INFORMALITY SECTORAL SELECTION AND EARNINGS IN URUGUAY*

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Resumen: Se identifica al trabajador informal como aquel que no contribuye al sistema de seguridad social. Se analiza la probabilidad de ser informal y se estima el diferencial de remuneraciones entre sectores, utilizando estimaciones MCO y un modelo de regresiones intercambiables. Se encuentra que la formalidad es más probable para los trabajadores con mayor nivel educativo, los hombres, los residentes en la capital y los jefes de hogar. De acuerdo con cinco medidas de la brecha promedio para los asalariados y diferentes sub-muestras, se encuentra que las remuneraciones son mayores para los trabajadores formales que para los informales.

Abstract: In this paper we define an informal worker as one who is not contributing to the social security system. We analyze the likelihood of being an informal worker, and we estimate the differentials in earnings between sectors using the OLS estimation and a switching regression model. We find that formality is more likely among the better-educated, and among men, those residing in the capital city, and heads of households. In addition, we find that according to five different proxies of the average gap for salaried workers and several sub-samples, earnings are higher in the formal than in the informal sector for all the samples.

Clasificación JEL/JEL Classification: J31

Palabras clave/keywords: informal sector, wage differential, informalidad, diferencial de salarios

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1. Introduction

In most Latin American countries, the social security system relies on obligatory contributions to smooth income and consumption over the life cycle and particularly, to prevent poverty among the elderly. Additionally, they offer benefits to workers. Thus, the low level of social security coverage among active workers has traditionally been a cause of concern for many policy makers, who interpret it as an indicator of lack of social protection. In recent years, interest in coverage has increased partly because of the implementation of social security reforms whose future success requires a certain number of workers with coverage. Indeed, several Latin American countries including Uruguay sought to tighten the link between personal contributions and benefits, and to reduce the level of evasion of administration controls. However, coverage tended to decrase from the early 1990s to mid-2000s (Economic Commission for Latin America and the Caribbean, 2006).

Following the definition that identifies informal workers as those for whom labor regulations are not applied (Portes, Castells and Benton, 1989), we will denote non-covered workers as informal.[1]

A strand of the literature traces the causes of the persistence of informality in the restrictions faced by workers who are unable to find a job in the formal sector. It also has been argued that at least part of the increase in informality in Latin America has stemmed from large modern enterprises that avoid labor regulation costs by subcontracting unprotected workers. Thus, informal workers would have worse working conditions and receive lower pay than formal workers. An alternative approach is to see informality as a choice made by workers and firms for whom the formal sector is not attractive because of the cost of complying with regulations. People may choose informality because the benefits of regulation are not well targeted, or because of workers myopia or as a transitory state, i.e. as an entry point to a permanent job. Thus, we would expect a wage differential stemming from the tax-evasion, in other words, informal workers would be overpaid. Recently, Perry *et al.* (2007) studied the causes and consequences of informality in Latin America and conclude that both "exclusion" and "exit" contribute to explaining Latin-American informality.[2]

[1] We do not use the defintion whereby informality is identified on the basis of unit size and that one of the characteristics of this size is a link to non-compliance with labor regulations (Tokman, 1990).

[2] "Exclusion" refers to the decision to remain in the informal sector due to

By Latin-American standards, Uruguay boasts a long tradition of social security programs, with high coverage among the elderly and more generally, an extended public benefits system. Since the mid 1950s, quality of public benefits and their financial situation has tended to worsen. During the 1990s, the sustainability of Uruguays social security system sustainability was seriously compromised. Like in other countries, a social security reform was introduced, contributions were increased, ,benefits were reduced, and levels of enforcement and requirements (in terms of periods of formal work) for access to pensions were strenghtened. In addition, the long-term trend of reducing benefits for non-contributors continued. However, levels of non-contribution increased, particularly during the severe downturn in economic activity in 1999-2002. In 2005, two years after the economic recovery began, informal workers accounted for around 38% of employment and 23% of salaried work. The apparent persistence of informality in the context of a reform that tended to discourage the "exit" causes, in a country with one of the lowest informality levels in Latin America, makes Uruguay an interesting case.

The purpose of this paper is to analyse the profile of formal and informal workers and their wage differential in Uruguay country, using cross-section information from a household survey. This survey inquires whether or not workers contribute to the social security system. Although contributions are compulsory for the whole labor force, informality is not socially strongly disapproved so the information collected can be considered reliable. The rest of the paper is organized as follows. In the first section we give a brief description of the social security system. In the second section we present the characteristics of the data and the methodology. In the third section we present the results, including a description of the main data, an estimation of the likelihood of being informal, and the earnings gap between sectors, using the whole sample of salaried workers and subsamples by industry. In the fourth section we discuss our results and lastly, we present our conclusions.

2. Institutional background

In Uruguay, the social security system was set up at the end of the 19th century on the basis of occupation-specific contributory pro-

restrictions such as taxes and regulations that they would face in the formal sector. "Exit" refers to the decision to remain in the informal sector that results from a costbenefit analysis of the advantages of both sectors.

grams that offered retirement pensions in a pay-as-you-go financial regime. Since then, the social security system has incorporated new programs covering other risks, and has gradually been extended to the whole of the workforce. Today, the system covers the risk of retirement, death, unemployment, maternity, sickness and medical benefits. Most of the programs are administered by a public institution and very few occupations have their own administration (police and armed forces personnel, financial services employees and self-employed university graduates are the exceptions). The general rules are similar for the whole labor force, though benefits are more generous for financial services employees.

Since 1996, the pension system has combined a pay-as-you go pillar and an individual account pillar. Workers below a certain threshold contribute only to the pay-as-you-go regime unless they explicitly choose to deposit half of their contributions in the individual account pillar. Workers with higher income must contribute to the pay-as-you-go pillar up to the threshold and save in an individual account for the amount above that threshold, up to a ceiling. Above this ceiling, contributions to the individual account pillar are voluntary.

The personal contribution rate is 18% and the employers contribution rate is 17.5%. The rates are somewhat higher for public servants. However, there are several exemptions. Specifically, manufacturing and transport are exempted from employers contributions.

When an individual does not contribute, we may infer that other labor costs are also avoided. Besides contributions, labor costs include compulsory insurance to cover work injury risk, and two taxes that range from 0.25% to 7.25%. On the other hand, informality means that the individual does not enjoy the benefits of the contributory systems. However, there are assistance programs that provide benefits for non-contributors. A review of these benefits suggests that the additional benefits of contributory programs might not be attractive enough, at least for some workers.

There are public institutions that provide free health care for the poor –i.e. medical services, medicines, hospitalization, etc. As people entitled to contributory medical benefits still have to make a payment when demanding health care, the contributory program is more onerous than public services. In any case, two features limit the use of public services: the fact that they involve a means test, and the widespread perception that they are of poorer quality than services in the private sector.

In addition, there is a family allowances program whereby informal workers with children receive a payment when the households

income is below a threshold. Its impact on poverty and income distribution is very limited because both the transfer and the threshold are low (Vigorito, 2005). There is also an assistance program for poor, non-active elderly persons who are not receiving a pension from the contributory program. This assistance program has always provided lower benefits than the contributory program; indeed, in 2005, the average assistance pension was 42% of the average contributory pension.

Finally, the most widely-quoted disincentive to contributing to the social security system is the weakness of eligibility requirement controls for pension access. Until 1996, there was no registration of individual contributions. This lack of administrative records meant that witness testimony concerning an individuals contribution history had to be allowed. There is a general perception that this procedure resulted in retirements that did not comply with the minimum of required years of contribution (Camacho, 1997; Rius, 2003). We may speculate that this situation undermined incentives to joining the formal sector.

In 1996, when the individual account pillar was introduced, a labor history register was set up. At the time, there was a belief that the introduction of an individual account pillar and the stringency of the enforcement system based on the labor history register- would work together to reduce informality. However, non-contribution increased, particularly in 1999-2002 when the labor market was affected by a severe downturn in economic activity. In 2005, two years after the economic recovery began, informality continued to account for around 38% of total employment and for 23% of salaried work.

3. Data and method of estimation

Let w_j be the earnings of worker j, x_j his observable characteristics, f and i two sub-indexes that denote formality and informality. We specify the following relationship:

$$\ln w_{i,j} = \alpha_i x_{i,j} + v_{i,j} \tag{1}$$

$$\ln w_{f,j} = \alpha_f x_{f,j} + v_{f,j} \tag{2}$$

If we assume that the disturbances v (which summarize the effects of non-observable variables) have a zero mean and are not correlated with observable variables, then the coefficients can be estimated

by OLS. Denoting the mean of the variables with a bar and making some calculations, we can disaggregate the raw earnings gap between sectors as the sum of two components, as proposed by Oaxaca (1973):

$$(\ln \overline{w}_f - \ln \overline{w}_i) = (\overline{x}_f - \overline{x}_i)' \hat{\alpha}_f + \overline{x}_i' \, (\hat{\alpha}_f - \hat{\alpha}_i) \tag{3}$$

The first term on the right is the difference among the mean values of the independent variables for the formal and informal sector, and the second is the difference in the coefficients of the earnings equations. This last term –the difference not explained by independent variables– may be interpreted as the earnings gap computed in the mean of the characteristics.

The decomposition specified in (3) is based on returns in the informal sector and the difference between coefficients is weighted by the average characteristics of informal workers. However, structure rewards (i.e. salaries) may be weighted by another stock of endowments, such as, for example, those of formal workers, as specified in equation (4)

$$(\ln \overline{w}_f - \ln \overline{w}_i) = (\overline{x}_f - \overline{x}_i)' r\hat{\alpha}_i + \overline{x}_f'(\hat{\alpha}_f - \hat{\alpha}_i) \tag{4}$$

Thus, we decide to estimate two proxies of the gap $G1$ and $G2$ as:

$$G1 = \overline{x}_i'(\hat{\alpha}_f - \hat{\alpha}_i) \tag{5}$$

$$G2 = \overline{x}_f'(\hat{\alpha}_f - \hat{\alpha}_i) \tag{6}$$

These estimations have the disadvantage of ignoring the endogeneity of the selection decision to be formal or informal. Suppose that an individual chooses to be formal or informal in accordance with his expected earnings in the two sectors. And suppose also that unobserved individual characteristics increase both earnings and the likelihood of choosing informality. For example, people with easy access to informal networks could enjoy greater potential gains by being informal. In this case observed income in the informal sector will be higher than expected income for the whole population, and the formal-informal gap estimated by OLS will be biased.

There are different strategies to deal with this problem. We choose to estimate an endogenous switching regression model (Maddala, 1986) which means jointly estimating the selection rule that sorts workers between sectors and the earnings equation of each sector.

A latent variable I^* defines a variable I that takes the value 1 when the worker is informal and 0 when he is formal. The variable I^* depends on two different types of characteristics: those that affect the level of earnings and hence the choice of being formal or informal, and those that have a direct effect on this choice. By Z we denote the vector of both types of characteristics (which contains vector x), and the earnings-generating model may be described by:

$$\mathrm{I}_j^* = \gamma z_j + u_j \tag{7}$$

$$\mathrm{I}_j = 1 \quad \text{if} \quad \mathrm{I}_j^* > 0;\ \mathrm{I}_j = 0 \quad \text{otherwise} \tag{8}$$

$$\ln w_{f,j} = \beta_f x_{f,j} + \varepsilon_{f,j} \quad \text{if} \quad \mathrm{I} = 0 \tag{9}$$

$$\ln w_{i,j} = \beta_i x_{i,j} + \varepsilon_{i,j} \quad \text{if} \quad \mathrm{I} = 1 \tag{10}$$

The disturbances u are potentially correlated with ε_i and ε_f. We assume that these residuals have a trivariate normal distribution:

$$(\varepsilon_f, \varepsilon_i, u) \approx N(0, \sum) \quad ; \quad \sum = \begin{bmatrix} \sigma_f^2 & \sigma_{f,i} & \sigma_{f,u} \\ & \sigma_i^2 & \sigma_{i,u} \\ & & \sigma_u^2 \end{bmatrix}$$

To the extent that in the selection model the parameters are identified up to scale, we normalize the variance of disturbances in (7) to 1 and we perform a joint estimation using the full-information maximum likelihood method (FIML). Note that endogenous switching may be fitted in two steps. When proceeding in two steps, the estimation requires potentially cumbersome adjustments to obtain consistent standard errors. Thus, in this paper we use the FIML to fit

binary and continuous parts simultaneously in order to yield consistent standard errors.

Hence we obtain estimations of the coefficients, the standard deviation of the disturbances of the selection equation (σ_u) and of the wage equations (σ_i and σ_f), the correlation coefficient between u and ε_i ($\rho_i = \sigma_{iu}/\sigma_i\sigma_u$), and finally, the correlation coefficient between u and $\varepsilon_f(\rho_f = \sigma_{fu}/\sigma_f\sigma_u)$.

A positive value of ρ_i may be interpreted as unobserved attributes that lead workers to informality by pushing the earnings in this sector up. For example, a high u_j of an informal self-employed person may be based on social networks that insure him against risks. At the same time, social networks may increase the informal self-employed persons number of clients, thus pushing up his earnings. Pisani and Pagan (2004) use this estimation in order to test whether the informal sector attracts the least able workers. A positive value would indicate that this hypothesis may be rejected. Indeed, a positive ρ_i implies that informal workers on average overstate what a randomly chosen worker could expect to earn when working in informality. Notice that ρ_f is an indicator of positive or negative selection in the formal sector.

We denote the density and cumulative function of a normal distribution by ϕ and Φ. These estimations allow us to predict the expected earnings in the informal sector conditional upon observing the worker in the informal sector:

$$E\left(\ln w_{i,j}/\mathrm{I}_j^* > 0; x_{i,j}\right) = E\left(\ln w_{i,j}/u_j > -\gamma z_j; x_{i,j}\right) \qquad (11)$$

$$= \beta_i x_{i,j} + \sigma_i \rho_i \frac{\phi(\gamma z_j)}{\Phi(\gamma z_j)}$$

Notice that a positive ρ_i adds a plus to unconditional expected earnings in informality ($\beta_i x_i$), as would be expected if this sector attracts the most able workers (given observed skills).

We can also estimate the expected earnings that a worker observed in the informal sector would receive in a formal job (equation 12). A positive ρ_f indicates that the expected earnings, given the selection rule, are higher than unconditional expected earnings.

$$E\left(\ln w_{f,j}/\mathrm{I}_j^* > 0; x_{i,j}\right) = E\left(\ln w_{f,j}/u_j > -\gamma z_j; x_{i,j}\right) \qquad (12)$$

$$= \beta_f x_{i,j} + \sigma_f \rho_f \frac{\phi(\gamma z_j)}{\Phi(\gamma z_j)}$$

Therefore we can estimate another proxy of the formal-informal gap as the average difference between equations 12 and 11 among informal workers. We denote the number of informal workers as n_i, and we calculate the gap $G3$ as:

$$G3 = \frac{1}{n_i} \sum_j \left[(\beta_f - \beta_i)\ x_{i,j} + (\sigma_f \rho_f - \sigma_i \rho_i)\ \frac{\phi(\gamma z_j)}{\Phi(\gamma z_j)} \right] \quad (13)$$

The gap $G3$ is the difference between the earnings that an "average" informal worker would have received in the formal sector and his expected earnings in the informal sector. It will be higher or lower than the non-conditional expected wage in accordance with the absolute values of the selection terms in (11) and (12).

A fourth proxy of the earnings gap is a calculation of the difference between the earnings of an "average" formal worker and those he would have received in the informal sector, both conditional on him being a formal-sector worker formal. The expected earnings in each situation are:

$$E\left(\ln w_{f,j} / \mathrm{I}_j^* < 0; x_{f,j}\right) = E\left(\ln w_{f,j} / u_j < -\gamma z_j ; x_{f,j}\right) \quad (14)$$

$$= \beta_f x_{f,j} - \sigma_f \rho_f \frac{\phi(\gamma z_j)}{1 - \Phi(\gamma z_j)}$$

$$E\left(\ln w_{i,j} / \mathrm{I}_j^* < 0; x_{f,j}\right) = E\left(\ln w_{i,j} / u_j < -\gamma z_j ; x_{f,j}\right) \quad (15)$$

$$= \beta_i x_{f,j} + \sigma_i \rho_i \frac{\phi(\gamma z_j)}{1 - \Phi(\gamma z_j)}$$

Thus, denoting the number of formal workers as n_f, we calculate $G4$ as:

$$G4 = \frac{1}{n_f} \sum_j \left[(\beta_f - \beta_i) x_{f,j} + (-\sigma_f \rho_f - \sigma_i \rho_i) \frac{\phi(\gamma z_j)}{1 - \Phi(\gamma z_j)} \right] \quad (16)$$

Finally, the gap may be estimated as the difference between expected earnings in the formal sector conditional on being selected as formal, and expected earnings in the informal sector conditional on the worker being selected as informal. Both terms are valued on the average characteristics of all workers. The gap thus defined ($G5$) is calculated for the whole sample ($n = n_i + n_f$) as:

$$G5 = \frac{1}{n} \sum_j \left[(\beta_f - \beta_i) x_j + (-\sigma_f \rho_f \frac{\phi(\gamma z_j)}{1 - \Phi(\gamma z_j)} - \sigma_i \rho_i \frac{\phi(\gamma z_j)}{\Phi(\gamma z_j)} \right] \quad (17)$$

In order to fit the earnings-generating models described above, we use the Continuous Household Survey, —*Encuesta continua de hogares* (ECH)— conducted by the National Statistics Institute – *Instituto Nacional de Estadística* (INE), in 2005. The ECH is a survey carried out in urban areas. As more than 90% of the Uruguayan population is urban, the survey gives a good representation of the country.

The data set comes from a stratified sample. Stratification could generate correlation within the stratum. Therefore, following Wooldridge (2002) we compute cluster-robust standard errors, that is, observations are considered independent across strata but not necessarily within them. We restrict the sample to 18-to-59-year-old workers who declared themselves to be salaried workers at the time of the interview. Thus, we exclude unpaid family members, domestic workers living in the house where they work, enterprise owners and the self-employed. We perform the estimations for the whole sample of salaried workers and for sub-samples of the private sector by industry.

The survey inquires into individual endowments (age, sex, marital status, schooling), labor characteristics (hours of work, industry) and income received in the preceding month, classified by source. Besides this, the survey reports whether or not the individual contributes to the social security system. When an individual has more than one job, we consider the characteristics of the main one that is, the job that accounts for the highest earnings. Wages are calculated as the sum of in-cash and in-kind labor income, including the in-cash regular wage, tips and bonuses. In addition, we estimate the amount of three labor benefits: medical benefits, a (compulsory) thirteenth monthly wage (the survey inquires into the effective payment of this) and the so-called "vacation pay", which is an amount that is paid when workers have their annual holiday –imputed to private salaried

workers who actually receive the thirteenth wage. We calculated the log hourly wage using the information reported about hours of work. Note that earnings are those received the preceding month but hours or type of work are those of the preceding week.

4. Results

4.1. *Data description*

As can be seen in table 1, in 2005 around of 23% of workers aged 18-to-59 are informal. Comparisons between sectors suggest that informal workers tend to be young and less-educated. Indeed, the average age is 38.7 in the formal sector and 34.6 in the informal sector, and the median values are 39 and 33, respectively. Many young people study and do part-time work at the same time, so working in the informal sector at this life-cycle stage is often seen as a desirable personal situation. The average years of schooling are 11.2 and 8.7 in the formal and informal sector, respectively. It is worth noting that informality is quite widespread among young students with incomplete tertiary studies who work, and this pushes up the education level of informal workers.

At the beginning of the 1990s informality was higher among women than men and that the gender gap steadily narrowed during that decade (Bucheli, 2004). The figures in table 1 show that in 2005 the rate of informality was higher among men than women.

As expected, most public servants contribute to the social security system. The few public-sector workers who are not in the formal sector may be explained by the lack of controls on private firms subcontracted by the public sector. Indeed, subcontracting has been an increasing mechanism that the public sector has been using to reduce the size of its work force. In addition, firm size appears to be closely correlated with formality. Employees in private firms with more than 10 employees account for 47% of salaried workers in the formal sector but only for 17% in the informal sector. On the other hand, the figures for firms with less than 5 employees are 12% and 65%, respectively.

As regards industrial classification, workers in the building industry, and trade, restaurants and hotels are overrepresented in the informal sector. At the other end of the scale, workers in the finance, electricity, gas and water sectors, which are activities with a relatively low weight in employment, are overrepresented in the formal sector. Note also that public enterprises are the main suppliers of these services.

Table 1
Summary statistics by category

	Full sample			Formal sector			Informal sector		
	Mean	Std Dev.	Medi-an	Mean	Std Dev.	Medi-an	Mean	Std Dev.	Medi-an-
Informal	.227	.419	0	.000	.000	0	1.000	.000	1
Log hourly earnings	3.641	.788	3.635	3.830	.707	3.791	2.998	.706	2.974
Age	37.8	11.350	38	38.7	11.023	39	34.6	11.871	33
Schooling	1.6	3.781	10	11.2	3.772	11	8.7	3.083	8
Female	.480	.500	0	.468	.499	0	.523	.500	1
Capital city	.574	.494	1	.612	.487	1	.445	.497	0
Employment type and firm size									
Public servants	.241	.428	0	.308	.462	0	.014	.116	0
Private firms	.759	.428	1	.692	.462	1	.986	.116	1
Less than 5 employ.	.242	.428	0	.120	.325	0	.655	.476	1
From 5 to 9 employ.	.112	.316	0	.099	.298	0	.158	.364	0
10 or more employ.	.405	.491	0	.473	.499	0	.174	.379	0
Industry									
Agriculture and mining	.036	.186	0	.030	.171	0	.056	.231	0
Manufacturing	.146	.353	0	.145	.353	0	.146	.353	0
Electricity, gas and water	.013	.113	0	.017	.128	0	.000	.018	0
Building	.050	.218	0	.042	.201	0	.077	.267	0
Trade, restau-rants and hotels	.192	.394	0	.185	.388	0	.216	.412	0
Transport and communications	.066	.248	0	.073	.260	0	.043	.202	0
Finance	.028	.165	0	.035	.185	0	.003	.051	0
Personal and com-munity services	.467	.499	0	.471	.499	0	.456	.498	0

Source: *Encuesta continua de hogares*, (2005), INE.

4.2. *Determinants of participation in informality*

The estimated coefficients of the equation for the switching regression model are given in table 2. The set of explanatory variables contains

variables included in the earning function and variables that influence the choice of the sector but not the individual wage. The former include years of schooling; potential experience (age - years of schooling 6) and squared potential experience; a gender dummy that takes the value 1 when the worker is a woman; a regional dummy that takes the value 1 for the capital city and 21 dummies that distinguish different industries.

The likelihood of working in the informal sector decreases with years of schooling, is lower for people who do not live in the capital city, and is higher for women than for men. We report the estimated coefficients of sectors in Annex 1. The sectors where informality is most likely are printing and furniture, building, wood and paper, and personal services. On the other hand, workers in electricity, gas and water, education, the financial system and health are the most likely to be in a formal situation.

As regards the characteristics that have a direct effect on selection and do not have an indirect effect through the level of earnings, we include: a set of dummies that capture position in the household (head, spouse, son/daughter, other relationship with the head –omitted–); a dummy variable that indicates cohabitation (legally married or not), a dummy variable that takes the value 1 when the worker is receiving a pension; and an index of household overcrowding (household size/number of dorms) as a proxy of wealth. Identification of the system of equations we want to estimate depends on the accuracy of these instruments. We perform a Wald test in order to evaluate the joint significance of the instruments in the selection equation. We reject the null hypothesis that jointly they are equal to zero.

Formality is more common for married workers, and it also depends on the position in the household. Heads of households are the most likely to be in the formal sector and spouses are the most likely to be in the informal sector.

The likelihood of working in the informal sector is greater for workers receiving a pension. Note that, with few exceptions, people who have a pension are forbidden to work, and that it is possible to avoid this regulation by having an informal job.

Lastly we find a negative sign for the effect of household overcrowding. As this variable is negatively correlated with wealth, we may infer that the poor obtain more benefits through being formal. Note that poverty is inversely related to both good health and stable work, and a lack of wealth means scant or null savings. Hence, the unemployment and sickness benefits (only offered by contribu-

tory social programs) that diminish the effect of the lost wage are more important for the poor. In addition, overcrowding is positively correlated with the number of children. So it is possible that the contributory family allowances program plays some role as an incentive to contribute to the social security system.

Table 2
Switching regression model: selection equation estimates (probability of informality)

Variable	*Coefficient*
Household head	-0.162**
	(0.070)
Spouse	0.142*
	(0.083)
Son/Daughter	0.058
	(0.058)
Married	-0.426***
	(0.056)
Pension	0.315***
	(0.069)
Household overcrowding	-0.230***
	(0.035)
Years of schooling	-0.109***
	(0.004)
Experience	-0.030***
	(0.007)
Experience (squared)	0.034**
	(0.015)
Female	0.195***
	(0.035)
Capital city	-0.187***
	(0.045)
Constant	1.393***
	(0.126)

Notes: Absolute value of t statistics in parentheses: *significant at 10%; **significant at 5%; ***significant at 1%. The estimation also includes a regional dummy and 21 industry dummies; the omitted category is agriculture.

4.3. *Earnings differential*

We estimate three wage equations by OLS: one for formal workers, one for informal workers and another for the whole sample. In addition, we estimate wage equations for formal and for informal workers in line with the switching regression model. As mentioned above, the explanatory variables are years of schooling, potential experience and its square, and the above-mentioned set of dummies that capture gender, region and industry. The OLS estimation for the whole sample of workers also includes a dummy that indicates informality.

We report the results of all these estimations in table 3. For all the estimations, we obtain the expected coefficient signs of the human capital variables, although the statistical significance varies. Earnings increase with experience at a decreasing rate, and rise with schooling. Both the OLS estimations and the switching regression model indicate that the returns to schooling and experience are greater in the formal sector than in the informal sector. Moreover, when using the switching regression model we cannot reject the hypothesis that experience does not affect earnings in informality.

In addition, as expected, earnings are higher for men and people residing in the capital city. The gap due to gender is greater in the informal sector. Furthermore, when using the switching regression model, the estimated coefficient of the female dummy is not different from 0 (at the usual standard statistical levels) for informal workers.

Although the coefficient signs are stable, the coefficient magnitudes differ depending on whether or not we use the selection procedure. Specifically, the returns to schooling and the gender gap are lower in the switching regression model for both sectors. Additionally, the difference in these coefficients between sectors is higher when using the selection procedure.

Table 3
Wage equation estimates

	OLS estimates wage equation without selection correction			*Switching regression wage equations*	
	All	*Formal*	*Informal*	*Formal*	*Informal*
Informal	-0.489***				
	(0.019)				
Schooling	0.094***	0.099***	0.073***	0.081***	0.036*
	(0.007)	(0.006)	(0.008)	(0.009)	(0.020)

Table 3
(*continued*)

	OLS estimates wage equation without selection correction			*Switching regression wage equations*	
	All	*Formal*	*Informal*	*Formal*	*Informal*
Experience	0.029***	0.030***	0.022***	0.022***	0.007
	(0.002)	(0.003)	(0.002)	(0.003)	(0.012)
Experience	- 0.029***	-0.030***	-0.024***	-0.020***	-0.006
(squared)	(0.003)	(0.005)	(0.004)	(0.005)	(0.016)
Female	-0.154***	-0.159***	-0.139***	-0.101***	-0.040
	(0.015)	(0.014)	(0.031)	(0.024)	(0.069)
Capital	0.182***	0.145***	0.298***	0.116***	0.240***
city	(0.029)	(0.027)	(0.055)	(0.026)	(0.054)
Constant	2.134***	2.139***	1.766***	2.626***	1.820***
	(0.077)	(0.086)	(0.068)	(0.118)	(0.074)
Observations	14 465	11 184	3 281		
R-squared	0.47	0.39	0.21		
σ_i					0.716
σ_f				0.602	
ρ_i					0.586
ρ_f				0.698	

Notes: Absolute value of t statistics in parentheses: *significant at 10%; **significant at 5%; ***significant at 1%. The estimation also includes a regional dummy and 21 industry dummies; the omitted category is agriculture. The switching regression is performed by a joint estimation using the full-information maximum likelihood method.

In table 4 we present the results of the different estimates of the formal-informal gap. The estimated gaps based on the OLS procedure indicate that earnings are lower in the informal sector. Similar conclusions can be drawn from estimations provided by Amarante (2002), who estimates the earnings gap for 1991-2000 following Oaxaca's proposal. With our data, the raw gap is 0.83 and the proxies resulting from the Oaxaca decomposition are 0.48 ($G1$) and 0.49 ($G2$). Notice that the figure obtained by weighting the difference of parameters by the average characteristics of informal workers is quite similar to the one calculated with the average characteristics of formal workers. Thus, in both cases, working in the informal sector is less rewarded and the non-explained difference is about 58% of the raw average gap.

Table 4
Gap in wage earnings between formal and informal workers: different measures of the mean gap and its components

	Average predicted earnings		*Average selection term*		*Mean Gap*
	Formal (A)	*Informal (B)*	*Formal (C)*	*Informal (D)*	*(E)*
Raw gap					**0.832**
$G1$	$3.483^{1/}$	$2.998^{1/}$			**0.485**
$G2$	$3.830^{2/}$	$3.335^{2/}$			**0.494**
$G3$	$4.161^{1/}$	$2.999^{1/}$	$0.453^{1/}$	$0.452^{1/}$	**1.161**
$G4$	$3.826^{2/}$	$2.820^{2/}$	$-0.136^{2/}$	$0.136^{2/}$	**1.007**
$G5$	$3.741^{3/}$	$3.282^{3/}$	$-0.164^{3/}$	$0.629^{3/}$	**0.459**

Notes: 1/ Weighted by the average characteristics of the informal-sector workers; 2/ Weighted by the average characteristics of the formal-sector workers; 3/ Weighted by the average characteristics of the whole sample.

However, $G1$ and $G2$ may be biased if the peculiarities that determine wages are those that drive workers to each sector. The selection bias may be due to individual preferences or to the rationing in the formal sector. There is no consensus about how workers sort themselves or are sorted between sectors. As explained in section 2, we choose to introduce a selection rule through modeling a switching regression specification and we calculate three additional proxies of the gap. Estimated gaps and their components are also given in table 4.

Let us first analyze the correlation coefficient between the error terms in the selection equation and the disturbances in each wage equation (ρ_i and ρ_f). Both correlation coefficients are positive and significant. A positive ρ_i means a positive selection into the informal sector (equation (11)). That is, observed informal sector workers derive a comparative advantage from working in informality and so they are more successful than a worker drawn from a random sample. The prediction of informal earnings which stems from a non-selection procedure estimation overestimates the expected informal earnings of a random worker. Analogous reasoning applies to a positive ρ_f.[3]

[3] This result may be surprising because one would expect that highly rewarded workers in the formal sector select themselves as formal. A similar result was found by Marcouiller, Ruiz de Castilla and Woodruff (1997) for Mexican men, but they did not find it for Mexican women or for workers in the other Latin American countries studied (El Salvador and Peru).

Thus, the positive ρ_i indicates that informal workers are not drawn from the lowest part of the informal earnings disturbance distribution. Besides, as ρ_f is positive, we may infer that formal sector workers are not drawn from the highest part of the formal distribution. In other words, actual informal-sector workers have an advantage in the sense that they perform above average independently of whether or not they contribute to the social security system. Conversely, actual formal workers have a below-average performance whether they are sorted into the formal or the informal sector.

In columns (C) and (D) in table 4, we report the average selection terms involved in the estimation of the gaps obtained after the switching regression model. The estimated gap $G3$ measures the difference between the predicted earnings in the formal sector and in the informal sector, conditional on informality. The selection terms signs are driven by the correlation coefficient signs, as stated in equations 11 and 12, that is, they are positive. As their magnitudes are similar, the difference between the selection terms is close to zero. We obtain an estimated gap $G3$ equal to 1.16.

The proxy $G4$ is the gap conditional on being formal. As formal sector workers do better in informality, the selection term of conditional average predicted earnings in the formal sector is negative (column (C)). Analytically, it is the result of a positive ρ_f in equation (14). On the other hand, the selection term of the conditional average predicted earnings in the informal sector is positive (column (D)). The difference between the selection terms is negative but the mean gap $G4$ is positive (close to 1).

Lastly, $G5$, the difference between earnings in the formal and informal sectors, conditioned on being selected in the sector where the worker is observed, is 0.46.

4.4. *Estimations for sub-samples of salaried workers*

We performed similar estimations for different sub-samples. Specifically, we choose the group of private sector salaried workers because of the extent of formality among public servants, whereas informality is an actual option in private sector. Additionally, we estimate the wage gap for several industries. These estimations allow us to compare patterns of the profile of contributors and the wage gaps.

Informality accounts for 29% of private sector salaried work, that is, somewhat more than salaried work as a whole (23%). The informality share varies among private industries. We do not perform

estimations for financial services activities because of its low informality rate (0.3%). Notice that this economic activity is ruled by modern and foreign enterprises, and their workers have their own security administration. As regards the selected samples, the share of informality is lower than the average rate in the private transport, storage and communications sector (18%); it is similar to the average in the private manufacturing sector (23%) and in the trade, restaurants and hotels sector (26%) and lastly, it is higher than the average in the private building sector (37%) and in the personal and community services sector (40%).

Table 5 shows the main results. Most of the signs of the selection equation coefficients are the same as those obtained with the full sample, at least when significant at the usual statistical levels. Household characteristics indicate that household heads are more likely to be in the formal sector than other members of the household, and the probability of being formal increases with overcrowding. In addition, being married, having a pension and living in the capital city reduce the households probability of informality. Lastly, formality increases with education and experience. The repeated patterns suggest that individual decisions or rationing in the labor market affect groups with the same characteristics, whatever the economic activity.

In contrast to the above-mentioned similar patterns, the sign of the female dummy variable is negative for the full private-sector wage earners sample and for most of the industries. In fact, the gender coefficient is non significant only for personal and community services, which is the most female intensive industry (79% of its employment).

Like in the result obtained with the full sample, the correlation coefficient between the selection equation and wage equation disturbances are positive in the private sample and the five industry subsamples. The only exception is that ρ_i is not statistically different from 0 at standard levels for salaried workers in the private transport, storage and communication sector, which suggests a random selection in informality.

Table 5 also shows the estimated gaps. For all the sub-samples, $G1$ and $G2$ are positive, and once again, the estimations obtained when using the switching regression model indicate that these positive values do not depend on formal/informal selection.

5. Discussion

In Uruguay, as in several other Latin American countries, in the mid 1990s a re-design of the social security system tightened the relation-

ship between contributions and benefits. Moreover, the institutional background description suggests that in 2005, assistance benefits were considerably lower than contributory benefits and in addition, the administration had improved its effectiveness in preventing informal workers from accessing contributory benefits. The success of these changes in providing support for the elderly in the future relied on the decline in informal work. There is a cause for concern today because the level of informality is quite similar to the level in the years prior to the reform, which would lead one to expect social pressure to extend (or even create) assistance programs. As supportive welfare systems are often quoted as a cause of informality,[4] the way this tension is tackled becomes an important challenge. In fact, today the government is pursuing three strategies: re-strengthening enforcement, relaxing the access requirements for pensions and increasing benefits for formal workers. Once again, the success of these policies requires that many workers adapt to new conditions.

Table 5
Estimated results for salaried workers in private sector by industry

Variable	*All private*	*Manufacture*	*Building*	*Trade, restaurant and hotels*	*Transport and communications*	*Personal and comunity services*
Selection						
Household head	-.179**	-.207*	-.055	-.208*	.200	-.233*
	(.078)	(.109)	(.133)	(.113)	(.244)	(.131)
Spouse	.033	.092	.223	-.004	.518**	-.101
	(.078)	(.129)	(.382)	(.116)	(.239)	(.139)
Son/ Daughter	.055	.109	.189	-.031	.300*	.007
	(.039)	(.089)	(.410)	(.076)	(.176)	(.080)
Married	-.346***	-.302***	-.455*	-.365***	-.717***	-.306***
	(.046)	(.062)	(.459)	(.060)	(.142)	(.097)
Pension	.235***	.309**	.467***	.168	-.097	.209**
	(.070)	(.128)	(.179)	(.152)	(.342)	(.085)

[4] For a review of the causes of informal sector, see Schneider and Enste (2000), Perry *et al.* (2007).

Table 5
(*continued*)

Variable	*All private*	*Manufacture*	*Building*	*Trade, restaurant and hotels*	*Transport and communications*	*Personal and comunity services*
Household overcrowding	-.227*** (.038)	-.232** (.092)	-.216 (.230)	-.308*** (.067)	-.332** (.155)	-.164*** (.060)
Years of schooling	-.092*** (.005)	-.099*** (.007)	-.070** (.028)	-.112*** (.009)	-.113*** (.021)	-.084*** (.010)
Experience	-.019*** (.006)	-.039*** (.009)	-.013 (.041)	-.016 (.010)	-.039** (.017)	-.020 (.012)
Experience (squared)	.019 (.015)	.058*** (.022)	.015 (.065)	.017 (.023)	.043 (.033)	.020 (.027)
Female	-.033 (.036)	.011 (.100)	-1.310*** (1.624)	-.285*** (.077)	-.521** (.232)	.429*** (.074)
Capital city	-.250*** (.050)	-.304*** (.092)	-.210** (.103)	-.423*** (.052)	-.184 (.138)	-.129* (.068)
Constant	1.137*** (.121)	1.674*** (.248)	1.052*** (.372)	1.713*** (.112)	1.870*** (.366)	.306 (.190)
Observations	10 974	1 947	641	2 600	748	3 405
ρ_i	.618	.332	.508	.652	.120	.671
ρ_f	.766	.828	.948	.597	.939	.592
Raw gap	.723	.813	.743	.638	.749	.774
$G1$	.435	.546	.645	.428	.582	.354
$G2$	.515	.650	.623	.442	.496	.461
$G3$	1.267	1.403	1.811	1.199	1.740	.960
$G4$	.931	.853	.725	.796	.569	.909
$G5$	.458	.605	.563	.410	.471	.383

Notes: Absolute value of t statistics in parentheses: *significant at 10%; **significant at 5%; ***significant at 1%. Each estimation also includes subindustry dummies.

Knowledge of the scope for both the "escape" and "exit" informality interpretations helps us to analyze the role that we may expect from the social security policies. However, it is worth noting that not only may both causes be present at the same time, but they also

reinforce each other. Indeed, since workers need a certain period of stability in the formal sector in order to reach the minimum required history of contributions to be able to access a pension, if a worker is "pushed" into informality in a downturn, the incentives to return to formality decrease with time. Thus, an "escape" cause could become an "exit" cause, which could help to explain the apparent persistence of informality in countries subject to periodic crises.

We find patterns of informality that are similar to those in other studies for Latin America. Like Auerbach, Genoni and Pagés, (2005), we find a greater likelihood of informality for the young, for women and for less-educated salaried workers. Auerbach, Genoni and Pagés, interpret their results within the "exit" approach. In turn, Pisani and Pagan (2004) –although defining informality on the basis of unit size, which is highly correlated to non-contribution- find that low education and being female were the main determinants of informality in Nicaragua. They find a positive selectivity in both the formal and informal sectors and conclude that each sector attracts the workers best suited to that sector, that is, selection is the result of voluntary choice.

The "exit" approach among the young may be explained as being the result of a transitory state. In the case of women, two factors may increase the cost of formality: their frequent exits from the labor market, which pushes down the probability of reaching the number of contributions required for a pension, and the quest for flexibility (schedule, absences, etc.). It is worth noting that in an analysis of the social security records, Bucheli, Forteza and Rossi (2006) find that the highly fragmented formal work of women seriously compromises their access to pensions. Therefore, in a voluntary decision approach the enforcement mechanisms would be less effective than the redesign of benefits and costs. However, in the case of Uruguay, we may remember that the likelihood of women of being informal is not robust among samples.

The voluntary decision of less-educated workers to opt for informality depends mainly on whether they will thus increase present income. Once again, the transitory (or non-transitory) nature of informality is important. Note that Maloney (1999) reports that in Mexico transitions are very frequent and formality and informality are relatively well integrated. However, in the case of Uruguay, it is worth noting that in the downturns at beginning of the 1980s and end of the 1990s, unemployment increased especially among less-educated workers. The same applies to informality in the second of these downturns, (we do not have available information for the first one). Thus,

we could accept the interpretation that there was an "escape" cause followed by an "exit" cause.

We find, using different estimations and different samples, that formal wages are higher than informal wages. Estimations for several Latin American countries yield different results. Pratap and Quintin (2003) do not find evidence of a formal sector premium for Argentina. Marcouiller, Ruiz de Castilla and Woodruff (1997) find a formal sector premium for El Salvador and Peru but not for Mexico. Saavedra and Chong (1999) find that in Peru, formal wage earners are better off than informal ones.

These different results indicate that informality in Latin America may have different explanations and the weight of each one would vary among countries, as indicated by Perry *et al.* (2007). In the case of positive gaps as in Uruguay, the "escape" approach seems to be appropriate since there is no evidence that the costs of evaded contributions are shared. In any case, from the political economic perspective, a positive gap casts doubt on the actual possibilities of enforcement strengthening. In this sense, Forteza (2003) claimed that before the reform, non-enforcement worked as an informal redistribution policy and, hence, was quite popular, although the rules for compliance were unclear. The challenge is how to design effective formal policies.

6. Conclusions

In 2005, around 23% of salaried workers between 18 and 59 years old were not covered by the social security system. This level of informality has been quite stable in the country in recent decades. The phenomenon of informality is widespread in Latin America and there have been many studies that, by evaluating the patterns of formal versus informal-sector employment and the earnings gap among sectors, examine whether it is the result of the presence of segmentation. In this paper we explore the patterns of the personal characteristics of informal workers and their jobs, and the extent to which their earnings differ from those of formal workers. Specifically, we analyze a sample of salaried workers and sub-samples in the private sector.

The empirical results of the sectoral selection indicate that formality is more likely among people who are better-educated, men, residents in the capital city and heads of households. In addition, the likelihood of being in the formal sector increases with household overcrowding. Job and sector characteristics also impact on the likelihood of being informal. Not surprisingly, informality is less widespread in

activities in which the public sector is important in terms of production volume. These broad patterns are similar among samples and similar to those ones obtained in other studies in Latin American countries. In order to evaluate the earnings gap between sectors, we estimate five proxies that involve different procedures. First, we estimate a wage equation for formal workers and another for informal workers, and we use these to disaggregate the gap in line with the traditional Oaxaca decomposition. We find that after controlling by skills and other characteristics, the average earnings of formal workers are higher than those of informal workers for all the samples. Then we look for a way to introduce the selection procedure underlying the sectoral status of workers. Secondly, we estimate a switching regression model and three proxies of the formal-informal gap.

The results obtained through the joint estimation of sectoral selection and earnings indicate that the gap estimation needs to take a selection rule into account. The signs of the selection terms indicate that informal workers are more successful in informality than a randomly chosen worker. Although this result suggests that the decision to work in the informal sector is a voluntary choice, the wage gaps indicate that the advantage of informality does not depend on an increase in present consumption. Indeed, the estimations that involve a selection rule indicate that earnings are lower in the informal sector than in the formal sector for all the samples.

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Annex 1. Estimated coefficients of dummy industries in the switching regression model: Selection equation (probability of informality) and wage equation estimates

	Selection equation	*Wage equations*	
		Formal	*Informal*
Mining	-0.595	0.00873	-0.639
	(0.564)	(0.21)	(0.64)
Food products and beverages	-0.289	-0.0146	0.147**
	(0.176)	(0.040)	(0.072)
Textiles	-0.257	-0.176***	-0.334***
	(0.196)	(0.049)	(0.097)
Wood/paper	0.299	-0.0214	0.115
	(0.230)	(0.076)	(0.11)
Printing/ Furniture	0.295**	0.0894	0.203**
	(0.145)	(0.057)	(0.093)
Chemicals and petroleum	-0.163	0.178***	0.0357
	(0.152)	(0.048)	(0.099)
Machinery and equipment	-0.148	-0.0105	0.0729
	(0.110)	(0.055)	(0.11)
Electricity, gas and water	-1.422***	0.255***	1.490**
	(0.458)	(0.056)	(0.62)
Building	0.115	0.153***	0.214***
	(0.173)	(0.042)	(0.066)
Retail trade	-0.127	-0.205***	0.0151
	(0.136)	(0.036)	(0.060)
Wholesale trade	-0.172	0.0318	0.170**
	(0.134)	(0.043)	(0.080)
Hotels and restaurants	-0.030	-0.0585	0.226***
	(0.161)	(0.046)	(0.078)
Transport	-0.292***	-0.0429	0.0659
	(0.109)	(0.040)	(0.081)
Post and telecom-munications	-0.303**	0.132**	-0.0631
	(0.130)	(0.054)	(0.14)
Financial services	-0.869***	0.601***	0.104
	(0.158)	(0.046)	(0.23)
Services	-0.218*	-0.119***	0.165**
	(0.122)	(0.039)	(0.074)

Annex 1
(*continued*)

	Selection equation	*Wage equations*	
		Formal	*Informal*
Education	-0.803***	0.0719*	0.445***
	(0.137)	(0.038)	(0.12)
Health	-0.656***	-0.0165	0.0388
	(0.084)	(0.038)	(0.091)
Personal services	0.148	0.194***	0.412***
	(0.110)	(0.034)	(0.059)
Others	0.805	-0.377	0.0900
	(0.51)	(0.32)	(0.35)

Notes: Absolute value of t statistics in parentheses: *significant at 10%; **significant at 5%; ***significant at 1%.