- and undereducation in the UK graduate labour market. *Studies in Higher Education, 23*(1), 17-34.

Amaral, P. S., & Quintin, E. (2006). A competitive model of the informal sector. *Journal of Monetary Economics, 53*(7), 1541-1553.

Attanasio, O., Goldberg, P. K., & Pavcnik, N. (2004). Trade reforms and wage inequality in Colombia. *Journal of Development Economics, 74*(2), 331-366.

Battu, H., Belfield, C., & Sloane, P. (2000). How well can we measure graduate overeducation and its effects? *National Institute Economic Review, 171*, 82–93.

Bauer, T. K. (2002). Educational mismatch and wages: a panel analysis. *Economics of Education Review, 21*(3), 221-229.

Becker, G. (1964). *Human Capital: A Theoretical and Empirical Analysis with Special Reference to Education*, New York: Columbia University Press.

Berry, A., & Sabot, R. H. (1978). Labour market performance in developing countries: A survey. *World Development, 6*, 1199-1242.

Buchel, F., & van Ham, M. (2003). Overeducation, regional labor markets, and spatial flexibility. *Journal of Urban Economics, 53*(3), 482-493.

Castillo, M. (2007). Desajuste educativo por regiones en Colombia: ¿competencia por salarios o por puestos de trabajo? In: Cuadernos de Economía, v. XXVI, n. 46, (pp. 107-145). Bogotá.

Charlot, O., & Decreuse, B. (2005). Self-selection in education with matching frictions. *Labour Economics, 12*(2), 251-267.

Chevalier, A. (2003). Measuring Over-education. *Economica, 70*(279), 509-531.

Cohen-Zada, D., & Elder, T. (2009). Historical religious concentrations and the effects of Catholic schooling. *Journal of Urban Economics, 66*(1), 65-74.

Devillanova, C. (2012). Over-education and spatial flexibility: New evidence from Italian survey data. *Papers in Regional Science*, in press.

Doeringer, P., & Piore, M. (1972). *Internal Labor Markets and Manpower Analysis*, Lexington, Mass.

Dolton, P., & Vignoles, A. (2000). The incidence and effects of overeducation in the U.K. graduate labour market. *Economics of Education Review, 19*(2), 179-198.

Duncan, G. J., & Hoffman, S. D. (1981). The incidence and wage effects of overeducation. *Economics of Education Review, 1*(1), 75-86.

Duryea, S., Galiani, S., Nopo, H., & Piras, C. C. (2007). The Educational Gender Gap in Latin America and the Caribbean. In: IDB Working Paper No. 502.

Evans, W. N., & Schwab, R. M. (1995). FinishingHighSchoolandStartingCollege: Do Catholic Schools Make a Difference *Quarterly Journal of Economics, 110* 947-974.

Flórez, C. E. (2002). The Function of the Urban Informal Sector in Employment: Evidence from Colombia 1984-2000. In: Documento CEDE No. 2002-04, Universidad de Los Andes. Bogotá D.C.

Goldberg, P. K., & Pavcnik, N. (2005). Trade, Wages, and the Political Economy of Trade Protection: Evidence from the Colombian Trade Reforms. *Journal of International Economics, 66*(1), 75-105.

Gong, X., & Van Soest, A. (2001). Wage differentials and mobility in the urban labor market: A panel data analysis for Mexico. In: IZA, Bonn Discussion Paper No. 329.

Green, F., McIntosh, S., & Vignoles, A. (2002). The Utilization of Education and Skills: Evidence from Britain. *The Manchester School, 70*(6), 792-811.

Groot, W., & van den Brink, H. (2000). Skill mismatches in the Dutch labor market. *International Journal of Manpower 21*(8), 584–595.

Hartog, J., & Oosterbeek, H. (1988). Education, allocation and earnings in the Netherlands: 0verschooling? *Economics of Education Review, 7*(2), 185-194.

Harris, J.R., Todaro, M.P., 1970. Migration, unemployment and development: A two-sector analysis. *American Economic Review 60*, 126–142.

Hill, M. A. (1983). Female Labor Force Participation in Developing and Developed Countries-- Consideration of the Informal Sector. *The Review of Economics and Statistics, 65*(3), 459-468.

Kiker, B. F., Santos, M. C., & de Oliveira, M. M. (1997). Overeducation and undereducation: Evidence for Portugal. *Economics of Education Review, 16*(2), 111-125.

Kim, Y.-J. Catholic schools or school quality? The effects of Catholic schools on labor market outcomes. *Economics of Education Review, 30*(3), 546-558.

Kugler, A., & Kugler, M. (2009). The Labor Market Effects of Payroll Taxes in a middle Income country: Evidence from Colombia. *Economic Development and Cultural Change*.

Magnac, T. (1991). Segmented or competitive labor markets. . *Econometrica, 59* 165–187.

Maloney, W. F. (2004). Informality Revisited. *World Development, 32*(7), 1159-1178.

Maloney, W. F., & Núñez, J. (2004). Measuring the Impact of Minimum wages: Evidence from Latin America. In *Law and Employment: Lessons from Latin America and the Caribbean,* (pp. 109-130). University of Chicago Press and National Bureau of Economic Research.

Marcouiller, D., Castilla, V. R. d., & Woodruff, C. (1997). Formal Measures of the Informal-Sector Wage Gap in Mexico, El Salvador, and Peru. *Economic Development and Cultural Change, 45*(2), 367-392.

Mavromaras, K., & McGuinness, S. (2012). Overskilling dynamics and education pathways. *Economics of Education Review, 31*(5), 619-628.

McGoldrick, K., & Robst, J. (1996). Gender differences in overeducation: a test of the theory of differential overqualification. *American Economic Review* (AEA Conference proceedings).

McGuinness, S. (2003). Graduate overeducation as a sheepskin effect: Evidence from Northern Ireland. *Applied Economics, 35*, 597–608.

McGuinness, S. (2006). Overeducation in the Labour Market. *Journal of Economic Surveys, 20*(3), 387-418.

Mehta, A., Felipe, J., Quising, P., & Camingue, S. (2011). Overeducation in developing economies: How can we test for it, and what does it mean? *Economics of Education Review, 30*(6), 1334-1347.

Mendes de Oliveira, M., Santos, M. C., & Kiker, B. F. (2000). The role of human capital and technological change in overeducation. *Economics of Education Review, 19*(2), 199-206.

Mondragón-Veléz, C., Peña, X., & Wills, D. (2010). Labor Market Rigidities and Informality in Colombia. In: Documento CEDE No. 2010-07, Universidad de Los Andes. Bogotá D.C.

Mora, J. J. (2005). Sobre educación en Cali (Colombia). ¿Desequilibrio temporal o permanente?: algunas ideas, 2000-2003. *Documentos Laborales y Ocupacionales, 2 SENA*.

Núñez, J. (2002). Empleo informal y evasión fiscal en Colombia. In *Archivos de Economía, 210, DNP*.

Pradhan, M., & van Soest, A. (1995). Formal and informal sector employment in urban areas of Bolivia. *Labour Economics, 2*(3), 275-297.

Pratap, S., & Quintin, E. (2006). Are labor markets segmented in developing countries? A semiparametric approach. *European Economic Review, 50*(7), 1817-1841.

Quinn, M. A., & Rubb, S. (2006). Mexico's labor market: The importance of education-occupation matching on wages and productivity in developing countries. *Economics of Education Review, 25*(2), 147-156.

Ramos, R., & Sanroma, E. (2011). Overeducation and Local Labour Markets in Spain. In *IZA Discussion Paper 6028*.

Rosen, S. (1972). Learning and experience in the labor market. *Journal of Human Resources, 7*, 326–342.

Rumberger, R. (1987). The impact of surplus schooling on productivity and earnings. *Journal of Human Resources, 22*, 24–50.

Sicherman, N. (1991). Overeducation in the labor market. *Journal of Labor Economics, 9* (2), 101–122.

Sicherman, N., & Galor, O. (1990). A theory of career mobility. *Journal of Political Economy, 98*(1), 169–192.

Tansel, A. (1999). Formal versus informal sector choice of wage earners and their wages in Turkey. In: Economic Research Forum Working Paper No. 9927.

Tenjo, J. (1990). Opportunities, Aspirations, and Urban Unemployment of Youth: The Case of Colombia. *Economic Development and Cultural Change, 38* (4), 733-761.

Thurow, L. C. (1975). *Generating Inequality.* New York: Basic Books.

Tinbergen, J. (1956). On the theory of income distribution. *Weltwirtchaftliches Archiv, 77*, 156–175.

Tsang, M. C., Rumberger, R. W., & Levin, H. M. (1991). The Impact of Surplus Schooling on Worker Productivity. *Industrial Relations: A Journal of Economy and Society, 30*(2), 209-228.

Verdugo, R., & Verdugo, N. (1989). The impact of surplus schooling on earnings. *Journal of Human Resources, 24* (4), 629–643.

Wooldridge, J. M. (2002). *Econometric Analysis of cross section and panel data*, Cambridge, MA: MIT Press.

Table 1. Descriptive statistics for the main variables in the analysis

	Total Sample			Men			Women		
Variable	Total	Informal	Formal	Total	Informal	Formal	Total	Informal	Formal
Overeducation	0.15	0.12	0.17	0.16	0.12	0.18	0.15	0.11	0.17
Informal employment	0.33	-	-	0.35	-	-	0.31	-	-
Age (years)	33.93	32.38	34.69	34.09	32.19	35.11	33.71	32.67	34.17
Experience (years)	17.97	18.23	17.85	18.77	18.64	18.84	16.91	17.60	16.60
Tenure (months)	48.56	27.51	59.00	48.69	27.92	59.84	48.39	26.90	57.94
Women	0.43	0.40	0.44	-	-	-	-	-	-
Married	0.53	0.48	0.55	0.61	0.54	0.65	0.41	0.39	0.42
Household Head	0.40	0.37	0.41	0.54	0.47	0.58	0.21	0.23	0.21
Educational Attainment									
Basic Primary or below	0.13	0.23	0.08	0.17	0.28	0.11	0.09	0.16	0.05
Basic secondary	0.14	0.22	0.10	0.17	0.25	0.13	0.10	0.17	0.07
Secondary	0.36	0.37	0.36	0.38	0.34	0.39	0.35	0.41	0.32
Higher education or more	0.36	0.18	0.45	0.28	0.13	0.37	0.46	0.26	0.56
Education (years)	10.96	9.16	11.85	10.32	8.55	11.27	11.80	10.07	12.57
Occupation									
Unskilled manufacture and agricultural	0.33	0.42	0.28	0.48	0.60	0.41	0.13	0.15	0.12
Professionals and Technicians 1	0.07	0.02	0.09	0.07	0.02	0.09	0.06	0.02	0.09
Professionals and Technicians 2	0.05	0.04	0.05	0.03	0.03	0.04	0.07	0.06	0.07
Managers and Public Officials	0.03	0.02	0.04	0.03	0.01	0.04	0.04	0.03	0.04
Administrative Staff	0.20	0.14	0.24	0.14	0.10	0.16	0.28	0.19	0.33
Merchant and Vendor	0.17	0.18	0.16	0.12	0.13	0.12	0.22	0.26	0.21
Service Worker	0.16	0.18	0.15	0.13	0.10	0.14	0.20	0.29	0.15
Firm size									
Micro (1 -10 workers)	0.32	0.68	0.15	0.33	0.68	0.14	0.31	0.67	0.16
Small (11 - 50 workers)	0.22	0.18	0.24	0.22	0.18	0.24	0.22	0.18	0.23
Medium (51 - 100 workers)	0.07	0.03	0.09	0.07	0.04	0.09	0.06	0.03	0.08
Large (101 workers or more)	0.39	0.11	0.53	0.38	0.10	0.53	0.40	0.13	0.53
Sector									
Agricultural, mining, electricity, gas and water	0.03	0.01	0.04	0.04	0.02	0.05	0.02	0.01	0.02
Industry	0.24	0.21	0.25	0.26	0.23	0.28	0.20	0.19	0.20
Construction	0.08	0.14	0.04	0.12	0.23	0.07	0.01	0.01	0.01
Sales, Hotels and Restaurants	0.28	0.36	0.24	0.26	0.31	0.24	0.31	0.44	0.26
Transportation	0.08	0.07	0.09	0.10	0.08	0.10	0.07	0.07	0.07
Financial Intermediation	0.12	0.07	0.14	0.12	0.08	0.14	0.13	0.07	0.15
Social Services	0.17	0.12	0.20	0.10	0.06	0.12	0.26	0.21	0.29
Observations	**15104**	**5006**	**10098**	**8629**	**3013**	**5616**	**6475**	**1993**	**4482**

Note: Figures are in percentages, excepting Age, Experience, Tenure and Education whose units of measurement are indicated in parenthesis.

Table 2. Estimates from the univariate probit over-education model

	Total		Men		Women	
	Coefficient	Marginal Effect	Coefficient	Marginal Effect	Coefficient	Marginal Effect
Formal job	-0.1498**	-0.0250**	-0.1321*	-0.0186*	-0.1457*	-0.0272*
	[0.0384]	[0.0065]	[0.0518]	[0.0073]	[0.0579]	[0.0109]
Schooling years	0.2409**	0.0401**	0.2700**	0.0381**	0.2166**	0.0404**
	[0.0056]	[0.0012]	[0.0078]	[0.0017]	[0.0087]	[0.0018]
Experience (years)	0.0096+	-0.0006+	-0.001	-0.0015	0.0190*	0.0011*
	[0.0056]	[0.0003]	[0.0081]	[0.0004]	[0.0082]	[0.0005]
Experience2	-0.0004*	-	-0.0002	-	-0.0004+	-
	[0.0001]	-	[0.0002]	-	[0.0002]	-
Tenure (months)	-0.0006	-0.0001	-0.0003	0	-0.0009	-0.0002
	[0.0006]	[0.0001]	[0.0008]	[0.0001]	[0.0009]	[0.0001]
Tenure2	0	-	0	-	0	-
	[0.0000]	-	[0.0000]	-	[0.0000]	-
Women	-0.2398**	-0.0400**	-	-	-	-
	[0.0419]	[0.0070]	-	-	-	-
Married	-0.0232	-0.0039	0.0111	0.0016	-0.0505	-0.0094
	[0.0493]	[0.0082]	[0.0524]	[0.0074]	[0.0458]	[0.0086]
Women Married	-0.001	-0.0002	-	-	-	-
	[0.0661]	[0.0110]	-	-	-	-
Household head	-0.049	-0.0082	-0.0283	-0.004	0.0744	0.0139
	[0.0493]	[0.0082]	[0.0525]	[0.0074]	[0.0532]	[0.0099]
Women Household head	0.1782*	0.0297*	-	-	-	-
	[0.0712]	[0.0119]	-	-	-	-
Industry	0.0737	0.0123	0.1432	0.0202	-0.04	-0.0075
	[0.0845]	[0.0141]	[0.1068]	[0.0150]	[0.1507]	[0.0281]
Construction	0.5034**	0.0839**	0.6339**	0.0894**	-0.1767	-0.033
	[0.0983]	[0.0164]	[0.1207]	[0.0171]	[0.2187]	[0.0408]
Sales, Hotels, Restaurants	-0.1029	-0.0171	-0.1376	-0.0194	-0.0354	-0.0066
	[0.0848]	[0.0142]	[0.1082]	[0.0153]	[0.1490]	[0.0278]
Transportation	-0.3531**	-0.0588**	-0.4494**	-0.0634**	-0.1926	-0.0359
	[0.0928]	[0.0156]	[0.1207]	[0.0173]	[0.1590]	[0.0297]
Financial Intermediation	-0.4160**	-0.0693**	-0.5263**	-0.0742**	-0.2867+	-0.0535+
	[0.0895]	[0.0150]	[0.1167]	[0.0167]	[0.1533]	[0.0286]
Social Services	-0.4907**	-0.0818**	-0.7589**	-0.1070**	-0.3402*	-0.0635*
	[0.0879]	[0.0147]	[0.1214]	[0.0173]	[0.1487]	[0.0277]
Firm Size Small	-0.0271	-0.0045	-0.0945	-0.0133	0.0594	0.0111
	[0.0428]	[0.0071]	[0.0584]	[0.0082]	[0.0640]	[0.0120]
Firm Size Medium	-0.2150**	-0.0358**	-0.2305*	-0.0325*	-0.1645	-0.0307
	[0.0662]	[0.0110]	[0.0896]	[0.0126]	[0.1012]	[0.0189]
Firm Size Large	0.0022	0.0004	-0.1092+	-0.0154+	0.1421*	0.0265*
	[0.0414]	[0.0069]	[0.0573]	[0.0081]	[0.0609]	[0.0114]
Metropolitan Area Unemployment Rate	0.0054	0.0009	0.0049	0.0007	0.0082	0.0015
	[0.0078]	[0.0013]	[0.0108]	[0.0015]	[0.0114]	[0.0021]
Constant	-3.6861**	-	-3.9013**	-	-3.8544**	-
	[0.1484]	-	[0.2000]	-	[0.2373]	-
Observations	15675		8890		6785	
Log pseudolikelihood	-5242.92		-2800.57		-2384.24	

Notes: standard errors in [].+ p<0.1, * p<0.05, ** p<0.01

Table 3. Estimates from the bivariate probit model for the over-education equation.

	Total		Men		Women	
	Coefficient	Marginal Effect	Coefficient	Marginal Effect	Coefficient	Marginal Effect
Formal job	-0.9075**	-0.1644**	-1.1884**	-0.2009**	-0.5617*	-0.1071*
	[0.1760]	[0.0380]	[0.2030]	[0.0468]	[0.2242]	[0.0459]
Schooling years	0.2509**	0.0454**	0.2750**	0.0465**	0.2250**	0.0429**
	[0.0056]	[0.0021]	[0.0080]	[0.0030]	[0.0094]	[0.0026]
Experience (years)	0.0122*	-0.0002*	0.0079	-0.0009	0.0171*	0.0011*
	[0.0056]	[0.0003]	[0.0078]	[0.0004]	[0.0083]	[0.0006]
Experience2	-0.0004**	-	-0.0004+	-	-0.0003	-
	[0.0001]	-	[0.0002]	-	[0.0002]	-
Tenure (months)	0.0007	0.0001	0.0009	0.0001	0.0004	0
	[0.0006]	[0.0001]	[0.0008]	[0.0001]	[0.0011]	[0.0001]
Tenure2	0.0000	-	0	-	0	-
	[0.0000]	-	[0.0000]	-	[0.0000]	-
Women	-0.2013**	-0.0365**	-	-	-	-
	[0.0421]	[0.0075]	-	-	-	-
Married	0.0278	0.005	0.0647	0.0109	-0.0566	-0.0108
	[0.0525]	[0.0095]	[0.0541]	[0.0092]	[0.0462]	[0.0089]
Women Married	-0.0614	-0.0111	-	-	-	-
	[0.0682]	[0.0124]	-	-	-	-
Household head	-0.0661	-0.012	-0.0466	-0.0079	0.0792	0.0151
	[0.0520]	[0.0094]	[0.0537]	[0.0091]	[0.0586]	[0.0111]
Women Household head	0.1967*	0.0356*	-	-	-	-
	[0.0765]	[0.0137]	-	-	-	-
Industry	0.0362	0.0066	0.0902	0.0153	-0.0577	-0.011
	[0.0847]	[0.0153]	[0.1046]	[0.0176]	[0.1511]	[0.0289]
Construction	0.3834**	0.0694**	0.4043**	0.0683**	-0.1085	-0.0207
	[0.1026]	[0.0179]	[0.1249]	[0.0199]	[0.2180]	[0.0416]
Sales, Hotels, Restaurants	-0.1266	-0.0229	-0.1639	-0.0277	-0.0343	-0.0065
	[0.0846]	[0.0154]	[0.1057]	[0.0180]	[0.1491]	[0.0285]
Transportation	-0.3724**	-0.0674**	-0.4605**	-0.0778**	-0.2033	-0.0388
	[0.0924]	[0.0171]	[0.1177]	[0.0205]	[0.1593]	[0.0305]
Financial Intermediation	-0.4038**	-0.0731**	-0.4760**	-0.0805**	-0.2901+	-0.0553+
	[0.0903]	[0.0163]	[0.1164]	[0.0196]	[0.1539]	[0.0293]
Social Services	-0.5382**	-0.0975**	-0.8044**	-0.1360**	-0.3604*	-0.0687*
	[0.0881]	[0.0166]	[0.1196]	[0.0217]	[0.1491]	[0.0286]
Firm Size Small	0.2540**	0.0460**	0.3062**	0.0518**	0.2190*	0.0418*
	[0.0765]	[0.0154]	[0.0982]	[0.0194]	[0.0986]	[0.0198]
Firm Size Medium	0.1438	0.0261	0.2765*	0.0467*	0.0326	0.0062
	[0.1029]	[0.0194]	[0.1288]	[0.0241]	[0.1383]	[0.0265]
Firm Size Large	0.3624**	0.0656**	0.4151**	0.0702**	0.3382**	0.0645**
	[0.0901]	[0.0186]	[0.1147]	[0.0233]	[0.1129]	[0.0232]
Metropolitan Area Unemployment Rate	-0.0005	-0.0001	-0.0051	-0.0009	0.0062	0.0012
	[0.0079]	[0.0014]	[0.0106]	[0.0018]	[0.0118]	[0.0022]
Constant	-3.4673**	-	-3.4839**	-	-3.7693**	-
	[0.1702]	-	[0.2268]	-	[0.2544]	-
ρ	0.4347**	-	0.5987**	-	0.2424+	-
	[0.1211]	-	[0.1670]	-	[0.1331]	-
Observations	15104		8629		6475	
Log pseudolikelihood	-11384.32		-6346.62		-4952.43	

Notes: standard errors in [].+ p<0.1, * p<0.05, ** p<0.01

Table 4. Reduced-form relationship between family characteristics and overeducation probability among public employees.

	Total		Men		Women	
	Coefficient	Marginal Effect	Coefficient	Marginal Effect	Coefficient	Marginal Effect
Average years of education other members	-0.0169	-0.0036	-0.0385*	-0.0075*	-0.0057	-0.0013
	[0.0117]	[0.0025]	[0.0192]	[0.0037]	[0.0155]	[0.0035]
Number of kids age 0	0.2367	0.051	0.226	0.0438	0.3455	0.0773
	[0.1832]	[0.0395]	[0.2525]	[0.0490]	[0.2823]	[0.0631]
Number of kids age 1	0.0261	0.0056	-0.1384	-0.0268	0.3952	0.0884
	[0.2318]	[0.0500]	[0.3191]	[0.0617]	[0.3319]	[0.0741]
Number of kids age 2	0.1287	0.0278	0.1939	0.0376	0.0395	0.0088
	[0.2065]	[0.0445]	[0.3155]	[0.0614]	[0.2791]	[0.0625]
Number of kids age 3	-0.0103	-0.0022	0.1534	0.0297	-0.2101	-0.047
	[0.1643]	[0.0354]	[0.2066]	[0.0398]	[0.2831]	[0.0634]
Number of kids age 4	0.105	0.0226	0.3126	0.0605	-0.49	-0.1097
	[0.1679]	[0.0362]	[0.2156]	[0.0415]	[0.3222]	[0.0721]
Number of kids age 5	0.1433	0.0309	0.0563	0.0109	0.2933	0.0656
	[0.1860]	[0.0401]	[0.2602]	[0.0504]	[0.2904]	[0.0649]
Number of kids age 6	-0.0861	-0.0186	-0.0475	-0.0092	-0.2374	-0.0531
	[0.1948]	[0.0420]	[0.2894]	[0.0560]	[0.2814]	[0.0632]
Number of kids age 7	-0.0882	-0.019	-0.1797	-0.0348	0.0336	0.0075
	[0.1528]	[0.0330]	[0.2163]	[0.0418]	[0.2103]	[0.0471]
Number of kids age 8	0.0324	0.007	-0.3145	-0.0609	0.2897	0.0648
	[0.1690]	[0.0365]	[0.2365]	[0.0457]	[0.2189]	[0.0489]
Observations	1823		882		938	
Log pseudolikelihood	-691.89739		-304.19913		-368.02025	

Notes: standard errors in [].+ p<0.1, * p<0.05, ** p<0.01. Other explanatory variables, except the sector of employment, listed in Table 2 are also included in the regression

Table 5. Estimates of the sector of employment on over-education with different set of instruments.

Total		Biprobit - IV		
	Probit	[1]	[2]	[3]
Formal job	-0.0250**	-0.1644**	-0.1581**	-0.1151**
	[0.0065]	[0.0380]	[0.0438]	[0.0434]
ρ	-	0.4657**	0.4406**	0.2991*
	-	[0.1211]	[0.1395]	[0.1390]
Men		Biprobit - IV		
	Probit	[1]	[5]	[4]
Formal job	-0.0186*	-0.2009**	-0.2175**	-0.1658**
	[0.0073]	[0.0468]	[0.0459]	[0.0718]
ρ	-	0.6911**	0.7440**	0.5529*
	-	[0.1670]	[0.1642]	[0.2527]
Women		Biprobit - IV		
	Probit	[1]	[5]	[4]
Formal job	-0.0272*	-0.1071*	-0.0616	-0.0749+
	[0.0109]	[0.0459]	[0.0444]	[0.0419]
ρ	-	0.2473+	0.109	0.1455
	-	[0.1331]	[0.1322]	[0.1220]
Instruments				
Average years of education other members		Yes	Yes	
Num. Chidren 0 - 8 years old		Yes		Yes

Notes: Marginal effects are presented. Standard errors are in brackets. The exogenous variables of individual's characteristics, job's characteristics and the unemployment rate of the metropolitan listed in Table 3 are included in all regressions. + p<0.1, * p<0.05, ** p<0.01

Table A1. Estimates from the bivariate probit model for the job equation (formal=1)

	Total	Men	Women
	Coefficient	Coefficient	Coefficient
Schooling years	0.0720**	0.0597**	0.0889**
	[0.0051]	[0.0063]	[0.0084]
Experience	0.0309**	0.0345**	0.0283**
	[0.0042]	[0.0057]	[0.0065]
Experience2	-0.0006**	-0.0006**	-0.0006**
	[0.0001]	[0.0001]	[0.0002]
Tenure (months)	0.0089**	0.0070**	0.0117**
	[0.0005]	[0.0007]	[0.0009]
Tenure2	-0.0000**	-0.0000**	-0.0000**
	[0.0000]	[0.0000]	[0.0000]
Women	0.1124**	-	-
	[0.0392]	-	-
Married	0.1578**	0.1240*	-0.0284
	[0.0490]	[0.0502]	[0.0448]
Women Married	-0.2146**	-	-
	[0.0625]	-	-
Household head	0.0123	0.0002	-0.0674
	[0.0472]	[0.0475]	[0.0534]
Women Household head	-0.1344*	-	-
	[0.0668]	-	-
Industry	-0.1677+	-0.1422	-0.1744
	[0.0895]	[0.1025]	[0.1754]
Construction	-0.4423**	-0.4828**	-0.3387
	[0.0961]	[0.1072]	[0.2387]
Sales, Hotels and Restaurants	-0.0913	-0.0659	-0.0949
	[0.0893]	[0.1028]	[0.1739]
Transportation	-0.156	-0.1542	-0.1814
	[0.0965]	[0.1112]	[0.1860]
Financial Intermediation	0.1458	0.1435	0.1448
	[0.0964]	[0.1131]	[0.1829]
Social Services	-0.3247**	-0.3393**	-0.3206+
	[0.0926]	[0.1132]	[0.1744]
Firm Size Small	1.0304**	1.0576**	1.0007**
	[0.0319]	[0.0418]	[0.0499]
Firm Size Medium	1.4108**	1.4002**	1.4456**
	[0.0556]	[0.0698]	[0.0925]
Firm Size Large	1.6865**	1.7470**	1.6118**
	[0.0331]	[0.0449]	[0.0506]
Metropolitan Area Unemployment Rate	-0.0285**	-0.0190*	-0.0413**
	[0.0069]	[0.0091]	[0.0105]
Average years of education other members	0.0301**	0.0360**	0.0243**
	[0.0046]	[0.0060]	[0.0071]
Number of kids age 0	-0.0916*	-0.1150*	-0.0344
	[0.0439]	[0.0528]	[0.0771]
Number of kids age 1	-0.0803+	-0.0920+	-0.0666
	[0.0432]	[0.0558]	[0.0680]
Number of kids age 2	-0.0573	-0.0053	-0.1549*
	[0.0429]	[0.0553]	[0.0692]
Number of kids age 3	-0.0761+	-0.0594	-0.0871
	[0.0449]	[0.0562]	[0.0732]
Number of kids age 4	-0.0886*	-0.0965+	-0.086
	[0.0441]	[0.0564]	[0.0694]
Number of kids age 5	-0.0534	-0.0158	-0.0797
	[0.0453]	[0.0580]	[0.0724]
Number of kids age 6	-0.0973*	-0.0473	-0.1701*
	[0.0463]	[0.0587]	[0.0735]
Number of kids age 7	-0.1567**	-0.1384*	-0.1752**
	[0.0435]	[0.0579]	[0.0658]
Number of kids age 8	-0.1525**	-0.0986	-0.2039**
	[0.0446]	[0.0604]	[0.0671]
Constant	-1.5313**	-1.5984**	-1.3881**
	[0.1395]	[0.1748]	[0.2426]
Observations	15104	8629	6475

Notes: standard errors in [].+ p<0.1, * p<0.05, ** p<0.01.

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