

A Model of Public-Private Employment Choice among University Graduates in Morocco

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Abstract: The situation of the Moroccan labor market significantly worsened during the 1980s and 1990s propelling the unemployment rate to 16% in 1999. Since the start of the new millennium, the unemployment rate dropped more than 6 percentage points, and for the first time in 35 years it went below 10% (9.6% in 2008, 8.8% in 1971). Despite this significant improvement, the unemployment rate remains very high among urban and educated workers. In 2008, the unemployment rate among workers with university education was 19.6% compared to 2.2% among workers with no schooling and 8.5% among those with elementary education. In urban areas, the unemployment rate was 14.7% versus only 4.0% in rural areas. Interestingly, stylized facts indicate that highly educated workers crave public jobs, even if they risk a long spell of unemployment while seeking these jobs. In this paper, I model this behavior in order to provide a rational explanation for the remarkably high unemployment rate affecting university graduates. For this purpose, I develop and estimate a model of endogenous choice of employment sector in an intertemporal context for a dual labor market. The wage gap between sectors, the expected unemployment duration differentials, as well as the individual discount rate, are the determinants of the workers' decisions in this model. The data is derived from a sample of 1,609 university graduates drawn from the 1998 Moroccan labor force survey. Structural estimates indicate that earnings and unemployment duration differentials significantly influence the choice of employment sector. In addition, the wage premium of the public sector, measured by the initial hourly wages gap, exceeds 42.5%. Finally, with an estimated individual intertemporal discount rate of 2.3%, I conclude that a 1% increase in the public-private lifetime earnings gap is the equivalent of queuing up to 5.3 months for a public job.

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1. Introduction

During the 1980s and 1990s, Morocco experienced a significantly worsening unemployment problem in urban areas, particularly among young educated workers. The situation improved during the recent years, but there was little change in the structure of unemployment. In 2008, the urban unemployment rate was 14.7% down from 22.9% in 1995, but still high compared to 12.3% in 1982. In rural areas, the unemployment rate was only 4.0%, down from 8.5% in 1995 and 9.5% in 1982. Another feature of the Moroccan labor market is the high unemployment risk among educated workers. In 2008, 19.6% of workers with university education were reported as unemployed, as compared to 2.2% of workers who never attended school, and 8.5% of those who attend only elementary school (Direction de la Statistique, Morocco, 2009). This phenomenon is not unique to Morocco, but is commonly observed in many other developing countries. Upadhyay (1994) refers to many examples of countries from Asia, Africa and Latin America in which unemployment is widespread among educated workers.

Several studies have addressed the situation in the Moroccan labor market and other comparable African countries. Lane, Hakim and Miranda (1999) blame the fast growth of the urban labor force confronted with inadequate labor demand, and in particular the structural shift in the employment composition of manufacturing to low-paying industries linked to the export sector, which ultimately favors uneducated and poorly educated workers. Bougroum, Ibourk and Trachen (2002) target educated workers' behavior as a decisive factor. These workers crave public jobs and, in this desire, they are willing to risk long periods of unemployment. The pronounced preference for employment in the public sector and formal jobs in general by educated workers also characterizes many African labor markets (Orivel, 1995; Rama, 1998). Upadhyay (1994) argues that government subsidies to education in developing countries have increased the demand for higher education at the expense of investment in physical capital, which results in too much education being produced relative to the needs of the labor market.¹

In the literature, developing labor markets are often depicted as being comprised of two sectors: a formal/primary sector paying high wages but with limited employment opportunities, and an informal/secondary sector with ready access, but paying low wages (see, for example, Harris and Todaro, 1970; Stiglitz, 1974; Eaton & Neher, 1975). Harris and Todaro (1970) explain the high urban

¹ As part of the policy aimed at encouraging the participation of higher education, postsecondary education in Moroccan public institutions is fully subsidized. The number of higher education graduates substantially increased during the 1970s at an average rate of 29.6% per year. However, there was a slowdown in this number thereafter with an average rate of growth of 10.3% per year during the 1980s, and only 4.1% during the 1990s (Statistics from the Moroccan Department of higher education.)

unemployment rate in LDCs by noting the substantial wage differential between urban and rural areas, which encourages some rural workers to migrate to urban areas. These unemployed workers are blamed for their situation because they seek urban jobs rather than taking available jobs in rural areas.

In Morocco, educated workers typically work in the public sector.² However, recruitment in the Moroccan public sector has dropped sharply since 1983 under structural adjustment policies required by the International Monetary Fund. The objective was a significant reduction of the government wage bill as a partial solution to government budgetary constraints. In recent years, around 15,000 new jobs have been created annually, down from 30,000 to 50,000 during the 1970s and early 1980s. This change in the public sector's role is seen as the starting point of the worsening unemployment problem of educated workers, which was almost nonexistent during the 1960s and 1970s. The unemployment rate among university graduates was only 2.0% in 1982, but just two years later (i.e. one year after the adjustment policies were implemented), it reached 35% among workers with Bachelor's degrees having completed the civil service (Boutata, 1987).³ In addition, since 1984 the share of workers with a university education in the unemployed population increased more than twice as fast as their share in the labor force, from 2.3% in 1984 to 20.4% in 2002 for the former, and from 5.3% to 12.7% for the latter. Despite these facts, the public sector remains highly coveted by workers, particularly those holding university degrees, as evidenced by their almost daily demonstrations demanding employment in this sector, and by the fact that they do little to pursue alternative options. In 1991, about 9 of 10 unemployed workers having completed at least two years of postsecondary education indicated that they preferred jobs in the public sector (El Aoufi and Bensaïd, 2005).

The desire for public jobs can be ascribed to several factors. Gelb, Knight and Sabot (1991) consider the surplus labor supply in the public sector a consequence of the search for high wages. In Morocco, the average wage in the public sector is 4 times GDP per capita as compared to 3 in Tunisia, 2.8 in Malaysia, 2 in Turkey and 1 in France (Ministère des Finances et de la Privatisation, Morocco, 2003). In addition, despite the adjustment policies' goals, the public wage bill continued to grow: 4.0% per year on average between 1996 and 2000, as opposed to 1.7% growth in the total number of civil servants during the same period (Ministère des Finances et de la Privatisation, Morocco, 2003). Agénor

² During the 1960s and 1970s, the development of the educational system aimed at meeting the needs of the public sector, making it the quasi-exclusive employer of educated workers. In 1998, the share of this sector in the employment of university graduates in urban areas was 65%. In 2005, the public sector still employed 51.2% of urban workers having a secondary diploma or a higher diploma/degree (Direction de la Statistique, Morocco, 2006).

³ In order to meet the needs of the public sector for educated labor, a legislation called "civil service" (as opposed to military service) requires that all new university graduates work in the public sector for two years at about half

and El Aynaoui (2003) estimate the total public wage premium in Morocco at between 150% and 200% when taking into account nonwage compensation such as working conditions and pension plans. With such a premium, the unemployment of educated workers could be at an equilibrium, since some workers may rationally prefer to remain unemployed while queuing for public jobs rather than seek employment in the private sector. There is a substantial literature on the relationship between job queues and wage differentials and working conditions (see for instance, Holzer, Lawrence and Krueger, 1991).

Many studies have examined public-private wage gaps in developed (Krueger, 1988; Ophem, 1993; Dustman and van Soest, 1998; Lassibille, 1998; Mueller 1998) and developing countries (Stelcner, Graag and Vijverbeg, 1989; Assaad, 1997; Mengistae, 1999; Nielsen and Rosholm, 2001; Tansel, 2005), and in transition economies (Adamchik and Bedi, 2000; Falaris, 2004). Assaad (1997) and Mengistae (1999) provide evidence for the positive correlation between the "wage premium" of public jobs and the queue for these jobs respectively in Egypt and Ethiopia. Other studies suggest that non-pecuniary factors also play a significant role in the selection of employment sector. Employment in the public sector is generally desired for its stability, which attracts risk-averse workers (Bellante and Link, 1981). Thus, even when the public sector pays the same as the private sector, some workers may still prefer public sector jobs. Assaad (1997) finds that despite the substantial wage erosion in the Egyptian public sector, the latter is still attractive to graduates because of nonwage benefits. In developing countries, public jobs are also associated with high social status.

The purpose of this paper is to examine the effects of public sector wage and employment policies on the selection of the employment sector by university graduates in Morocco. Given the manifest preference of university graduates for public sector jobs, the Moroccan labor market for educated workers can be more effectively described as consisting of a primary/public sector and a secondary/private sector, rather than the traditional division into formal versus informal sectors. In addition, there are very limited employment opportunities in the informal sector for university graduates compared to other workers,⁴ which suggests that the decision for this labor force sector likely concerns public and formal private sectors. Also, I consider only wage employment. In fact, university graduates are much less likely to consider self-employment than other workers. For instance, only 7.4% of employed workers with university degrees were reported as self-employed in 1998, as

regular wages. Prior to 1983, all interested workers were granted tenure after completing their service. This provision was dropped during the 1990s.

⁴ In 1999, jobs held by workers having secondary and postsecondary diplomas/degrees represented 16.1% of the total urban employment, which is to say more than five times their share of informal employment available,

compared to 34.5% of uneducated workers. Also, I dispense with the assumption that a secondary job is always available (like in Harris and Todaro, 1970, for instance), since employment opportunities for educated workers seem to be limited in the private sector as well, though to a lesser extent than the public sector. My empirical model allows for an estimation of the weight of consideration workers put upon expected earnings and unemployment duration differentials when they select a sector for employment. In other words, it allows us to evaluate the tradeoff between higher wages and longer unemployment durations in workers' decisions. For the estimation, I use data from a sample of 1609 university graduates drawn from the 1998 Moroccan labor force survey. The main empirical results of this study indicate that workers emphasize the importance of expected earnings and expected unemployment durations when choosing a sector for employment, that the individual intertemporal discount rate is 2.3%, and that the initial hourly public-private wage gap is 42.5% in favor of the public sector. I also conclude that a 1% increase in the public-private lifetime earnings gap is the equivalent of queuing up to 5.3 months for a public job.

The remainder of the paper is organized as follows: Section 2 presents the econometric approach, Section 3 presents the data, and the empirical results are discussed in Section 4. Section 5 presents my conclusions.

2. Model of Sector Selection

For the sake of simplicity, I assume that workers can only choose between two employment sectors: sector 1 (public / high-wage) and sector 2 (private / low-wage). I also assume that the schooling level of workers is independent of the sector choice and constant during the life cycle (workers do not go back to school).⁵ Let I_t^* be an unobserved reduced form utility index corresponding to pursuing employment in sector 1 in time period t , expressed as a linear function of the expected log discounted lifetime income differential between the public and the private sectors, $\Delta \ln LE_t$, a vector of observed individual characteristics Z (including a constant) and an unobserved random component η_t that captures unobserved variables and heterogeneity:

excluding agriculture (Direction de la Statistique, Morocco, 2002). The ratio would certainly be higher if one excludes workers with secondary diplomas only and includes agricultural employment.

⁵ Our empirical study concerns only university graduates. The latter are relatively less likely to go back to school after entering the labor force as compared to other workers with schooling below university level.

$$I_t^* = b\Delta \ln LE_t + \theta Z + \eta_t^6 \quad (1)$$

When entering the labor market, the expected log discounted lifetime income in sector j can be expressed as follows:

$$\begin{aligned} \ln LE_j &= \ln \left[\int_{E(T_j)}^{\infty} W_j^0 e^{(t-E(T_j))g_j} e^{-\rho t} dt \right] = \ln \left[W_j^0 \int_0^{\infty} e^{-(\rho-g_j)t} dt \right] - \rho E(T_j) \\ &= w_j - \rho E(T_j)^7 \end{aligned} \quad (2)$$

where W_j^0 is the initial wage, g_j is a constant wage's rate of growth, ρ is the individual discount rate, and $E(T_j) \geq 0$ is the expected unemployment duration prior to finding employment in sector j . There is no income while unemployed, since unemployed workers or people with low incomes in Morocco can't rely on any public income support program. For a worker who is still unemployed at time period t , the conditional expected log discounted lifetime income in sector j is simply:

$$\ln LE_{It} = w_j - \rho [E(T_j | T_j \geq t) - t] \quad (3)$$

Hence, the log discounted lifetime income differential between the two sectors is given by:

$$\Delta \ln LE_t = (w_1 - w_2) + \rho [E(T_1 | T_1 \geq t) - E(T_2 | T_2 \geq t)] \quad (4)$$

The expected unemployment durations differential is weighted by the individual discount rate.⁸ By substituting (4) into (1), I obtain:

$$I_t^* = \alpha \Delta w + \delta \Delta U_t + \theta Z + \eta_t \quad (5)$$

where $\Delta w = (w_1 - w_2)$, $\Delta U_t = [E(T_1 | T_1 \geq t) - E(T_2 | T_2 \geq t)]$, and α , δ and θ are parameters to be estimated. The utility of public sector employment should increase as the lifetime income differential Δw increases or the expected unemployment duration gap ΔU_t decreases implying $\alpha > 0$

⁶ See Dolton, Makepeace and Klaauw (1989) for a similar approach for estimating occupational choices.

⁷ In the empirical model, we consider a finite horizon as well as the non-linearity of earnings toward the end of the life cycle. The consequences of ignoring these empirical facts at this point are, however, lightly weighted for non-negligible values of the discount rate (See Willis and Rosen, 1979, for a similar approach).

⁸ In a discrete time horizon, we can also show that the weight on unemployment duration is an increasing function of the discount rate.

and $\delta < 0$. The individual discount rate can be estimated by the ratio $-\delta / \alpha$. Empirically, this parameter has an important significance. It reflects the extent to which a worker is willing to trade a longer unemployment episode for a higher future income. Lower the value of that ratio, and the longer the unemployment duration the worker is willing to risk in exchange for a better paid job in the public sector.

In the empirical estimation, and because I am using cross-section data, t in Equation (5) is the observed duration of unemployment until the day of the survey for unemployed workers, while for employed workers, t corresponds to the duration of unemployment prior to finding employment in their sector. Hence, t is an individual-specific time period.

Like in Berger (1988), I use a finite discrete time horizon to calculate the log of the discounted lifetime income:

$$w_j = \ln \left[\sum_{t=0}^L \frac{Y_{jt} H}{(1 + \rho)^t} \right], j = 1, 2 \quad (6)$$

where $L + 1$ is the duration of employment in years, Y_{jt} is the hourly wage in sector j at time t , H is the number of hours worked per year, and ρ is the discount rate. For the sake of simplicity, L and H are assumed to be constant over time and across sectors.

I specify earnings equations of the form:

$$y_{jt} = X_t \beta_j + \varepsilon_j, j=1,2 \quad (7)$$

where $y_{jt} = \ln(Y_{jt})$ is the log of the hourly wage in sector j at time t , X_t is a vector of observed characteristics, and ε_j is a random component. For empirical purposes, the discounted lifetime income is computed over a period of 35 years of career.⁹ Combining (6) and (7), we obtain:

$$w_j = s_j + \ln(H) + \varepsilon_j \quad (8)$$

where $s_j = \ln \left[\sum_{t=1}^{35} \frac{\exp(X_t \beta_j)}{(1 + \rho)^t} \right], j = 1, 2$. The evaluation of s_j requires an estimate of the individual

discount rate. Following upon my discussion above, I set $\rho = -\delta / \alpha$.

⁹ Increasing this horizon does not affect our results. In addition, 98.7% of employed workers in our sample have less than 35 years of work experience.

The log discounted lifetime income differential between sector 1 and sector 2 is:

$$\Delta w = \Delta s + (\varepsilon_1 - \varepsilon_2) \quad (9)$$

Finally, substituting (9) into (5) implies:

$$I_t^* = \alpha \Delta s + \delta \Delta U_t + \theta Z + \alpha(\varepsilon_1 - \varepsilon_2) + \eta_t \quad (10)$$

With regard to the durations of unemployment, I assume that T_j , the unemployment duration in sector j , has a Weibull distribution.¹⁰ The hazard function and survival function are, respectively:

$$h(t) = \lambda_j p_j (\lambda_j t)^{p_j - 1} \quad \text{and} \quad S(t) = e^{-(\lambda_j t)^{p_j}} \quad t > 0, \lambda_j, p_j > 0, j=1,2 \quad (11)$$

Parameters p and λ fully characterize the Weibull distribution: p determines the shape of the hazard function, while λ determines its scaling. External factors are given a role in the hazard function by setting the scale parameter λ_j as a function of a set of observed characteristics V and a random variable μ_j representing unobserved heterogeneity:

$$\lambda_j = e^{-(V\psi_j + \mu_j)} \quad (12)$$

By substituting (12) into (11), I obtain:

$$h(t) = p_j t^{p_j - 1} \left[e^{-(V\psi_j + \mu_j)} \right]^{p_j} = h_{j0}(t) g(V, \mu_j) \quad (13)$$

where $h_{j0}(t) = p_j t^{p_j - 1}$ is the baseline hazard function and $g(V, \mu_j)$ is a nonnegative function of V and μ_j . Consequently, covariates with negative coefficients increase the baseline hazard rate and vice-versa.

With regard unobserved heterogeneity, I adopt discrete distributions with unrestricted points of support in order to avoid misspecification problems with parametric distributions (see Heckman and Singer,

¹⁰ We choose this distribution because the empirical hazard function tends to increase over time in both employment sectors (not shown).

1984). I also assume that μ_1 and μ_2 have two points of support each: μ_{11} and μ_{12} for μ_1 and μ_{21} and μ_{22} for μ_2 .¹¹ The associated probabilities are as follows:

$$q_{km} = Pr(\mu_1 = \mu_{1k}, \mu_2 = \mu_{2m}), \text{ with } k, m \in \{1, 2\} \text{ and } \sum q_{km} = 1 \quad (14)$$

The estimation of the duration models requires first the identification of the observed unemployment durations that apply to each sector. In Harris and Todaro's (1970) model, rural and urban areas are geographically separated, so workers can seek employment in one and only one sector at a time, depending upon their physical location. Moreover, unemployment applies to urban areas only, since a rural job is assumed to be always available. In subsequent models (Eaton and Neher, 1975, for instance), workers are unemployed because they seek employment only in the high-wage sector rather than being willing to take available jobs in the opposite sector. Hence, their unemployment status is undoubtedly linked to the high-wage sector. My case is further complicated, since workers face unemployment risk even in the low-wage sector, and with cross-sectional data I do not observe the dynamic of the job-search. Naturally, all workers prefer employment in the high-wage sector, and it is rational for them to seek employment in this sector. Depending upon their discount rates and perceived probabilities of finding jobs in the high-wage sector, some workers will also seek employment in the low-wage sector. Simultaneous search in both sectors is possible, but assumes that the worker is willing to consider offers from the low-wage sector. In Morocco, there is strong evidence that university graduates crave public jobs sector and some of them are not willing to consider any offer from the private sector. Hence, seeking exclusively public jobs is an observed behavior. Data used in this study inform on the employment sectors where unemployed workers currently seek employment. Given the abovementioned stylized fact, I will assume that workers who seek employment in the private sector are also seeking employment in the public sector, whereas those who declare seeking employment in the public sector seek employment in this sector only. Regarding employed workers, data does not inform on the preferred sector for employment when unemployed. I only observe the current employment sector for each worker. This situation raises an identification problem for workers who were seeking employment in both sectors simultaneously. Some of these workers may have ended in the high-wage sector, while they were disposed to accept employment in the low-wage sector. However, it is cogent to assume that workers are more likely to be employed in the sector where they were actively searching employment. Consequently, I estimate the model empirically under the assumption that the current employment sector is the one preferred while unemployed.

¹¹ In the empirical estimation, I searched for additional points of support, but their corresponding estimated probabilities were not statistically significant.

Finally, a point that deserves discussion relates to the possibility for workers to take jobs in the private sector while they queue for public jobs. An argument often used to explain voluntarily unemployment in LDCs, is that workers increase the probability of obtaining jobs in the high-wage sector by being unemployed and investing in search (Pinera and Selowsky, 1978). In addition, accepting a private job may significantly reduce the chance of obtaining a public job given the government hiring policy. In fact, there is an institutional constraint for workers seeking employment in the Moroccan public sector. Since employment in this sector mainly aims at fighting against unemployment among educated workers, unemployed workers looking for their first jobs are more likely to be hired as compared to workers who already have accepted jobs in the private sector.¹² So, workers who accept employment in the private sector likely are willing to keep their jobs in the future. A typical example of the institutional constraint is the recruitment of doctors. Those who take jobs in the private sector have little chance to be hired in the public sector as compared to doctors who are still looking for their first jobs. In addition, work experience in the private sector generally has little effect, if there is any, on initial wages in the public sector. Also, any time spent queuing for public jobs will have no depreciative impact on initial public wages.¹³ Besides, a distinguishing characteristic of the Moroccan labor market in comparison with the North American is that transitions between specific forms of employment, and between employment and unemployment, are less frequent. For instance, in 2002 more than 80% of unemployed workers with secondary diplomas or university degrees were still seeking their first jobs. Also, a follow-up of vocational training graduates shows that five years after graduation, more than 80% of graduates either never found employment or are at their first jobs (Département de la Formation Professionnelle, Morocco, 1998). Therefore, I consider the option of taking a private job while awaiting a public job unlikely, though possible.

In sum, I assume that observed (censored or not) unemployment durations for workers who seek employment or are employed in the private sector (sector 2) also apply to the public sector (sector 1). Consequently, the correlation between unobserved heterogeneity components in eq. (12) can be estimated.

The structural model is given by Equations (7) through (14). For the sake of simplicity, I will assume that T_1 and T_2 are independent of ε_1 , ε_2 and η_t . This assumption, though counterintuitive (as one would expect wages in a given sector to be negatively correlated with unemployment duration in that sector) simplifies to a large extent the estimation of the model. In this case, unemployment equations

¹² Employment in the public sector is primarily seen as a social program instead of as a mean to meet the needs of the public sector in labor.

¹³ Overall, public workers in the same category receive the same wages regardless of differences in abilities or given efforts (Ministère des Finances et de la Privatisation, Morocco, 2003).

are estimated separately from selection and earnings equations, then estimated expected unemployment durations per sector are fed into Equation (10). I mention that unemployment has no effect on starting wages in the public sector since these wages are determined institutionally in connection with the level of education only. Thus, the assumption in question mainly concerns unemployment and wages in the private sector.¹⁴

I also assume that $(\varepsilon_1, \varepsilon_2, \eta_t)$ is a normal vector with mean 0 and variance Σ , with:

$$\Sigma = \begin{bmatrix} \sigma_1^2 & \sigma_{12} & \sigma_{13} \\ & \sigma_2^2 & \sigma_{23} \\ & & I \end{bmatrix} \quad (15)$$

The selection criteria are:

$$\begin{aligned} Pr(\text{choose sector 1}) &= P(I_t^* \geq 0) \\ Pr(\text{choose sector 2}) &= P(I_t^* < 0) \end{aligned} \quad (16)$$

The model is estimated in two steps. First, I estimate unemployment duration equations and obtain \hat{q}_{km} , $\hat{\mu}_{1k}$ and $\hat{\mu}_{2m}$ estimates of q_{km} , μ_{1k} and μ_{2m} . The individual contribution to the maximized likelihood function is:

$$\sum_{k,m=1}^2 q_{km} \left\{ f_1(t)^{pe} S_1(t)^{p(1-e)} [f_2(t)S_1(t)]^{(1-p)e} [S_2(t)S_1(t)]^{(1-p)(1-e)} \mid \mu_1 = \mu_{1k}, \mu_2 = \mu_{2m} \right\} \quad (17)$$

where p is a dummy variable which takes value 1 if the worker seeks employment or works in sector 1 and value 0 otherwise, and e is a dummy variable which takes value 1 if the worker is employed, and value 0 otherwise.

Second, selection and earnings equations are estimated jointly by maximum likelihood. The individual contribution to the likelihood function depends upon the worker's status (employed or unemployed) and his or her employment/preferred sector. For instance, the contribution to the likelihood function of a worker who is currently employed in the public sector is:

$$\sum_{k,m=1}^2 \hat{q}_{km} Pr(I^* \geq 0 \mid \varepsilon_1 = y_1 - X\beta_1, \mu_1 = \hat{\mu}_{1k}, \mu_2 = \hat{\mu}_{1m}) \phi\left(\frac{y_1 - X\beta_1}{\sigma_1}\right) \quad (21)$$

¹⁴ I run a regression of the private log hourly wage on experience, experience squared, gender, education levels, and log unemployment duration. Surprisingly, the estimated coefficient on the latter variable is highly

where $\phi(\cdot)$ is the density function of the univariate standard normal.¹⁵

As a final point, a question of identification naturally arises in the model. The selection equation requires individual wages estimates in both sectors, whereas one only ever observes the wage someone would make in a given sector if work was actually undertaken in that sector. Because I account for the possible correlation between ε_j and η_t (see Equation, 15), my approach amounts to predicting the wage in each sector on the basis of selection adjusted wage equation estimates in this sector.¹⁶ However, the reliability of this econometric approach depends on the availability of instruments that can predict differences in the choice of employment sector across individuals, without directly affecting the wages. Variables in X_t (eq., 7) are experience, experience squared, gender and education level, and variables in Z (eq., 10) are gender and education level. Hence, if I consider a reduced form of the selection equation (10), I end up with almost the same variables explaining the selection and wages. Yet, structural wage equations might be identified off the nonlinearity (Willis and Rosen, 1979). In addition, in a model where the selection function depends directly on the wage gap between options, the coefficient on the wage gap is estimable if at least one variable in X_t is not included in Z (Maddala, 1983, p. 239).¹⁷ I satisfy this condition, since experience and experience squared are not included in Z . Similarly, the coefficient on the expected unemployment duration differential is identified off the nonlinearity of V in the selection function and the fact that V includes a dummy variable, which takes a value of 1 for workers who entered the labor force or are still looking for a job in 1983 (year of implementation of adjustment policies) or later. This variable is not included in Z .

The Moroccan labor force survey unfortunately contains little data on family background that may be used as instruments. The survey is designed to track the evolution of the main indicators of the labor market. There are no questions concerned with the family income, parents' education, siblings or non-labor income. These variables might reflect the capacity of workers to sustain unemployment while awaiting public jobs. However, the family background might have a rather ambiguous role in the workers decisions in a developing country such as Morocco. For instance, the concept "family" has a broader and stronger meaning compared to what one sees in developed societies, making it hard to

insignificant. I obtain the same conclusion when I run the regression separately for each education group.

¹⁵ The whole likelihood function is available upon request.

¹⁶ Notice that I am estimating selection and wages equations jointly using the maximum likelihood method. In the literature, the two-stage estimator proposed by Heckman (1979), for the one selection rule, and by Lee (1983), for the multi-selection rule, was largely used because it is computationally more attractive than the maximum likelihood method.

¹⁷ Lee (1978) uses the same argument to estimate the structural parameters of the union status. The author includes one variable (industrial classification) in the wage equations and excludes it from the union status equation.

reflect the relationship with individual decisions.¹⁸ Yet, by using only data for university graduates, I limit to some extent the heterogeneity of individuals taken as a whole regarding their respective family backgrounds, since there is a strong relationship between the (direct) family background and university participation.

3. Data

Data used in this study is drawn from the Moroccan Labor Force Survey (LFS) conducted in urban areas in 1998. The LFS is an annual cross-section survey aimed at collecting principal information on labor force participation, employment and unemployment. Rural areas were included in the scope of the survey starting 1999. A distinctive feature of the survey is that it provides information on the employment sectors preferred by unemployed workers (either public or private).

I restrict the sample examined herein to workers with university degrees. The reasons for this are multiple. First, there are still public employment opportunities for this population sector, far more, relatively speaking, than to other workers. New public positions are still mainly geared towards university graduates, though in smaller numbers compared to the period prior to 1983. Second, data indicates that university graduates are the ones who express unambiguous preferences for one of the two employment sectors. Third, having invested a long time in getting an education, university graduates are likely to have closer discount rate values (Card, 2000). This allows us to estimate the model, assuming that the same discount rate applies for this group of workers. Finally, education increases job stability and then reduces transitions between employment and unemployment states. In 2002, 81% of unemployed workers with secondary diplomas or university degrees were seeking their first jobs, versus 27% among uneducated unemployed and 54% among unemployed with education below secondary.

The Moroccan LFS provides earnings only for paid workers (i.e., only wages). Self-employed workers are not asked about their earnings. I therefore drop self-employed workers from the sample and focus on wage employment only. Nonetheless, self-employment is an unlikely option for highly educated workers, since only 7.4% of employed workers with university degrees were reported self-employed in 1998 compared to 34.5% for uneducated workers.

¹⁸ For instance, a worker coming from a rural low-income family could be supported by a relative living in urban areas while looking for a public job. Also, having a wealthy or influential close relative, other than the father and the mother, may be very effective in finding a job given the role of connections, regardless of the father/mother situation.

With regard to the durations of unemployment, the survey provides information only for unemployed workers, whereas the estimation of the model also requires unemployment durations prior to employment for workers who are currently employed. Fortunately, the survey gives the durations of search for first jobs by employed workers who started working within the five years before the survey was taken. Given the fact that there is limited mobility in the Moroccan labor market, especially for university graduates, current jobs are likely to be the first ones. Consequently, I use unemployment durations before first jobs in the estimation of the model. Concerning employed workers who started working more than five years before the survey was taken, I estimate the durations of unemployment by the difference between the estimated age at graduation (based upon the highest degree) and the age at the start of employment. The latter is provided by the survey. Finally, I included only workers aged 64 years or younger, with a duration of unemployment, censored or not, less than ten years. The final sample consists of 1607 workers.

Descriptive statistics are presented in Table 1. Women represent 34.5% of the sample. Four types of university degrees are distinguishable:

- University degree below Bachelor's, obtained after two years at university: 8.7%.
- Bachelor's, requiring four successful years of university studies: 47.4%.
- University degree above Bachelor's, such as Master's and Doctorate: 7.2%.
- Technical school degree, generally obtained after five years of post-secondary studies in a technical/professional school (for instance engineering schools): 36.7%.

It can therefore be seen that the analysis undertaken in this sample focuses upon workers holding degrees corresponding to four to five years of postsecondary education. The Moroccan education system offers few opportunities for students who want to pursue postgraduate studies. The system admits a very limited number of students at this level. Regarding university degrees below Bachelor's, they have little professional relevance. They simply attest that the student has successfully completed the first two years of university education.

The unemployed constitute 23.8% of the sample. The mean hourly wage is 50.9 Moroccan Dirhams (MAD),¹⁹ and it is 20% higher in the public sector as compared to the private sector. In addition, the public sector workers accumulated more years of work experience on average than did their peers in the private sector (about four years of difference). In general, public workers are also more educated

¹⁹ \$1 US is worth about MAD 9.

than private workers, a feature that other developing labor markets also exhibit (Glick and Sahn, 1997, for Guinea; and Tansel, 2005, for Turkey).

Finally, more than four out of five unemployed in the sample expressed the desire to obtain employment in the public sector, and the mean duration of unemployment (censored or not) is 2.4 years, and is slightly higher among people working or preferring to work in the public sector.

4. Empirical Results

All estimates are reported in Tables 2 through 4. Coefficients from Table 2 were estimated separately in a first step, at which point expected unemployment durations estimates were obtained and fed into the selection equation (10). In the second step, coefficients from Tables 3 and 4 were simultaneously estimated by maximum likelihood.

4.1 Unemployment duration equations

Estimated unemployment duration equations are presented in Table 2. In order to identify the direction of the effect of the covariates on the hazard rate one must consider the opposite sign of the estimated coefficients of these variables. Subjacent logic is that variables with negative coefficients increase the instantaneous probability of finding employment in each time period (c.f. Equation 13).

Surprisingly, results indicate that there are only two combined types of workers for a potential total of four, each type representing around 50% of the population. A type 1 worker is exposed to higher risk of unemployment in the sector whereas a type 2 worker is not, and vice versa. Therefore, each type is largely favored in one and only one sector with respect to access to employment, and largely disfavored in the opposite sector. The probabilities of being favored (or disfavored) in both sectors at the same time are not statistically significant. Therefore, public and private sectors do not appear to be competing on the labor market on the basis of unobservable worker characteristics.

Concerning observed characteristics, there is no significant difference between the two genders with regard employment in the two sectors. Consequently, there is no discrimination at this point for university graduates. On the other hand, workers holding degrees from technical schools and those with university degrees above Bachelor's, experience lower unemployment durations, particularly in the public sector as compared to other workers. Workers with Bachelor's degrees do not have any advantage at this point over workers with less than Bachelor's degrees (reference group) since the coefficient on Bachelor's degree is not statistically significant. To approach the evolution of

employment after the implementation of adjustment policies, I include in the set of covariates a dummy variable (Year 1983) that takes value 1 for workers who entered the labor force or are still looking for a job in 1983 or later. Results indicate that the probability of being employed in the public sector decreased after 1983, whereas the probability of being employed in the private sector was not affected.

Finally, with regard to the shape of the hazard rate functions, results indicate that hazard rates are increasing over time in both sectors, a fact that agrees with the overall trend in the empirical hazard rates. Results from the public sector may be explained, among other things, by the hiring policy, since long-term unemployed are favored over recent ones. Results from the private sector are somewhat surprising if one considers that employers from the private sector would favor recent graduates when hiring. Nonetheless, I maintain that a hazard rate at a given time is evaluated based upon being unemployed at that time. Consequently, over time, it applies to a decreasing number of workers.

4.2 Wage equations

Estimates are reported in Table 3. The public sector pays notably higher initial hourly wages as compared to the private sector. The wage differential is 42.5% for the reference group (i.e. workers with degrees below Bachelor's) and this premium is even higher for other groups of workers, particularly workers holding Bachelor's degrees or above Bachelor's degrees.

Initial wages are clearly lower in the private sector, but are increasing about twice as fast in this sector, causing the gap between the sectors to narrow over time. Lifetime income is even higher in the private sector for some workers. For instance, the total income over the first 35 years of work discounted using a discount rate of 2.3% (see results below from selection equation) is 13% higher in the private sector for males holding degrees from technical schools (9% when considering a 45-year horizon),²⁰ whereas it is 20% lower for males with Bachelor's degrees (24% when considering a 45-year horizon). Incidentally, the unemployment rate is the lowest among the former group and the highest among the later one.

A significant issue that emerges from the results in Table 3 concerns the gap between males and females. This gap is not significant in the private sector in opposition to about 12% in favor of males in the public sector. Glick and Sahn (1997) find similar quality results for Guinea, with average male earnings exceeding female earnings by about 20% in the public sector, while this gap is not significantly different from zero in the private sector; however, Tansel (2005) finds opposite results for

²⁰ The decrease in the gap when enlarging the horizon is due to the quadratic term. The estimated coefficient on that term is -0.0012 in the public sector versus -0.0022 in the private sector.

Turkey. The two studies use samples representative of all levels of education, while my study exclusively focuses upon university graduates. Since wage levels in the Moroccan public sector are fixed institutionally, regardless of gender, the apparent wage discrimination against women may mirror the fact that promotions are more often given to men in the public sector.

Finally, notice that the estimated standard error of the random component is higher in the private sector as compared to that obtained for the public sector (0.82 versus 0.67) and that the correlation between the two random components of the earnings equations is small though significant (0.32). This may reflect the emphasis put by each sector upon productivity in wage determination. This emphasis is manifestly greater in the private sector, while earnings in the public sector are mainly based on the education level. A study by the Ministère des Finances et de la Privatisation, Morocco (2003) indicates that differences amongst public workers regarding productivity do not affect wages, which tend to be more homogenous.

4.3 Selection equation

The most novel empirical results are the structural probit estimates in Table 4. The weights put on earnings and unemployment duration when choosing an employment sector are significantly different from zero. In addition, the signs of these parameters correspond to those anticipated ($\alpha > 0$ and $\delta < 0$). These results suggest that an increase in the expected lifetime income in a given sector increases the probability that workers favor employment in this sector, holding all else constant. Similarly, a contraction in employment opportunities in a given sector naturally reduces the probability that workers will thereafter seek employment in this sector, holding all else constant. The effect of earnings on sector choice is also reflected by the significant correlation between the error component in the selection equation on one hand, and the error component in each of the two earnings equations on the other (σ_{j3} estimates in Table 4). Notice also that the constant in the selection equation is positive and statistically significant. It might represent non-pecuniary factors as well as factors unrelated to unemployment that make workers appreciate employment in the public sector, such as job stability and the prestige of being a civil servant in a developing society. There is no difference at this point between men and women. On the other hand, workers with Bachelor's degrees are more inclined to prefer employment in the public sector as compared to other workers. Therefore, in their desire to obtain civil servant employment these workers consider risking long periods of unemployment. Actually, this is the case, since the unemployment rate is the highest among workers with Bachelor's degrees.

The high fixed value allocated to employment in the public sector implies that even at equal wages and equal unemployment durations workers are likely to prefer employment in the public sector. This agrees with the results of Bellante and Link study (1981), which indicates that even if the public and the private sectors pay same wages there will still be an excess of labor supply for the public sector.

I have also determined that the estimated personal discount rate, given by the ratio of the estimated coefficients on the expected log-lifetime earnings differential and the expected unemployment durations gap, is about 2.3%. This parameter reflects the duration of unemployment that workers can bear in exchange for the public wage advantage. The smaller this parameter the longer the unemployment spell that the worker is able to risk. A personal discount rate of 2.3% suggests a 1% increase in the public-private wage differential, holding all else constant, is worth up to 5.3 months (0.44 year) queuing for a public job.

As a final point, one may wonder how results on the estimates of the parameters that drive workers' behavior could be effectively incorporated in setting a policy aiming at easing unemployment among university graduates in Morocco. The answer is not obvious since the model is merely a partial equilibrium model. In particular, wages and unemployment durations in the private sector are most likely to react to any induced change in the sector choices by unemployed workers. In addition, the situation in the Moroccan labor market is somewhat complicated due to the great fixed value allocated by workers to employment in the public sector and to serious difficulties in finding employment even in the private sector. Nonetheless, the government might still need to adjust its compensation policies in order to lessen the substantial gap with the private sector, especially given that the workers' discount rate is far too small. However, this policy might have an effect on the quality of the public service by deterring good applicants and possibly increasing the turnover.

5. Conclusion

The models developed in the early 1970s (for example Harris and Todaro, 1970; Stiglitz, 1974; and Eaton and Neher, 1975) have stressed the role of wage differentials in employment sector choice. "Migration" from the low-wage sector to the high-wage sector will continue as long as the expected wage in the second sector is higher than the ongoing wage in the first sector. The unemployment rate will then continue to increase until workers expect the same wage level in both sectors, thus causing the migration to stop. In these models, unemployment is voluntary since unemployed workers refuse to take available jobs in the low-wage sector. The model developed in this paper fits within the same framework without, however, "putting all the blame on the unemployed" since the latter face

unemployment risk in all sectors. Naturally, the risk is higher in the high-wage sector. Workers' expectations about wages and unemployment duration largely determine their behavior regarding sector choice. Workers face a loss of income due to unemployment as well as lost opportunity costs incurred by forgoing employment opportunities in the low-wage sector. This loss of income, which depends upon unemployment duration, is weighted by the discount rate. A worker with a low discount rate can withstand a longer duration of unemployment in order to obtain employment in the high-wage sector. A substantial wage differential between sectors also initiates this "waiting for employment" feature, a process that results in an increase in the aggregate unemployment rate.

The econometric model I developed using Moroccan data provides estimates of parameters that drive workers' decisions. The empirical application to the choice between the public and the private sector as occupational possibilities in Morocco is motivated by the fact that in this country highly educated workers strongly prefer employment in the public sector. Structural estimates in Table 4 support the hypothesis that earnings and unemployment durations significantly influence the choice of employment sector. The estimated personal discount rate is 2.3%, a value that makes workers relatively more sensitive to earnings (and other benefits) over unemployment durations. I also find that the self-selection adjusted initial hourly wage gap between the private and the public sector is 42.5%. Thus, an adjustment of the remuneration policy in the public sector seems necessary, especially since a higher earnings gap generates a higher unemployment rate (workers with Bachelor's degrees versus workers with technical schools degrees). Also, the government should consider a hiring policy that deters queuing for public jobs for long time without pursuing alternative options. Other public policies that aim at improving employment opportunities and working conditions in the private sector, and reducing the share of the informal sector in the economy should also be considered.

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Table 1: Descriptive Statistics

Variables	Mean
# observations	1,607
Age (years)	36 (8.3)
Female	0.345
Degree:	
. Technical Schools	0.367
. University, Below Bachelor's	0.087
. University, Bachelor's	0.474
. University, Above Bachelor's	0.072
Labor Force Status:	
. Employed	0.762
. Unemployed	0.238
Employed x Sector:	
. Public	0.780
. Private	0.220
Unemployed x Preferred Sector:	
. Public	0.841
. Private	0.159
Hourly Wage (in Moroccan Dirham ²¹):	50.94 (60.43)
. Public	52.93 (58.80)
. Private	43.91 (65.52)
Experience (years):	13.6 (8.9)
. Public	14.5 (8.6)
. Private	10.8 (9.4)
Unemployment Duration (years):	2.4 (2.3)
. Public	2.5 (2.3)
. Private	2.1 (2.2)

Notes: The sample is drawn from the 1998 Moroccan Labor Force Survey, and includes workers aged 64 years or younger and for whom unemployment duration is less than 10 years. Missing unemployment durations are estimated by age at starting first job minus age at graduation. Figures in parentheses are standard-deviations.

²¹ 10 Moroccan Dirham \approx \$1 US

Table 2: Unemployment Duration Equations Estimates

Negative coefficients mean that higher values of the variable imply getting employed faster.

	Public Sector		Private Sector	
	(1)	(2)	(1)	(2)
	Coefficient	Standard-Error	Coefficient	Standard-Error
Constant 1	2.0123 ^(a)	0.1374	-0.4572 ^(b)	0.2136
Constant 2	0.6560 ^(a)	0.1620	1.5853 ^(a)	0.2090
Male	-0.0651	0.0716	-0.0648	0.1175
Technical School	-1.1581 ^(a)	0.1290	-0.5354 ^(a)	0.1716
University, Bachelor's	-0.1693	0.1244	-0.1764	0.1647
University, Above Bachelor's	-1.2735 ^(a)	0.1670	-0.4773 ^(b)	0.2202
Year 1983	0.8539 ^(a)	0.0670	0.1734	0.1440
p_j	1.2492 ^(a)	0.0440	1.3312 ^(a)	0.0899
q_{11}	0.4914 ^(a)	0.0370		
q_{12}	0.0000	0.0001		
q_{21}	0.0000	0.0000		
q_{22}	0.5086 ^(a)	0.0370		

Notes: The reference group for education is "University, Below Bachelor's." The unemployment duration is in years. Year 1983 is a dummy variable that takes value 1 if a worker entered the labor force in 1983 or later. $q_{ij} = Prob(\text{Constant } i \text{ for public sector and Constant } j \text{ for private sector})$. (a), (b) and (c): significant at the level 1, 5 and 10 percent.

Table 3: Wage Equations Estimates

	Public Sector		Private Sector	
	(1)	(2)	(1)	(2)
	Coefficient	Standard-Error	Coefficient	Standard-Error
Constant	2.1584 ^(a)	0.0905	1.7333 ^(a)	0.2404
Male	0.1169 ^(a)	0.0431	0.0570	0.1069
Technical School	0.8114 ^(a)	0.0768	0.7837 ^(a)	0.1530
University, Bachelor's	0.5738 ^(a)	0.0753	0.2191	0.1400
University, Above Bachelor's	1.5074 ^(a)	0.0973	1.1509 ^(a)	0.2143
Experience	0.0603 ^(a)	0.0069	0.1151 ^(a)	0.0072
Experience squared	-0.0012 ^(a)	0.0002	-0.0022 ^(a)	0.0002
σ_j (*)	0.6701 ^(a)	0.0251	0.8219 ^(a)	0.0411
σ_{j3} (*)	0.5786 ^(a)	0.0497	0.7481 ^(a)	0.0866
σ_{l2} (*)	0.3184 ^(a)	0.1014		

Notes: The dependent variable is log hourly wage. (*) See variance matrix given in eq. (15). The reference group for education is “University, Below Bachelor’s.” (a), (b) and (c): significant at the level 1, 5 and 10 percent.

Table 4: Selection Equation Estimates

	Coefficient	Standard-Error
Constant (ω)	1.4633 ^(a)	0.2589
Log wage differential (α)	2.8625 ^(a)	0.3448
Expected unemployment duration gap, in years (δ)	-0.0651 ^(a)	0.0349
Male	-0.0374	0.1433
Technical School	0.2770	0.2602
University, Bachelor's	0.3824 ^(b)	0.1653
University, Above Bachelor's	0.4196	0.3375
Discount Rate ($-\delta/\alpha$)	0.0227 ^(a)	0.0120
Mean Log-Likelihood		-1.2405
# observations		1,607

Notes: The reference group for education is "University, Below Bachelor's." (a), (b) and (c): significant at the level 1, 5 and 10 percent. Tests for the significance of α , δ and the discount rate ($-\delta/\alpha$) are one-tailed.