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EMPLOYMENT VULNERABILITY AND EARNINGS IN URBAN WEST AFRICA[1]

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Abstract

In this article, we develop indicators of vulnerability in employment in seven economic capitals of West Africa and study their links with individual incomes from the main job. We draw on data from the *1-2-3 Surveys* in 2002-2003 to make a cross-country comparison using rigorously the same variables and methodology for each country. The theory of compensating differentials states that workers may receive pecuniary compensation commensurate with the strenuous or hazardous nature of their tasks or adverse working conditions. Our interpretation of the link between employment status and incomes draws on these developments, applying them to both working conditions themselves and more broadly to vulnerability in employment. The main tested assumption is that high levels of employment vulnerability could be compensated by greater earnings. We allow for individual and job characteristics (the latter being used to construct the composite index of vulnerability) to be differentially valued for conditionally high and low income earners. Our composite index of employment vulnerability indicates that 85% of the private sector workers in all the economic capitals studied are vulnerable on the basis of at least one criterion. The results show that the average impact of vulnerability on earnings is generally negative for an average level of vulnerability. In the formal private sector of the West African cities, losses of income due to vulnerability are lower for high levels of vulnerability, but do not translate into gains. In the informal sector, however, the average predicted income for a high vulnerability level is higher than the average predicted income for a low vulnerability level. Quantitative, distributional and qualitative analyses show that vulnerability compensating mechanism is mainly seen in the informal sector, in the upper tail of the earnings distribution, and particularly in the circumstance of visible underemployment. Employment vulnerability is not compensated for the poorest workers in the private sector of these large west-African cities.

Key words : Vulnerability, working conditions, compensating differentials, earnings, informal sector, West Africa.

Résumé

Dans cet article, nous construisons des indicateurs de la vulnérabilité au travail dans sept capitales économiques d'Afrique de l'Ouest et étudions leurs liens avec les revenus individuels de l'activité principale. Selon la théorie des salaires compensatoires, les travailleurs pourraient recevoir des compensations pécuniaires à hauteur de la pénibilité de leur tâche ou de leurs conditions de travail. Notre interprétation du lien entre le statut dans l'emploi et le revenu s'inspire de ces développements, en les appliquant non seulement aux conditions de travail proprement dites, mais plus largement à la vulnérabilité dans l'emploi (précarité contractuelle, conditions d'exercice, sous-emploi, emploi de secours inadapté aux caractéristiques individuelles). Notre indicateur composite de la vulnérabilité dans l'emploi révèle que 85% des travailleurs des secteurs privés de l'ensemble des capitales économiques étudiées sont vulnérables selon au moins un de nos critères de vulnérabilité (sur huit critères). L'effet moyen de la vulnérabilité sur les gains est généralement négatif pour un niveau moyen de vulnérabilité. Dans le secteur privé formel, les pertes de revenu causées par la vulnérabilité diminuent pour des hauts niveaux de vulnérabilité, mais ne se transforment pas en gains. Dans le secteur informel en revanche, le revenu prédit moyen pour une vulnérabilité élevée est supérieur à ce revenu pour une vulnérabilité faible. Finalement, nos analyses, qui sont tour à tour quantitative, distributive et « qualitative », montrent que des mécanismes compensatoires de la vulnérabilité dans l'emploi n'existeraient que dans le secteur informel, pour les travailleurs de la partie haute de la distribution des revenus, et en particulier dans le cas du sous-emploi visible. La vulnérabilité dans l'emploi n'est donc pas compensée pour les travailleurs les plus pauvres du secteur privé de ces grandes villes ouest-africaines.

Mots clés : Vulnérabilité, conditions de travail, différentiels compensatoires, revenus, secteur informel, Afrique de l'Ouest.

JEL Classification : J24, J31, O12

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1.INTRODUCTION

Urban labor market workers in sub-Saharan Africa work in often highly insecure conditions. The World Bank's 2000 report states that job insecurity is a major concern among poor workers and job instability is a leading cause and expression of poverty. One of the main focuses of studies on labor markets in sub-Saharan Africa is the institutional segmentation between formal and informal sectors (Maloney, 2004). Informal work is defined from the point of view of the firm, worker or line of business depending on the policy aims. The 1993 System of National Accounts (SNA93) – comprising a set of international standards designed to establish a framework for the production of statistics on national accounts – defines a distinction at firm level based on statistical or tax registration criteria and keeping written accounts.

Yet this distinction serves no purpose when it comes to capturing individuals' working conditions, especially employment vulnerability. By vulnerability, we mean how hard it is for individuals to manage the risks or cope with the losses and costs associated with the occurrence of risky events or situations.[1] For example, the vulnerability of workers can be seen, among other things, in terms of contract insecurity (unstable remuneration and no written contract), or adverse working conditions. Vulnerable workers can be found in all sorts of formal and informal private firms, but also in administrations and public and semi-public corporations. A good many vulnerable workers work in the formal private sector, as per the SNA93 definition of the term. This paper focuses solely on the private sector (formal and informal businesses), based on the assumption that vulnerability is driven by different mechanisms in the public and private sectors.

[1] The still-developing economic literature on vulnerability includes a range of definitions of this notion. Wilson and Ramphele (1989) define it as the risk of destitution, famine or death. The concept of vulnerability moved forwards recently with Amartya Sen's capability approach (1992 and 1999). Cheli and Lemmi (1995) consequently propose a fuzzy and relative approach to vulnerability, which enables them to define an "exposure to the risk of poverty" notion. The vulnerability concept used in Qizilbash (2003 and 2006) is an individual's distance from a definite, unambiguous state of poverty. The closer individuals are to being definitely poor, the greater their vulnerability. In Dubois and Rousseau (2001), vulnerability is a person's own structure of "capabilities" that enables that person to replace (or not) one capability with another in the event of an exogenous shock. The loss of a job would therefore have a greater impact on an individual with less leeway to work in different occupations and a low level of economic and social capital. We refer in this article to a notion similar to that developed by Cheli and Lemmi (1995) and Qizilbash (2006), privileging the relative and multidimensional aspect of poverty.

We build employment vulnerability indicators and study their links with earned income. The theory of compensating differentials formalized in the 1980s[2] states that workers may receive pecuniary compensation commensurate with the strenuous or hazardous nature of their tasks or adverse working conditions. In the developed countries, for example, it has been observed that physically hazardous and highly strenuous jobs are often better paid than less strenuous or hazardous jobs.[3] Our interpretation of the link between vulnerability and income draws then on developments in the theory of compensating differentials. While the overall purpose of this paper is not to test the predictions of this theory in all its components, a working assumption we still investigate is whether, other things being equal, workers classified as vulnerable may be better paid than more stable workers occupying less strenuous jobs. Should this be the case, an incentive should be found for certain individuals to hold a vulnerable job, especially if the medium- or long-run advantage associated with stable jobs is not valued by households forced into short-term income management. These households should prefer higher, immediate earnings – even from a vulnerable job – to stable earnings over a longer period. A high earnings incentive for vulnerable jobs would increase the risk to fall into poverty. In this paper, we do not deal with adverse working conditions *stricto sensu*, such as job health hazards, but use a broader concept of vulnerability in employment. This concept does not necessarily entail compensating mechanisms as predicted by the theory of compensating differentials. Our results cannot therefore be used to validate the applicability of the theoretical predictions across developed and developing countries. The motivation for this study is rather to determine whether possible compensating differentials can explain the acceptance of generally bad working conditions as observed in these cities or not.

The questions of vulnerability determinants and the link between vulnerability and remuneration raise a certain number of methodological problems that this paper endeavors to

[2] See Brown (1980), Rosen (1986), and Murphy and Topel (1987).
[3] However, there is not a great deal of empirical evidence to support this point. See, in particular, Poggi (2007) and Fernández and Nordman (2009).

solve. First of all, there is the existence of labor market entry selection and endogenous sector allocation across the public, formal private or informal private sectors. Observable individual characteristics (such as human capital in general), but also unobservable individual characteristics, influence both the decision to participate to a labor market segment and the level of individual earnings in Africa[4]. Not taking this into account may lead to biased estimates of the determinants of individual earnings. Secondly, there is a likelihood of vulnerability being endogenous in the earnings equations. Vulnerability would be endogenous if the individuals' unobservable characteristics are correlated with both their level of vulnerability and their level of earnings. Selection and endogeneity, if not taken into account, can produce biases in the estimation of the relationship between vulnerability and earnings. For instance, an overestimation of the positive impact of vulnerability on individual earnings may appear if unobservable characteristics, such as worker perseverance, are positively correlated with the probability of taking up a vulnerable job while simultaneously being positively correlated with earnings.[5]

Our analysis also takes a distributional approach. Another working assumption is that vulnerability can have a different effect on income depending on the worker's relative position on the remuneration scale. Hence, for equal observable characteristics, workers at the lower tail of the earnings distribution (poor) could be penalized in monetary terms by their vulnerability whereas workers at the top of the distribution (wealthy) might not be penalized and may well receive pecuniary compensation in vulnerable jobs. These different pay mechanisms depending on remuneration scale position could be due to bargaining power differences and labor market imbalances. In the first case, greater bargaining power for the wealthy would enable workers at the upper tail of the earnings distribution to secure higher compensation for the vulnerability of their jobs. Conversely, workers at the bottom of the earnings distribution might be more forceful

[4] See Dimova, Nordman and Roubaud (2010).

[5] Alternatively, unaccounted low worker motivation may produce an underestimation of any compensating mechanism on earnings if these characteristics are positively correlated with the probability of bearing a job with adverse working conditions.

in negotiations for premium pay if they are seeking to secure a living wage. Compensation for vulnerability would therefore decrease the further the worker moved from a minimum subsistence income. In the case of labor market imbalances, the employer's capacity to provide financial compensation for adverse working conditions might also differ depending on the type of imbalances found in certain market segments, in particular along the length of the skills and hence earnings distribution. For example, it would make sense to find that employers in segments where labor supply far outstrips demand are reluctant to pay workers more for adverse working conditions. These hypotheses, which assume that the effect of vulnerability on earnings differs depending on the position in the earnings distribution, are tested using quantile regressions.

Lastly, our analysis takes a 'qualitative' approach, conducting a principal component factor analysis on the different aspects of the vulnerability phenomenon. The main components obtained, which represent the different qualitative facets of vulnerability (contractual insecurity, working conditions, underemployment and stopgap jobs mismatched with the individual's characteristics), are then used as vulnerability variables.

This paper gives empirical results on seven West African capital cities that are part of a fairly economically integrated West African Economic and Monetary Union (WAEMU), sharing a common currency (CFA Franc) with fixed parity to the Euro. The data were collected in 2001-2002 in a context of relative political stability, low inflation (4.1%; 1999-2003 average: 2.1%) and reasonably high GDP growth in the WAEMU region (3.9%; 1999-2003 average: 2.4%) (UEMOA, 2004), which contrasted with the 2001 global economic slowdown. The exception is Côte d'Ivoire where political turmoil[6] led to an economic downturn (virtually no growth in 2001, and an average of -0.8% in 1999-2003). Except in this country, the relative economic prosperity in 2001 is hypothesized to effect positively on wages and on compensating differentials.

[6] The 1999 coup was followed by elections in 2000 and a military uprising in 2002 that led rebels to hold the Northern part of the country until 2004.

The remainder of the paper is structured as follows. In Section 2, we briefly study the theoretical arguments underlying the existence of compensating differentials and highlight some theoretical implications for our case study. In Section 3, we present the data drawn from the *1-2-3 Surveys* of the West African economic capitals and the construction of certain key variables for our analyses. Section 4 details our econometric models. The results of these analyses are discussed in Section 5 and our conclusions are put forward in Section 6.

2. THEORETICAL VIEWS ON COMPENSATING DIFFERENTIALS

There is a long history of economic research into the forces that narrow or widen wage differentials between individuals. The first models focused on competitive markets where they found wage premiums compensating non-pecuniary job attributes, such as working conditions, and differences in job stability across industries (Brown, 1980; Rosen, 1986; Murphy and Topel, 1987). Most of the authors acknowledge that when job characteristics (other than wages) enter into players' labor market decisions (firms and workers), then the market balance is due to the equalization of workers' utilities rather than their wages.

Rosen (1986) posits that the reasoning behind this is to be found in a simple supply and demand structure. Labor supply decisions are based on a trade-off between earned income (wages) and the cost of doing the job (stress, repetition, production deadlines, etc.) such that, at optimum, wage differences correspond to the marginal rate of substitution between consumption and working conditions. Labor demand decisions by firms are based on a trade-off between the necessity of paying the workers compensation commensurate with the strenuous or hazardous nature of their task and the need to improve the working conditions offered.

Hence, under the assumptions of homogeneous individuals, heterogeneous work environments, perfect information with regard to wages and working conditions, and also perfect

mobility in the labor market, wages differ between workers such that they all obtain the same utility. To encourage workers to accept more adverse working conditions, firms therefore have to offer higher wages. This is the basic idea behind the theory of compensating wage differentials. Lifting the assumption of homogeneous individuals necessarily introduces a great deal of uncertainty as to the existence of compensation for working conditions when it is observed at the midpoint of the worker distribution. It could prove necessary to divide the population observed into more homogeneous groups, for example by using conditional wage quantiles.

More recently, non-competitive theories have argued that wage deviations between apparently identical individuals tend more to reflect non-compensating differentials, such as the workers' relative bargaining power (Daniel and Sofer, 1998; Manning, 2003) and the existence of efficiency wages (for a review, see Katz, 1986). Other recent hypotheses have pointed up the existence of information asymmetries, which allegedly increase the friction in the labor supply-demand match (Hwang, Mortensen and Reed, 1998), and the existence of factor productivity differences between firms (Pissarides, 2000; Mortensen, 2003).

Although some empirical studies focus on the relationship between wage structure and non-monetary job satisfaction,[7] there is a patent paucity of research into the link between compensating differentials and observed job attributes, especially when it comes to distributional approaches. In the first study of this kind, Fernández and Nordman (2009) show that the compensating differential actually differs depending on the worker's relative position in the earnings distribution. For example, pecuniary compensation for adverse working conditions could well be overestimated if the most capable (or resistant) workers are selected for employment statuses where these attributes are more commonplace. Moreover, given the assumption that the most capable individuals are also the most likely to receive efficiency wages, or to have a certain amount of bargaining power, working conditions could well have less to do

[7] The studies on this issue often generate contradictory findings. See, for example, French and Dunlap (1998), Groot and Maassen van den Brink (1998), Lanfranchi *et al.* (2002), Magnani (2002), Bockerman and Ilmakunnas (2006), and Poggi (2007).

with the wage-setting process for these individuals than for other workers without these characteristics. More generally, workers could also find it easier to ask for premiums for adverse working conditions when the demand for labor exceeds the available manpower, creating a labor market imbalance that probably varies along the earnings distribution.

3. DATA AND DEFINITION OF VULNERABILITY

(a) The samples used

The data used are taken from phase 1 of the *1-2-3 Surveys* conducted by the PARSTAT, French acronym for the regional statistical assistance program for multilateral monitoring set up by the WAEMU Commission[8]. Data collection took place in the following economic capitals in 2001-2002: Niamey (Niger), Ouagadougou (Burkina Faso), Dakar (Senegal), Bamako (Mali), Cotonou (Benin), Lome (Togo) and Abidjan (Côte d'Ivoire).[9]

The sample was first of all restricted to all working-age individuals as defined by the International Labor Organization standards, i.e. 15 years old and over. We then reduced the samples further to individuals aged 15 and over with at least five years of potential labor market experience in order to take account of workers' employment histories and thereby understand the longitudinal aspects of vulnerability. Potential experience is defined as the individual's age minus the number of years of education and the six years theoretically preceding the start of school. The five-year potential experience span is broad enough to circumvent the problem of date measurement errors (end of education and end of previous job) and narrow enough to prevent the samples from being too small.

[Table 1 here]

[8] WAEMU: West African Economic and Monetary Union.
[9] See Brilleau, Ouedraogo and Roubaud (2005) for details on the survey methodology.

The total sample (seven cities) is thereby reduced from 58,385 individuals aged 15 years and over to 50,772 individuals aged 15 years and over with five years or more of potential experience, and from 33,390 employed workers aged 15 and over to 32,314 employed workers aged 15 and over with five years or more of potential experience. Among these employed workers, we are only interested in private sector workers. The institutional sector – public, formal private or informal private sectors – is defined at the firm level, according to the SNA93 definitions. A firm belongs to the informal private sector if it is not registered in the statistical or tax institution or if it does not keep written accounts. The formal private sector regression samples range from 302 to 950 workers (in Lome and Dakar) depending on the country, with a majority of dependent workers (employees). The informal private sector regression samples range from 2,230 to 3,492 workers (in Niamey and Dakar), with a majority of independent workers (self-employed and employers).

(b) Construction of the vulnerability variables

Our approach consists of using a number of employment status indicators for the individual (main and second job), which we believe best sum up the multifaceted nature of vulnerability in the main job. Business or production unit criteria (activity sector, business size and institutional sector) are not used as they reflect interfirm rather than interworker dualism. Worker vulnerability is therefore defined here by employment differentiation criteria. Nine dichotomous variables are built corresponding to different aspects of vulnerability.

The first variable, called contractual insecurity, concerns the informal nature of the contract. This variable equals 1 if the individual has no written contract or does not receive a pay slip. It equals 0 if the individual has both a pay slip and a contract. It is not defined for independent workers, to whom it does not apply. Where workers have a contract, we make no distinction between those with a fixed-term contract and those with an open-ended contract.

The second variable concerns independent workers only. It is equal to 1 if an independent worker has no employees, wage-earning or otherwise. Self-employed professionals working alone in intellectual professions are not considered to be vulnerable.

Adverse working conditions are assessed in terms of the place or premises where the individual works. This variable is equal to 1 if the individual's main job is itinerant, worked from a makeshift or fixed street pitch, at the customer's home or from the individual's own home without having a dedicated set-up for the job. It is equal to 0 if the individual works using a vehicle, from home with a dedicated set-up for the job, in a public market or on business premises (including fields in the case of urban market gardening). Where certain jobs do not require premises even though they are not physically strenuous, the existence of premises, an office or a surgery is still taken as an indication of stability and non-adverse working conditions. To exclude all the intellectual professions from vulnerability in terms of working conditions would be tantamount to defining a vulnerable worker profile (comprising mainly roving street vendors and servants versus the intellectual professions). This would be inconsistent with the analysis of the many forms of vulnerability and its link with earnings.

Casual labor is a source of vulnerability. Pagès (2003), who based her work on West African labor markets, states that vulnerability in employment "is polysemous and covers as much the different forms of underemployment as the lack of socioeconomic security at work associated more with institutional variables (employment contracts, compliance with labor code, etc.) and their time-related factors (casual and unstable employment)." So even if a job is protected or worked in good conditions, the casual nature of the employment means that this protection is not guaranteed over time and that the risk of visible underemployment is high. Therefore, a casual labor variable is created and is equal to 1 if the individual is a piece-rate, day or seasonal worker. It is equal to 0 if the individual has a steady job.

An unstable remuneration variable is equal to 1 if a dependent worker is not paid a fixed wage (monthly, fortnightly or weekly) or if an independent worker is not paid in the form of a fixed wage or profits (i.e. paid by the day, hour, piece rate, commission, in kind or not paid at all). This variable differs from the variable above. Workers in steady jobs may be paid erratically. They are then assumed to be more vulnerable since they cannot predict their situation in the coming days or weeks.

Visible underemployment corresponds to a situation where an individual works less than the statutory working week when he would like to work more. The underemployment variable is equal to 1 if the individual works less than 35 hours and would like to work more. It is equal to 0 otherwise. The interest in computing this variable lies in the fact that pecuniary compensation for vulnerability may depend on the workers bargaining power to secure daily, weekly or monthly earnings that will enable their household to survive, making total earnings virtually equal to those of employees working longer hours.

Working a second job could, in certain cases, reflect underemployment or instability in the main job. Granted, public-sector and private-sector wage earners – often seen as not being vulnerable precisely because they work in these sectors – work a second job to earn money for their retirement or their children. Yet a visibly or invisibly underemployed individual or a piece-rate worker may hold down a second job to keep money coming in when they are temporarily laid off from their main job. Working a second job may be seen as a way of reducing or spreading the risks of an income loss or decrease. The second job variable is equal to 1 if the individual works a vulnerable second job, i.e. outside the public sector, in a place or premises not dedicated to this job and in a firm of less than five people, and if the number of cumulative hours worked in the two jobs is 70 hours or more a week.

Pagès (2005) emphasizes the importance of considering the dynamic aspect of vulnerability. The above employment situation impacts on the workers' capacities and behavior

(the skills-employment causality is reversed). The author measures the dynamic facet of vulnerability at work in terms of labor mobility and employment integration. Similarly, we define two dynamic vulnerability criteria.

Instability in employment is defined by a change of job without an improvement or with a drop in status in the last five years. This variable is equal to 0 if the individual is in his or her first job or has found a job following a period of unemployment or inactivity over the last five years. It is also equal to 0 if the individual has been in the same job for five years. Lastly, it is equal to 0 if the individual has changed job with an improvement in job status (from the point of view of socioeconomic group, reflecting upward professional mobility) in the last five years. However, it is equal to 1 when the individual has changed job in the last five years without an improvement in status (drop in or identical socioeconomic group). The adopted status hierarchy is as follows, from top to bottom: senior executives, engineers or equivalent; middle managers and supervisors, skilled and semi-skilled non-manual and manual employees; unskilled workers; apprentices and family workers. In the case of an independent-dependent worker transition, the reason for the change of job – voluntary or involuntary – is used to determine whether the transition represents an upwardly mobile professional move or not.

An unwanted job is defined as a job with which the worker is dissatisfied and which the worker has taken on following an involuntary departure from the previous job. Job dissatisfaction is measured by the answer to a question about the individual's aspirations (keep or change job and, if the interviewee is willing to change, for what type of job). An unwanted job is more probably occupied due to constraints and is hence mismatched with the worker's expertise, skills and preferences. Workers may be dissatisfied in their jobs because they are overqualified for it, because their working conditions are physically strenuous, because the hours are unsuitable for them, etc. Working an unwanted job may therefore indicate a subsistence job, a "stopgap job" taken in the hope of immediate gains.

Other potential vulnerability criteria have not been taken into account. For example, we do not create a social security variable as Pagès does (2005), since our income variable includes all welfare benefits. However, unstable remuneration or no written contract, for example, should be enough to reflect the worker's social insecurity.

So for each employment status (dependent or independent), we define the intensity of vulnerability *I* as the sum of the eight previously defined criteria applicable to this status. Maximum vulnerability intensity ranges from 4 to 7 depending on the city and sector. No city posts the maximum score of 8 whereby all the vulnerability criteria applicable to a status are fulfilled.

A dichotomous dummy variable for vulnerability, built by setting a vulnerability threshold (a minimum number of vulnerability criteria to be met to be deemed vulnerable), would have simplified our measurement. However, the effect of vulnerability on income might be nonlinear and a dichotomous dummy variable would not show this up. The fact that workers fulfill one or two vulnerability criteria may be due to constraints imposed on them on the labor market. However, whereas a certain level of vulnerability might be imposed on the worker, it might also be chosen by the same worker who prefers to be more vulnerable for higher earnings.

(c) Descriptive statistics

[Table 2 here]

Contractual insecurity concerns virtually all (97%) of the dependent workers in the informal sector. More surprisingly, it affects half of the employees in the formal private sector: A total of 40% do not have written contracts or pay slips. Similarly, 23% of the dependent workers in the formal private sector and 60% of the dependent workers in the informal private sector do not receive a fixed wage. This implies that the distinction between formal private firms and informal private firms is not enough to analyze workers' living and working conditions.

The main sources of vulnerability among independent workers in the informal sector are adverse working conditions (59% of independent workers), in terms of no dedicated premises or workplace, and own-account employment, i.e. not having any employees (68% of independent workers). These percentages are small in the formal private sector, where self-employed workers are a minority (less than 20%) in all cities.

A total of 17% of dependent private sector workers and 14% of independent private sector workers are not at all vulnerable since they do not fulfill one single vulnerability criterion. Yet these rates mask huge differences between the formal and informal sectors. In the informal sector alone, the rates fall to 2% and 12% respectively. So 85% of the private sector workers in all the economic capitals studied are vulnerable on the basis of at least one criterion.

[Chart 1a here] [Chart 1b here]

Chart 1a (resp. Chart 1b) shows the log of average earnings in the formal private sector (resp. informal sector) for each level of vulnerability, without any control of the workers' individual characteristics. The income curves are not linear in vulnerability intensity in either sector. For a vulnerability level of over 5, the earnings curves for the different capitals' informal sectors display different trends with sudden slope changes. These cannot be interpreted since they are based on very low observation numbers. Similarly, the shape of the formal private sector curves above vulnerability level 4 cannot be interpreted.

For all the cities and sectors, the earnings curves are convex around a point of inflection situated near a vulnerability intensity of 2 or 3. It could be that the job market restricts all workers to an "incompressible" vulnerability level regardless of their aptitudes and networks. However, higher earnings are found at a vulnerability level of over 2 or 3. Above this

vulnerability level, then, workers appear to be able to negotiate premium pay for their vulnerability.[10]

4. ECONOMETRIC APPROACHES

In a first step, the determinants of vulnerability are analyzed using a simple linear model whose dependent variable is the intensity of vulnerability. The explanatory variables introduced are dummy variables for the individual's status in the household (1 if household head) and the institutional sector in which the individual's father (public, formal private or informal private) worked when the individual was 15 years old. These first variables are denoted *Z*. The set of control variables included in all the estimated equations (*X*) covers gender, education (number of years of successfully completed education) and its square, potential experience and its square, religion (Christian, reference: Muslim), migratory status (rural, urban or foreign migrant, reference: native of the city studied), marital status (conjugal status, reference: widowed, divorced or single), seniority in the firm or main job and its square, and independent status (self-employed employer or own-account worker versus dependent worker).

Secondly, to examine the existence of compensating wage differentials for vulnerability, we estimate the log of the hourly wage rate for the main job for each city. Included in this wage rate are rare benefits offered to few by a small part of the formal sector such as year-end bonuses, profit-sharing, paid leave, medical service benefit, social security, and benefits in kind such as

[10] Additional statistics were computed to describe the workers' individual and job characteristics depending on their relative position in the earnings distribution (not shown). In the formal sector, while the upper tail of the earnings distribution (fourth quartile) corresponds to less vulnerable jobs, this relationship is not necessarily observed for each specific criterion of vulnerability. For instance, there is no clear pattern between earnings deciles and the fact of having a second vulnerable job, an unstable job, being an independent with no employees, or knowing a situation of visible underemployment. In the informal sector, there is no significant correlation between higher earnings and having unstable remuneration, employment instability, exerting a second vulnerable job, having an unwanted job and enduring adverse working conditions.

housing, electricity, and transport.[11] The wage rate is calculated from the monthly earnings for the reference month and the number of hours worked per week.[12]

(a) Quantitative approach

We talk about a quantitative approach when we study the impact of vulnerability intensity on income. In this approach, what counts is the cumulative number of vulnerability criteria fulfilled by an individual rather than such or such a criterion.

Let E be all four institutional sector categories (h=1: zero income, h=2: public sector, h=3: formal private sector, and h=4: informal sector). Our purpose is to estimate the effect $\varphi_h = (\varphi_{1h}, \varphi_{2h})$ of vulnerability I on earnings in the formal and informal private sectors using:

$$Y_h = \beta_h X + \varphi_{1h} I + \varphi_{2h} I^2 + \varepsilon_h, \ \forall h = 3,4 \qquad (1)$$

The introduction of a second-degree vulnerability intensity polynomial[13] is designed to take into account any nonlinearity in the effect of vulnerability on income. Y_h is only observed if the individual has a paid job and if sector h is chosen by the individual.[14]

Given that the labor markets in developing countries are potentially segmented[15], sector entry selection may exist in addition to labor market entry selection, calling for a selection model. We use the Lee (1983) model, an extension of the Heckman method, to estimate the earnings equation with multinomial selection. This method corrects the selection bias, by estimating:

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[11] These benefits are not to be confused with bonuses rewarding productivity as they are usually included in the contract offered by some firms.

[12] Earning misreporting was expected and has been partially avoided in the *1-2-3 Surveys*. For example, the interviewers were asked to help self-employed workers reconstitute their earnings by recapping incomings and outgoings over a reference period to which the interviewee could relate (for further details, see Kuepie *et al.*, 2009).

[13] The introduction of a third-degree polynomial into the earnings equations was tested, but did not find evidence that vulnerability has a cubic effect on income. Dummy variables were also introduced for each vulnerability level to test for nonlinearity, but this made it harder to interpret the estimated coefficients with no added explanatory power.

[14] The earnings Y_h and vulnerability index I are defined at the individual level. We just omit the subscript i to lighten the notations.

[15] We make the assumption that the potential segmentation of the urban labor markets manifests itself essentially across the institutional sectors of employment, i.e. across the public, formal private and informal sectors, thus allowing workers to freely move from one job to another within each institutional sector.

$$Y_h = \beta_h X + \varphi_{1h} I + \varphi_{2h} I^2 + \lambda_h + \kappa_h \quad \forall h = 3,4 \qquad (2)$$

where λ_h, a generalization of the inverse Mills ratio in Heckman's method, corrects the selection bias generated by the fact that belonging to sector *h* rather than sector *k* ($k \neq h$) may be due to the action of unobservable variables also associated with income.

In our model, the identifying variables required for the robustness of the selection model are the inverse of the dependency ratio (number of employed workers to household size), two dummy variables indicating whether the individual's father went to primary school and whether the individual's head of household is a woman. These variables are introduced into the selection equation (multinomial logit model with four categories for *h*: 1…4), but not into the earnings equation. The assumption is that these variables only influence income via sector allocation. Let us briefly comment on this identification strategy.

One may argue that father's schooling is not an appropriate instrument for sector allocation if father's schooling measured the father's ability to nurture unobserved ability in his child that would effect on his child's earnings. This may be true if the father's education was affecting educational choice for more able children. Yet, in a study of the returns to education using the same dataset, Kuepie, Nordman and Roubaud (2009) have shown that the father's characteristics (either dummies for his level of education or dummies for his work status) were never significant in the earnings functions. The authors then cast doubt on the validity of using the father's characteristics as proxies for ability – or more generally heterogeneity – of his children with these data. In our case, father's schooling is employed as an exclusion restriction instead. In addition, we believe that the household's dependency ratio, as well as the sex of the household head, can be considered as exogenous to individual earnings. Similar assumptions are made by Appleton, Hoddinott and Krishnan (1999) or Kuepie *et al.* (2009). In order to preserve as much comparability across countries as possible, we rely on the same exclusion restrictions for each city and sector. However, bearing in mind the methodological controversies surrounding

the choice of identifying variables in general, we report summary results from uncorrected earnings functions (OLS) as well.

A second problem that needs to be solved is that the intensity of vulnerability is potentially endogenous. Unobservable characteristics may affect both the explanatory variable for vulnerability and the level of earnings. This would be case, for example, if less (best) performing workers, a characteristic all too often unobserved in the surveys, were selected for employment statuses where vulnerability is the most widespread (see Section 2). In this case, any positive effect vulnerability might have on earnings could be under-(over-)estimated. Since disregarding this factor could produce non-convergent estimators of $\varphi_h = (\varphi_{1h}, \varphi_{2h})$, I needs to be instrumented.

To do this, we use the control function method rather than the two-stage least squares estimator (Wooldridge, 2002). Where income is nonlinear in the potentially endogenous variable, this method provides more accurate estimators than the two-stage least squares method (Card, 2001). The control function method involves regressing, in a first step, the intensity of vulnerability on the individual characteristics X and on the instrumental variables Z, not correlated with κ, the residual from the earnings equation (2). The estimated residual from this first linear regression, $\hat{\mu}$, is introduced as an explanatory variable, controlling for unobserved heterogeneity, into the earnings equation.

The chosen instruments are the dummy variable for the status of the head of household and three dummy variables for the institutional sector of the father when the individual was 15 years old. In principle, these variables do not have a direct impact on earned income since they have nothing to do with productivity or the worker's capacities. Yet, being a head of household could form an incentive to accept a more vulnerable job when faced with the urgent need to find a job to feed the family or a less vulnerable job to guarantee stability for the household. The heads of household could have a longer term horizon than other individuals in the household.

They may see things more in the long run, be less drawn by immediate gains than other members of the household who would prefer an immediate gain at the cost of a vulnerable job, all things being equal.

We also believe that exogenous sources of variation can be obtained with the father's occupation when the worker was 15 years old. It is indeed likely that the type of job held by the father when the worker was younger will influence his child's leaning to take up a good or a bad job, in the sense of a more or less vulnerable work situation. There is no determinism implied in this process but simply the assumption that the father's professional situation has somehow an influence on his child's future preference for certain job attributes or capacity to cope with transition periods (for instance aversion, liking or resistance to adverse working conditions).

(b) Distributional approach

The impact of vulnerability on income may differ across the earnings distribution (see Section 2). Quantile regressions are used to take into account these potential effects. Firstly, the estimation of equation (1) is resumed using conditional quantiles, such that

$$q_\tau(Y_h|X, I, I^2) = \beta_h(\tau)X + \varphi_{1h}(\tau)I + \varphi_{2h}(\tau)I^2 \quad \forall h = 3,4 \quad (3)$$

where $q_\tau(Y_h|X, I, I^2)$ is the τ^{th} conditional quantile of Y_h and where vector $\hat{\beta}_h(\tau)$ and the estimated coefficients $\hat{\varphi}_{1h}(\tau)$ and $\hat{\varphi}_{2h}(\tau)$ provide the effects of the different regressors at the τ^{th} quantile of the earnings distribution in sector *h*.

This framework does not take selection effects into account. Whereas the control function method can also be used in the case of quantile regression, to our knowledge, no model equivalent to Lee's exists that can estimate quantile regressions with multinomial selection. Then, this distributional approach corrects solely the supposed endogeneity of vulnerability.[16]

[16] This is not a major drawback since, as we will see in Section 5, the results of the quantitative approach are not sensitive to the consideration of a possible selection effect.

(c) Qualitative approach

To build a cumulative index of vulnerability intensity is to assume that all the criteria involved in vulnerability have the same weight. Is income influenced by the number of vulnerability criteria satisfied or the existence of one given vulnerability criterion? Moreover, certain vulnerability criteria (such as casual labor and unstable remuneration) are potentially collinear, invalidating the coherence of the cumulative index and introducing all the criteria into the earnings equations. We therefore put the vulnerability criteria through a principal component analysis (PCA) to extract orthogonal factor axes.[17] PCA is conducted separately for independent workers and dependent workers. For each of these two statuses, the first four axes are taken so that all the criteria are sufficiently well represented by the axes (all contribute to at least one axis to the tune of 50% or more) and such that the variance explained by the chosen axes is approximately 60%. In keeping with the method used in Jellal *et al.* (2008), these axes are then introduced into the earnings equations.

The axes generated by the PCA of dependent workers are not defined for independent workers (and vice versa). One way of introducing them into the earnings equation is to conduct a separate regression for each subsample of dependent and independent workers. This solution can only apply to the informal sector, but not to the formal private sector due to the small numbers involved. Another solution is to cross the factor variable with the status dummy variable. Let D_1 be the first vulnerability axis extracted by the PCA on dependent workers. The value D_1 for each dependent worker is their co-ordinate on this axis. For an independent worker, this variable is equal to zero. The two options were tested and produced very similar results, so we only present the results of crossing the factor axes with the independent or dependent status.

[17] We tried many other techniques of factor analysis. They lead to similar conclusions.

5.RESULTS

(a) Quantitative approach

Let us first describe the effects of the instruments on the vulnerability index.[18] For each city and each sector, at least one instrument is found to have a significant effect on vulnerability, except in the formal private sectors of Niamey and Bamako.[19]

For instance, in the formal private sector, the impact of the head of household's status is negative and significant in Ouagadougou, Dakar and Abidjan, and significantly positive in Cotonou. In the informal sector, its impact is negative in the seven cities, but not significant in Dakar and Cotonou. While the father's institutional sector does not predict well the intensity of vulnerability for workers in the formal sector, the quality of the father's institutional sector instrument is better since it appears to influence vulnerability in five out of seven cases, i.e. except in Lome and Abidjan. By and large, however, we note the satisfactory quality of our instruments since the condition required to correlate the instruments with the endogenous variable is satisfied.

(i) Effects of vulnerability on earnings

Let us now look at the effect of vulnerability on earnings based on models (1), (2) and their extension taking into account an endogenous vulnerability variable.

[Table 3 here]

Table 3 shows the marginal effects of the vulnerability indicator on earnings, calculated at the average vulnerability point.[20] Regardless of whether or not the sample selection and endogeneity of vulnerability are corrected, the marginal effect of average vulnerability is negative in both sectors for all the cities except in the informal sector in Dakar, where this effect is slightly

[18] The results, not shown to save space, are available from the authors upon request.
[19] Hence, the estimates corrected for the endogeneity of vulnerability need to be interpreted with more caution in the case of these two cities' formal sectors given the inefficient instrumental variable procedure in both cases.
[20] All the regression tables are available from the authors.

positive. In both sectors, formal and informal private, the selection correction barely alters the results. However, the vulnerability endogeneity correction alters the magnitude of the marginal effects (we come back to this point below).

In the formal private sector, one additional point of vulnerability reduces income by 16% (Cotonou) to 34% (Dakar).[21] In the informal sector, the marginal effect of vulnerability on earnings is smaller. If the endogeneity of vulnerability had not been taken into account, the effect of vulnerability on income would have been deemed negligible. However, once the endogeneity of vulnerability is included, it has a large impact on earnings. One additional point of vulnerability reduces income by 3% (Cotonou) to 20% (Abidjan). The marginal effect is positive in Dakar only. For example, if workers vulnerability intensity were to increase from 2 points to 3 points, their earnings would increase an average 1%.

(ii) The convex effect of vulnerability on earnings

These marginal effects are calculated for average vulnerability intensity. In the formal private sector, workers satisfy one in eight vulnerability criteria on average. In the informal sector, this average vulnerability point is close to 2. Hence, if we wanted to identify any compensating effects for higher than average vulnerability levels, we would have to study the coefficients estimated for the second-degree vulnerability intensity polynomial.

[Table 4 here] [Table 5 here]

Tables 4 and 5 show that, regardless of the model used, vulnerability has a negative effect on earnings in all the cities and in both institutional sectors. However, in these two sectors in all the cities, the effect of vulnerability is nonlinear and convex since the coefficient of I^2 is positive and significant. This quadratic effect is significant at least at the 5% level and mostly at the 1% level in all the cities and sectors, except in the formal private sector in Bamako. In formal

[21] Bear in mind that caution is called for when considering the estimation corrected for endogeneity in the case of the formal sector in Bamako (37%).

Bamako businesses, vulnerability squared has no significant impact on earnings, just like first-degree vulnerability.

So the convexity observed in the descriptive analysis holds in the formal and informal private sectors once the individual's characteristics, selection and endogeneity are controlled for. It can be seen in charts 2a and 2b, which represent the average income predicted by the Lee model with endogenisation of vulnerability by vulnerability level (the curves produced by the OLS model and the simple Lee model are similar).

[Chart 2a here] [Chart 2b here]

In the formal private sector, income is convex in vulnerability intensity in all the capitals. The slope is markedly decreasing for low levels of vulnerability. A change of sign only appears at vulnerability levels that are not well represented in terms of numbers (4 or more). In other words, income losses due to vulnerability are lower for high levels of vulnerability, but do not translate into gains. In Cotonou, however, the level of gains for a vulnerability of 4 is similar to the level of gains obtained for zero vulnerability.

In the informal sector, convexity is observed for all the cities. The earnings curves even steepen above a vulnerability level of 2. In all the cities, average predicted income for a vulnerability of 4 or 5 is higher than the average predicted income for a vulnerability of 2. In Cotonou, the average predicted income for a vulnerability of 5 is even higher than the average predicted income for workers who are not vulnerable at all.

The assumption that earnings can compensate for a certain level of vulnerability therefore holds in the informal sector[22]. Workers with a vulnerability level of 2 endure this vulnerability,

[22] We think differences between sectors are not concerned by earnings misreporting. Because a large majority of workers in both the formal and the informal sectors are not regularly paid, have no pay slip or are reticent to disclose their earnings, measure bias can occur in both sectors. But even if under-reporting was more important in the informal private sector, this would lead to accentuate our results. First, assuming vulnerability is correlated with under reported earnings would imply that any compensation effects would be in fact more important than observed effects. Second, higher under-reporting in the informal sector means that the real compensation in the informal private sector would be more pronounced than the one observed.

which is imposed on them by the labor market. The more vulnerable workers are better paid. In keeping with the theory of compensating wage differentials for dependent workers' jobs (see Section 2), this finding can be explained by the fact that their employers are encouraged to offer higher earnings to find employees prepared to work in such vulnerable jobs. For the independent workers, vulnerability can be a way of earning more immediate gains from their work. For example, some independent workers may choose not to have work premises, making their working conditions more vulnerable, if the itinerant nature of their work brings them into contact with more customers or if it means that they do not have to worry about paying rent or whatever taxes. Without these vulnerable conditions, their business would probably be not sustainable.

In the informal sector of all cities, the marginal effect at average vulnerability is negative, except in Dakar where it is slightly positive. The average vulnerability points (approximately 2) are close to the minima of the convex curves. At these average points, income is a decreasing function of vulnerability. Yet above these points, earnings are an increasing function of vulnerability. A not-inconsiderable proportion of workers are found above the average vulnerability level. Depending on the cities, from 27% to 62% of the workers in the formal private sector are more vulnerable than average (respectively in Abidjan and Cotonou) and from 38% to 65% of informal sector workers are more vulnerable than average (respectively in Niamey and Lome). Therefore, the compensation (or rather lesser-loss mechanism) for high levels of vulnerability concerns a sizable share of workers.

To sum up the vulnerability effect on earnings, the labor market of the cities studied imposes a minimum level of vulnerability. This non-compensated vulnerability, common to nearly all the workers, is a characteristic of the job markets in these cities. The average level vulnerability is not a wage bargaining element or a profit adjustment variable for the independent worker. However, workers can negotiate wage compensation for above-average levels of

vulnerability. If dependent workers consider that they are more vulnerable than their fellow citizens on average, they are in a position to negotiate premium pay. If the market imposes a certain level of vulnerability on independent workers, they will be inclined to make their jobs that bit more vulnerable to earn a higher income since, the way things stand, they "might as well".

(iii) The endogeneity of vulnerability in the earnings function

In all the cities' formal private sectors, the impact of vulnerability is all the more negative when the endogeneity of vulnerability is controlled for (Table 4). However, significance also drops, except in Dakar. The underestimation of the negative impact of vulnerability implies that the workers have unobservable characteristics both positively correlated with their earnings and with the intensity of their vulnerability. These unobservables may reflect the dependent workers' ability and/or bargaining capacities, but also their household's situation. For example, dependent workers who have strong ability and bargaining power are capable of negotiating wage rises to compensate for adverse working conditions and may also be more able to cope with difficult work situations. On the other hand, a worker with an extended social network and/or whose household is capable of coping with shocks would be in a better position to negotiate working conditions and earnings. For instance, an individual with extended social network or whose household can respond to shocks has the bargaining power and time to negotiate higher earnings in case of bad working conditions.

In the informal sector, the negative impact of vulnerability disappears in the cities of Dakar and Cotonou when the endogeneity of vulnerability is corrected for: its coefficient is no longer significantly different from zero (Table 5). In the five other cities, vulnerability has a more pronounced negative impact on income once endogeneity is controlled for. Unobservable characteristics are again at work here, affecting the intensity of vulnerability and the level of earnings. This sector is made up mainly of independent workers, for whom bargaining power is not so relevant. However, the interpretation in terms of social insecurity holds. An independent

worker without an extended social network who is shaken by a household shock cannot develop a viable, stable or profitable business, for lack of time to invest, conduct market studies, etc.

Lastly, the use of the control function provides a direct test of the assumption of the endogeneity of vulnerability in the earnings function. The significance of the coefficient assigned to the correction term $\hat{\mu}$ (the vulnerability equation residual) indicates whether the unexplained variation in vulnerability intensity also affects the variation in the level of individual earnings. In other words, in the cases where this coefficient is significant, the assumption of endogeneity of vulnerability cannot be rejected. The findings for the informal sector (Table 5) confirm that, in the four out of seven cases (Ouagadougou, Bamako, Lome and Abidjan), the endogeneity of vulnerability cannot be rejected. This contrasts with the diagnosis for the formal private sector (Table 4), where endogeneity has to be rejected in six of seven cases, the exception being Dakar. In the following, however, rather than using a method for each sector and each city, we refer to estimations derived from models corrected for endogeneity in all cases in order to maintain uniform treatment for all the cities studied.

(b) Distributional approach

[Chart 3a here] [Chart 3b here]

This approach involves estimating model (3) for a certain number of income quantiles (see Section 4b). For simplicity of presentation, we only report on the series of marginal effects at the average vulnerability point calculated by income deciles in charts 3a and 3b, respectively for the formal and informal private sectors. The curves presented are the third-degree trend curves, which are more flexible than the quadratic function. The marginal effects are calculated using the coefficients resulting from the quantile regressions, taking into account the endogeneity of vulnerability.

In the formal private sector, the marginal effect of average vulnerability is negative across the entire distribution. This means that there is no compensating mechanism in the formal private sector at the average point. The cities of Niamey, Ouagadougou, Dakar, Cotonou and Lome present the same concave and then convex marginal effect curves; the points of inflection being close to median earnings in the distributions. The Bamako's curve differs. It is solely concave and reaches its maximum for median earnings and a greater marginal effect than the other curves. However, one additional point of vulnerability prompts a 10% decrease in the earnings of an individual with average vulnerability in the fifth decile of the distribution. Abidjan's curve is slightly convex at the lower tail of the distribution and then concave. The marginal effect of vulnerability on earnings varies little along the distribution in Abidjan (from 20% to 30% income loss).

In the informal sector, Dakar, Cotonou and Bamako present a rising and mainly concave curve of the marginal effect of vulnerability along the conditional distribution of earnings. Moreover, the marginal effect becomes positive as of the third decile in Dakar and as of the sixth decile in Cotonou and Bamako. Hence for Dakar workers in the seventh decile with an average level of vulnerability, a one-point increase in vulnerability drives an average 25% increase in earnings. In Cotonou, a one-point increase in the vulnerability of workers in the ninth decile with average vulnerability generates an average increase of 15% to 20% in earnings. Lastly, Bamako returns a lower, but not negligible, effect since the increase in earnings can be as high as nearly 5% for workers in the eighth decile. In the other cities (Niamey, Ouagadougou, Lome and Abidjan), one additional degree of vulnerability produces no increase in earnings compared with average vulnerability, regardless of distribution position.

To sum up, Dakar, Cotonou and – to a lesser extent – Bamako display both the highest compensation for vulnerability, in terms of earnings for high levels of vulnerability, and positive effects of vulnerability on high earnings for average levels of vulnerability. Hence in these three

cities' informal sectors, vulnerability has a different effect on income depending on the worker's relative position on the remuneration scale. For equal observable characteristics, workers at the lower tail of the earnings distribution (poor) are penalized in monetary terms for their vulnerability whereas workers at the upper tail of the distribution (rich) are not and receive compensation for their vulnerability. This can be explained by greater bargaining power among the independent workers at the upper tail of the earnings distribution. The poorest independent workers cannot raise their income to compensate for the vulnerability of their work since, without room for maneuver, they cannot adopt a strategy to increase their profits. An independent worker at the upper tail of the earnings distribution could more easily make trade-offs between working conditions and earnings.

(c) 'Qualitative' approach

The approach taken up to this point cannot distinguish between the different roles of each aspect of vulnerability. There is a possibility that only certain facets of vulnerability are behind the compensating phenomena found above. The analysis therefore focuses on the different vulnerability criteria using a factor analysis (see Section 4c).

(i) Results of the principal component analysis

[Table 6 here]

The first PCA factor axis for dependent workers is defined mainly by the informal nature of the contract, casual labor and unstable remuneration, and adverse working conditions (Table 6). This axis hence covers three aspects of vulnerability: contractual insecurity, adverse working conditions and the casual nature of employment. The second axis defines subsistence and stopgap jobs. Having lost their previous job, workers find themselves on a downward professional slope and accept the first job offer, which is far from being the job they want. This job may therefore be mismatched with their skills. The third axis for dependent workers is

underemployment since the variables that contribute the most to it are visible underemployment and casual labor. Underemployment is associated with piece-rate work and day work, since a casual worker finds it hard to work full time and is therefore subject to low demand. The fourth axis is working a second highly vulnerable job. Working a second highly vulnerable job is a reflection of vulnerability in the main job, as distinct from the vulnerability induced by underemployment, since the third and fourth axes are orthogonal.

The first PCA axis for independent workers corresponds to the second axis for dependent workers, the subsistence job axis. The second axis covers underemployment. Unlike the underemployment axis for dependent workers, here the unstable remuneration variable contributes to the axis. When their work is not steady, the remuneration of independent workers is automatically variable since own-account workers and self-employed employers find it hard to smooth their income. The third axis for independent workers covers having no employees, a variable defined solely for these workers, and adverse working conditions. This axis characterizes itinerant jobs low on physical capital (low on physical capital since there are no work premises and low labor factor since worked by just one person), such as repairers and roving street vendors. The fourth axis is the same as the fourth axis for dependent workers: working a second highly vulnerable job.

(ii) Earnings equations with the factor axes

The summary results of earnings functions including factor axes crossed with independent or dependent status (see Section 4c) are reported in Tables 7 and 8. Since the OLS and Lee models produce similar results, we only report on the Lee model results here.

[Table 7 here] [Table 8 here]

The independent workers' axes very rarely play a significant role in the formal private sector due to the small proportion of independent workers in this sector. We therefore do not comment on these coefficients.

The contractual insecurity and adverse working conditions axis has a definitely negative and highly significant impact (at 1%) on the earnings of dependent workers in the formal private sector in all the economic capitals. The impact of dependent workers employed in a subsistence job, taken on as a last resort, is significantly negative in Niamey (at 5%), Bamako (at 5%) and Abidjan (at 5%). In the other cities, its impact is not significantly different from zero. The underemployment axis has a positive and highly significant effect on earnings in the formal private sector in all the cities except Dakar, where the effect is not significant. Lastly, working a second job has no impact on the income earned in the main job.

The contractual insecurity axis has a negative and significant impact (except in Bamako) on the earnings of dependent workers in the informal sector. The underemployment axis positively and significantly affects the earnings of dependent workers in the informal sector in all the cities. For these workers, the subsistence job axis coefficient is never significantly different to zero and the coefficient for working a second vulnerable job is only significantly negative in Cotonou.

The subsistence job axis has no clear effect on the earnings of independent workers in the informal sector. However, underemployment here again has a significantly positive impact on the earnings of independent workers in the informal sectors of the seven cities, while the axis defined by zero employees and adverse working conditions has a significantly negative impact at the 1% level in all the cities except Dakar. Working a second job has a significantly negative impact on earnings, except in Ouagadougou.

Different aspects of vulnerability therefore have different impacts on earnings. For example, subsistence jobs tend to have a negative effect in the formal sector, although it is rarely significant. Working a second job has a negative effect on the earnings of independent workers in the informal sector, but no impact in the formal private sector. So working a second vulnerable job would be a sign of main job vulnerability in the informal sector, a way of diversifying excessive risks. However, for a worker in the formal private sector, working a second

vulnerable job is not a sign of lower earnings in the main job, but a "sideline" to prepare for formal retirement, just like public sector workers. Lastly, there is no compensation for contractual insecurity among dependent workers or for itinerant, solitary work among independent workers in any of the cities or the institutional sectors.

Visible underemployment has a positive impact on the earnings of dependent workers in both sectors and independent workers in the informal sector. Here, then, a pecuniary compensating mechanism for vulnerability is at work. Employers cannot pay their employees exactly pro rata to the hours worked if the number of hours worked is constrained by customer demand and not by the employee's wishes. Employees will negotiate to bring their earnings up to the minimum living wage, even if this is supposed to be earned from a greater number of hours than those actually worked. For independent workers, a possible explanation for this compensation is that independents worker will bill their services in a way that will give them a certain level of earnings, regardless of the number of hours worked. Lastly, underemployed workers may have made less of an effort to work more than the individuals who work longer than the statutory working week, simply because their hourly wage is higher.

6. CONCLUSION

In this paper, we develop indicators of employment vulnerability in seven West African economic capitals (Abidjan, Bamako, Cotonou, Dakar, Lome, Niamey and Ouagadougou) and study their links with individual earnings from the main job. The theory of compensating differentials, formalized in the 1980s, states that workers may receive pecuniary compensation commensurate with the strenuous or hazardous nature of their tasks or adverse working conditions. A certain number of empirical studies have recently found evidence of this type of compensation in developed countries, but often with contradictory conclusions. Our

interpretation of the link between employment status and income draws on these developments, applying them not just to working conditions themselves, but more broadly to vulnerability in employment (contractual insecurity, working conditions, underemployment, and stopgap jobs mismatched with individual characteristics). Employment vulnerability is a dominant characteristic of the urban labor markets in sub-Saharan Africa, where the overwhelming majority of workers work in insecure jobs and/or in the informal sector. Our composite indicator of vulnerability in employment reveals that 85% of the private sector workers in all the economic capitals studied are vulnerable on the basis of at least one criterion. This would suggest that all the cities' labor markets impose a minimum level of vulnerability.

Our analysis of the effects of vulnerability on earnings is in turn quantitative, distributional and qualitative. The quantitative analysis finds that the impact of vulnerability on earnings is generally negative for an average level of vulnerability despite a relative economic prosperity in the year 2001 when the data were collected. In the formal private sector, income losses due to vulnerability are lower for high levels of vulnerability, but do not translate into gains. In the informal sector, however, the average predicted income for high vulnerability is higher than the average predicted income for relatively low vulnerability. The assumption that average earnings may compensate for a certain level of vulnerability cannot be rejected in the informal sector. This could partly explain why the informal sector is attracting more workers than the formal sector. This compensation or lesser-loss mechanism for high levels of vulnerability is moreover found to concern a not-inconsiderable share of workers. However, imposed 'minimum' vulnerability is not compensated for since it is common to nearly all workers: it is an inherent characteristic of the job markets in these cities.

Regarding the absence of compensating mechanisms in the formal private sector, one may think of it as a consequence of the long "job queue" at this sector's entry (see the influential theoretical model of Thurow, 1972). Indeed, for years, the existence of significant rents in the

formal sector in these countries is known to be so high that it is rational for individuals to queue for a formal sector job. The massive decrease in access to public jobs is common to many countries in sub-Saharan Africa, confronted since the early 1980s with a serious crisis in public finances and engaged in structural adjustment policies. This difficulty to access formal sector jobs[23] then certainly reduces workers' bargaining power once they have the chance to become insiders.

The abovementioned marginal effects are estimated by regressions on the earnings average, which conceals variations in the magnitude of the impact of vulnerability along the earnings distribution. Our quantile regressions find evidence that the impact of vulnerability on earnings is not uniform, particularly in the informal sector. For example, in the informal sectors in Dakar, Cotonou and Bamako, the marginal effect of average vulnerability is positive for the upper deciles of the earnings distribution. Informal sector in these cities – Dakar, Cotonou and, to a lesser extent, Bamako – display both the highest compensation for high levels of vulnerability and positive effects of average vulnerability on income among the highest earnings.

Compensating wage differentials are then found for earnings at the upper tail of the distribution. The compensating mechanism does not concern the poorest workers. Although the poorest dependent workers should be the most forceful in wage bargaining in an endeavor to earn a living wage, they have less bargaining power due to the urgent nature of their needs. Urban labor market imbalances could also explain this absence of compensating wage differentials at the lower tail of the distribution, where labor supply probably far exceeds demand.[24] Similarly, the poorest independent workers suffer more from their vulnerability and do not adopt strategies to compensate for it by increasing their profits (raising receipts or reducing

[23] Not to mention potential informational asymmetries, the assumption of perfect information being, in the theory of compensating differentials, a necessary condition for pecuniary compensations to apply.

[24] For example, Fernández and Nordman (2009) interpret the absence of compensating wage differentials for working conditions at the tail ends of the earnings distribution in the United Kingdom as evidence of a « missing middle » in the distribution of manpower skills in this country. In other words, where labor demand exceeds labor supply, employers would be more inclined to compensate for adverse working conditions.

expenditure). An independent worker at the upper tail of the earnings distribution could more easily make trade-offs between working conditions and earnings.

However, the different aspects of vulnerability have diverse impacts on income. For example, working a second vulnerable job has a negative effect on the average earnings of independent workers in the informal sector, but no impact in the formal private sector. So working a second insecure job could be seen as a way of diversifying excessive risks associated with a vulnerable main job in the informal sector. Also, wages do not compensate for contractual insecurity among dependent workers or for itinerant, solitary work among independent workers in any of the cities or institutional sectors. The only pecuniary compensation mechanism for vulnerability is found with visible underemployment, which has a positive impact on the average earnings of dependent workers in both sectors and independent workers in the informal sector.

In a nutshell, vulnerability compensating mechanism is mainly seen in the informal sector, in the upper tail of the earning distribution, and particularly in the circumstance of visible underemployment. The private formal sector does not offer the best protection against the common features of employment vulnerability. Vulnerability, which is the norm in West African cities, is not compensated for the largest part of the labor force, i.e. the full-time workers in the private sector. A slight compensating mechanism is at work in the informal sector, all things being equal, but even then, the marginal effect of the vulnerability on earnings appears well above the mean vulnerability index, the only clear exception being Dakar.

Whereas our analysis does not generally confirm the applicability of the theory of compensating differentials on West African cities, especially where these compensating mechanisms should be most expected (i.e. in the formal sector), an institutional approach might be more relevant in the African urban context. In such peripheral cities in the world economy, workers' unions are essentially active in the public sector, notably weak in the formal private sector, and virtually non-existent in the informal private sector. The same can be said of

employment laws and worker's rights that are hardly enforced. As a result, the bargaining power of both independent and dependent workers is very weak. There remains to confirm if our results, based on the relatively homogenous WAEMU region, can be generalized to the continent. For instance, we may expect more compensating mechanisms in cities in South Africa or in Northern African countries. Being less peripheral than West African cities, workers unions are more powerful there, while workers rights and employment regulations are better respected.

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Appendices

Table 1: Samples used

		Niamey	Ouagadougou	Dakar	Bamako	Cotonou	Lome	Abidjan
Sample total		14,524	13,733	19,054	13,002	11,574	9,906	11,343
Working-age population (WAP)		8,284	8,525	12,487	7,529	7,639	6,418	7,503
WAP with five or more years of potential experience		7,269	7,328	11,014	6,561	6,517	6,546	6,537
Regression samples	Zero income	4,053	3,663	6,074	2,746	2,374	2,081	2,568
	Public sector (positive income)	577	584	498	457	398	306	302
	Formal private sector (positive income):	409	336	950	452	509	302	825
	- Dependent	373	307	868	365	423	261	782
	- Independent	36	29	82	87	86	41	43
	Informal private sector (positive income):	2,230	2,745	3,492	2,906	3,236	2,857	2,842
	- Dependent	562	724	1,123	528	460	508	894
	- Independent	1,668	2,021	2,369	2,378	2,776	2,349	1,948

Source: *1-2-3 Surveys*, Phase 1 (2001-2002), National Institutes of Statistics, AFRISTAT, DIAL; authors' calculations.
Note: The informal private sector gathers all individuals working in firms which are not registered or in which no written accounts are kept. Dependent workers are employees (wage employees or not). Independent workers are self-employed workers and employers.

Table 2: Distribution of vulnerability criteria in all seven cities

		Formal private	Informal private	Total private sector
Contractual insecurity: no contract OR no pay slip	Independent			
	Dependent	0.49	0.97	0.76
	All			
Independent with no employees (wage-earning or otherwise)	Independent	0.11	0.68	0.66
	Dependent			
	All			
Adverse working conditions: premises not dedicated to the job	Independent	0.17	0.60	0.59
	Dependent	0.05	0.22	0.15
	All	0.06	0.50	0.42
Casual labor: Piece-rate, day or seasonal work	Independent	0.13	0.20	0.20
	Dependent	0.10	0.15	0.13
	All	0.10	0.19	0.17
Unstable remuneration: paid in a form other than a fixed wage (monthly, fortnightly or weekly) or, for independent workers, in a form other than profits	Independent	0.06	0.05	0.05
	Dependent	0.18	0.40	0.31
	All	0.17	0.14	0.15
Visible underemployment: Works fewer hours than the statutory working week AND would like to work more	Independent	0.09	0.13	0.13
	Dependent	0.07	0.07	0.07
	All	0.07	0.12	0.11
Working a second vulnerable job: outside the public sector in a place or premises not dedicated to the job and in a firm of less than 5 people	Independent	0.00	0.02	0.02
	Dependent	0.01	0.01	0.01
	All	0.01	0.01	0.01
Employment instability: on a downwardly mobile or unstable career path	Independent	0.01	0.03	0.03
	Dependent	0.08	0.08	0.08
	All	0.07	0.04	0.05
unwanted job: involuntary departure from the previous job or job dissatisfaction	Independent	0.05	0.06	0.06
	Dependent	0.09	0.06	0.07
	All	0.09	0.06	0.06
vulnerable: meets at least one of the vulnerability criteria	Independent	0.42	0.87	0.86
	Dependent	0.62	0.98	0.82
	All	0.60	0.90	0.85

Source: *1-2-3 Surveys*, authors' calculations on the weighted data.
Reading: The mean of the contractual insecurity variable for the subsample of formal private sector dependent workers who report strictly positive earnings is 0.49. This means that 49% of the dependent workers in the formal private sector do not have a written contract or do not receive a pay slip.

Table 3: Marginal effects of vulnerability intensity on earnings

	Niamey	Ouagadougou	Dakar	Bamako	Cotonou	Lome	Abidjan
Marginal effect at the average vulnerability point in the formal private sector							
No selection correction, exogenous vulnerability	-14.3%*** *(4.9)*	-9.3%* *(5.2)*	-16.2%** *(7.7)*	-13.9%*** *(4.1)*	-10.9% *(8.6)*	-7.4% *(6.1)*	-12.6% *(8.7)*
Selection correction, exogenous vulnerability	-14.2%*** *(4.9)*	-9.3% *(7.7)*	-16.2%*** *(4.2)*	-13.8% *(8.6)*	-10.9%* *(6.2)*	-7.0% *(10.0)*	-12.5%*** *(4.6)*
Selection correction, endogenous vulnerability	-23.0%*** *(6.2)*	-22.5% *(15.2)*	-33.5%*** *(1.4)*	-37.3%*** *(10.4)*	-15.5% *(17.9)*	-24.8%*** *(4.5)*	-24.2%* *(13.2)*
Observations	409	336	950	452	509	302	825
Average intensity	1.325	1.077	1.024	0.858	0.967	1.199	1.035
Marginal effect at the average vulnerability point in the informal sector							
No selection correction, exogenous vulnerability	-1.0% *(5.2)*	-1.7% *(3.5)*	0.2% *(4.3)*	-1.3% *(4.1)*	-0.6% *(5.2)*	-0.1% *(3.8)*	-2.8% *(3.4)*
Selection correction, exogenous vulnerability	-1.0% *(3.6)*	-1.6% *(4.2)*	0.2% *(4.4)*	-1.3% *(5.6)*	-0.7% *(3.6)*	-0.3% *(3.4)*	-2.9% *(3.9)*
Selection correction, endogenous vulnerability	-9.7%*** *(1.9)*	-15.6%*** *(1.2)*	1.0% *(20.5)*	-17.2%*** *(1.5)*	-3.4% *(18.4)*	-13.1%*** *(3.3)*	-19.9%*** *(0.7)*
Observations	2,230	2,745	3,492	2,906	3,236	2,857	2,842
Average intensity	2.229	1.787	1.959	1.801	1.757	1.960	1.661

Note: Calculation of the marginal effect at the average point of intensity (denoted $\bar{I}$): $\log(y) = a.I + b.I^2 \Rightarrow y = \exp(a.I + b.I^2) \Rightarrow em(\bar{I}) = \frac{\partial y}{\partial I}(\bar{I}) = (\hat{a} + 2\hat{b}\bar{I})\exp(\hat{a}.\bar{I} + \hat{b}.\bar{I}^2)$

Standard errors of the marginal effects are in parenthesis and were calculated using the delta-method. Significance of the coefficients: * at the 10% level; ** at the 5% level; *** at the 1% level.Reading: In the informal sector of Niamey, according the model with selection correction and endogeneous vulnerability, one additional point of vulnerability reduces income by 9.7%, which is significant at the 1% level.

Table 4: Effect of vulnerability on earnings in the formal private sector

	Formal private sector						
	Niamey	**Ouagadougou**	**Dakar**	**Bamako**	**Cotonou**	**Lome**	**Abidjan**
OLS							
I	-0.418***	-0.418***	-0.247***	-0.304***	-0.223**	-0.285***	-0.304***
	(0.090)	*(0.095)*	*(0.096)*	*(0.058)*	*(0.104)*	*(0.076)*	*(0.116)*
I^2	0.076***	0.076***	0.062**	0.046***	0.034	0.079***	0.088***
	(0.025)	*(0.025)*	*(0.027)*	*(0.016)*	*(0.033)*	*(0.023)*	*(0.032)*
Adjusted R^2	0.52	0.52	0.53	0.41	0.39	0.40	0.41
Obs.	409	336	950	452	509	302	825
Lee model							
I	-0.414***	-0.252***	-0.304***	-0.219**	-0.286***	-0.297**	-0.220***
	(0.092)	*(0.096)*	*(0.062)*	*(0.103)*	*(0.079)*	*(0.129)*	*(0.058)*
I^2	0.075***	0.064**	0.046***	0.033	0.079***	0.087**	0.033**
	(0.025)	*(0.028)*	*(0.017)*	*(0.034)*	*(0.025)*	*(0.037)*	*(0.016)*
λ_h	-0.460**	0.225	0.053	0.456	0.121	-0.550	0.157
	(0.199)	*(0.238)*	*(0.157)*	*(0.313)*	*(0.164)*	*(0.418)*	*(0.133)*
Adjusted R^2	0.51	0.51	0.40	0.37	0.38	0.38	0.48
Lee model with correction for the endogeneity of vulnerability using the control function method							
I	-1.227**	-0.495	-0.886***	-0.741	-0.355	-0.747**	-0.434
	(0.561)	*(0.435)*	*(0.186)*	*(0.487)*	*(0.316)*	*(0.349)*	*(0.338)*
I^2	0.077***	0.065**	0.046***	0.030	0.079***	0.089**	0.033**
	(0.023)	*(0.028)*	*(0.016)*	*(0.035)*	*(0.023)*	*(0.035)*	*(0.017)*
$\hat{\mu}$	0.809	0.243	0.589***	0.533	0.071	0.454	0.216
	(0.552)	*(0.411)*	*(0.174)*	*(0.486)*	*(0.319)*	*(0.324)*	*(0.329)*
λ_h	-0.505***	0.152	0.045	0.410	0.127	-0.518	0.130
	(0.191)	*(0.272)*	*(0.164)*	*(0.305)*	*(0.179)*	*(0.409)*	*(0.139)*
Adjusted R^2	0.51	0.51	0.40	0.37	0.38	0.38	0.48

Notes: The standard errors are bootstrapped (500 replications). Significance of the coefficients: *: at the 10% level; ** at the 5% level; *** at the 1% level.
The control variables are a dummy variable for gender, an education variable (number of years of successfully completed education), potential experience and seniority in the firm, religion (Christian, reference: Muslim), migratory status (rural, urban or foreign migrant, reference: native of the city studied), marital status (conjugal status, reference: widowed, divorced or single), and independent status (self-employed employer or own-account worker versus dependent worker).
The selection identifying variables are the inverse of the dependency ratio (number of employed workers to household size), a dummy variable for whether the individual's father went to primary school and a dummy variable for whether the individual's head of household is a woman.
The control function instruments are the status of the head of household and the institutional sector in which the interviewee's father worked.

Table 5: Effect of vulnerability on earnings in the informal private sector

	Informal sector						
	Niamey	**Ouagadougou**	**Dakar**	**Bamako**	**Cotonou**	**Lome**	**Abidjan**
OLS							
I	-0.221***	-0.309***	-0.251***	-0.128***	-0.164***	-0.240***	-0.253***
	(0.059)	*(0.056)*	*(0.048)*	*(0.040)*	*(0.052)*	*(0.041)*	*(0.043)*
I^2	0.033**	0.066***	0.064***	0.033***	0.041***	0.066***	0.064***
	(0.016)	*(0.011)*	*(0.012)*	*(0.009)*	*(0.013)*	*(0.010)*	*(0.010)*
Adjusted R^2	0.49	0.23	0.33	0.25	0.27	0.28	0.24
Obs.	2,230	2,745	3,492	2,906	3,236	2,857	2,842
Lee model							
I	-0.310***	-0.252***	-0.128***	-0.163***	-0.242***	-0.256***	-0.157***
	(0.053)	*(0.050)*	*(0.042)*	*(0.055)*	*(0.042)*	*(0.041)*	*(0.041)*
I^2	0.066***	0.065***	0.033***	0.041***	0.066***	0.064***	0.037***
	(0.011)	*(0.012)*	*(0.009)*	*(0.014)*	*(0.010)*	*(0.009)*	*(0.010)*
λ_h	0.055	-0.051	-0.019	-0.046	0.071	0.155**	0.182***
	(0.065)	*(0.069)*	*(0.055)*	*(0.055)*	*(0.057)*	*(0.072)*	*(0.064)*
Adjusted R^2	0.22	0.33	0.25	0.27	0.28	0.24	0.26
Lee model with correction for the endogeneity of vulnerability using the control function method							
I	-0.515***	-0.605***	-0.119	-0.561***	-0.278	-1.045***	-0.648***
	(0.184)	*(0.135)*	*(0.252)*	*(0.206)*	*(0.339)*	*(0.251)*	*(0.184)*
I^2	0.066***	0.065***	0.033***	0.041***	0.066***	0.064***	0.036***
	(0.010)	*(0.011)*	*(0.009)*	*(0.013)*	*(0.010)*	*(0.009)*	*(0.011)*
$\hat{\mu}$	0.206	0.358***	-0.009	0.401**	0.036	0.793***	0.500***
	(0.180)	*(0.127)*	*(0.250)*	*(0.200)*	*(0.337)*	*(0.247)*	*(0.183)*
λ_h	0.047	-0.063	-0.019	-0.053	0.070	0.088	0.157**
	(0.065)	*(0.065)*	*(0.060)*	*(0.060)*	*(0.056)*	*(0.076)*	*(0.064)*
Adjusted R2	0.22	0.33	0.25	0.27	0.28	0.24	0.26

Notes: The standard errors are bootstrapped (500 replications). Significance of the coefficients: *: at the 10% level; ** at the 5% level; *** at the 1% level.
The control variables are a dummy variable for gender, the number of years of successfully completed education), potential experience and seniority in the firm, religion, migratory status, marital status, and independent status. The selection identifying variables are the inverse of the dependency ratio, a dummy variable for whether the individual's father went to primary school and a dummy variable for whether the individual's head of household is a woman. The control function instruments are the status of the head of household and the institutional sector in which the interviewee's father worked.

Table 6: Correlations between the principal component analysis axes and the vulnerability criteria

	Axis 1	Axis 2	Axis 3	Axis 4
Dependent workers				
Correlations between the variables and the axes				
Contractual insecurity	**70.67*** **	09.58***	06.84***	05.74***
Adverse working conditions	**68.17*** **	-00.94	00.29	00.52
Casual labor	**53.24*** **	03.54***	**60.34*** **	03.28***
Unstable remuneration	**76.43*** **	-01.17	27.12***	-00.35
Visible underemployment	12.27***	03.76***	**89.04*** **	-02.10**
Working a second vulnerable job	02.86***	01.02	-01.27	**99.69*** **
Employment instability	00.20	**76.96*** **	-02.79***	-04.11***
Unwanted job	05.63***	**75.00*** **	10.33***	06.00***
Explained variance (%)	*22.19*	*14.53*	*14.33*	*12.52*
Independent workers				
Correlations between the variables and the axes				
Independent, no employees	00.39	-05.39***	**75.61*** **	-06.47***
Adverse working conditions	01.33*	26.99***	**70.27*** **	13.77***
Casual labor	03.03***	**74.95*** **	13.84***	01.59**
Unstable remuneration	-05.13***	**57.96*** **	-28.91***	04.24***
Visible underemployment	12.30***	**58.23*** **	28.13***	-20.60***
Working a second vulnerable job	01.29	-02.38***	00.74	**97.24*** **
Employment instability	**82.75*** **	-00.92	01.08	01.86**
Unwanted job	**82.55*** **	07.50***	02.52***	00.58
Explained variance (%)	*17.27*	*16.29*	*15.43*	*12.66*

Reading: For dependent workers, correlation between contractual insecurity and the first axis is equal to 70.67 and is significant at the 1% level. Also axis 1 is largely determined by this vulnerability criterion. To interpret the axes, we focus on variables whose correlations are far higher than the average correlation. Those variables' correlations are marked in bold characters.

Table 7: Effects of the vulnerability axes on earnings in the formal private sector (Lee model)

	Formal private sector						
	Niamey	**Ouagadougou**	**Dakar**	**Bamako**	**Cotonou**	**Lome**	**Abidjan**
Axis 1 - Dependent workers: Contractual insecurity, casual employment and adverse working conditions	-0.205*** *(0.034)*	-0.129*** *(0.043)*	-0.181*** *(0.023)*	-0.130*** *(0.045)*	-0.137*** *(0.037)*	-0.186*** *(0.062)*	-0.179*** *(0.030)*
Axis 2 - Dependent workers: Subsistence job	-0.067** *(0.030)*	0.006 *(0.030)*	-0.023 *(0.028)*	-0.070** *(0.029)*	-0.006 *(0.025)*	-0.018 *(0.035)*	-0.047*** *(0.017)*
Axis 3 - Dependent workers: Underemployment	0.121*** *(0.041)*	0.137*** *(0.037)*	0.031 *(0.021)*	0.079** *(0.037)*	0.183*** *(0.044)*	0.260*** *(0.064)*	0.127*** *(0.030)*
Axis 4 - Dependent workers: Working a second highly vulnerable job	-0.023 *(0.224)*	-0.070 *(0.210)*	0.003 *(0.026)*	-0.053 *(0.043)*	-0.033 *(0.023)*	0.051 *(0.037)*	-0.096 *(0.374)*
Axis 1 - Independent workers: Subsistence job	0.289 *(0.958)*	-0.273 *(24.789)*	-0.164 *(0.125)*	0.074 *(2.058)*	0.063 *(0.193)*	-0.142 *(0.278)*	-0.340 *(2.750)*
Axis 2 - Independent workers: Underemployment	0.048 *(0.196)*	0.266 *(0.199)*	-0.031 *(0.087)*	-0.317 *(0.288)*	0.353* *(0.182)*	0.170 *(1.229)*	-0.006 *(0.271)*
Axis 3 - Independent workers: No employees and adverse working conditions	-0.235 *(0.216)*	0.033 *(0.570)*	-0.103 *(0.121)*	-0.077 *(0.180)*	-0.279** *(0.119)*	0.068 *(1.387)*	-0.276 *(0.182)*
Axis 4 - Independent workers: Working a second highly vulnerable job	-0.026 *(0.753)*	-2.585 *(2.208)*	-0.138 *(0.491)*	-0.577 *(1.007)*	0.147 *(0.583)*	-1.275 *(2.316)*	-2.306** *(0.935)*
Selection correction	-0.400** *(0.185)*	0.196 *(0.216)*	0.048 *(0.164)*	0.475 *(0.306)*	0.046 *(0.163)*	-0.629 *(0.399)*	0.078 *(0.127)*
Observations	409	336	950	452	509	302	825
Adjusted R^2	0.53	0.55	0.40	0.37	0.41	0.44	0.51

Notes: The standard errors are bootstrapped (500 replications). Significance of the coefficients: * at the 10% level; ** at the 5% level; *** at the 1% level.
Axis i – Dependent workers, i=1 to 4, is equal to 0 for independent workers. Axis i – Independent workers, i=1 to 4, is equal to 0 for dependent workers.
The control variables are a dummy variable for gender, an education variable (number of years of successfully completed education), potential experience and seniority in the firm, religion, migratory status, marital status, and independent status (self-employed employer or own-account worker versus dependent worker).
The selection identifying variables are the inverse of the dependency ratio (number of employed workers to household size), a dummy variable for whether the individual's father went to primary school and a dummy variable for whether the individual's head of household is a woman.

Table 8: Effects of the vulnerability axes on earnings in the informal private sector (Lee model)

	Informal private sector						
	Niamey	**Ouagadougou**	**Dakar**	**Bamako**	**Cotonou**	**Lome**	**Abidjan**
Axis 1 - Dependent workers: Contractual insecurity, casual employment and adverse working conditions	-0.080*** *(0.026)*	-0.107*** *(0.023)*	-0.059*** *(0.020)*	-0.040 *(0.030)*	-0.064** *(0.029)*	-0.088*** *(0.030)*	-0.104*** *(0.023)*
Axis 2 - Dependent workers: Subsistence job	-0.019 *(0.028)*	0.018 *(0.035)*	-0.014 *(0.022)*	0.006 *(0.048)*	-0.006 *(0.035)*	-0.025 *(0.024)*	-0.019 *(0.020)*
Axis 3 - Dependent workers: Underemployment	0.164*** *(0.031)*	0.165*** *(0.026)*	0.161*** *(0.029)*	0.134*** *(0.033)*	0.078** *(0.031)*	0.168*** *(0.025)*	0.165*** *(0.024)*
Axis 4 - Dependent workers: Working a second highly vulnerable job	0.011 *(0.028)*	-0.027 *(0.022)*	-0.076 *(0.083)*	-0.028 *(0.022)*	-0.051*** *(0.015)*	-0.016 *(0.033)*	-0.010 *(0.022)*
Axis 1 - Independent workers: Subsistence job	-0.021 *(0.020)*	0.034* *(0.019)*	-0.009 *(0.024)*	-0.045** *(0.019)*	0.005 *(0.015)*	-0.003 *(0.012)*	-0.011 *(0.014)*
Axis 2 - Independent workers: Underemployment	0.062*** *(0.015)*	0.177*** *(0.020)*	0.084*** *(0.014)*	0.137*** *(0.022)*	0.177*** *(0.019)*	0.165*** *(0.020)*	0.195*** *(0.030)*
Axis 3 - Independent workers: No employees and adverse working conditions	-0.055*** *(0.019)*	-0.108*** *(0.018)*	-0.026 *(0.017)*	-0.083*** *(0.020)*	-0.079*** *(0.016)*	-0.089*** *(0.018)*	-0.098*** *(0.021)*
Axis 4 - Independent workers: Working a second highly vulnerable job	-0.050* *(0.029)*	-0.018 *(0.021)*	-0.082*** *(0.022)*	-0.052*** *(0.017)*	-0.040*** *(0.013)*	-0.050*** *(0.015)*	-0.112*** *(0.034)*
Selection correction	0.051 *(0.060)*	-0.021 *(0.060)*	0.004 *(0.056)*	-0.027 *(0.057)*	0.077 *(0.052)*	0.153** *(0.077)*	0.181*** *(0.064)*
Observations	2,230	2,745	3,492	2,906	3,236	2,857	2,842
Adjusted R^2	0.23	0.35	-0.26	0.29	0.30	0.26	0.28

Notes: The standard errors are bootstrapped (500 replications). Significance of the coefficients: *: at the 10% level; ** at the 5% level; *** at the 1% level.
Axis i – Dependent workers, i=1 to 4, is equal to 0 for independent workers. Axis i – Independent workers, i=1 to 4, is equal to 0 for dependent workers.
The control variables are a dummy variable for gender, an education variable (number of years of successfully completed education), potential experience and seniority in the firm, religion, migratory status, marital status, and independent status (self-employed employer or own-account worker versus dependent worker).
The selection identifying variables are the inverse of the dependency ratio (number of employed workers to household size), a dummy variable for whether the individual's father went to primary school and a dummy variable for whether the individual's head of household is a woman drawn between 1 and 2.

Chart 1a: Average income by vulnerability intensity

(Formal private sector)

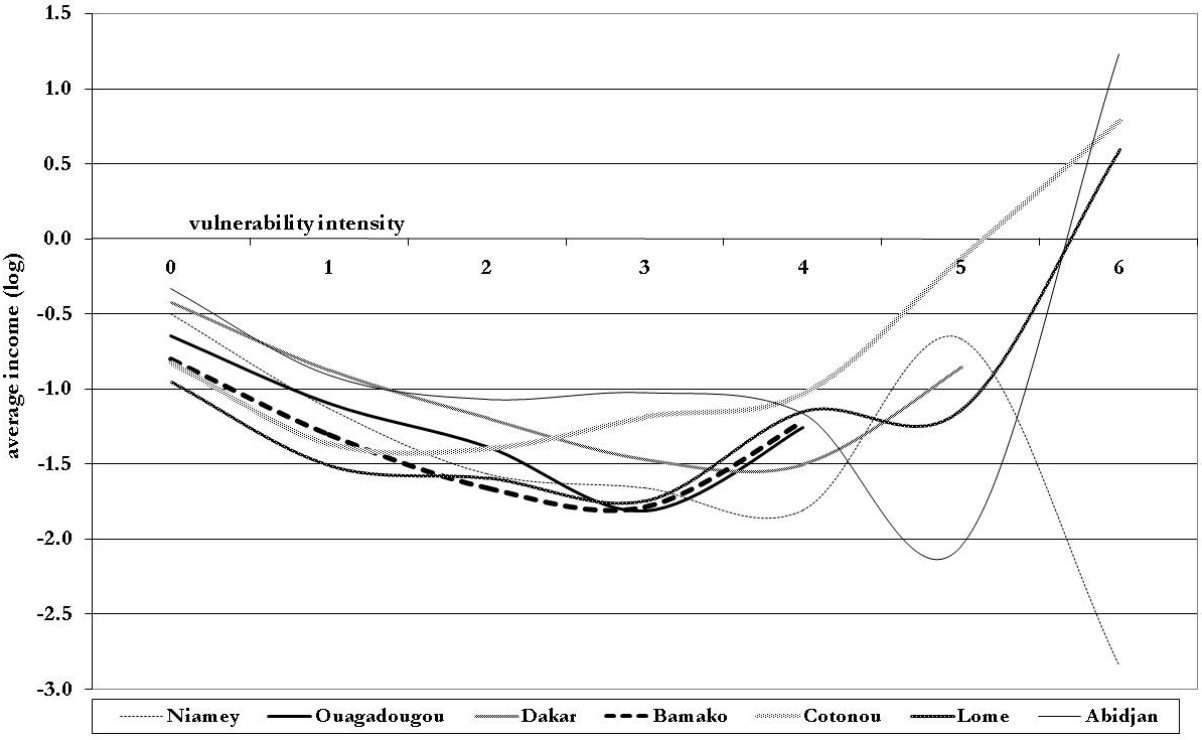

Chart 1b: Average income by vulnerability intensity

(Informal sector)

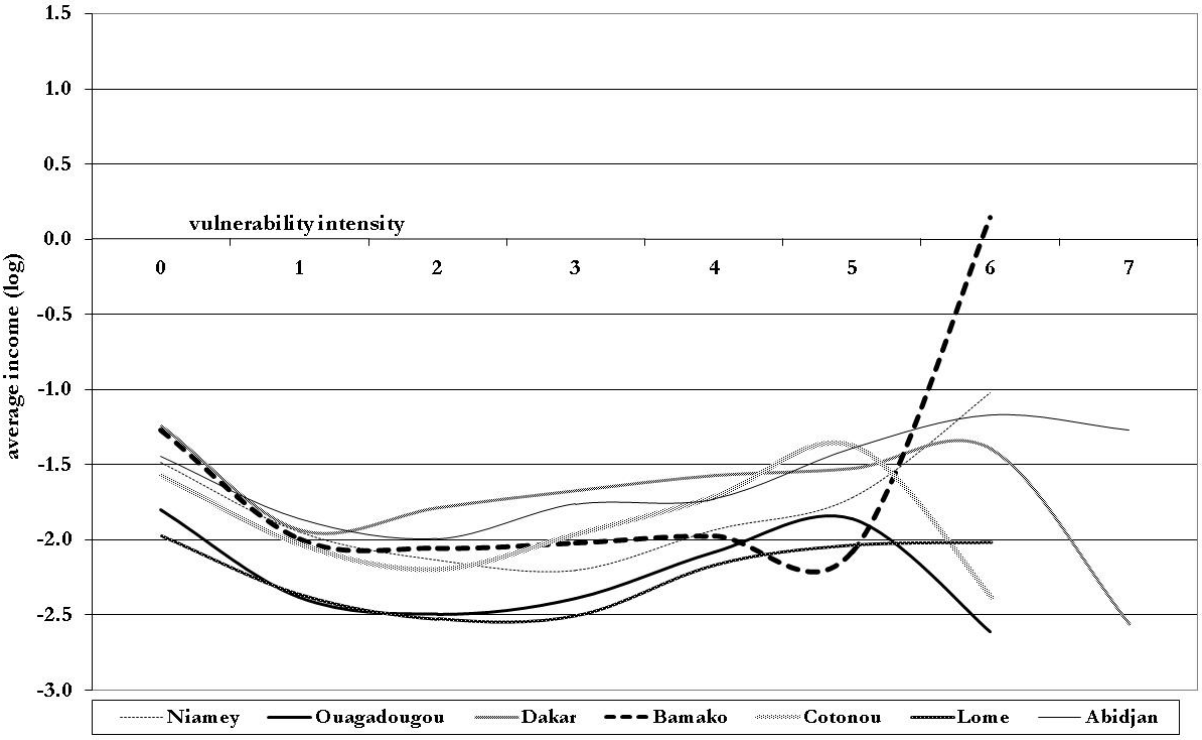

Chart 2a: Average predicted income (Lee model with endogenous vulnerability) by vulnerability intensity (formal private sector)

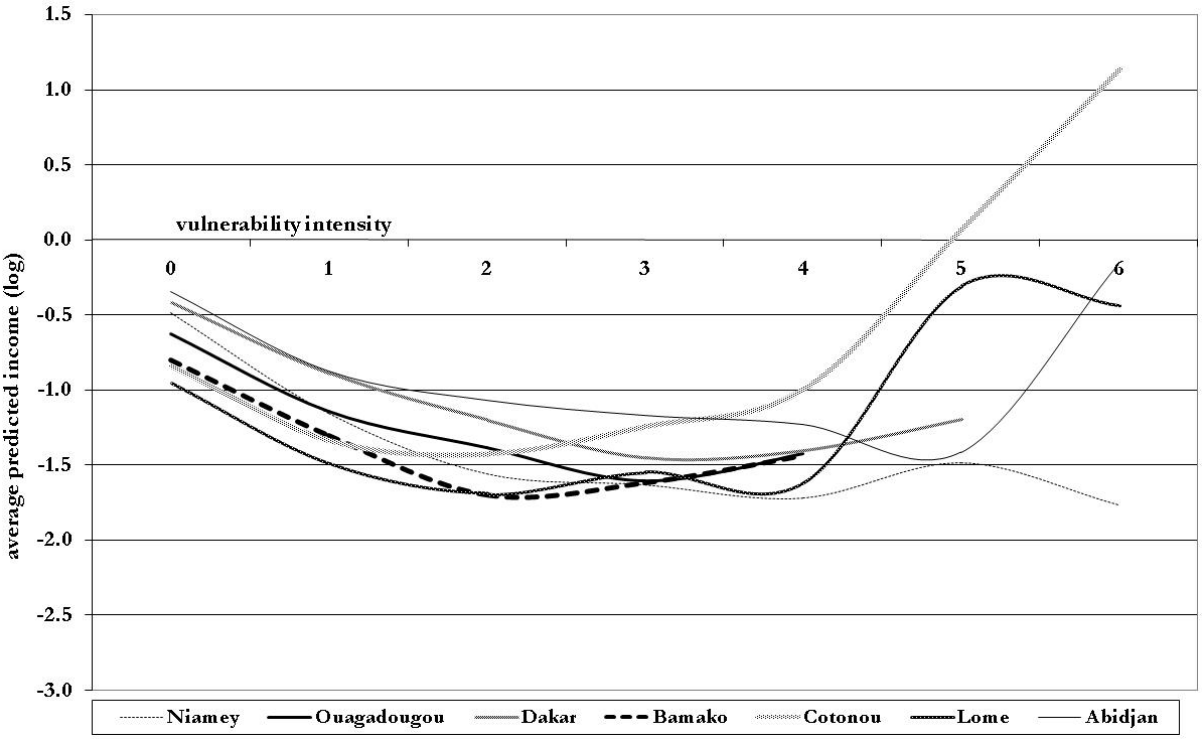

Chart 2b: Average predicted income (Lee model with endogenous vulnerability) by vulnerability intensity (informal private sector)

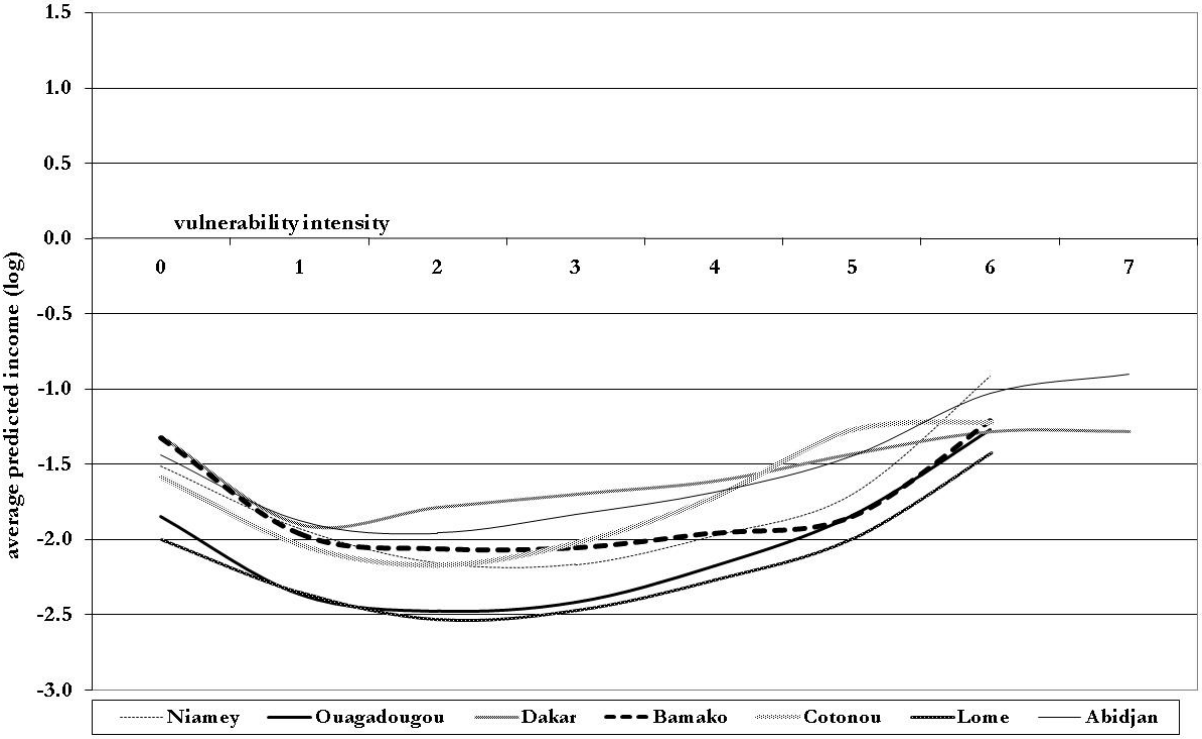

Chart 3a: Marginal effect of vulnerability on income by decile

(Formal private sector)

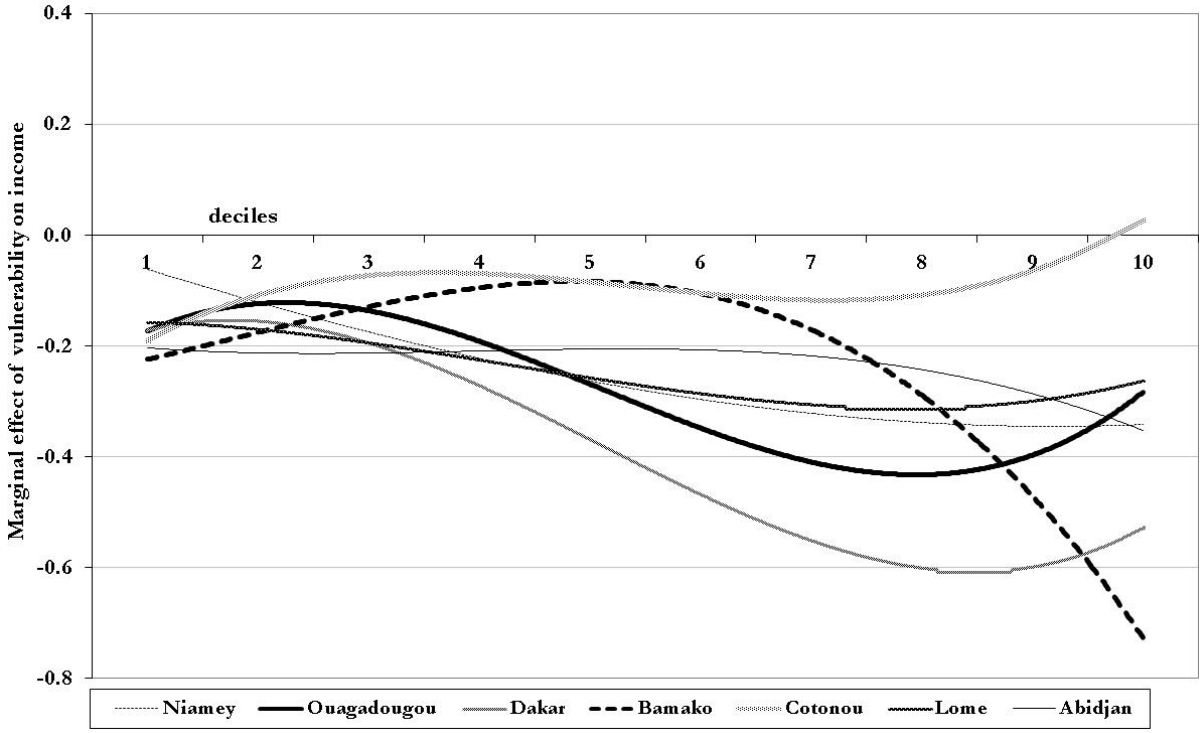

Chart 3b: Marginal effect of vulnerability on income by decile

(Informal private sector)