

Social Security Entitlement in Maghreb Countries: Who is Excluded? Who is not Interested?

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Abstract

The issue of whether informal jobs are chosen voluntarily by the workers or as a strategy of last resort is controversial. Many authors recognize the informal sector is heterogeneous and it is composed of workers who voluntarily choose it and others who are pushed inside because of entry barriers to the formal sector (Günther & Launov, 2012). Using the SAHWA survey and discrete choice models, this article confirms the heterogeneity of the informal labor market in three Maghreb countries: Algeria, Morocco and Tunisia. Furthermore, this article highlights the profiles of workers who choose voluntarily informality, which is a lack in previous studies. Finally, this article proposes policy recommendations in order to extend social security to informal workers and include them into the formal labour market.

Key words: Informal employment, social security, Maghreb countries, individual preferences, discrete choice model.

1- Introduction

In his seminal contribution to understanding the mechanisms of informality¹ in developing countries, Maloney (2004) highlights the cost of social protections for poor workers. Given the low quality of services in many developing countries, mandatory contributions can be disadvantageous.

Alternative explanations include Lopez (1970) who postulates that individuals would choose informal job if they do not have access to formal one and Fields (1990) who shows that informal employment can be chosen for its easy access and flexibility of work. Günther and Launov (2012) show that the informal labor market is partly composed of workers who find it attractive and other that use it as a last resort opportunity. Shehu and Nilsson (2014) highlight the socio-demographic determinants of informality showing the impact of some variables on the probability of being enrolled in social security systems.

In this article, we address the issue of low social security coverage in three Arabic countries: Algeria, Morocco and Tunisia. We will show that some categories of workers are excluded, while others have the choice between formality and informality.

The methodology is based on an estimation of discrete choice models to study the determinants of informality. We rely on an original survey ("Sahwa") which provides a unique opportunity for cross country comparative analysis. The dataset covers 10 000 youth (15-29 years old) in five Arabic countries. It measures variables about the labour market, demographics, values, confidence in government and institutions and the importance of religion.

Our main focus is on the reasons of not being affiliated to social security. Some respondents declare that they choose to work informally to avoid income decrease or because they are simply not interested in social security coverage. Other workers declare that they are excluded from social insurance because their employers do not want to declare them to social security; in some cases, the employer himself is not insured. The likelihood to choose informality varies according to socio-demographic characteristics and other behavioural variables such as confidence in government and job satisfaction.

Our findings clearly show that job satisfaction decreases the willingness of choosing informality. Furthermore, we show that income has a negative impact on the probability of choosing informality for the second and third quartiles of workers; however this impact is positive for the last quartile. Self-employed are more likely to choose informality. Informality is more likely to be chosen in the agricultural sector. Even if education has negative impact on informality, it has a positive impact on the probability of choosing it. The probability of choosing informality is higher for risk averse and individualistic workers. Finally, the cross-country comparison shows that informality is more likely to be chosen in Morocco and Tunisia.

The empirical verification of the aforementioned postulate allows policy makers to assist the excluded workers and provide some nudges to participate to social insurance schemes for free riders who choose informality.

Extending social security could be made using a Beveridgian strategy and assistance programs for people who are excluded, particularly: female, low educated, temporary salaried workers, family workers, low income workers and singles according to our empirical results. However,

¹ From here, we will use "informality" and "non affiliation to social security" interchangeably.

governments of the investigated countries should also provide some incentives to increase the willingness of free-riders to participate to the social insurance scheme. These nudges may target: male, high educated, self-employed and employers and workers with high income (fourth quartile).

The reminder of this article is organised as follow. Section 2 will describe social security systems in the three studies countries. Section 3 will review the theoretical and empirical studies that deal with informality. Section 4 describes the data and the econometric approach. Section 5 displays the empirical results. Section 6 concludes.

2- Social security systems in Maghreb countries

Social security systems across Maghreb countries are quite similar. They are straightforward and made only by one basic public pillar. The systems are corporatist and contributive. In every country there is a set of insurance funds that cover the workers against the different categories of social risks. We will present some details about these founds in this section:

Algeria: The Algerian social security system is made up of five insurance funds that offer coverage against all social risks (sickness, maternity, accident and injury at work, death, disability, unemployment² and retirement). The first found is the "Caisse Nationale D'assurance des Salariés" CNAS. This found cover employees against sickness, maternity, accident at work and invalidity. The rate of contribution to this fund is 34% (9% supported by the employee and the rest by the employer) of monthly wage. 18.75% of this last is reversed to the pension found "Caisse National des Retraites" (CNR). It administers pensions of the salaried workers of the public and private sector. It offers a pension with maximum replacement rate of 80% of the mean of the five best wages of the active life (reference wage). On the other hand, the self employed and employer has to buy insurance from the "Caisse National d'Assurance des Non Salariés" (CASNOS). This fund covers the insured against the same risk as the CNAS except for maternity leave and accident at work. CASNOS administers pension scheme for non salaried workers as well. The contribution rate to CASNOS is 15% of the annual income of the self employed. However, there is a possibility for workers to pay a fixed amount of 32.400DZD per year if the annual revenue is not declared by the self employed. The replacement rate provided by CASNOS is the same (80%) as the CNR replacement rate. However, the retirement age is 65 years old (60 years old for women) for self-employed rather than 60 years (55 years for women) for employees. The two last insurance funds are the Caisse Assurance des Congé Payés et du Chômage Intempéries pour les travailleurs de Bâtiment, de Travaux publique et Hydraulique" (CACOBATH) and "Caisse National d'Assurance Chômage" CNAC. These funds cover respectively the leave caused by bad weather of the workers of construction sector and unemployment risk of the employees with permanent contracts (Merouani *et al.*, 2014).

Morocco: The social security system in Morocco provides coverage against all social risks. It is made up by the "Caisse Nationale de Sécurité Sociale" (CNSS), l'Agence Nationale d'Assurance Maladie" (ANAM) and "La Caisse Nationale des Organismes de prévoyance sociale" (CNOPS). These last three funds cover the salaried workers of the public and private sectors against all social risks (sickness, maternity leave, work injury and accident at work, invalidity and death). The contribution rate to social security in morocco is 28.40% of the wage (21.47% paid by the employer). 11.89% of this contribution is used to finance pensions which is administered by " la Caisse Marocaine des Retraites" (CMR). The maximum replacement rate of the pension system in Morocco can reach 100% for the employees of public sector and 70% for the employees of private sector. These latter can also subscribe for supplementary pension scheme which is

² Only employees with permanent contract are eligible to unemployment insurance

administered by the "Caisse Interprofessionnelle Marocaine de Retraite" (Dupuis et al, 2010). Otherwise, the government has established a law in 2010 (law n° 03-07) allowing to self employed to be entitled to the social security system. However this law is not yet applied which mean that the self employed can only be insured through the voluntary insurance in the market. This voluntary insurance charges the insured 12.89% and 4.52% for pension and health insurance respectively.

Tunisia: Tunisian social security system is made up of two principal schemes: the schemes of salaried workers and the schemes of non salaried workers. The first one is administered by the "Caisse Nationale de Sécurité Sociale". This fund provides insurance against invalidity, death, unemployment and provides pension and family allowance as well. Health insurance of the employees is administered by "Caisse Nationale d'Assurance Maladie" (CNAM). This fund provides coverage against sickness, maternity leave, work injury and accident at work. The total contribution rate³ is between 26.15% and 29.75% (the employer part is between 16,97% et 20,57 %). 12.5% of the contribution goes to retirement insurance. The maximum replacement rate for pension is 90% and 80% for the employees of the public and private sectors respectively. The legal age of retirement is 60; however due to preretirement possibility the average age of retirement is 58 (Ben Othman & Marouani, 2016). Furthermore, there is a pension fund for public sector workers, its named "Caisse Nationale de Retraite et de Prévoyance Sociale" (CNRPS). This found administer pension and death insurance for public sector workers.

The Tunisian social security system also includes the self-employed scheme; it is administered by the same fund as for employees. The affiliation of the self employed is mandatory to CNSS and CNAM. However, the insurance against accidents at work and work injury is voluntary. The contribution of self employed workers is about 14.71% of the declared income. The pension replacement rate varies from 30% of the average income of the 10 first years of the active life to 80% if the workers have contributed for 35 years.

In order to extend coverage, Tunisia has improved its social security system in 2002 by creating a special scheme for low income workers and a special scheme for artist and intellectuals (Ben Brahem & Marouani, 2016)

3-Literature review on informal employment.

This article is related to the literature on labor market segmentation. A general observation in developing countries is the coexistence of a small formal and a large informal labor market. The first segment is usually well organized and covered by social security systems. However, the second segment is not covered by social security. Researchers have studied whether or not the informal employment is chosen voluntarily or whether people are pushed in because of the barriers to access to the formal job (Günther et al, 2012). The majority of researchers argue that the informal labor market is composed of individuals who choose informality and others who do not. Lopez (1970) argues that individuals may choose informal employment if they find barriers to access to formal one. In a study on the Indian labor market, Duggal (2006) stipulates that unemployed uses the strategy of "let's start with something"; in this sense they choose any kind of job (even the informal job without social security coverage). Falco (2013) shows that unemployed can choose between formal employment with difficult access and informal jobs with easy access. Renena (1998) shows that, in India, social security is not the priority of the workers; the famous expression of female workers is: "Let us earn enough income and we can take care of all our other needs", these women prefer economic security (income) rather than social security. Other researchers analyzed job satisfaction in the formal and informal sectors; Razafindrakoto et

³ Contribution rate is variable according to the probability to having accident at work and work injury.

al (2012) explore Vietnamese workplace. They show that 39% of informal workers are satisfied with their job; 50% declare that they are neither satisfied nor not satisfied and less than 10% declare that they are not satisfied. Their results show the heterogeneity of labor markets and the need for further researches to identify who is really satisfied with informal job as we will show in the present article. Fields (1990 et 1975) lead a study on informal workers Malaysia and Costa Rica, he shows that informal workers are satisfied with their job and they do not want to look for a formal employment. According to Fields, people choose informal employment for many reasons; for the easy access and also because informal employment do not require a high level of education or a high cash flow. These flexibilities allow people to look for another better job (Fields, 1990). De Soto (1989), argues that choosing informality is a rational behavior adopted by the self employed to escape the bureaucratic burdens and costs of formality. Others consider informality as a result of the multinational firms strategy that tend to employ local workers without social security coverage in order to minimize their cost of work (Moser, 1978; Portes, Castells and Benton, 1989).

Banerjee (1983) shows that 41% of the informal workers in India are looking for a new job which means that more than half of his sample is satisfied with their informal job. A similar result was found by Rhee (1986) in south Korea. By applying an econometric model on seven Latin American countries, Auerbach et al (2007) show that low social security coverage is the result of the workers' low willingness to participate to this system.

Some studies on the mobility of workers in labor markets shows that workers may move from formal to informal jobs; Bellache (2010) shows by using a survey in the region of Bejaia (Algeria) that a high proportion (42%) of informal workers have left a formal job. Maloney (2004) shows that among formal workers who move to the informal sector in Mexico, two thirds move voluntarily looking for more independence or higher income. He assumes that informal employment maybe be chosen by individuals for the desirable non-wage features; those individuals maximize their utility rather than their income. Mazumdar (1981) and Balan et al. (1975) have led a study in Malaysia and Mexico respectively; they both show that workers leave formal job to occupy informal one. The authors argue that informal jobs offer more flexible hours of work and sometimes a higher income than formal employment.

A more recent study in the MENA region (Libanon, Morocco, Syria and Jordan) shows the heterogeneity among workers behavior in labor market (Gatti et al, 2014). The authors ask the question whether or not the workers are looking for a new job. The findings show that 45% of the informal workers are looking for a new job, which confirms the behavioral heterogeneity between workers with regards to informality.

In the light of this literature, we argue that there are two main thoughts about the origin of informal employment: the first one believes that informal employment is chosen voluntarily and the second one see informal employment as activity of subsistence and a strategy of last resort. We believe that the two thoughts can be simultaneously true. In the following section, we will be concerned with the identification of the individual characteristics of those who chose informality. We will also reveal the characteristics of workers who are pushed involuntarily in informal employment. To do this we will rely on the "Sahwa" dataset.

4- Data and Econometric approach.

4-1 Data.

This article uses the "Sahwa" dataset which is issued from a representative survey covering 10.000 households in five Arabic countries: Algeria, Egypt, Lebanon, Morocco and Tunisia. The sample was chosen using stratified sampling. Conducted in 2016, this survey focuses on youth empowerment and analyses the situation of one young person (15-29 years old) from each household. This gives 2000 young per country and 10.000 young respondents in the total sample.

In our article we focus only on the active young workers in the three Maghreb countries (Algeria, Morocco and Tunisia) which reduce our sample to 1525 employed. We focus in this article on the issue of affiliation to social security. We adopt the ILO definition of informality: informal employment is the employment not covered by the social security system.

We dropped some incoherent results from the dataset. We deleted the self-employed who declare that they are not insured because their employers do not want to declare them. Even if it is reduced, the size of the sample still allows for econometric modelling.

4-2-Econometric approach.

In order to uncover the factors making workers choose informality, we estimated a weighted logit model for the entire sample including the three countries⁴. We use weight to get a representative result for all the population. Weighting is used in surveys to show how many persons, of the total population, are represented by the surveyed person. This variable (weight) is larger than one for under-represented groups and smaller than one for over represented groups⁵.

As we mentioned before, we utilize a logit⁶ model which allows us to estimate the impact of socio-demographics variables on the likelihood of choosing informality.

$$CH_i = \beta + aSD_i + \varepsilon_i \quad (1)$$

The dependent variable of choosing informality CH_i was measured using the following question : Why you are not affiliated to the social security system ?

- My employer does not want to declare me
- My employer is not insured
- I am not interested in social security
- To avoid decrease in my salary

We group the two first answers in the category of "excluded" and the two last categories in the category of "chosen informality". SD_i is a vector of socio-demographic variables. Hence, collinearity problem can rise in the model. We care about this problem in this article through measuring Variation Inflation Factor (VIF). This factors measure the inflation of the coefficients of the model induced by the correlation between the independents variables. Collinearity occurs when the VIF are greater than 10 (Mansfield & Helms, 1981).

Finally, in order to get more precise result, we measure interaction effects in the logit model. Interaction effects measure the impact of two independent variables simultaneously on the probability of choosing informality. This can be formalised in the following equation:

$$y = a + \beta_1 X_1 + B_2 X_2 + \beta_3 X_1 X_2 + \varepsilon$$

Analysing interaction effect consists of the interpretation of β_3 which measures the impact of X_2 on y controlling for X_1 . For example, if y is the variable that measure the probability of getting disease, X_2 is a dummy variable of "smoking" which take the value 1 if the individual smokes. X_1 is gender variable. In the model below β_3 would measure the impact of smoking on the likelihood of getting sick among female.

⁴ The sample of workers by country is low and it is less likely to provide a consistent results.

⁵ For more details about method of weighting see Solon et al; 2015.

⁶ For more detailed on logit model see Merouani et al 2016.

5-The empirical results

5-1- Who are the free riders? Disruptive statistics.

As is well known in employment surveys for the studied societies, the Sahwa survey confirms the low rate of participation in the social security system. Among 1525 workers in the three countries, only 485 (31%) participate. The low participation is observed for the three countries, the participation rate to social security (to formality) is about 41% in Algeria; 21% in Morocco and 30% in Tunisia. These proportions constitute the formal employment of the labour market. According to Gunther et al (2012) income provided for the respective employments (formal and informal) can be a determinant of individual choices. We present the distribution of logarithm income for formal and informal employment in following figure:

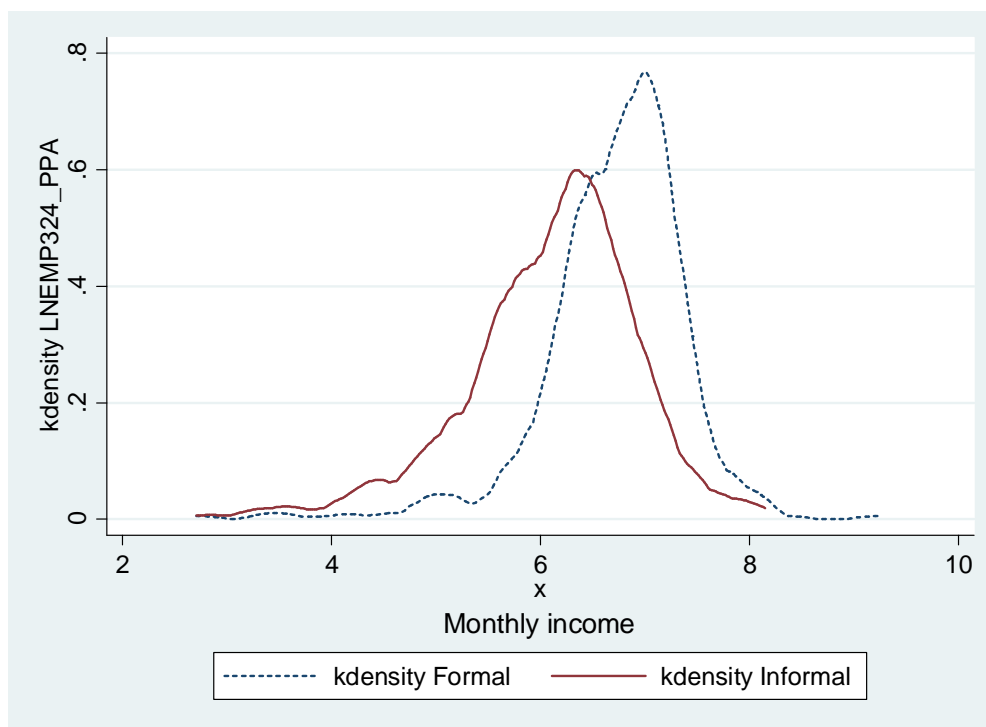


Figure 1: densities of monthly log-income.
Source : Sahwa dataset using stata.

The figure below shows that formal and informal incomes overlap and it also demonstrate that not all informal workers earn less than formal workers. This result is in line with (Günther et al, 2012) when they plot the wages of formal in informal workers in Côte d'Ivoire.

The reasons of not being insured are summarized in the following table:

	Algeria	Morocco	Tunisia	Total
Employer refuses to insure me	11,46	13,28	11,14	11,97
I am not interested	35,29	59,6	41,23	45,66
Reduction in my salary/ earnings	9,29	16,95	15,88	14,19
Employer is not insured	23,22	9,6	13,09	15,06
Other (specify)	20,74	0,56	18,66	13,13

Total	100.00	100	100	100
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Table 1: reasons of not being insured.

The table below shows that the largest part of the respondents (46%) are not interested in social security. 14% are not affiliated to avoid reduction in their earning; 12% and 15% of the workers declare that their employer is not unsure or does not want to insure them. These workers would be excluded from the social security system.

In order to simplify the result reading, we group the four categories into two categories distinguishing between workers who chose⁷ informality and those who are excluded⁸ from social security system. The result shows that 69% of the workers prefer to not being insured. The rest of the workers (31%) are excluded. The proportion of workers that choose informality varies across countries: it is equal to 56% in Algeria 77% in Morocco and in 70% in Tunisia.

The summary statistics of the survey show that informality is chosen both in rural and urban areas; 70% and 67% of the workers in the rural and urban area respectively choose informality. The highly educated seem to be more likely to choose informality; 73% of people with secondary and high educated choose informality. This number is about 66% for the low and medium educated. Marital status analysis shows 75% of married workers prefer informality and 68% of single choose informality⁹. Given that self-employed workers do not depend on an employer to purchase social security, they all choose informality if they are not affiliated to social security.

We analyzed the question about confidence in government and we found that 67% of the people who choose informality are not confident in the government, which means that confidence in government might be a significant determinant of choosing informality and avoiding public social security system. This article analyzed the variable of choosing informality with respect to job satisfaction and found that people who are very satisfied with their job are more likely to choose informality. Hence, people would prefer informal job for the satisfaction that this job provides. The result shows that 62% of workers who choose informality are satisfied with their job and 38% are not satisfied. We are aware in our study about household composition; the result shows that 67% of respondents who live with parents and 75% of respondents who do not live with parents choose informality. The result shows also that when parents are not insured, children are more likely to choose informality: 72% of children choose informality. When parents are insured, 65% of workers choose informality.

In order to reveal the relationship between choosing informality and the religious factor, we explore the question of the importance of religion in place of work and the importance of religion in trade and financial transaction. We found that the proportion of people who choose informality is less important (67%) for people that care about religion (religion is very important in place of work) and more important (75%) for people who do not care about religion (religion is unimportant in place of work). The same result has been found for the importance of religion in trade and financial transaction. These results let think about the negative impact of religion on the preference for informality.

The survey allows knowing if the workers are looking for a new job and shows that 76% of workers who choose informality are not looking for a new job. We also test the relationship

⁷ Workers who declare that they are not insured because they are not interested or to avoid reduction in their income.

⁸ Workers who declare that the employers do not want to declare them or he is himself not declared to social security.

⁹ The number of divorced and widowed is very small in the sample.

between risk aversion¹⁰ and the informality preference. This relation shows that risk takers are more likely to choose informality than risk adverse workers. We test a second behavioural variable which is altruism¹¹. This variable does not seem to affect preference for informality. The proportion of altruistic people who choose informality is almost equal to the proportion of individualistic workers who choose informality.

We display more details and descriptive statics in the Annex.

5-2- Econometric Results.

The summary statistics displayed above show a general tendency and correlation between socio-demographics and informality preference. In order to get more precise result about the causality, we run weighted logit regression. As mentioned in section 3, this model will reveal the impact of the different socio-demographic variables on the probability of being insured first and then we run a second model to show the determinant of informality preference. The results of the two models are presented in the table below.

¹⁰ Having adventures and taking risks is important to this person; living an exciting life. The answers are ranked from 1 this greatly resembles me to 6 Does not resemble me at all.

¹¹ It is important to this person to take care of the people around them. The answers are ranked from 1 this greatly resembles me to 6 Does not resemble me at all.

VARIABLES	(1) odds ratio Affiliation to social security	(2) odds ratio choosing informality
Urban	1.142 (0.188)	0.770 (0.156)
More than secondary education	2.091*** (0.324)	1.802*** (0.380)
Single	0.411*** (0.105)	0.887 (0.335)
2. Permanent employee	6.404*** (1.268)	0.306*** (0.120)
3. non permanent employee	0.879 (0.165)	0.372*** (0.121)
4. Contributing family help	0.467** (0.176)	
2. Neither confident or not confident	0.915 (0.188)	0.877 (0.256)
3. confident in government	0.988 (0.177)	0.866 (0.220)
2. satisfied	0.700* (0.130)	0.755 (0.251)
3. dissatisfied	0.512*** (0.121)	0.507* (0.186)
4. very dissatisfied	0.249*** (0.0833)	0.421** (0.162)
Living with parent	2.014*** (0.449)	0.760 (0.211)
Parent insured	2.552*** (0.430)	0.781 (0.157)
Femal	1.094 (0.192)	1.028 (0.255)
Religion at work		
2 Important	0.791 (0.176)	0.900 (0.245)
3. Neither important nor unimportant	0.725 (0.207)	1.303 (0.493)
4. Unimportant	0.735 (0.268)	1.328 (0.622)
5. Not important at all important	0.689	1.953
Religion in commercial transaction	(0.286)	(1.029)
2. Important	1.103	1.131

	(0.251)	(0.306)
3. Neither important nor unimportant	0.634	1.418
	(0.191)	(0.516)
4. Unimportant	1.276	1.403
	(0.409)	(0.659)
5. Not important at all important	1.148	0.790
	(0.477)	(0.367)
Not looking for a new job	1.733***	1.513*
Risk seeking (ref1)	(0.303)	(0.322)
2.risk2	1.415	0.811
	(0.366)	(0.260)
3.Risk3	1.504	0.690
	(0.402)	(0.219)
4.Risk4	1.451	0.908
	(0.413)	(0.329)
5.Risk5	2.196***	0.378***
	(0.599)	(0.130)
6. Risk6: high risk aversion	2.167***	0.750
Altruistic 1	(0.556)	(0.294)
2.Altruism2	0.819	1.252
	(0.177)	(0.351)
3.Altruism3	0.846	0.948
	(0.186)	(0.275)
4.Altruism4	0.668	1.677
	(0.185)	(0.617)
5.Altruism5	0.608	0.763
	(0.246)	(0.349)
6.Altruism6 (individualistic)	0.819	0.250*
	(0.427)	(0.211)
Constant	0.0720***	4.258*
	(0.0363)	(3.322)
Observations	1,387	583

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table2: Weighted logit model. Dependent variables (1) affiliation to social security and (2) choosing informality
Source: Sahwa dataset using Stata.

Model 1: the second column of the table below displays the odds ratio of the logit model that explains the determinant of informality (not being insured by social security). It appears that stratum do not have a significant impact on informality in the studied societies. However, our study confirm a set of previous researches (Bellach, 2010, Galiani, 2012, Merouani et al, 2016) by showing that education has a negative impact on informality. The analysis of the marital status shows that single workers are less likely to be affiliated to social security; this maybe because they do not have to care about family numbers or because the family insurance replaces the social security system for this category of workers. The logit model also displays the impact of

employment status on the probability of being insured. It shows that permanent employees are more likely to be affiliated to social security than employers and the self employed. These latter are risk seeking and free riders (Falco, 2013); they tend to avoid formal institutions, hence, they avoid social insurance funds. Finally, family contribution workers are less likely to be affiliated to social security system comparing to employer and self employed. This may be due to the low qualification of this category of workers and the lack of flexibility of the social security systems which do not enable family workers to be entitled to social security. The results about confidence in the government do not raise any significant impact on the likelihood of informality. Job satisfaction tends to be a significant determinant of informality. People who are satisfied with their job are ready to stay into even if the job is informal. The result of the logit model shows that people who are not satisfied are less likely to be affiliated to social security. Furthermore, the household composition has a significant impact on the probability of participation in the social security system; the model shows that people who live with their parents are more likely to be affiliated. This is because the affiliation of the workers aims to cover the other members of the household. The results show also that the probability of being insured is higher for those who have insured parents. Surprisingly, gender has no effect on the probability of being insured, previous studies about Algeria have shown that female are less likely to be insured (Merouani et al; 2016. Bellache et al 2010). As we said before, the Sahwa dataset offer an opportunity to test the impact of some behavioural variables on the social security entitlement. We test particularly the impact of religion, risk aversion and altruism on the probability of being insured. The religion does not seem to have a significant impact. However, risk aversion has a positive impact on the probability of being insured. More risk adverse people are more likely to be insured by social security. These results are in line with Merouani et al (2016). Altruism has no significant impact on the probability of being insured.

Model 2: the second model in the third column of the table regresses the same variables than the first model on the probability on choosing informality. The results show that the stratum does not impact significantly the probability of choosing informality. The relationship between education and the probability of choosing informality is positive. Among informal workers, high educated are more likely to avoid social security system. The marital status does not seem to have a significant impact on the willingness to choose informality. The analysis of the job status shows that self-employed and employers are more likely to choose informality compared to employees (permanents and non permanents contracts). Surprisingly, the model shows that confidence in government does not have a significant impact on the probability of choosing informality. As we have mentioned in the first model, job satisfaction may be one of the significant determinants of choosing informality. The second model shows that the most satisfied with job are more likely to choose informality. This informal job may give satisfaction higher than the satisfaction provided by social security in a formal job. We have also tested the inverse relationship (impact of social security on job satisfaction, table 13 in the appendix); we find that insured people are more satisfied with job. We also find that people who choose informality are more satisfied. Otherwise, living with parents or having insured parents does not have an effect on the likelihood of choosing informality. The impact of gender and religion on the probability of choosing informality is not significant. Furthermore, we have explored in this model the question that asks respondents if they are looking for a new job. Results show that people who choose informality are not looking for a new job which means that they might be satisfied with their job. Otherwise, risk aversion has been selected as a significant determinant of pension saving (Bommier, 2014) and social security participation (Merouani, et al; 2016), this is we are aware about the impact of risk aversion on the probability of choosing informality in this study. Our findings are in line with

the previous literature, they show that risk averse individuals are less likely to choose informality. The second behavioral variable is altruism, this variable play an important role in social dilemma (Murphy et al, 2012; Alger et al, 2013; Triol, 2017). This article shows that individualistic people are more likely to choose informality. These individuals do not want to participate to a system based on solidarity where the young pay pension for elderly and healthy people pay for sick people. We believe that the impact of these behavioral variable on the probability of choosing informality area value add to the literature.

In order to avoid collinearity, especially between income and education, we run another model that reveals the impact of income, sector of activity and age on informality. This model also allows to know in which country informality is more preferred. The results are presented in the following table:

VARIABLES	(1) Affiliation to social security odds ratio	(2) Choosing informality odds ratio
2.Pincome2	1.760** (0.432)	0.672* (0.149)
3. Pincome3	4.139*** (0.979)	0.574** (0.135)
4. Pincome4	8.086*** (1.916)	1.740* (0.536)
2.Manufacture	6.843*** (2.628)	0.809 (0.271)
3.Building	1.358 (0.549)	0.513** (0.142)
4.Trade and services	3.823*** (1.269)	1.283 (0.295)
Age	1.173*** (0.0283)	1.018 (0.0235)
4.Morocco	0.288*** (0.0662)	2.932*** (0.700)
5.Tunisia	0.931 (0.164)	2.059*** (0.433)
Constant	0.00120*** (0.000920)	1.000 (0.570)
Observations	1,305	760

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 3: Logit models. Dependent variables: affiliation to social security and choosing informality. Source: Sahwa dataset using Stata.

The table shows that income has a positive impact on the likelihood of affiliation to social security. This result is in line with the literature (Bellach, 2010. Merouani et al, 2016). Furthermore, other studies argue that income in informal employment is lower than the income of formal employment (Shehu and Nilsson, 2014). However, the impact of income on the probability of choosing informality is negative for the first three quintile of income and it is

positive for the highest category of income. Workers of this last category are more likely to choose informality. Sector of activity analysis shows that workers in manufacture are more likely to be affiliated to social security; the second best covered sector is trade and services and then building sector. The agricultural sector is the worst covered by social security in the studies society. This result is in line with the data of the household employment survey. Those surveys show that the coverage rate in agriculture sector is very low (see ONS for Algeria, HCP for morocco and INS for Tunisia). In term of preference for informality, the model in the last column of the table shows that workers of construction sector are less likely to choose informality. This confirms Portes et al (1989) hypothesis that argues that firms do not declare their employees in order to maximize their profits. Otherwise, Age has a positive impact on the probability of being insured wich is in line with Shehu et , al (2014) and Merouani et al (2016). However age does not seem to affect the preference for informality.

This article is leaded in a context of cross country comparative study. The result shows that the probability of being insured is higher in Algeria comparing to Tunisia and Morocco. However, In Tunisia the probability of choosing informality is twice higher than the probability of choosing informality in Algeria. This might due to Arab spring events.

Finally, to test the robustness of our model, we insure that collinearity problem does not occur in our models. As we said in the second section colliniarity happens when the independents variables are correlated. In the following table we display VIFs variation inflation factor to show that colliniarity problem does not exist in our models. The VIFs are all inferior to 10.

Variable	VIF	Squared VIF	Tolerance	R-Squared
Urbain	1.15	1.07	0.8712	0.1288
Education	1.15	1.07	0.8668	0.1332
Marital status	1.38	1.17	0.7267	0.2733
Job situation	1.08	1.04	0.9252	0.0748
Confidence in gouvernement	1.01	1.01	0.9869	0.0131
Job satisfaction	1.30	1.14	0.7707	0.2293
Living with parent	1.40	1.18	0.7136	0.2864
Parents insured	1.15	1.07	0.8678	0.1322
Gender	1.07	1.04	0.9309	0.0691
Religion	1.17	1.08	0.8520	0.1480
Search for a job	1.27	1.13	0.7894	0.2106
Risk aversion	1.15	1.07	0.8677	0.1323
Altruism	1.15	1.07	0.8712	0.1288
Mean VIF	1.19			
Model 3 & 4				
Variable	VIF	Squared VIF	Tolerance	R-Squared

Pct	1.22	1.10	0.8194	0.1806
Sect	1.03	1.01	0.9714	0.0286
Age	1.07	1.04	0.9307	0.0693
Country	1.15	1.07	0.8713	0.1287
Mean VIF	1.12			

Table 4: collinearity diagnostic.

Source: Sahwa dataset.

In order to get more detailed results, we test interaction effects in this article. As mentioned in section 3, interaction effect analysis allows to measure the impact of two variables simultaneously on the dependents variables which are being informal worker and the probability of choosing this informality. The results of interaction effects are presented in the table 12 in the annex. They confirm the positive impact of education on the probability of being insured and the probability of choosing informality as well. The gender analysis shows that female are less likely to choose informality. However, the interaction between education and gender does not give a significant result.

Even if it was not significant in the previous models, marital status analysis shows that single workers are less likely to be insured than married. The impact of the job situation on the dependent variables is confirmed in this model, we tested its interaction with gender and no effect appeared which means that there not a significant difference between man and women given their job situation. The cross country analysis shows again that in morocco people are more likely to choose informality than in Algeria. The interaction between countries and gender shows that female in morocco and in Tunisia are less likely to be insured than female in Algeria. Interaction between countries and sector activity shows that in Morocco, trade and services sector are less likely to be covered by social security system. In Tunisia, workers of building and services sector are less likely to be insured. Last but not least the interaction between quartile of income and gender shows that female of the last quartile of income are more likely to choose informality.

6. Conclusion

This article challenged a topical issue of informality in Maghreb countries. We have explored an original survey data to reveal the profile of workers in the studied countries. We have discovered the main variables that make workers choosing informality. We believe that the result will enable us to formulate policy recommendation enhancing the extension of social security to all the workers in the studied countries.

We have shown that more educated people are more likely to be insured, but they are also more likely to choose informality. Social security system and insurance companies must incentives this category of workers by a good nudges (Thaler, 2016) because they are able to make a rational choice. The insurance contracts must be fair enough to attract high educated workers. We have also shown that self employed are more likely to choose informality; this is due to the distortion of the insurance system dedicated to self employed in these countries. The self employed schemes need to develop their insurance contracts and offer the same benefit to self employed as to employees. Actually, self employed are excluded from some benefits such accident at work, and maternity leave. Allowing access to this benefit will improve participation of self employed to social security system. Furthermore, some authors (Renana, 1998) suggest to improve social security coverage through the market and insurance companies, this companies would be more likely to offer a contract suitable to income and needs of self employed. The results show that workers may prefer informal employment because it offers higher job satisfaction than formal one. Risk aversion seems to be a significant determinant of social security participation. Hence

social security systems may offer high quality of protection in order to get more adherents. The result about altruism shows that individualistic workers are more likely to choose informality. This category (individualistic) of people may prefer saving in individual account rather than saving in pay as you go system based on solidarity.

Our next general conclusion states that some categories of workers are excluded from formal labor market and they need a particular assistance through the beveredgian component of social protection system. According to the result of our models those categories are contributing family workers, non permanent employees, female, single, low educated workers, workers with low income and workers of building sector.

Moving now for more particular result, according to the result of interaction effect, that in Morocco, female with high income are more likely to choose informality, hence they should be targeted by a particular nudges to participate to formal sector. This can be done through the existing systems of social security or through the market that offer more suitable insurance contract to wealthy female workers. Female in Morocco and Tunisia are less covered by social security system compared to Algeria, which may push policy makers to think about implementing particular measures in order to cover these categories of workers. The results show also that, comparing to Algerian system, the Moroccan and Tunisian systems are less likely to cover workers in the sector of building and in the sector of trade and services. These countries may focus in those sectors.

Last but not least, we should note that this article need further research attention. We have focus only on three Maghreb countries; the result can be extended to two more Arabic countries which the data are available. The econometric models can be improved by including instrumental variable and test the problem of selection. Also, we can include some macroeconomic predictors to explain the informality such GDP per capita in each country.

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Appendix :

Summary statistics

Affiliation to social security				Choose informality			
No	1,039	68.13	68.13	No	280	31.11	31.11
Yes	486	31.87	100.00	Yes	620	68.89	100.00
Total	1,525	100.00		Total	900	100.00	
Affiliation to social security.dz				Choose informality.dz			
No	326	58.74	58.74	Non	112	43.75	43.75
Yes	229	41.26	100.00	Oui	144	56.25	100.00
Total	555	100.00		Total	256	100.00	
Affiliation to social security.ma				Choose informality.ma			
No	354	78.15	78.15	Non	81	23.01	23.01
Yes	99	21.85	100.00	Oui	271	76.99	100.00
Total	453	100.00		Total	352	100.00	
Affiliation to social security.tn				Choose informality.tn			
No	359	69.44	69.44	Non	87	29.79	29.79
Yes	158	30.56	100.00	Oui	205	70.21	100.00
Total	517	100.00		Total	292	100.00	

Table5: Affiliation to social security and the reason for not being insured.

Source: Sahwa dataset.

Affiliation to social security				Choose informality			
	No	Yes	Total		No	Yes	Total
Married	112	80	192	Married	26	74	100
Single	911	401	1,312	Single	252	532	784
Total	1,023	481	1,504	Total	278	606	884
Affiliation to social security.dz				Choose informality.dz			
	No	Yes	Total		No	Yes	Total
Married	25	26	51	Married	5	14	19
Single	299	203	502	Single	106	129	235
Total	324	229	553	Total	111	143	254
Affiliation to social security.ma				Choose informality.ma			
	No	Yes	Total		No	Yes	Total
Married	57	22	79	Married	15	41	56
Single	285	72	357	Single	65	219	284
Total	342	94	436	Total	80	260	340
Affiliation to social security.tn				Choose informality.tn			
	No	Yes	Total		No	Yes	Total

Married	30	32	62	Married	6	19	25
Single	327	126	453	Single	81	184	265
Total	357	158	515	Total	87	203	290

Table 6: Affiliation to social security and the reason for not being insured by marital status
Source: Sahwa dataset.

Affiliation to social security				Choose informality			
	Yes	No	Total		Yes	No	Total
Medium education and less	611	157	768	Medium education and less	183	359	542
More than medium education	428	329	757	More than medium education	97	261	358
Total	1,039	486	1,525	Total	280	620	900
Affiliation to social security .dz				Choose informality.dz			
	Yes	No	Total		Yes	No	Total
Medium education and less	208	75	283	Medium education and less	82	84	166
More than medium education	118	154	272	More than medium education	30	60	90
Total	326	229	555	Total	112	144	256
Affiliation to social security .ma				Choose informality.ma			
	Yes	No	Total		Yes	No	Total
Medium education and less	222	41	263	Medium education and less	46	176	222
More than medium education	132	58	190	More than medium education	35	95	130
Total	354	99	453	Total	81	271	352
Affiliation to social security .tn				Choose informality.tn			
	Yes	No	Total		Yes	No	Total
Medium education and less	181	41	222	Medium education and less	55	99	154
More than medium education	178	117	295	More than medium education	32	106	138
Total	359	158	517	Total	87	205	292

Table 7: Affiliation to social security and the reason for not being insured by level of education
Source: Sahwa dataset.

Affiliation to social security				Choose informality			
	No	Yes	Total		No	Yes	Total
Not confident in government	678	291	969	Not confident in government	181	415	596

Neither confident or not confident	152	86	238	Neither confident or not confident	40	87	127
Confident	209	109	318	Confident	59	118	177
Total	1,039	486	1,525	Total	280	620	900
Affiliation to social security.dz				Choose informality.dz			
	No	Yes	Total		No	Yes	Total
Not confident in government	182	126	308	Not confident in government	59	86	145
Neither confident or not confident	47	35	82	Neither confident or not confident	17	16	33
Confident	97	68	165	Confident	36	42	78
Total	326	229	555	Total	112	144	256
Affiliation to social security.ma				Choose informality.ma			
	No	Yes	Total		No	Yes	Total
Not confident in government	222	64	286	Not confident in government	55	166	221
Neither confident or not confident	60	16	76	Neither confident or not confident	15	44	59
Confident	72	19	91	Confident	11	61	72
Total	354	99	453	Total	81	271	352
Affiliation to social security.tn				Choose informality.tn			
	No	Yes	Total		No	Yes	Total
Not confident in government	274	101	375	Not confident in government	67	163	230

Neither confident or not confident	45	35	80	Neither confident or not confident	8	27	35
Confident	40	22	62	Confident	12	15	27
Total	359	158	517	Total	87	205	292

Table 8: Affiliation to social security and the reason for not being insured by confidence in government.
Source: Sahwa dataset.

Affiliation to social security				choose informality			
	Non	Yes	Total		Non	Yes	Total
Agriculture	174	26	200	Agriculture	50	106	156
Industry	98	94	192	Industry	32	54	86
Building	154	31	185	Building and	63	70	133
Services	613	335	948	Services	135	390	525
Total	1,039	486	1,525	Total	280	620	900
Affiliation to social security.dz				choose informality.dz			
	Non	Yes	Total		Non	Yes	Total
Agriculture	58	6	64	Agriculture	28	22	50
Industry	27	23	50	Industry	9	16	25
Building and	66	19	85	Building and	36	23	59
Services	175	181	356	Services	39	83	122
Total	326	229	555	Total	112	144	256
Affiliation to social security.ma				choose informality.ma			
	Non	Yes	Total		Non	Yes	Total
Agriculture	62	12	74	Agriculture	10	52	62
Industry	21	14	35	Industry	5	16	21
Building	24	2	26	Building	8	16	24
Services	247	71	318	Services	58	187	245
Total	354	99	453	Total	81	271	352
Affiliation to social security.tn				choose informality.tn			
	Non	Yes	Total		Non	Yes	Total
Agriculture	54	8	62	Agriculture	12	32	44
Industry	50	57	107	Industry	18	22	40
Building	64	10	74	Building	19	31	50
Services	191	83	274	Services	38	120	158
Total	359	158	517	Total	87	205	292

Table 9: Affiliation to social security and the reason for not being insured by sector of activity.
Source: Sahwa dataset.

Affiliation to social security				Choose informality			
	No	Yes	Total		No	Yes	Total
Yes (search for job)	477	129	606	Yes (search for job)	161	237	398
No	562	357	919	No	119	383	502
Total	1,039	486	1,525	Total	280	620	900
Affiliation to social security.dz				Choose informality.dz			
	No	Yes	Total		No	Yes	Total
Yes (search for job)	198	60	258	Yes (search for job)	82	76	158
No	128	169	297	No	30	68	98
Total	326	229	555	Total	112	144	256
Affiliation to social security.ma				Choose informality.ma			
	No	Yes	Total		No	Yes	Total
Yes (search for job)	92	24	116	Yes (search for job)	26	65	91
No	262	75	337	No	55	206	261
Total	354	99	453	Total	81	271	352
Affiliation to social security.tn				Choose informality.tn			
	No	Yes	Total		No	Yes	Total
Yes (search for job)	187	45	232	Yes (search for job)	53	96	149
No	172	113	285	No	34	109	143
Total	359	158	517	Total	87	205	292

Table 10: Affiliation to social security and the reason for not being insured among new job seekers
Source: Sahwa dataset.

Affiliation to social security				Choose informality			
	No	Yes	Total		No	Yes	Total
Very satisfied	166	161	327	Very satisfied	24	128	152
Satisfied	413	232	645	Satisfied	104	259	363
Dissatisfied	272	66	338	Dissatisfied	83	142	225
Very dissatisfied	188	27	215	Very dissatisfied	69	91	160
Total	1,039	486	1,525	Total	280	620	900
Affiliation to social security.dz				Choose informality.dz			
	No	Yes	Total		No	Yes	Total
Very satisfied	38	75	113	Very satisfied	6	27	33
Satisfied	106	113	219	Satisfied	32	49	81
Dissatisfied	128	34	162	Dissatisfied	51	47	98
Very dissatisfied	54	7	61	Very dissatisfied	23	21	44

Total	326	229	555	Total	112	144	256
Affiliation to social security.ma				Choose informality.ma			
	No	Yes	Total		No	Yes	Total
Very satisfied	59	36	95	Very satisfied	5	54	59
Satisfied	189	53	242	Satisfied	48	140	188
Dissatisfied	74	5	79	Dissatisfied	17	57	74
Very dissatisfied	32	5	37	Very dissatisfied	11	20	31
Total	354	99	453	Total	81	271	352
Affiliation to social security.tn				Choose informality.tn			
	No	Yes	Total		No	Yes	Total
Very satisfied	69	50	119	Very satisfied	13	47	60
Satisfied	118	66	184	Satisfied	24	70	94
Dissatisfied	70	27	97	Dissatisfied	15	38	53
Very dissatisfied	102	15	117	Very dissatisfied	35	50	85
Total	359	158	517	Total	87	205	292

Table 11: Affiliation to social security and the reason for not being insured by job satisfaction.
Source: Sahwa dataset.

VARIABLES	(1) odds ratio	(2) odds ratio
2.Female	2.301 (1.719)	0.0650** (0.0778)
1. more than medium education	2.116*** (0.427)	1.628* (0.409)
1b. Male#0b. medium and less education	1 (0)	1 (0)
1b.Male#1o. more than medium education	1 (0)	1 (0)
2o.Female#0b. medium education and less	1 (0)	1 (0)
2.Female#1. More than medium education	1.434 (0.599)	1.476 (0.799)
1.Single	0.302*** (0.116)	0.598 (0.296)
0b.married#1b.Male	1 (0)	1 (0)
0b. married #2o.Female	1 (0)	1 (0)
1o.Single #1b.Male	1	1

	(0)	(0)
1.Single#2.Female	2.052	2.204
	(1.471)	(1.969)
2.permanent employees	8.641***	0.324**
	(2.371)	(0.145)
3.Non paermanent employees	0.805	0.328***
	(0.220)	(0.119)
4.Family workers	0.360*	
	(0.215)	
1b.Self employed#1b.Male	1	1
	(0)	(0)
1b. Self employed #2o.Female	1	1
	(0)	(0)
2o. permanent employees	1	1
#1b.HM23_1		
	(0)	(0)
2. permanent employees	0.687	0.913
#2.HM23_1		
	(0.419)	(0.850)
3o. Non paermanent employees	1	1
#1b.Male		
	(0)	(0)
3. Non paermanent employees	1.540	1.738
#2.Female		
	(0.866)	(1.340)
4o.Family workers#1b.Male	1	1
	(0)	(0)
4.Family workers#2.Male	2.063	
	(1.907)	
1.Living with parents	1.716	0.762
	(0.629)	(0.276)
1b.Male#0b. Not Living with parents	1	1
	(0)	(0)
1b.Male#1o. Living with parents	1	1
	(0)	(0)
2o.Female#0b. Not Living with parents	1	1
	(0)	(0)
2. Female #1. Living with parents	0.497	0.922
	(0.339)	(0.657)
4.Morocco	3.867	3.716*
	(3.561)	(2.570)
5.Tunisia	7.628***	1.955
	(5.352)	(1.264)
1b.Algeria#1b.Male	1	1
	(0)	(0)
1b. Algeria #2o.Female	1	1
	(0)	(0)
4o.Morocco#1b.Male	1	1

	(0)	(0)
4.Morocco#2.Female	0.229**	2.418
	(0.156)	(2.231)
5o.Tunisia#1b.Male	1	1
	(0)	(0)
5.Tunisia#2.Female	0.461*	1.906
	(0.206)	(1.739)
2. Industry	3.783**	1.550
	(2.170)	(1.128)
3. Building	4.409***	0.690
	(2.358)	(0.409)
4. Services	6.977***	1.813
	(3.308)	(1.017)
1b.Algeria#1b. Agricultue	1	1
	(0)	(0)
1b. Algeria#2o. Industry	1	1
	(0)	(0)
1b. Algeria#3o. Building	1	1
	(0)	(0)
1b. Algeria#4o. Services	1	1
	(0)	(0)
4o.Morocco#1b.Agricultue	1	1
	(0)	(0)
4. Morocco#2.Industry	0.127	2.880
	(0.167)	(4.182)
4. Morocco#3.Building	0.138	1.179
	(0.217)	(1.200)
4. Morocco#4.Services	0.0631***	0.480
	(0.0574)	(0.370)
5o.Tunisia#1b. Agricultue	1	1
	(0)	(0)
5.Tunisia#2. Industry	0.472	0.612
	(0.394)	(0.559)
5.Tunisia#3. Building	0.0986***	1.372
	(0.0832)	(1.095)
5.Tunisia#4. Services	0.0894***	0.895
	(0.0677)	(0.654)
2.second quantil of income	2.131*	0.519**
	(0.836)	(0.154)
3.third quantil of income	5.435***	0.427***
	(1.918)	(0.135)
4.Fourth quantil of income	10.66***	0.583
	(3.809)	(0.242)
1b.first quantil of income#1b.Male	1	1
	(0)	(0)
1b.first quantil of income#2o.Female	1	1
	(0)	(0)
2o. second quantil of income	1	1

#1b.Male	(0)	(0)
2. second quantil of income #2.Female	1.114 (0.616)	1.921 (1.057)
3o. third quantil of income #1b.Male	1 (0)	1 (0)
3. third quantil of income #2.Female	0.914 (0.557)	3.665 (4.182)
4o. Fourth quantil of income #1b.Male	1 (0)	1 (0)
4. Fourth quantil of income #2.Female	0.585 (0.357)	16.26** (21.60)
Constant	0.0185*** (0.0124)	4.618** (3.355)
Observations	1,202	509

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 12: logit model with interaction effects. Dependent variables being insured and choosing informality
Source: Sahwa dataset.

VARIABLES	(Odds ratio)	(Odds ratio2)
	Job satisfaction	Job satisfaction
Affiliation to social security	0.543*** (0.0708)	
Looking for a new job.	0.180*** (0.0235)	0.171*** (0.0291)
Urban	0.723*** (0.0841)	0.649*** (0.0955)
Female	1.084 (0.142)	0.910 (0.167)
2. Permanent employees	1.327* (0.220)	1.241 (0.321)
3. Non permanent employees	2.133*** (0.308)	1.851*** (0.350)
4. Family workers	1.916** (0.536)	1.789* (0.588)
Single	1.493** (0.257)	1.877*** (0.443)
1. more than medium education	0.883	0.970

	(0.101)	(0.144)
2.Risk2	1.008	1.194
	(0.187)	(0.275)
3. Risk3	1.189	1.266
	(0.213)	(0.297)
4. Risk4	1.361	1.305
	(0.282)	(0.332)
5. Risk5	0.913	0.670
	(0.179)	(0.198)
6. Risk6	1.012	0.855
	(0.223)	(0.278)
2.Altruism2	0.984	0.717
	(0.145)	(0.146)
3. Altruism3	1.076	0.898
	(0.173)	(0.200)
4. Altruism4	1.286	1.138
	(0.271)	(0.309)
5. Altruism5	0.855	1.198
	(0.234)	(0.474)
6. Altruism6	0.673	0.579
	(0.322)	(0.426)
7. Altruism7	0.506***	
	(0.131)	
Chose informality		0.684**
		(0.117)
Constant cut1	0.0214***	0.0126***
	(0.00815)	(0.00638)
Constant cut2	0.237***	0.127***
	(0.0854)	(0.0601)
Constant cut3	1.128	0.602
	(0.396)	(0.272)
Observations	1,388	798

Table 13: orderd logit model, the dependent variable is job satisfaction. Orderd form very satisfied to not at all satisfied. Source authors using SAHWA and Stata.