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THE FLEXIBLE FORMS OF  
EMPLOYMENT AND WORKING CONDITIONS:  
EMPIRICAL INVESTIGATION FROM TUNISIA

Ilham Haouas and Mahmoud Yagoubi

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**The Flexible Forms of Employment and Working Conditions:  
Empirical Investigation from Tunisia**

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## **Abstract**

We investigate the impact of flexible forms of employment on working conditions in Tunisia. The dataset used comes from a unique survey covering 2000 workers in Tunisia and providing information on individual workers for the year 2004. Flexible forms of employment include job rotation, team work, fixed-term contract, part-time, flexible work hours, week-end work, night work, and over-time work. Working conditions are captured by occupational injuries as well as indicators of mental strain. We find that workers involved in the flexible work practices faces a higher risk of work injuries and more mental strain than workers involved in a more traditional work organization.

2000

.2004

## 1. Introduction

Throughout the world, governments and legislators weigh the benefits of social protection against the efficiency costs of rigid labor markets when designing labor regulation. There is now important evidence that stringent labor market regulations have important efficiency effects for both developed and developing countries<sup>1</sup>. But a more stringent labor market regulation also increases the incentive of firms to avoid these regulations by hiring informal workers. The informal economy has a considerable size in most developing countries. Informality may leave the poorest workers in the economy in a very vulnerable position since they cannot benefit from the social protection regulations established by their respective governments. This is a major source of concern for policy makers. Therefore, many governments have for some time proclaimed the advantages of a flexible economy and a flexible workforce, and many firms have experienced a reorganization of their workplace. New flexible forms of employment have been adopted such as job rotation, de-layering, work-teams, just-in-time, sub-contracting, contract workers, flexible hours and total quality management. This phenomenon first started in the United-States and has since spread out to the rest of the world. In Tunisia, according to the IEQ (Quantitative Economy Institute's) survey (2007), the share of ISO-certified private establishments went up from 19 to 28 % between 2005 and 2006.

Literature first developed in management and more recently used in economics, has studied the consequences of these flexible forms of employment on firms' performance and skill requirements<sup>2</sup>. Using either industry or firm-level data, most of these studies confirm the positive impact of new work practices upon productivity, especially in connection with information technologies. Data drawn from the Cranet-E International Survey of Strategic Human Resource Management, Valverde, Tregaskis and Brewster (2006) showed that only one form of numerical flexibility has a positive relationship with firm performance. Almeida and Carneiro (2005) studied whether access to informality affects manufacturing performance using a cross section of firms in Brazil. They used (exogenous) regional variation in the enforcement of the labor law to identify the effects of more flexibility on firms' outcomes. The preliminary findings suggested that firms with an easier access to informal labor tend to have a more educated workforce, a higher capital-to-labor ratio and a more advanced technology. This translates into a higher output and value added per employee. Additionally, these firms tend to pay higher average wages per employee. They find this is either caused by a higher firm productivity and by the labor tax savings being shared with informal workers. Moreover, authors did not find evidence that informality increases firm's employment or employment turnover. On a sample of steel finishing lines, Ichniowski et al. (1997) showed that the introduction of new human resource management practices positively influenced productivity. On a larger panel of US firms, Black and Lynch (2004) found that re-engineering, profit sharing and employees' voice also have a positive impact on productivity. The same result was found through de-layering on a panel of French firms by Caroli and Van Reenen (2001) who also stressed that organizational change was biased against unskilled labor. Bresnahan et al. (2002) found that skills, technology and new organizational practices mutually complemented each other in a sample of U.S. establishments.

In contrast, little statistical evidence is available on the potential impact of new organizational practices upon working conditions. In a number of Maghreb countries, an increasing

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<sup>1</sup> Heckman and Pages (2003) survey evidence for Latin America. The evidence strongly suggests that a restrictive labor market regulation decreases labor flexibility and reduces employment, turnover and bias employment composition towards more skilled workers.

<sup>2</sup> See Caroli (2001) for a review.

proportion of workers report work-related health problems<sup>3</sup>. In Tunisia, the frequency of occupational injuries has increased in recent years (Yazidi, 2004).

Despite this upward trend in work related health problems, until recently there was little interest in the consequences of the flexible forms of employment on working conditions and safety. The difficulty of such an exercise lies in finding reliable data sources on both work flexibility and working conditions. Most of the literature (in economics, sociology, ergonomics...) has historically been based on case studies and qualitative arguments (ILO, 1998). More recently, some statistical analyses have been conducted using firm or industry level data. For example, using the dataset of the Third European Survey on working conditions, conducted in 2000 and involving 21,505 workers, Costa et al. (2006) found that flexibility and variability of working hours were inversely related to health and psycho-social well-being: the most favorable effects were associated with higher flexibility and lower variability. The analysis of the interactions with twelve intervening variables showed that shift and night work confirmed to have a negative influence on sleep, digestive and cardiovascular troubles, as well as health and safety at work. Time pressure also showed a significant influence on both the stress level of the worker and his social life.

In a recent paper Guest and Clinton (2006) used a sample of 642 UK workers from 19 organizations. Approximately 25 percent had temporary contracts of various sorts. They found that temporary workers reported higher levels of job insecurity compared to permanent workers. However, their insecurity did not have a major impact on their wellbeing or work attitudes and behavior. Fairris and Brenner (2001) investigated the relationships between workplace transformation and the rise in cumulative trauma disorders. They matched Osterman's (1994) survey of private American establishments to sectoral data on CTDs and found no clear correlation between new work practices and the frequency of illnesses - except for quality circles where it was positive. Askenazy (2001) also used Osterman's survey and a statistical treatment of 1.5 million articles from 1,000 management journals in conjunction with the longitudinal OSHA data on occupational injuries. He found that flexible work practices (autonomous work teams, job rotation and total quality management) elevated, by some 30 percent, the frequency of injuries in the USA. Green (2004) used the British Workplace Employee Relations Survey (WERS, 1998) which contained information from both employers and workers. He found that technical innovation, new work organization and high commitment practices have generated an intensification of work.

Although they provided suggestive results, these works mainly relied on sectoral or firm level data. In this paper, we aim to complement existing evidence by using individual worker data. This allows us to investigate the impact of flexible forms of employment in relation to a number of indicators of workplace well-being, including occupational injuries and mental strain. We perform this analysis on a large representative sample of Tunisian workers. The dataset we use comes from a unique survey (Employment Flexibility and Competition in the Product and Service Market: Effect on Working Conditions and Informal Sector Development) which covers surveys 2000 workers in Tunisia in 2004. It provides unique information on workers' characteristics, occupation, involvement in new work practices, working conditions and occupational hazards. This allows us to take into account the potential heterogeneity across workers, which is likely to be important when dealing with working conditions and subjective well-being at work. In addition, Tunisia has balanced institutions somewhere between the "laissez-faire" American model and the Scandinavian regulation, which makes it an interesting country to study.

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<sup>3</sup> See Femise research n°2220 directed by ROSES (2005).

The paper is organized as follows. Some theoretical considerations on the relationships between flexible forms of employment and well-being at work are provided in section 2. Section 3 presents the econometric specification. Section 4 describes the data we use. Section 5 discusses the results and section 6 concludes the paper.

## **2. Flexible Forms of Employment and Working Conditions: Some Theoretical Considerations**

The literature offers numerous descriptions of current organizational changes. The starting point is that flexible forms of employment have deeply changed the way firms operate. Traditional “Taylorist” organizations were based on hierarchical communication and required from their employees specialized skills consistent with the standardization of the production process. On the contrary, reorganized enterprises have more horizontal communication channels and favor multi-skill labor force as opposed to specialization.

Despite the difficulty of identifying what is really “new” in terms of organization, some workplace practices do reflect real economic changes. They mainly respond to globalization and changes in the technological environment which make information processing, adaptability and product quality keys for firm competitiveness. Basically, flexible work practices encompass broad types of changes:

- *Globalization*: The globalization principle legitimizes expansion by the most powerful firms to wherever costs are lowest and profits highest. For this, they have developed two interlocking practices: national and international relocation of production and outsourcing. It has enabled transnational firms to shift risks wholesale from their stable workforce onto “outside” workers with no job security, from workers in the North onto those of the South.
- *Competitiveness*: Competitiveness is central to the way work organization is used to confer social and political legitimacy on the creation of inter-worker rivalries between all production workers – a divide and rule policy between established workers of large firms and subcontractors’ employees, between permanent workers and temporary workers. The acquired social legitimacy of subcontracting and temporary work have denied a growing number of workers any possible opportunity for bargaining between the work resource (the prime contractor or employer of the user firm) and the work performers outside (temporary workers). The work becomes a service package deal negotiated between two employers predicated on a job performance obligation by the workers responsible for providing the service within a “customer-supplier” relationship (Thébaud-Mony, 2000).
- *Flexibility*: This principle - the Holy Grail of the 80s elevated into the essence of labor and jobs - legitimized the questioning of existing guarantees, rights and regulations on employment (legalization of sweated labor in the guise of temporary work) and working time (deregulation of the forms of working time: “flexible” working hours, night and week-end work, “flexible” part-time,...). As a result, governments voluntarily relinquished areas of control over the consequences of flexibility for jobs, working time, and the associated work intensification. Business “health” - dependent on flexibility - was seen as a more legitimate claim than employees’ right to health, which depends on economic security, a relaxation of time constraints and a consistent tempo of social and family life. Finally, the various forms of flexibility have radically affected workers’ representation and the exercise of their right of consultation, especially, but not only, for “outside” and temporary workers.
- *Productivity*: The “modern” embodiment of this founding principle of capitalism is to fit the size of the employed workforce and paid working time as closely as possible to the volume of goods and services immediately required. Business has used productivity to

legitimize human resource management methods which push workers to their physical and mental breaking points; to select healthy workers; to abdicate responsibility for the consequences of these management methods, both in terms of the human and financial cost of unemployment, or meeting the health and economic costs of occupationally disabled workers excluded from the labor market.

- *Empowerment and total quality*: Who could deny the value of empowerment and raising quality standards in work? In the “modern” organization of work, these principles legitimize new forms of subordination by shifting responsibility for production control and imponderables from management onto the workers actually doing the work. Individual workers are asked to be actively involved in other team members’ tasks and to participate to the design of the organization of the workplace. According to management claims, such systems convey greater autonomy to workers. Both decentralization of decision making and production imply that workers be involved in job rotation. Prime contractors and employers set the productivity targets, quality and safety standards to be met and production lead times, leaving the workers to work out their own strategies, trade-offs and ways of meeting all these demands. They have a performance obligation which for many will determine whether they keep their job. So, they have sole responsibility for choosing between productivity (meeting productivity targets) and their health (the deadlines or quality standards set are often at odds with observance of safety rules and/or simply preserving their physical or mental faculties) (Thébaud-Mony, 2000).

An important literature in occupational medicine, ergonomics, psychology or sociology<sup>4</sup> has been devoted to the consequences of changing workplace organization on the well-being of workers. Most works take the form of theoretical models or case studies which illustrate various conjectural arguments<sup>5</sup>. They underline the extreme heterogeneity of the impact of flexible forms of employment across firms and occupations. For the sake of simplicity, they can be divided into two groups defending opposite, although not necessarily exclusive, views (Askenazy and Caroli, 2006):

a) In the new production model, there is a natural synergy between firm performance and worker well-being. So, because flexible forms of employment aim at optimizing the production process, safety should be a necessary objective for firms to pursue. This would allow them to reduce one of the main sources of waste, in particular absenteeism due to occupational hazards, workers’ stress and the costs of related incidents. New work practices, in particular total quality management and quality norms, help to reduce failures in the production process. To the extent that such failures induce risks of injuries in the workplace, quality management should result in an improvement of occupational safety, especially by reducing serious dangers. In addition, job rotation and delegation of authority make work more diversified and therefore potentially more interesting. Underlying the new organizational model is the idea that increased responsibility should enhance workers’ motivation and thereby increase their productivity. Indeed, boredom reduces alertness thus contributing to the risk of injuries.

b) A second line of analysis stresses that flexible forms of employment increase the pressure exerted on workers for performance, hence work intensity. Indeed, job rotation and quality procedures reduce slack time, thus raising the pace of work. The setting of safety procedures requires a stable work environment which was guaranteed in “Taylorist” organizations. Workers used to build up personal routines which improved their safety and reduced their efforts through a long learning-by-doing process. Job rotation, continuous process

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<sup>4</sup> See Gollac and Volko. (2000) for evidence about France.

<sup>5</sup> See Askenazy (2001) for a survey of this literature.

improvement and changes in the production process, as well as frequent product changes, are therefore detrimental to the building up of such safety mechanisms. Precarious jobs are another source of mental strain. They increase the risk of injury by shifting workers' attention from their working environment to their professional situation. Work time flexibility is likely to disturb the organization of workers' lives. Moreover, it implies that short working days may be followed by very long ones; while it is well-known that mental strain and environmental tensions increase more than proportionally with the number of hours worked per day (see Hanecke et al. (1998) for occupational injuries).

As suggested by this discussion, the impact of flexible forms of employment on working conditions runs through a complex causality chain. An econometric study may not capture all details of the mechanisms at work. However, it should help to assess the net impact of the diffusion of these practices.

### 3. The Econometric Method

A first estimate of the consequences of flexible forms of employment  $Q$  (quality norms) on an indicator  $X$  of mental strain or occupational safety can be obtained by comparing the average value of  $X$  for workers who are involved in this form of employment ( $q=1$ ) and for workers who are not ( $q=0$ ). We will call this benchmark estimator "naïve". Indeed, it is well known that such an estimation method raises serious selection problems induced by workers' heterogeneity (due to age, education, tenure, position...). For example, temporary workers have a greater risk of occupational injury as compared to other employees.

A standard solution to handle this problem is to perform linear or logistic regressions of the working condition variable on flexible forms of employment, including a number of control variables. But another specification problem stems from the fact that the impact of flexible forms of employment may be non linear. In particular, it may be different for different groups of workers.

The impact of flexible forms of employment can be expressed in Rubin's (1974) framework as follows. The risk of injury (or mental strain...) is described by two probabilities  $(x_0, x_1)$  conditional on the realization of the variable  $Q$ . To simplify the presentation, and without loss of generality, we assume that  $X$  denotes the rate of occupational injuries. Worker  $i$  is thus characterized by the unobservable couple  $(x_{0i}, x_{1i})$  where  $x_{1i}$  is the qualitative variable of having an injury if the worker is involved in the flexible forms of employment  $q$  ( $q_i = 1$ ) and  $x_{0i}$  is the variable if  $q_i = 0$ . We only observe  $x_i$  :

$$x_i = q_i \times x_{1i} + (1 - q_i) \times x_{0i} \quad (1)$$

Using Rubin's terminology, the "causal effect"  $c_i$  of the practice  $Q$  on the risk of injuries (or mental strain...) is defined as:

$$c_i = x_{1i} - x_{0i} \quad (2)$$

This parameter is not identifiable, since we do not observe simultaneously a realization of  $x_{0i}$  and a realization of  $x_{1i}$  (at a given point in time, a worker cannot both be involved in  $Q$  and not be involved in  $Q$ ). With these notations, the "naïve" estimator of  $c$  is

$$\tilde{c} = E(x_i | q_i = 1) - E(x_i | q_i = 0) \quad (3)$$

Again, this estimator is biased because it does not take into account heterogeneity across workers nor across occupations jobs. Crépon and Iung (1999) follows Rosenbaum and



Rubin's (1983) work in the construction of an unbiased, robust estimator and provide a continuous estimator of the causal effect. This "weighted" estimator is defined as follows

$$\tilde{c}_w = E(c_i) = E\left[x_i \left\{ \frac{q_i}{\pi(y_i)} - \frac{1 - q_i}{1 - \pi(y_i)} \right\}\right] \quad (4)$$

Where  $\pi(Y_i) = \Pr(q_i = 1|Y_i)$  is the propensity score of being involved in  $Q$  given all the observable characteristics of the worker and her position ( $Y$ ).

In practice, the estimation method consists of two steps: first, we estimate the probability that a worker  $i$  be assigned to the flexible forms of employment  $Q$ , conditional on her characteristics and those of her job  $Y_i$ :  $\pi(Y_i) = P(q_i = 1|Y_i)$  (using a properly specified logit model); second we use this estimate to compute  $\tilde{c}_w$  according to equation (4). Crépon and Iung (1999) show that  $\tilde{c}_w$  is asymptotically normal. Its asymptotic variance is the variance of  $\phi_i$  defined as:

$$\phi_i = x_i \left\{ \frac{q_i}{\pi(y_i)} - \frac{1 - q_i}{1 - \pi(y_i)} \right\} - c_0 - E\left[ \left\{ \frac{Q_i(1 - \pi(y_i))}{\pi(y_i)} - \frac{\pi(y_i)(1 - Q_i)}{1 - \pi(y_i)} \right\} x_i y_i \right] E[\pi(y_i) (1 - \pi(y_i)) y_i' y_i]^{-1} [(Q_i - \pi(y_i)) y_i'] \quad (5)$$

The weighted estimator yields an absolute risk. Let us assume, for example, that the "causal" impact of job rotation on the risk of being injured is  $\tilde{c}_w = 0.05$ . If a worker  $I$ , who does not rotate, has a probability  $z$  of being injured our estimation says that if she starts rotating, her risk of occupational injury should go up to  $0.05+z$ . Therefore, the relative increase of individual risk is  $0.05/z$ . However, because of the selection bias, we cannot determine the true average value of  $z$  and therefore, we cannot calculate the relative estimated causal effect. Nevertheless, in the case of a positive causal impact, the true value of  $z$  should be lower than the average rate of injuries in the whole sample. Therefore, if  $r$  denotes the average risk of injury (resp. metal strain) in the whole population, then  $\tilde{c} / r$  provides a lower bound estimate of the relative causal effect of the flexible forms of employment on the risk of being injured at work. Obviously, this reasoning expands to other workplace practices and other indicators of working conditions. The method described above is employed by Crépon and Iung (1999) in the context of innovation, employment and performances.

#### 4. Data

The data we use comes from a unique Tunisian survey conducted in 2004 by ROSES in collaboration with ISTIS (Employment Flexibility and Competition in the Product and Service Market: Effect on Working Conditions and Informal Sector Development). Our dataset thus contains information for a representative sample – 2000 individuals of the working population. This database provides detailed information on: 1) flexible forms of employment and workers' positions, 2) working conditions and 3) numerous personal characteristics of workers. Appendix Table A provides descriptive statistics of all variables used in the paper.

*Flexible Forms of Employment:* There are a number of dimensions to the concept of a flexible workforce and Beatson (1995) among others has distinguished numerical and functional flexibility. The questions used in this survey adopt a similar approach. Workers are asked about selected flexible practices in which they are involved. These include eight key forms: job rotation (defined as regular rotation among jobs), team work, fixed-term contract,

part-time, flexible work hours (worker does not know her work hours for the next days), weekend work, night work and over-time work. In our sample, 63% of workers have a fixed-term contract, 44% of workers work in a team, while 42% rotate among jobs.

*Working Conditions:* The survey also provides information on mental strain, including factors of psychological stress such as tensions in the relationships with other people within the work environment. Most questions rely to a large extent on the personal interpretation of the worker. For example, one of the questions relating to psychological strain is formulated as follows: Do you need to cope on your own with difficult situations? What constitutes a difficult situation is not defined in the questionnaire, so the respondent must decide on her own what this means. On the one hand, this is an obvious limitation on the information we have. On the other hand, the data provide unique information on working conditions, as perceived subjectively by workers, and therefore allow an accurate description of mental strain. We will particularly focus on four indicators of psychological strain:

The first indicator captures time pressure. We define a binary variable coded as 1 if the individual declares that she has not enough time to do her job properly and 0 otherwise (NO-TIME).

The second group of indicators captures stress due to uncertainty. It includes a variable indicating whether the individual has to cope on her own with difficult situations (COPE) and whether she declares receiving contradictory prescriptions (CONTRAD). Eventually the last variable captures the social environment at work, in particular tensions in the relationships with colleagues (TENS-COLL).

In our sample, a large proportion of workers appear to suffer from psychological discomfort. 10.3 % feel they do not have enough time to do their work properly, 56.7% declare they have to cope on their own with difficult situations and tensions with colleagues are quite frequent, 21.7%. Eventually, the proportion of workers who receive contradictory prescriptions is very high (29%). In addition to these variables; the questionnaire also asks workers about occupational injuries (OI). This question was formulated as follows: “In the past 12 months, have you had, while working, any injury even benign, that forced you to be nursed?” Due to the emphasis put on what happened in the past twelve months, we only kept those workers with more than one year of seniority. Indeed, for those with less than a year at work, the risk of incident in their present job is mechanically lower than for the same type with higher seniority, thus introducing measurement error. Despite this precaution and due to the formulation of the question, our injury variable (OI) will underestimate the true probability of injury. Indeed, individuals who have had more than one injury in the course of the past year will appear in our data as having only one. Given this limitation, the mean proportion of occupational injuries, 17.9 % in our population, will have to be considered as a lower bound.

*Workers' Characteristics:* To control for heterogeneity across workers, we also include the characteristics of workers and their position. The survey provides rich information on variables such as education, sex, age, marital status, seniority and occupation. Regarding the characteristics of individuals in our sample, 26% of workers have at least a high school degree as opposed to 7% with no education at all. The sample has a mean age of 35 years.

The survey also provides information on the technology that is used by the worker. Technology variables include whether the worker uses any numerically controlled equipment (NUMER), whether she uses manual equipment (MANUAL) or a microcomputer (COMP). We also exploit variables describing numerous aspects of workers' jobs and working environments. The survey provides information on each worker's industry or activity, as well as the size of the firm for which she works. Moreover, the survey contains a wealth of

complementary information on the number of hours worked per week and the number of break per day.

## **5. Results**

### ***5.1. Flexible Work Practices and Occupational Injuries***

In this section, we investigate the impact of flexible forms of employment upon occupational injuries when other possible determinants are taken into account. Thus by doing this, we check whether our results are consistent with what is usually found in the literature regarding the socio-demographic factors influencing work injuries (such as ILO, 1998). The results are presented in Table 1. All regressions include three groups of controls. First are the variables we are most interested in, namely flexible forms of employment (team work, fixed-term contract, part-time, flexible work hours, weekend work, night work and work overtime). Second, in order to make sure that the impact of these practices does not actually capture characteristics of the individual or of her position, we introduce a full set of socio-demographic variables (age and seniority, education and occupation, nationality, marital status, etc). Our last group of indicators is labeled as controls for the characteristics of the job, such as the size of the firm, the industry, the equipment used, as well as a large number of position characteristics.

Considering the risk of injury, our results are consistent with the big bulk of literature. Education reduces the probability of injury, as does seniority. Once conditioned on seniority, age has no significant impact. As expected, men have many more injuries than women due to the fact that, other things being equal, firms prefer to allocate a man rather than a woman to a dangerous task. Having children does not reduce the probability of injuries, which means that these variables do not properly proxy for the unobserved propensity to take risks.

As for job characteristics, occupation is, as expected, an important determinant of the risk that is borne by individuals. The size of the firm a worker is employed in does not seem to make much difference in terms of safety. In contrast, the effects of equipment used are quite diversified. Using manual equipment is associated with a higher probability of injury while the opposite holds for using a computer. This probably reflects characteristics of the job that were not captured by occupations. The branches of the firm where a worker is employed seem to make a difference in terms of safety. Textile, leather, electrical and mechanical industries are associated with a higher probability of injury. These results are similar to those found by Yazidi (2004)<sup>6</sup>. The majority of occupational injuries are found in these sectors (Figure 1).

In addition to these factors, the risk of injury is also strongly correlated with the use of flexible forms of employment. According to first estimate, workers involved in having a job rotation, team work, fixed-term contract, weekend work and over-time have a higher probability of being injured at work, *ceteris paribus*. These practices are strongly correlated to the risk of injury. Their respective coefficients are 0.110 (*0.020*) for fixed-term contract, 0.071 (*0.027*) for weekend work, 0.046 (*0.021*) for over-time, 0.094 (*0.018*) for team work and 0.078 (*0.021*) for job rotation (where standard errors are in italics). Part-time work, night work and flexible hours are also correlated with the risk of injury, but their coefficients are not significant.

### ***5.2. Flexible Work Practices and Psychological Strain***

As mentioned in Section 4, beyond occupational injuries our database also contains information on mental strain. We use it to investigate the impact of flexible work practices

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<sup>6</sup> Yazidi (2004), « 300 Deaths in One Year because of Occupational Injuries », Echourouk, 6 August.

upon a number of indicators of psychological strain. Here again, we use Rubin's "causal" model in order to correct for potential sample selection bias. The results are presented in Table 2.

The main result from this analysis is that flexible work practices appear to be associated with greater psychological strain. Workers with fixed-term contracts, and who are involved in part-time, night and weekend work and also in team work and job rotation tend to receive more contradictory prescriptions (CONTRAD). Moreover, workers with fixed-term contracts and who work on the weekend feel more stress due to uncertainty. They have to cope on their own with difficult situations more often than workers with permanent contracts. Estimated coefficients are positive and statistically significant.

Eventually, the social environment is negatively affected for fixed-term contracts workers and who are involved in a job rotation and team work. They experience situations of tensions with their colleagues (TENS-COLL) more often. While flexible work hours, (specifically work hours that can be freely chosen by the employer so as to match the firm's requirement) is negatively and significantly correlated with tensions with colleagues. One reason for this may be that the flexibility of hours worked appears to reduce this form of stress. Workers avoid situations of tensions with their colleagues through flexibility. Weekends worked and job rotations are significantly correlated with the feeling of lacking time to do one's work properly (NO-TIME).

### ***5.3. Impact of Psychological Strain on Occupational Injury***

In what follows, we estimate the correlations between mental strain and occupational injuries. The main result (Table 3) from this analysis indicated that workers who have to cope on their own with difficult situations (COPE), to receive more contradictory prescriptions (CONTRAD) and to experience situations of tensions with their colleagues (TENS\_COLL) are associated with a higher probability of injury.

Their respective coefficients are 0.082 (0.019) for COPE, 0.099(0.019) for CONTRAD and 0.148 (0.024) for TEN-COLL (where standard errors are in parenthesis).

Obviously, given the lack of adequate instruments, one interpretation of these results could be that firms, in which the rate of occupational injuries was high – and more generally, working conditions were bad, have reacted by introducing new work practices, which should result in an improvement in safety and psychological comfort for their workers in the future. However, such a mechanism appears to be quite unlikely for at least two reasons. First, by 2000, flexible work practices were already quite widespread in Tunisia. If such practices could improve working conditions, safety at work would have improved in an increasing number of firms. Figures on occupational injuries at the aggregate level do not provide any indication of such an evolution (Figure2).

## **6. Conclusion**

This paper has investigated the relationships between flexible work practices, which are dramatically spreading in the new economy, and a series of indicators of working conditions. We first show that workers involved in any of these practices face a higher risk of work injuries. This is robust while controlling for a large number of characteristics of the individual and her working environment. The pattern of results is quite similar for indicators of psychological discomfort. Workers involved in flexible work practices face more mental strain. In particular, they declare having to cope on their own with difficult situations, receiving contradictory orders, and facing tension with their colleagues.

This is a key element to take into account when assessing the performance of the new productive paradigms. In particular, a deterioration of working conditions in the form of rising work injuries or greater stress would bear important distributional consequences. In a number of countries, this would have a direct impact on public expenditure through health budgets. Moreover, work incentives are likely to be modified as highlighted by the growing literature on job satisfaction. All these implications are complex, intricate and deserve more analysis in particular in relation with economic policy issues. This should of course be confirmed by further empirical analysis. Here, more than anywhere else, the call for better data is to be made. In particular, given the lack of time dimension in our dataset, we are not able to properly assess the causality in the model.

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**Figure 1: Number of Injuries per Activity in 2003**



Sources: ROSES 2004 Survey

**Figure 2: Number of Injuries in Tunisian Economy**



According to Direction Générale de l'Inspection du Travail and UGTT



**Table 1: Impact of Flexible Work Forms upon Injury**

	<b>Coeff.</b>	<b>Std Errors</b>
Fixed-term contract	0.110***	0.020
Part-time	0.0004	0.007
Night work	0.036	0.034
Weekend work	0.071***	0.027
Over-time	0.046**	0.021
Team work	0.094***	0.018
Job rotation	0.078***	0.021
Flexible hours	0.002	0.024

Note: Significance at 1%, 5% and 10% level is indicated by \*\*\*, \*\* and \* respectively.

**Table 2: Impact of Flexible Work Practices on Psychological Strain**

	<b>TENS-COLL</b>	<b>CONTRAD</b>	<b>COPE</b>	<b>NO-TIME</b>
Fixed-term contract	0.096*** (0.022)	0.105*** (0.028)	0.063** (0.028)	0.002 (0.015)
Part-time	-0.0002 (0.008)	0.023 ** (0.010)	0.011 (0.010)	-0.001 (0.006)
Night work	0.049 (0.037)	0.122 ** (0.048)	-0.016 (0.047)	-0.001 (0.026)
Weekend work	-0.028 (0.029)	0.088** (0.039)	0.076** (0.038)	0.055*** (0.021)
Over-time	-0.006 (0.022)	-0.023 (0.029)	0.030 (0.029)	-0.022 (0.016)
Team work	0.088*** (0.020)	0.026*** (0.127)	-0.013 (0.026)	0.001, (0.014)
Job rotation	0.160*** (0.023)	0.190*** (0.030)	0.034 (0.030)	0.068*** (0.016)
Flexible hours	-0.045* (0.026)	-0.032 (0.034)	-0.030 (0.034)	-0.019 (0.018)

Note: Significance at 1%, 5% and 10% level is indicated by \*\*\*, \*\* and \* respectively. Std. errors are reported in parentheses.

**Table 3: Impact of Psychological Strain on Injury**

	<b>Coeff.</b>	<b>Std Errors</b>
NO-TIME	-0.003	0.023
COPE	0.082***	0.019
CONTRAD	0.099***	0.019
TENS-COLL	0.148***	0.024

Note: Significance at 1%, 5% and 10% level is indicated by \*\*\*, \*\* and \* respectively.

**Appendix Table A**  
**Descriptive Statistics**

Variable	Mean	Std dev	Variable	Mean	Std dev
<b>Workers' characteristics</b>					
Sex (women = 0)	0,672	0,469	<b>Working conditions</b>	0,103	0,388
Age	35,328	9,041	Not enough time	0,567	0,495
Marital Status	0,593	0,528	Cope with difficult situations	0,289	0,514
Nber of children	2,431	1,330	Contradictory orders	0,217	0,416
			Tensions with colleagues	0,179	0,391
			Occupational Injury		
<b>Education level</b>	0,067	0,332			
No education	0,203	0,402			
1mary education	0,483	0,499			
2dary education	0,255	0,487			
higher education					
<b>Characteristics of position</b>	0,160	0,366	<b>Equipment used</b>	0,135	0,342
Manager	0,137	0,344	Numerically	0,277	0,447
Middle manager	0,398	0,489	Manual	0,300	0,458
Clerks	0,300	0,458	Computer		
Unskilled	7,018	6,568		92,594	151,580
Seniority	0,953	1,526	<i>Size of the firm</i>		
Break per day	47,164	4,912	<b>Activities Branches</b>	0,186	0,389
Hours per week			Textile and leather	0,087	0,283
			Food processing	0,158	0,365
<b>Flexible work practices</b>	0,627	0,483	Electrical and mechanical I	0,194	0,395
Fixed-term contract	0,108	1,591	Trade	0,040	0,196
Part-time	0,121	0,326	Transportation	0,095	0,294
Night work	0,219	0,413	Hotel/restaurant	0,051	0,221
Weekend work	0,393	0,488	Construction materials, ceramics		
Over-time work	0,438	0,552	Chemical industries	0,060	0,239
Team work	0,418	0,493	Others activities	0,125	0,331
Job rotation	0,209	0,407			
Flexible hours work					