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A SURVEY ON LABOR MARKETS IMPERFECTIONS IN MEXICO USING A STOCHASTIC FRONTIER

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Abstract

It is assumed that observed labor income is the result of three stages across the job search process from the reservation wage formation, the bargaining between employers and potential employees when the match, and finally a possible additional adjustment once the worker is completely hired. This paper provides a methodological proposal and an intuitive estimation of the wage gain due to the presence of labor market imperfections across those three stages. The part of the wage that is explained by labor markets imperfections is estimated by performing a stochastic frontier model with panel data belonging to the Mexican labor survey – ENOE. The results suggest that 82.7% of the variance of the wages of the subordinated workers is explained by market imperfections. Moreover, public labor offices and small firms are negatively correlated with their presence.

Keywords*:* labor market imperfections, wage formation, reservation wage, job search, job matching, stochastic frontier, Mexico, ENOE

JEL Classification: J21, J31

1. Introduction

The labor income of a typical worker is the observable outcome of a complex process shaped by the overall competence conditions of the labor market before a job offer is accepted and once the recruitment is completed. The basic question that still remains by theoretically and empirically unanswered is how this outcome may differ among similar workers. As the explanations might be diverse, the answer does not only entail the analysis of the current conditions of employees, but also the circumstances under which unemployed workers performed the job search task similarly with their reservation wage formation.

In a competitive market, firms or employers would not have an incentive to pay wages over those reservation wages in accordance given their productivity level but, certainly, observable wages become a representative symptom of how the competitive result is modified and a cause of why the labor market is not cleared (Fields 2007).

Why similar workers earn different wages is an issue that has been theoretically addressed but at the same time is has been barely quantified and rarely connected with a wage formation process. As an attempt to contribute to the empirical analysis of labor markets, the main purpose of this document is to quantify the proportion of the wages that is caused by the labor market imperfections in Mexico.

2. Intuition on labor markets imperfection and wages formation

2.1. A brief review of the theory

There are three stages that intervene in the determination of wage levels, from the job search process through the duration of unemployment to the job offer acceptance and an eventual and subsequent wage adjustment. At a starting point, the reservation wages works as a lower bound of the final labor income assignment. As long as agents interact depending on the exposure of the workers to the labor markets imperfections upon each one of these stages, an observable gain above that reservation wage would probably arise.

One may distinguish the origin of the heterogeneity in wages. When it depends on the supply side, there are certain characteristics from workers that are not easily detectable by linear regressions (i.e. ability, job search preferences, etc.). On the other hand, the source of the differences on the demand side emerges with the presence of similar unobservable behavior from employers, such as prejudiced preferences, biased assessments of a worker's productivity, asymmetric information or monopsony (Van Klopin, and Singell 1996).

Similarly, as corroborated by the labor literature, these market imperfections are seldom studied as a whole. Although they have been studied separately, the quantification of their effect on wages between workers and employers has been practically ignored. For instance, since Stigler (1962) addressed the information in the search stage of wage formation it became the most studied issue. Rogerson *et al* (2005) address bargaining power in an effort of obtaining conclusions on the employers – employees relation. Baldwin (1991) exhibits a

labor discrimination model among black and white workers. Arnott, and Stiglitz (1985), and Arnott *et al.* (1988) broadly assess the labor turnover conditions and van den Berg (2003) surveys the consequences of the existence of minimum wages as an inhibitor of monopsony power.

In the job search stage, reservation wages determine the core of what will be the final observed wage once the employee is hired in a new job. The existence of inherent worker properties shapes the minimum amount of money that he or she would be willing to receive to accept a vacancy according to its optimal labor supply plan. Number of children, marital status, gender, location and some others characteristics of workers contribute to the variations of that amount of money or in kind payment amongst them. Examples of these empirical findings are found in Owen (1971), Heckman and Willis (1979) or Heckman (1986), who have employed empirical labor market participation models to determine which characteristic has a higher weight (*see* also Moffitt, and Wolfe 1992; Siegfried, *et al.* 1993).

The characterization of reservation wage models has treated it as a constant variable over time (Kiefer, and Neumann 1979) even during the job search when it works as an essential input of the seeker's stopping rule as shown by Mortensen (1986). Nevertheless, evidence of a decreasing reservation wage as long as unemployment duration was found in empirical studies such as Blau (1991) who does not only include an expected wage offer but rather the expected number of workable hours as the solution of the worker's labor supply plan. Thus, even though one source of overall wages decrease throughout negative business cycles is the reaction that reservation wages have when consequently the unemployment duration increases. Besides business cycle, the lack of information about vacancies might worsen the situation of unemployed workers whose labor income comes down when they do not know where employers are and duration increases.

Information on vacancies is the first element that job seekers attempt to retrieve once the unemployment begins. The better the information one gets, the better a job offer is in terms of its remuneration (Bloemen 2005) that modifies the worker's reservations wage. Several studies have shown that job seekers prefer direct information sources, such as "relatives and friends" or "directly at the work place" (Kahn, and Low 1990) over indirect information sources like Labor Market Intermediaries (Autor 2008). The main reason why this occurs is that the cost of information is smaller using the direct sources than using the indirect sources, determined by the job seeker's characteristics and their optimal level of demand for information.

Therefore, asymmetric information is the first imperfection that job seekers and employers generate in the labor market, firstly because employers cannot predict the potential productivity of a given worker and because the latter cannot predict the real conditions of an accepted job offer (most of the jobs characteristics are revealed after recruitment and not during the job search task). For example, Mavromaras *et al*. (2009) survey over-education as the most important concern of workers and a subsequent job mismatching issue in the presence of the asymmetric information that leads to the unavoidable dissatisfaction of workers or firms. This causes undesirable and costly job turnover and hence, employers decide to hire those workers with potential specific skills in terms of trainability, productivity and the least-likely to give up (Salop, and Salop 1976).

Although wage discrimination has led the vast amount of theory assessments and empirical evidence (especially for gender) as well as significant pool of causes of labor market segregation[39]. During the job search stage of wage formation firms or employers do not only have specific preferences for certain workers but rather job seekers aim their search towards those jobs that brings them a considerable satisfaction. For instance, men and women often do quite different jobs because men have less risk aversion than women (Cobb-Clarck, and Tan 2009).

Rogerson, Shimer and Wright (2005) offer an interesting approach in the transition from the first to the second stage of this survey on wage formation and its relation with markets imperfection. They question how there may be unemployed workers and unfilled vacancies at the same time and argue that "*Workers do not encounter firms completely at random but try to locate those posting attractive terms of trade*[40]". They conclude that their job bargaining models are linked to the available matching technology in the job search and job offer process.

The availability of empirical evidence on wage differentials and job bargaining has shown that in the absence of unions, a worker's productivity determines further wage adjustments. Bartolucci (2009) manages

[39] *See* for example Carroll, and Rolph (1973), Swinton (1977), Gannon, and Zenou (1997), Heckman (1998), Aslund, and Rooth (2005).

[40] Rogerson, R. Robert, Wright, R.S. 2005. Search-Theoretic Models of the Labor Market: A Survey. *Journal of Economic Literature*. Vol. XLIII (December 2005): 959-988.

matched employer-employee data in Germany, showing that wage disparities among genders are explained in large part by differences in productivity and by a smaller part by segregation or the firms' preferences.

The existence of unions is an important element in the wage formation through its third and final stage as well. They play an essential role in sorting out wage inequalities originated by the firms' predominant bargaining power and provide an explanation of why wage gaps are sharper when unionization does not take place (Card, 2001). Nonetheless, as referenced by Bemmels (1987) for the US manufacturing industry, unions are often the source of a possible mismatching of wages and the real productivity that they represent. As Wessels (1985) affirms, "(…) *Unions must decrease employment far more than is commonly thought, or they do not substantially increase the productivity of firm*[41]".

2.2 Intuition on the methodology

The intuition behind the estimation of the part of the labor income originated by the influence of the market imperfections on the wage formation process begins with the generic specification of the classic Mincer (1974) Equation. From the latter it is only drawn its theoretical components rather than an attempt to assess the returns to schooling. The specification for each employee i in period t is:

$$lnw_{it} = \beta_0 + \sum_{j=1}^{k} \beta_j x_{jit} + e_{it} \quad (1)$$

Where the core variables of the covariates x_{jit} are commonly denominated education and experience (or rather, worker's age). Arbitrarily it is complemented by the number of hours worked per month (*whm*) and the economic sector (*sector*) where the employee actually works. In any econometric context the error term e_{it} is the part of the observable labor income lnw_{it} that is not explained by the covariates x_{jit} and hence, if two workers have the same age, education, worked hours per month and economic sector, the differences in their wage would be incorporated into their own error component. Thus, the larger is the exposure of workers to the presence of labor market imperfections, the greater the error term $e_{it}$is.

The stochastic frontier model divides e_{it} into two error terms:

$$e_{it} = v_{it} + u_{it} \quad (2)$$

Where $v_{it} \overset{iid}{\sim} N(0, \sigma_v^2)$, is the part of the wage differences among similar workers due to idiosyncratic exceptional characteristics which are also personals traits commonly described as "abilities"[42]. The error term $u_{it} \overset{iid}{\sim} N^{+}(\mu, \sigma_v^2)$, reflects the wage gained by employees as a consequence of the existence of labor market imperfections.

Thus, under competitive conditions the labor income amongst workers with the same characteristics would differ only by v_{it}, or simultaneously, by their ability gain. Therefore, after the estimation of Equation 1 the rest of the heterogeneity of the observable wage, (u_{it}), does not have any other explanation besides the role of markets in generating this differential. Regardless its origin, across the stages of wage formation it is not fully controllable by workers[43].

It is necessary to point out that regarding our theoretical context, the part of Equation 1 that reveals the reservation wage of a given worker *i* comes up when u_{it} is subtracted from it (Hofler, and Murphy 1994). An employer with perfect information would not pay u_{it}, nonetheless, it emerges over the three stages of wage formation, from the job search, the job matching and a subsequent adjustment.

Another factor in the specification of Equation 1 is time. Given that the data have an evident unbalanced panel framework because of the re-contacting failures, Greene (2003) explains two restrictions of a feasible time-invariant specification for Equation 1. First, that a time invariant heterogeneity would yield a biased estimation of u_i and supposes the independence between the whole error and the covariates of the model. Second as the

[41] Wessels, W. 1985. The Effects of Unions on Employment and Productivity: An Unresolved Contradiction. *Journal of Labor Economics*, Vol. 3, No. 1, Part 1 (Jan., 1985): 101-108.

[42] These cognitive and non-cognitive abilities are also estimated by Heckman et al (2006) or Cawley *et al.* (2001). This is an alternative to the estimation of this term, even though this is not the focus of this assessment.

[43] See for instance Boehm and Hofler (1987) where this technique is implemented to also separate markets effects on prices.

model supposes a time-invariance of u_i, even though the time span of the data (two quarters), it is preferable to generalize the specification of the model over a time-variant basis. Thus, substituting the random parameter e_{it} of the Equation 2 into the Equation 1 is rewritten as follows[44]:

$$lnw_{it} = \beta + \sum_{j=1}^{k} \beta_j x_{jit} + v_{it} + u_{it} \quad (2.3)$$

Where u_{it} is achieved by including one dummy for each individual. Under any specification of Equation 3, in the end it is performed a generalization of u_{it} term proposed by Battese and Coelli (1995) where it is changed into the expression,

$$e^{-\eta(t-T_i)} u_i \quad (2.4)$$

That allows the model to adapt the variation of the market imperfection term across time and individuals. If η is statistically equals to zero, the model would yield a time-invariant random effect estimation. This stochastic frontier model in addition produces a parameter $\gamma = \sigma_u^2/(\sigma_u^2 + \sigma_v^2)$ manifesting the proportion to which the markets imperfections explain the variation of wages for similar employees. Later γ becomes the center of our analysis.

3. Data and Mexican labor markets

The data for the estimation of Equation 3 belongs to the National Survey of Occupation and Employment-ENOE[45], continually carried out in 124.260 dwellings by the National Institute of Statistics and Geography-INEGI[46]. The thematic coverage of the survey entails gender and age composition of the national inhabitants and the labor composition of the working age population. It is stratified on rural and urban areas of the 32 Mexican states over a continuous periodicity and a quarterly report (it follows up most of the observations on a panel structure).

The time scheme of the ENOE involves a continuous fieldwork across the whole year, but given that the re-contact of the households does not remain stable over time, the selected periods for the estimation of Equation 3 are the first two quarters of 2009, which allows us to find more accurate information of the reported households in a previous period[47]. The loss of people quarter by quarter averages about 25% of them, and after one year there is not trace of any dwelling. For instance, 76.3% of the people that were polled in I-2009 appear again in II-2009 while the rest is expected to be in III-2009.

Now, the focus of the periods I-2009 and II-2009 is placed on the main indicators of the Mexican labor markets in order to understand the structure, their potential role and scope of the labor market imperfections. As part of our initial description, it is firstly presented the hierarchical decomposition of the population of Mexico with a Working Age Population between 15 and 65 years of age:

Table 1. Hierarchical decomposition of the Labor Force.

Hierarchical Decomposition of the Labor Force (Hierarchical rates)		
Period:	**I-2009**	**II-2009**
0. Total population	100.0	100.0
1. Population six years and above	89.4	89.5
1.1 Child population (6-14 years of age)	20.3	20.0
1.1.1 Child laborers	2.7	2.9
1.2 Population 65+ years of age	9.3	9.4
1.2.1 Employed	21.0	21.8
1.3 Working age population (15-64 years of age)	70.4	70.6
1.3.1 Inactive	37.4	37.2
1.3.2 Active	62.6	62.8
1.3.2.1 Employed	94.8	94.6
1.3.2.2 Unemployed	5.2	5.4

[44] *See* Kumbhakar and Lovell (2000) for further explanation on this specification.

[45] Encuesta Nacional de Ocupación y Empleo.

[46] Instituto Nacional de Estadística y Geografía - http://www.inegi.org.mx/inegi/default.aspx.

[47] Using more than two quarters would lead to a small re-contract of individual and a low track of them along time. Find out more information at INEGI's homepage.

Source: ENOE-INEGI. I-2009 and II-2009.

The Mexican working age population has been recognized for having the lowest rates of labor participation (IADB, 2004). The active population rate reached a level less than the Latin-American rate and its unemployment rate barely had been above 5% in the last decade. A slower business rhythm has led Mexicans to increase their labor participation between I-2009 and II-2009 that was absorbed by the unemployment rate rather than the employment rate.

Additionally, the distribution of employees among sectors and education levels reveals a concentration of workers in the service sector and among those who have reached the high school education level. During this period, the re-arrangements among these shares also shows and trend towards a mild increase of level of education of Mexican workers and a higher participation of them in the service and agricultural sectors:

Table 2. Distribution of employees – Level of Education.

Distribution of the Employed - Level of Education		
Level of education %	**I-2009**	**II-2009**
Incomplete elementary	14.9	14.4
Elementary	22.2	21.6
High school	33.8	34.0
Technical	14.4	14.8
Graduate	14.7	15.1
Not specified	0.0	0.0
Total	**100.0**	**100.0**

Source: ENOE-INEGI. I-2009 and II-2009.

Table 3. Distribution of employees by Economic Sector.

Distribution of the Employed by Economic Sector		
Sector of economic activity	**I-2009**	**II-2009**
Construction	8.4	8.3
Manufacturing	15.8	15.3
Commerce	19.6	19.6
Services	42.8	43.2
Others	1.0	1.0
Agriculture	11.7	12.0
Total	**100.0**	**100.0**

Source: ENOE-INEGI. I-2009 and II-2009.

The mobility of workers to the service and agricultural sectors was accompanied by an increase of self-employed (non-subordinated) and non-remunerated workers as shown in Table 4:

Table 4. Employment categories, shares in total employment.

Employment Categories, Shares in Total Employment		
Occupational category	**I-2009**	**II-2009**
Remunerated workers	69.0	68.0
Employers	4.2	4.3
Self-employed	20.9	21.4
Non-remunerated workers	5.9	6.2

Source: ENOE-INEGI. I-2009 and II-2009.

A possible symptom of a superfluous inflow of workers in the service sector has turned out between these two periods given the observed changes in the work categories and economic sectors share. Spite of the fact that

the employment in the service sector increased, it yielded a lesser share of remunerated workers that coincided with a decrease of the share of workers in the construction and manufacturing sectors (presented in Table 3). Regarding unemployment, Table 5 presents its rates and shares among groups of gender, age, area of residence and level of education. It is possible to notice an important share of youth and males in the overall unemployment share and a low sharing of rural areas:

Table 5. Unemployment rate among groups.

Unemployment Rates Among Groups				
	Unemployment Rate by Groups %		Group Share Among Unemployed %	
Period:	**I-2009**	**II-2009**	**I-2009**	**II-2009**
Gender				
Female	5.2	5.0	37.3	35.0
Male	5.3	5.6	62.7	65.0
Age				
15-24	9.6	10.0	38.6	39.3
25-54	4.2	4.2	56.5	55.4
55-64	2.8	3.1	4.9	5.3
Area of residence				
Urban	5.3	5.3	92.7	90.9
Rural	4.7	5.8	7.3	9.1
Level of education				
Incomplete elementary	3.3	3.4	9.3	9.0
Elementary	5.0	4.7	21.0	18.9
High school	5.9	6.1	38.5	39.4
Technical	6.7	6.9	18.7	19.3
Graduate	4.5	4.8	12.5	13.4

Source: ENOE-INEGI. I-2009 and II-2009.

Despite almost all groups obtained an increase on their unemployment rates, It can be also inferred that males, youths, urban inhabitants and technicians who mostly seek jobs. Since the share of workers holding high school education is the largest group of employees in the Mexican labor markets, they represent the highest rate of the unemployment share among level of education groups.

One starting points of the previous theoretical review is the job search stage and the information sources that job seekers account on. The ENOE enquires what actions they do to find out the information on vacancies, which are grouped into direct and indirect mechanisms differed by how costly they are (recall that direct mechanisms are the least costly).

Table 6. Unemployed workers - job search mechanisms.

Unemployed workers - job search mechanisms		Type	I-2009	II-2009
1	Directly at the work place	Direct	75.4%	76.2%
2	At a private labor office	Indirect	2.2%	1.7%
3	At a public labor office	Indirect	2.0%	1.8%
4	A temporary program of public jobs	Direct	1.3%	1.5%
5	Attempt to start a own business	Direct	0.8%	1.0%
6	On line - Internet	Indirect	7.5%	9.2%
7	A public announcement	Indirect	10.0%	9.2%
8	A labor union or group	Direct	0.7%	0.8%
9	A friend or relative	Direct	16.6%	14.9%
10	A Classified ad	Indirect	2.4%	2.6%
11	Does not know		1.1%	1.4%

Source: ENOE-INEGI. I-2009 and II-2009.

These job search mechanisms are not excluding and hence job seekers might find information on vacancies using one or more sources. It is evident that rationally, Mexicans prefer direct mechanisms that are

more restrictive in terms of the flow of information between employers and unemployed workers. For instance, in Table 6 it is seen that a 75.4% and 16.6% of job seekers look for information directly at the work place and through a friend or relative in I-2009, respectively. Even though labor markets intermediaries are less restrictive in the flow of information, they are barely used in Mexico. However, the Internet has become an important source and alternative for unemployed workers in comparison to alternate government agencies.

Table 7 presents the job search mechanisms of employees before they were hired:

Table 7. Employees – job search mechanisms.

Employed – job search mechanisms		I-2009
1	Directly at the work place	19.9%
2	At a private labor office	0.2%
3	At a public labor office	0.2%
4	A temporary program of public jobs	0.2%
5	A labor union or group	1.2%
6	On line - Internet	1.1%
7	A public announcement	7.8%
8	A friend or relative	56.0%
9	Someone offered a vacant	11.0%
10	Other	1.0%
11	Does not know	1.3%

Source: ENOE-INEGI. I-2009.

Table 6 is compared to Table 7 which presents how employed actually found information about his or her current job in the period I-2009 (not available for II-2009). This contrast demonstrates de effectiveness of direct mechanism during the job search and matching stages, particularly for those who learned about a job through a person close to them. Here the proportions are switched: as consequence of not finding any response directly at the work place, the observed proportion for friends or relatives reaches 56%[48].

Another important issue to address is the distribution of wages among education levels and economic sectors. Tables 6 and 7 present the Gini coefficients of wages earned by employees during the first two quarters of 2009 that are relevant in the study of wage differences. It is worth to notice a systematic increase of the concentration of wages across this period. Agriculture was the only sector with a decrease in the concentration of wages, though it is the most inequitable amongst the others.

Table 8. Gini coefficient by level of education.

Gini Coefficient by Level of Education.		
Level of education	**I-2009**	**II-2009**
Incomplete elementary	38.5	39.2
Elementary	35.1	36.2
High school	34.0	34.3
Technical	36.6	36.0
Graduate	37.2	38.2
Not specified	31.4	24.7
Total	**40.7**	**41.4**

Source: ENOE-INEGI. I-2009 and II-2009.

[48] *See* Appendix 1 for further details in Mexican States.

Table 9. Gini coefficient by sector of economic activity.

Gini Coefficient by Sector of Economic Activity		
Gini coefficient	**I-2009**	**II-2009**
Construction	29.7	30.3
Manufacturing	37.3	38.0
Commerce	41.0	41.5
Services	40.1	40.9
Others	36.9	38.7
Agriculture	44.4	44.1
Total	**40.7**	**41.4**

Source: ENOE-INEGI. I-2009 and II-2009.

The Gini coefficient among levels of education has a U-shaped in Mexico. The distribution of wages for low educated workers is similar to those who have a Graduate level of education, while the Gini coefficient reaches a minimum level for employees with a high school degree.

4. Estimations and results

The estimation of Equation 3 is explained in this section and the estimation of the error terms for the Mexican states is detailed in the Appendix 2. Besides the covariates included in x_{jit} previously mentioned in Section 2.1, it was also incorporated the inverse of Mills ratio (Heckman, 1979) as a correction of the selection of remunerated workers in each period separately[49]. The values of the parameter $\gamma = \sigma_u^2/(\sigma_u^2 + \sigma_v^2)$ were derived in a second stage of a post-estimation procedure of the stochastic frontier on the time-variant model. It is also calculated a pseudo R-squared as a proxy of the determination coefficient for the overall model plus for the estimations amongst states. This is carried out applying the formula:

$$pseudoR^2 = 1 - (lnL_R/lnL_{UR}) \quad (4)$$

Where L_{UR} stands for the log-likelihood of the unrestricted model (only with its constant term) and L_R for the restricted term (including covariates).

4.1 Overall model

The estimations of the model for the nationwide data yielded a pseudo determination coefficient of 19.2%, which means that the power of prediction of the estimated coefficients is not strong. Nevertheless, accordingly with these kinds of studies and the specification methods supports satisfactorily a good fit of the model. In addition, as the results are aimed at explaining a part of the Mexican's wages using a stochastic frontier analysis, the central attention here is paid on the error term. As well, the estimations of Equation 3 present a starting point of what Hofler and Murphy (1994) called *reservation wages* but for the purpose of this document they represent the base line of wages in the first stage of their formation:

[49] The inverse of Mills ratio included the variables gender, marital status, household's head, head's age and education, average of household's age, urban area).

Table 10. Stochastic Frontier Estimates.

Mexico - Stochastic Frontier Estimates			
lnw_i	**Coefficient**	**Std. Error**	
edu_i	0.049	0.00	***
age_i	0.031	0.00	***
age_i^2	0.000	0.00	***
whm_i	0.003	0.00	***
wht_2^i	0.000	0.00	***
$manufacturing_i$	0.127	0.01	***
$services_i$	0.132	0.00	***
$mills_i$	-0.203	0.00	***
$constant$	6.386	0.01	**
η	-0.010	0.00	***
σ^2	0.499	0.01	
γ	0.827	0.00	
σ_u^2	0.412	0.01	
σ_v^2	0.086	0.00	
$pseudoR^2$	19.2%		

*: Significant at 10%; **: Significant at 5%; ***: Significant at 1%.

Source: ENOE-INEGI. I-2009 and II-2009.

It turned out that the estimation of γ leads it to infer that 82.7% of the variation of the heterogeneity among Mexican workers is explained by labor markets imperfections and the rest 17.3%, is due to the exceptional conditions of the workers that are also a part of their human capital. These results also suggest that this variation has a decreasing and significant rate over time since the coefficient η obtained a negative value. These findings advise that in spite of the fact that Mexico counts on several job search mechanisms and strict labor laws (Levy, 2008), if two workers are similar in their skills and qualifications the differences between their wages are not mostly explained by their individual and specific conditions but rather the nature of the labor markets they face. Both start the wage formation process from a similar condition but as long as they interact with employers, match them or receive further adjustments, their wages get different paths over time.

Furthermore, if the statistical inference on η would have yielded a coefficient equals to zero, one had concluded that these variations were expected to be constant over time. Nevertheless, in this case the implications entail that despite the estimations were obtained using a two period data, the perspectives on the prevalence of the market imperfection will fade (ceteris paribus) in the future at a rate of -1% quarterly. As remarked before, under the absence of market imperfections the proportion of wages explained by them would be indeed equals to zero. Since the model has the restriction of non-negative values of u_i, it was not sensible to think of a negative effect of markets on wages below their base line because otherwise workers would remain inactive. Besides, our theoretical framework puts the interaction between job seekers and employers as a wage gaining process that mismatch the productivity of a given worker to the real requirements of a vacancy.

The estimation of the coefficients for the covariates of the model allowed it to estimate the ratio u_i/lnw_i in addition to the single parameter σ_u^2. This average proportion of wage that corresponds to the markets imperfection effect obtained an average of 0.052 and a standard deviation of 0.03. Even though this proportion seems small it determines most of the variation among wages while the idiosyncratic component apparently is not such volatile. The next chart plots the density distribution of u_i/lnw_icovering more than 90% of the individuals between 0 and 0.15:

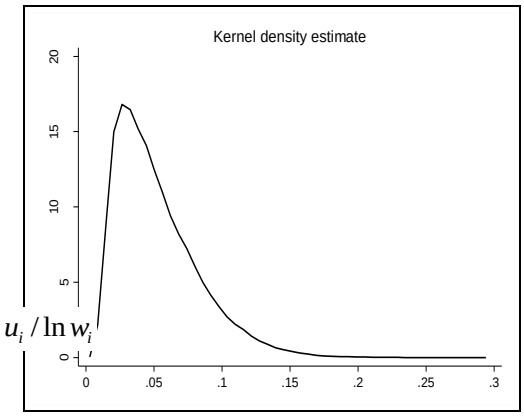

Figure 1. Non-parametric histogram of $u_i / \ln w_i$

Source: ENOE-INEGI. I-2009 and II-2009.

This non-negligible part of the wages explained by factors besides human capital and abilities is also compared to the circumstances of the employee that lead to a large or small u_i. The variations of this parameter depend on the degree in which the markets imperfections were presented during the wage formation process.

As pointed out before, the job search process has an essential role in the determination of wages and the success of job seekers accepting a wage offer above their reservation wage. It is now presented the partial correlations of u_i with respect to covariates that theoretically may mitigate or spur the presence of market imperfections:

Table 11. Partial correlations for u_i.

	Partial correlations for w_i		
Job search	Union member	0.0718	***
	Written contract	0.0424	***
	Directly at the work place	-0.0128	***
	At a private labor office	0.005	
	At a public labor office	-0.0115	***
	A temporary program of public jobs	-0.016	***
	A labor union or group	0.0107	***
	On line - Internet	0.0308	***
	A public announcement	-0.0291	***
	A friend or relative	-0.004	
	Someone offered a vacant	0.0098	***
	Other	0.0145	***
Firm size	1 person	-0.0546	***
	2 - 5 people	-0.0382	***
	6 - 10 people	-0.0086	**
	11 - 15 people	-0.001	
	16 - 20 people	0.0061	*
	21 - 30 people	0.0107	***
	31 - 50 people	0.0114	***
	51 - 100 people	0.0168	***
	101 - 250 people	0.0192	***
	251 - 500 people	0.0187	***
	500 and more people	0.0513	***

*: Significant at 10%; **: Significant at 5%; ***: Significant at 1%.

Source: ENOE-INEGI. I-2009.

In spite of the fact that the correlations are low, they manifest the direction of the behavior of each covariate jointly with u_i. For instance, besides having a written contract, being part of a labor union presented de higher positive correlation and leads the differences among wages in the third stage of wage formation. As mentioned, unions often exercise power to increase wages even if the real productivity of a given employee does not match his or her wage.

Moreover, the job search mechanisms give us the chance to infer on the evolution of wages from the job search stage. The analysis is divided into those sources with a least restrictive information flow and the others that enable the existence of asymmetric information. In this manner, even though asking for information to friends or relatives obtained a tiny and non-significant and negative partial correlation, the signs of the other search mechanisms were those expected and predictable by the theory.

The firm size draws a singular attention because it has a negative correlation among small ones and a higher positive correlation among the rest. This finding suggest that the firm size is a key factor in the markets imperfection condition in Mexico, and that larger firms measured by the number of workers are correlated with non-competitive outcomes on the markets. As large firms have better possibilities to offer higher wages and to train workers at their own expense, it is even less costly to replace a vacant.

4.2 The State level estimation

Appendix 2 presents the estimations of Equation 3 for Mexican States and makes possible the comparison among them. This sub-national analysis is aimed at understanding particular characteristics of segmented regional labor markets. The regional differences contribute to identify the sources of the labor markets imperfections replicating the previous Table 9.

The description of Table A3 starts firstly focusing on the time-varying parameter η. This estimates divide the Mexican States into three groups where the market imperfections component of wages is fixed over time (e.g. Aguascalientes, Puebla and Tabasco), some other where η determines an increasing u_i (Colima, Chiapas, and Guanajuato) and the rest where it is expected to decrease (Baja California, Chihuahua, Distrito Federal, Morelos, Sonora, Tlaxcala and Veracruz). It is evident that Chihuahua is the State with the highest negative value of the time-varying parameter, which entails a decreasing trend of the market imperfections component for the employees located there. The implications of this division of Mexican States and their characterization of the labor markets would detour our attention, but in any case this could be the beginning of a future follow up estimation of the Equation 3.

The second and most important parameter of the estimation output in Table A3, is the proportion of the variance of the heterogeneity of wages explained by market imperfections, γ. It turned out that most of the Mexican States have a variability of this component relatively high. There are few whose γ is barely lesser than the one obtained with the overall model. This component is compared to Table A2 that contains the proportions of employees that found their current job through a direct or indirect information source (as explained before).

The discussion around chart A1 has a surprising implication in terms of the use of direct and indirect job search mechanisms or information sources. Even though the observed relation between γ and the proportion of employed that found their current job through an indirect source contradicts the theory up to some extend. For low levels of the share of indirect mechanisms the parameter γ takes small values, as seen for Michoacan and Oxaca. Nonetheless, the trend line that was also plotted suggests a decreasing marginal relation between these two variables as long as the indirect share increases, as seen for Quintana and Nuevo Leon.

The States that obtained the maximum and minimum values of γ were Baja California and Oxaca, respectively. Table 9 is now replicated for these two States to address which covariates are more correlated with the component of wages attributable to the market imperfections. These correlations exhibit a common pattern: they are significant and have the same sign for employees belonging to a labor union and holding a written contract, however, the significances of the firm size variables are only relevant for Oxaca.

Table 12. Partial correlations for u_i in Baja California and Oxaca.

Partial correlations for u_i					
		Baja California		Oxaca	
Job search	Union member	-0.1797	***	-0.0903	***
	Written contract	-0.0949	***	-0.0385	*
	Directly at the work place	0.0128		0.0365	*
	At a private labor office	0.0176		0.0312	
	At a public labor office	0.0042		-0.0171	*
	A temporary program of public jobs	0.0241		0.0041	
	A labor union or group	0.0089		0.0237	
	On line - Internet	0.0321	**	0.0599	***
	A public announcement	0.0122		-0.0114	
	A friend or relative	0.0158		0.0259	
	Someone offered a vacant	0.0158		0.0595	***
	Other	0.0042		0.0809	***
Firm size	1 person	-0.008		-0.0724	***
	2 - 5 people	-0.023		-0.0469	**
	6 - 10 people	-0.0159		-0.0136	
	11 - 15 people	-0.0214		-0.0065	
	16 - 20 people	-0.0125		-0.0139	
	21 - 30 people	-0.0165		0.0022	
	31 - 50 people	-0.0129		0.0196	
	51 - 100 people	-0.0122		0.0085	
	101 - 250 people	-0.0169		0.017	
	251 - 500 people	-0.0164		0.0052	
	500 and more people	-0.0165		0.0422	**

*: Significant at 10%; **: Significant at 5%; ***: Significant at 1%.

Source: ENOE-INEGI. I-2009.

Surprisingly the signs of the first two variables are negative, in contrast of those presented in Table 9. Besides, the union membership in Baja California obtained the highest partial correlation coefficient with a negative sign. This suggest that this kind of labor condition decreases the labor imperfection wage u_i.

Regarding the sources of information during the job search stage for employees located in these two regions, it turned out that Internet is highly correlated with the market imperfection gain in both States. A possible conjecture for this finding is the existence of only one selected group of employees that have access to computers or afford all the cost that it takes to look for information online. Furthermore, the only one job search mechanism and that makes de difference between these two States is the information consultancy at public labor offices in Oxaca, which with a significance of 10% it obtained a negative sign (it is negatively correlated related with u_i)

Finally, it is pointed out the importance of the firm size in Oxaca, where the prevalence of small or single worker firms leads a negative partial correlation in comparison to the rest of the firm sizes. As exception, larger firms yielded a positive sign, as seen for the overall nationwide model.

5. Conclusions

This document presented an attempt to link the job search and job matching theory as a background of the wage formation process divided into three stages. Beginning with the reservation wage resulting from the labor supply and job search plans of potential workers; a subsequent bargaining moment and a further adjustment once they are completely hired.

The National Survey on Employment from Mexico was explored to find the evidence of labor markets imperfection plausibly presented along those three stages. Adapting former studies of reservation wage estimation it was possible to subtract the part of the observable wages that corresponds to the wage gain of workers due to markets imperfections. It was estimated that 82.7% of the variation of unexplained wages by human capital among workers are caused by asymmetric information, monopsonic power, discrimination, and so on.

The estimations were also obtained for Mexican States to identify which of them presents the highest and lowest variation of wages due to the presence of markets imperfections. This exercise led the analysis to deeply explore the relations between some theoretical variables that enable the existence of a proportion of wages that are not explained by human capital or abilities. It turned out that public labor offices have an important diminishing role on this proportion in the State of Oxaca. At the same time, it was observed that Internet is quite related to the augmentation of the mentioned wage gain.

It is important for policy makers to understand de dynamic of these labor market imperfections in terms of the firm size (although large firms are more susceptible to be regulated). Indeed, any intervention to mitigate this situation must not only count on workers' characteristics but also on the conditions of the potential working place.

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Appendix 1

Table A1. Unemployed workers - job search mechanisms.

Mexican States - Proportion of unemployed workers by search mechanism				
Period:	**I-2009**		**II-2009**	
State	**Direct**	**Indirect**	**Direct**	**Indirect**
Aguascalientes	71.1%	27.5%	72.0%	27.3%
Baja California	87.6%	10.8%	87.2%	8.2%
Baja California Sur	80.5%	14.5%	91.1%	8.0%
Campeche	91.7%	3.9%	95.8%	3.2%
Coahuila de Zaragoza	91.4%	6.8%	86.1%	9.7%
Colima	88.7%	9.6%	89.8%	9.2%
Chiapas	95.2%	4.5%	93.0%	6.4%
Chihuahua	86.5%	6.1%	82.6%	6.4%
Distrito Federal	64.8%	30.4%	68.5%	30.5%
Durango	90.9%	8.6%	90.4%	8.9%
Guanajuato	76.8%	21.6%	81.9%	14.3%
Guerrero	83.9%	9.0%	91.7%	6.5%
Hidalgo	81.3%	17.6%	79.2%	19.8%
Jalisco	75.5%	22.3%	74.3%	22.1%
México	79.8%	18.6%	77.0%	21.5%
Michoacán de Ocampo	93.2%	5.9%	95.6%	3.4%
Morelos	79.1%	19.3%	80.3%	17.8%
Nayarit	89.9%	5.6%	90.8%	6.5%
Nuevo León	70.8%	24.9%	73.3%	22.6%
Oaxaca	93.5%	4.8%	93.0%	6.2%
Puebla	76.2%	22.7%	74.9%	24.1%
Querétaro Arteaga	76.5%	21.0%	77.5%	20.3%
Quintana Roo	65.1%	30.1%	74.0%	24.2%
San Luís Potosí	90.3%	8.5%	85.6%	14.1%
Sinaloa	85.2%	9.2%	80.2%	9.3%
Sonora	79.7%	18.5%	82.0%	14.3%
Tabasco	91.6%	4.9%	92.8%	5.0%
Tamaulipas	83.6%	14.5%	84.6%	11.6%
Tlaxcala	92.9%	6.5%	91.8%	4.7%
Veracruz Ignacio de la Llave	84.2%	14.5%	78.2%	17.0%
Yucatán	77.0%	16.7%	78.5%	20.0%
Zacatecas	90.8%	7.6%	91.1%	5.9%

Source: ENOE-INEGI. I-2009 and II-2009.

Table A2. Unemployed workers - job search mechanisms.

Mexican States - Proportion of employed by search mechanism		
Period:	**I-2009**	
State	**Direct**	**Indirect**
Aguascalientes	89.9%	10.1%
Baja California	89.0%	11.0%
Baja California Sur	93.7%	6.3%
Campeche	92.2%	7.8%
Coahuila de Zaragoza	92.0%	8.0%
Colima	95.4%	4.6%
Chiapas	96.1%	3.9%
Chihuahua	83.0%	17.0%
Distrito Federal	87.1%	12.9%
Durango	94.2%	5.8%

Guanajuato	90.7%	9.3%
Guerrero	94.8%	5.2%
Hidalgo	93.6%	6.4%
Jalisco	89.8%	10.2%
México	88.1%	11.9%
Michoacán de Ocampo	96.6%	3.4%
Morelos	92.1%	7.9%
Nayarit	95.8%	4.2%
Nuevo León	85.6%	14.4%
Oaxaca	94.4%	5.6%
Puebla	90.8%	9.2%
Querétaro Arteaga	88.8%	11.2%
Quintana Roo	86.3%	13.7%
San Luís Potosí	89.7%	10.3%
Sinaloa	93.1%	6.9%
Sonora	92.9%	7.1%
Tabasco	94.6%	5.4%
Tamaulipas	92.7%	7.3%
Tlaxcala	92.4%	7.6%
Veracruz Ignacio de la Llave	93.5%	6.5%
Yucatán	90.0%	10.0%
Zacatecas	95.8%	4.2%

Source: ENOE-INEGI. I-2009 and II-2009.

Appendix 2.

Table A3. Unemployed workers - job search mechanisms.

State	Mexican States - Error term estimates σ_u^2	σ_v^2	γ	η		pseudo R^2
Aguascalientes	0.3833	0.0634	0.8580	-0.0019		0.2329
Baja California	6.4440	0.0870	0.9867	-0.0529	**	0.2839
Baja California Sur	0.3099	0.1039	0.7489	-0.0008		0.1574
Campeche	0.5076	0.0958	0.8413	0.0075		0.1936
Coahuila de Zaragoza	2.0589	0.0811	0.9621	-0.0032		0.1861
Colima	0.2480	0.0871	0.7400	0.0608	**	0.2241
Chiapas	0.2680	0.0847	0.7599	0.0611	**	0.2778
Chihuahua	2.1359	0.1051	0.9531	-0.1493	***	0.2257
Distrito Federal	0.6448	0.1029	0.8624	-0.0539	**	0.1911
Durango	0.4924	0.0829	0.8559	-0.0368		0.2236
Guanajuato	2.7899	0.0754	0.9737	0.0595	**	0.3110
Guerrero	0.2751	0.0833	0.7676	0.0088		0.1330
Hidalgo	0.7335	0.1039	0.8759	-0.0229		0.2123
Jalisco	1.1176	0.0778	0.9349	-0.0356		0.2489
México	2.5794	0.0915	0.9658	-0.0441		0.2506
Michoacán de Ocampo	0.1646	0.0749	0.6874	-0.0237		0.2485
Morelos	0.8284	0.0697	0.9224	-0.0729	**	0.2179
Nayarit	0.1650	0.0731	0.6931	-0.0093		0.2128
Nuevo León	0.8282	0.0773	0.9147	-0.0181		0.2133
Oaxaca	0.1292	0.0657	0.6629	-0.0143		0.2582
Puebla	0.5356	0.0851	0.8629	-0.0312		0.2180
Querétaro Arteaga	1.2001	0.0774	0.9394	-0.0131		0.2812
Quintana Roo	0.4988	0.1056	0.8252	0.0249		0.1584
San Luís Potosí	0.8415	0.0966	0.8970	-0.0155		0.1955
Sinaloa	0.3179	0.0788	0.8013	-0.0071		0.2063
Sonora	1.4101	0.1120	0.9264	-0.0479	*	0.2145
Tabasco	0.4073	0.0979	0.8062	0.0175		0.2170
Tamaulipas	0.3953	0.0953	0.8057	0.0178		0.1665
Tlaxcala	0.3633	0.0711	0.8363	-0.0796	***	0.2346
Veracruz Ignacio de la Llave	0.6104	0.0766	0.8885	-0.0330	**	0.1792
Yucatán	0.5364	0.0706	0.8838	0.0020		0.1771
Zacatecas	0.4047	0.0856	0.8255	-0.0111		0.2161

*: Significant at 10%; **: Significant at 5%; ***: Significant at 1%.

Source: ENOE-INEGI. I-2009 and II-2009.

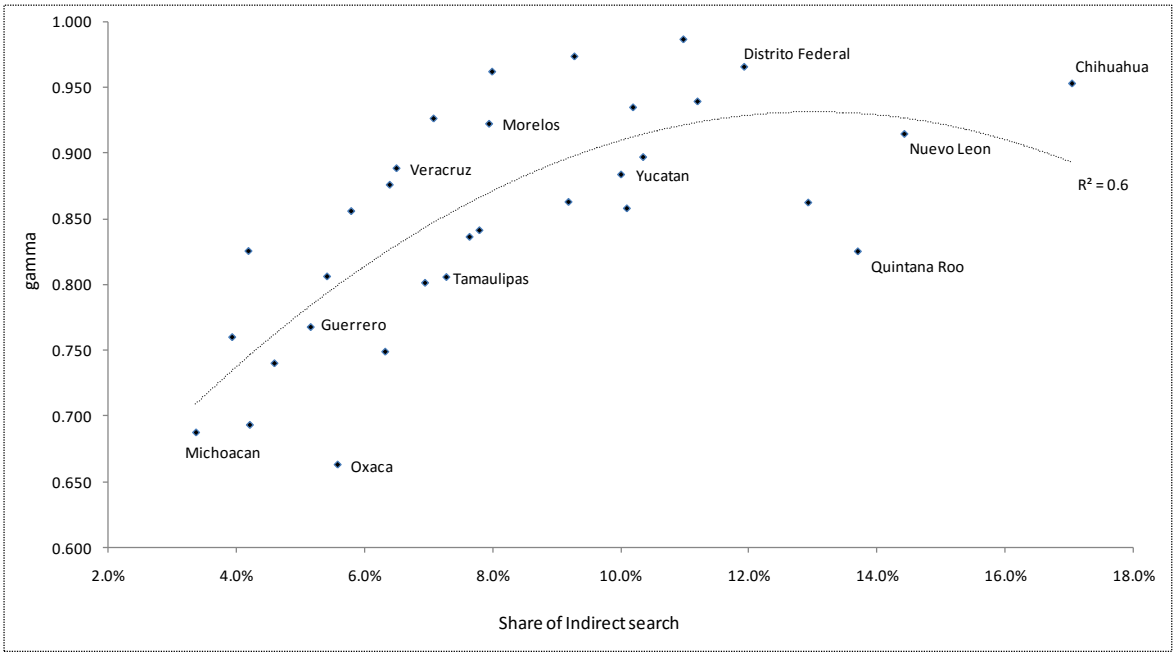

Chart A1. Plot of gamma and share of indirect search mechanisms

Source: ENOE-INEGI. I-2009 and II-2009.

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