NOT SO HAPPY WITH VULNERABILITY: PANEL EVIDENCE FROM URBAN GHANA ON THE EFFECT OF INCOME VULNERABILITY ON LIFE SATISFACTION*

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Abstract

We explore the *missing link* between vulnerability to poverty and happiness in the context of urban Ghana. Using panel data, we estimate an individual measure of vulnerability and investigate its effect on happiness. After controlling for unobservable individual fixed effects, work-satisfaction, relative income and other relevant worker characteristics, we find a sizeable impact of vulnerability, 3 to 10 times higher than the income effect. Further, we find that while aspiration adaptation to current income may be driving a transitory income effect, there is no evidence of the vulnerability effect being transitory and due to adaptation of aspirations to current vulnerability levels. Instead, using a direct measure of attitudes to risk from field-experiments, we find support for the hypothesis that vulnerability impacts happiness through agents' risk-aversion. Our findings support policy interventions that aim to reduce vulnerability, as we expect such policies to have a 'direct' impact on agents' happiness. Moreover, our results suggests that non-Rawlsian growth models, whereby "someone is left behind", may fail to enhance general welfare, for high enough levels of risk-aversion in the population, if the risk of falling behind is sufficiently widespread.

JEL codes: I30, O12, C93

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1 Introduction

THE STUDY OF HAPPINESS and of the mechanisms that generate it has been increasingly attracting the attention of economists in recent years. Partly due to wider availability of survey data that provide "direct" measures of life-satisfaction, many researchers have explored the link between pecuniary and non-pecuniary aspects of life and people's happiness.

Particular efforts have been dedicated to investigate the link between income and life-satisfaction. An established result in the existing literature is that such link exists at a cross-sectional level, where richer people are generally observed to report higher levels of happines, but is not found in aggregate time-series, where generalised income gains fail to deliver generalised improvements in life-satisfaction. This body of work is particularly valuable as it directly tests the important economic tenet according to which income is closely linked to well-being. Since welfare goes well beyond material wealth, measuring life satisfaction and documenting such link is a step towards strengthening the foundations of economic analysis. However, if the connection between happiness and income has been heavily researched, the one between happiness and income-vulnerability is still unexplored to the best of our knowledge. This is partly due to the challenges of estimating the probability distribution of income. At the same time, it appears to be a very important area of research, especially in developing countries, where the lack of formal insurance often leaves workers exposed to severe income shocks that may have dramatic impact on their welfare. In particular, we may expect that being 'vulnerabile' should have a direct impact on utility and ultimately on life-satisfaction, *over and above* any income effect. The main object of this paper is to investigate this *missing* link.

Our approach builds on the work of Chaudhuri, Jalan, and Suryahadi (2002), who propose a methodology to construct a measure of vulnerability based on income variation at the level of the individual. We construct this measure using data from the Ghana Household Urban Panel Survey (a long panel collected by the Centre for the Study of African Economies be-

tween 2004 and 2008) and study its relationship with life-satisfaction. Given the length of our panel, which is rather uncommon in developing countries, we are able to perform our estimation controlling for individual fixed effects and we are able to explore a number of hypotheses on the role of work-conditions, relative-income, adaptive expectations and risk-aversion in the shaping of one's happiness. In particular, we use an *experimental measure of risk-aversion* to document the interaction between vulnerability to poverty and attitudes to risk in the generation of happiness.

Aside our sheer scientific interest in documenting a potentially important and so far overlooked mechanism, the results of this analysis bear important policy implications. Uncovering whether income vulnerability has a direct impact on people's life-satisfaction will help motivate policy interventions whose aim is to reduce people's exposure to risk. If Ghanaians directly suffer from being exposed to downside risks, non-Rawlsian models of growth where "someone is left behind" may fail to enhance general welfare if the risk of "falling behind" is high enough and sufficiently widespread among the population.

The paper is structured as follows. In Section 2 we briefly outline the existing empirical literature on life-satisfaction, with the aim to motivate the main hypotheses we set out to test. Section 3 presents our dataset and reports descriptive statistics for the variables of interest, including our experimental measure of risk-aversion. In Section 4 we outline our empirical strategy in two steps. First, we explain the methodology to estimate income vulnerability; second, we outline our happiness model and how it changes according to the hypothesis we are aiming to test. In Section 5 we present our results. Section 6 concludes.

2 Related literature

There now exists a substantial literatures that explores the covariates of life satisfaction, in both developed and developing countries. Both pecuniary and non-pecuniary factors have

been explored. Among the latter, health, marriage, unemployment and institutional arrangements have received particular attention (Layard, 2005; Frey and Stutzer, 2002). Among the former, the literature has focused with particular emphasis on the role of income. The question of whether income matters for happiness, in fact, has been inspiring social and economic research for a long time (Powdthavee, 2010; Blanchflower and Oswald, 2002).

Two separate stylized facts, with opposing prima facie interpretation, have shaped the modern debate. First, cross-sectional studies almost always report a positive correlation between income and life satisfaction (Frey and Stutzer, 2002). De Neve and Cooper (1998), for example, summarizing 85 independent studies on the subject quote a mean positive correlation coefficient of about 0.17. Second, aggregate life satisfaction time series for rich, growing economies tend to be fairly flat (Easterlin, 1995; Blanchflower and Oswald, 2002; Layard, 2005). If, at one point in time, richer individuals tend to be more satisfied with their lives, why do generalized income gains fail to deliver improvements in generalized life satisfaction?

Increases in income may also be associated with time-varying omitted variables, for example more stressful working conditions or less leisure (Powdthavee, 2010). Cassar (2010) presents evidence for both procedural preferences and lack of facilities determining Chilean's workers job-satisfaction, findings that had been previously established for workers in developed economies (Blanchflower, 2000). Hence it is not surprising that when income is instrumented, IV and FE-IV estimates are larger than OLS (Powdthavee, 2010; Knight, 2008), although, clearly, the validity of the instruments for income is an issue. In general, the question of time-varying omitted variables is an important one the researcher has to confront

A second possibility to explain the two stylized facts mentioned above is to invoke a model whereby life satisfaction is determined by the the gap between realized and endogenously

determined aspired income. Income aspirations can be formed by comparison with a relevant reference group, or with own past or current levels of income (Easterlin, 2001; Frey and Stutzer, 2002). At a given point in time, a rise in income will reduce the "aspiration gap" between actual and desired income and it will hence have a positive effect on life satisfaction. But this effect will not be long lasting- and hence it will fail to show in time series of aggregated life satisfaction- if the desired level of income will soon increase due to adaptation to current income levels or if the mean income of the reference group is also increasing. Evidence for adaptation to current income has been presented by Di Tella, Haisken-De New, and MacCulloch (2007) for Germany and by Knight (2008) for China. In particular, Di Tella, Haisken-De New, and MacCulloch (2007) argue that *"the size of adaptation is sufficiently large that no significant income effects on happiness remain after the fourth year" (pp.2-3)*. Similarly, evidence on the importance of relative income to life satisfaction has been presented both for developed (Blanchflower and Oswald, 2002; Luttmer, 2005) and developing (Kingdon and Knight, 2004) countries.

To the best of our knowledge, the effect on life satisfaction of the uncertainty and downside risk associated with future outcomes, and in particular income, has not yet been explored. This is perhaps not surprising, given the difficulties of estimating the probability distribution of stochastic outcomes. Nevertheless, it stands out as an important area for research, especially in a developing country context, given what we know about the high variability of income of poor people; the widespread preference for less risky and loss-safe outcomes and the importance that risk and vulnerability have in determining a number of livelihood, technology and asset holding choices. Let us look at these three issues in turn.

First, the poor in developing countries face substantial risk, especially income risk (Fafchamps, 2009). The increasing availability of panel data for developing countries has showed researchers widespread idiosyncratic income variability and substantial movement across time of the same households in and out of income poverty (Dercon, 2004). Evidence for

substantial downside risk has been collected in a number of papers showing persistent income effects following shocks (Dercon, Hoddinott, and Woldehanna, 2005).

Second, there exists extensive evidence on the importance of risk and loss aversion, that is aversion to downside risk, among the poor in developing countries. Binswanger (1980) pioneering field experiments with Indian farmers first documented risk aversion among the poor in a developing country. Liu (2008), Falco (2010) and Caria (2009) present recent evidence of (surprisingly similar levels) of risk aversion among rural Chinese and both urban and rural Ghanaians. Bellemare, Barrett, and Just (2009) estimate price risk aversion for Ethiopian farmers and argue that farmers would be willing to pay a substantial amount of their income in order to stabilize prices at their mean level. Liu (2008) also experimentally documents loss aversion. Tversky (1991) and Fafchamps (2009) argue that individual preferences are more driven by loss than risk aversion.

Finally, risk and downside risk have been shown to influence livelihood strategies, technology adoption and asset holding strategies. Dercon (1996) shows how Tanzanian farmers with less protection against shocks prefer to plant drought resistant crops. Dercon and Christiaensen (2007) find evidence, again in Tanzania, of consumption risk discouraging technology adoption. Rosenzweig and Binswanger (2003) provide evidence for Indian farmers that the composition of productive and non productive asset holdings varies with idiosyncratic weather risk. Fafchamps (2009, 2003) provides a summary of the literature and some further insights.

Holzmann and Jorgensen (2000) and Chaudhuri, Jalan, and Suryahadi (2002) make good normative and instrumental cases for considering vulnerability reduction, and in particular, the promotion of comprehensive safety nets, as a priority for development policy.

3 The Data

The Ghana Urban Household Panel Survey ('GUHPS') has been conducted by the Centre for the Study of African Economies in the cities of Accra, Kumasi, Takoradi and Cape-Coast since 2004. It has run annually since then and it now spans six years.[1] Panel datasets of this duration are unusual in developing countries, and are particularly uncommon for Africa.

A module on subjective well-being was added to the questionnaire in 2005 and it was administered in every subsequent wave with the exception of 2007. Comparable information on respondents' "happiness" is therefore available for the years 2005, 2006, 2008 and 2009. The questions that compose the module were designed to be in line with the existing literature on subjective well-being. For the purpose of this analysis, we will focus on the answers to the following two questions: (a) *"All things considered, how satisfied are you with your life as a whole these days?"* (b) *"All things considered, how satisfied are you with your current work?"*

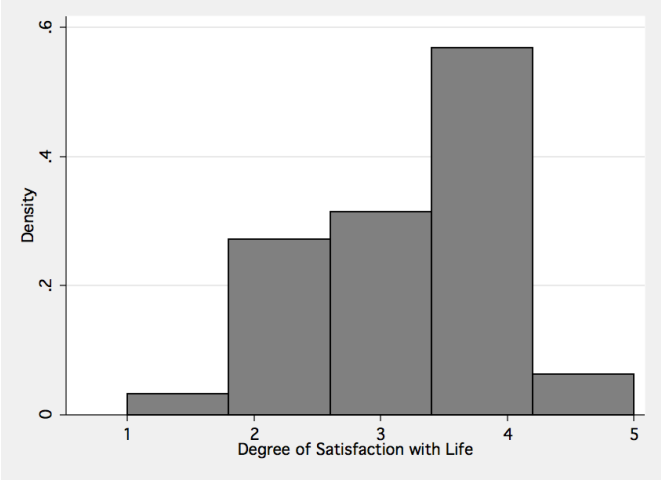
In both cases, the options given to respondents were: *"1.Very Dissatisfied, 2. Dissatisfied, 3. Neither Satisfied Nor Dissatisfied, 4. Satisfied, 5. Very Satisfied"*. Figure 1 depicts the distribution of answers. Responses appear to be skewed towards positive values. For our quantitative analysis, we attribute numerical values on a scale from 1 to 5 to these answers, where 1 corresponds to "Very Dissatisfied" and 5 to "Very Satisfied".

A selection of key summary statistics for the GUHPS dataset is presented in Table 4 (in the Empirical Appendix), where we pool the 4 waves that contain life-satisfaction data and we restrict the sample to include only the observations that will be used in the regression analysis.[2]

[1] There was one exception: the survey was not conducted in 2007, but information for that year was collected in 2008 as a 'recall' questionnaire. However, due to the low reliability of retrospective questions on subjective well-being, the happiness module was not part of this recall questionnaire.

[2] Our analysis will focus on paid workers, for whom income is observed and for whom we are able to construct a measure of income vulnerability. Workers who are unemployed, unpaid or out of the labour force are excluded.

Figure 1: Distribution of Life-Satisfaction

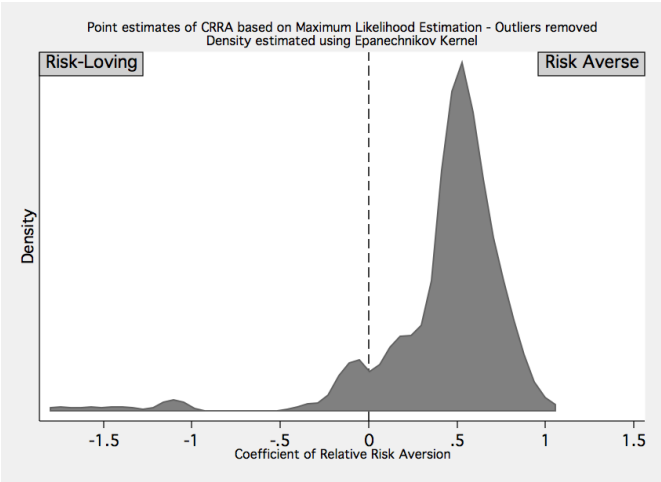


Finally, our paper makes use of an experimental data component that distinguishes the GUHPS panel from most available household data-sets from both developed and developing countries. In 2007, a random sub-sample of GUHPS respondents was invited to participate in a behavioural experiment designed to elicit their attitudes to risk. The experiment, designed by Dr Abigail Barr, consisted of 21 choices between pairs of monetary lotteries. Each 'game' was framed as a choice between two opaque urns containing marbles of different colours (and, correspondingly, different monetary values).[3] After being shown the composition of each urn, respondents were asked to choose the one from which they would prefer to draw a marble. Prior to making their choices, they were informed that at the end of the game one of their 21 preferred lotteries would be randomly selected and played out. The winnings of that game would then be paid to the respondent. Monetary incentives of this kind are used to induce truthful revelation of preferences. Following the same procedure as in Falco (2010) we use this data to estimate a choice model based on an underlying utility function (assumed CRRA) using maximum likelihood techniques. This allows us to obtain an estimate of the individual coefficients of risk-aversion that best fit the individual series of 21 choices. Details on the estimation procedure are further outlined

[3] A detailed description of the experimental setup is contained in (Barr, 2007). "Attitudes to Risk in Ghana: Field Manual." Unpublished.

in Harrison (2008) and Falco (2010). Figure 2 shows the distribution of estimated coefficients of relative risk-aversion. Values below 0 indicate risk-loving behaviour, while values between 0 and 1 indicate moderate risk-aversion. These estimates are comparable to the results obtained by similar studies both in Ghana (Caria, 2009) and elsewhere (e.g. Liu (2008) on China)

Figure 2: Distribution of Risk-Aversion



4 Empirical methodology

4.1 Constructing a vulnerability indicator

We define the income vulnerability of a household as the probability that the household's income will fall below the poverty line in the next period. Let ν_{it} be the inverse of vulnerability, that is, i's likelihood at t of not being poor at $t+1$:

$$\nu_{it} = Pr(lny_{i,t+1} > lnz) \tag{1}$$

where lny_{it} is the log of income at time t and z is the poverty threshold.

We assume lny_{it} is generated by the following process.:

$$lny_{it} = \delta X_{it} + e_{it} \tag{2}$$

where X_{it} is a bundle of observable characteristics and e_{it} is a stochastic component. We assume the variance of e_{it} is also a function of worker and household characteristics:

$$\sigma_{it}^2 = \theta K_{it} \tag{3}$$

Consistent estimates of δ and θ can be obtained with a three-step feasible generalized least squares estimator (FGLS), which is described in detail in Chaudhuri, Jalan, and Suryahadi (2002). Here, we summarise the procedure. First we estimate equation (2) using simple OLS (we fit an OLS-estimated equation for each year we are interested in). We then use the residuals - $\hat{e}_{it}^2$ - from the OLS estimation of (2) as the dependent variable of a new regression:

$$\hat{e}_{it}^2 = \theta K_{it} + \eta_{it} \tag{4}$$

We can thus obtain predicted values for the variance of income - $\hat{\theta} K_{it}$ and use them to adjust equation (4) as follows:

$$\frac{\hat{e}_{it}^2}{\hat{\theta} K_{it}} = \frac{\theta K_{it}}{\hat{\theta} K_{it}} + \frac{\eta_{it}}{\hat{\theta} K_{it}} \tag{5}$$

From this adjusted equation, Chaudury (2002) shows that we can estimate the asymptotically efficient FGLS estimator - $\hat{\theta}_{FGLS}$. The next step is to obtain a consistent prediction for the variance of income, $\hat{\sigma}^2 = (\hat{\theta}_{FGLS} K_{it})$ and use it to adjust equation (2):

$$\frac{lny_{it}}{\hat{\sigma}^2} = \frac{\delta X_{it}}{\hat{\sigma}^2} + \frac{e_{it}}{\hat{\sigma}^2} \tag{6}$$

which delivers $\hat{\delta}_{FGLS}$.

Having obtained asymptotically efficient estimates of δ and θ, we can now obtain consistent predictions for the first two moments of the income distribution:

$$E(lny_{it}|X_i t) = \hat{\delta} X_{it} \tag{7}$$

$$V(lny_{it}|K_i t) = \hat{\theta} K_{it} \tag{8}$$

Assuming income to be (log)normally distributed and Φ to be the cumulative distribution function of the log normal distribution, we can then calculate the vulnerability variable:

$$\nu_{it} = Pr(lny_{it} > lnz|X_{it,}K_{it}, \hat{\delta}, \hat{\theta}) = 1 - \Phi[\frac{lnz - \hat{\delta} X_{it}}{\hat{\theta} K_{it}}] \tag{9}$$

4.2 Empirical model of happiness

The following equation describes our empirical model of happiness:

$$h_{it} = \alpha_{it} + \beta lny_{it} + \gamma ln\nu_{it} + \delta Z_{it} + e_{it} \tag{10}$$

where h_{it} is an individual's level of life satisfaction, lny_{it} and $ln\nu_{it}$ are the logs of income and (the opposite of) income vulnerability respectively; Z_{it} is a vector of worker characteristics that are expected to be correlated with life-satisfaction. Our main hypothesis is that β and γ are positive: *increasing income and decreasing vulnerability enhances life satisfaction*. In order to test it, however, we will have to overcome a number of econometric issues

that complicate identification of β and γ.

First, a number of both time-varying and time-invariant determinants of happiness may be correlated with income and vulnerability. If omitted from the analysis, those variables will bias our estimates. Among the time-invariant factors, one can think of *personality traits* or endowments of *social and human capital*, which may have a direct impact on life-satisfaction. More extroverted and optimistic individuals, for instance, may be both 'naturally' satisfied with their life and more likely to find good, secure employment. The same may hold for educated or well-connected people. Among the time varying unobservables, *working conditions* are a first, obvious source of bias. Powdthavee (2010) argues that income gains are often correlated with deterioration in the conditions of work and the latter may have an important influence on life satisfaction. Vulnerability might also be correlated with working conditions, though we have no strong a-priori evidence of the sign of such correlation. *Relative income* is a third potentially confounding factor. Extensive empirical evidence has been generated showing that relative income is correlated with the life satisfaction of individuals in both developed and developing countries (Blanchflower and Oswald, 2002; Luttmer, 2005; Kingdon and Knight, 2004) and it is natural to assume that relative income will be correlated with absolute income and vulnerability.
In addition to controlling for unobserved fixed effects by means of *within group* and *first-difference* estimators, our empirical model will include controls for working-conditions (proxied by a measure of satisfaction with work) and for a worker's position in the income distribution.

Second, *aspirations* may play an important role in the generation of happiness. In particular, aspirations may adapt to current conditions rapidly enough to reduce mid-run life satisfaction effects of income or vulnerability gains (Easterlin, 2001; Frey and Stutzer, 2002). If individuals have adaptive income aspirations that are relevant to life-satisfaction (i.e. distance from an 'desired' level of income drives their happiness), we would expect past

income to negatively influence current happiness once current income is controlled for. A higher level of past income would in fact raise income aspirations and hence, ceteris paribus, *reduce* life-satisfaction for a given level of current income. Furthermore, we may expect past income to *increase* the effect of vulnerability on life satisfaction if individuals with higher income aspirations are more concerned with the prospect of future income poverty. Similarly, if individuals have adaptive vulnerability aspirations relevant to life satisfaction, we would expect low past vulnerability to reduce current happiness.

In our dataset, we observe roughly contemporaneous realizations of income, vulnerability and life satisfaction. Restricting the analysis to such contemporaneous outcomes will be misleading if the effect of those variables is limited to a short period of time, after which the individual 'adapts' her aspirations to her new conditions and reverts to her initial level of happiness. It may also be misleading if happiness responds to changes in income and vulnerability with a lag. In order to address these issues, we include lagged income and vulnerability in our model, as well as the interaction between lagged income and current vulnerability:

$$h_{it} = \alpha_{it} + \beta ln y_{it} + \gamma ln \nu_{it} + \beta'' L.ln y_{it} + \gamma'' L.ln \nu_{it} + \lambda (L.ln y_{it} * ln \nu_{it}) + \delta X_i t + e_{it} \quad (11)$$

Under the adaptive income aspirations hypothesis, we would expect β'' to be negative and λ to be positive. Under the adaptive vulnerability aspirations hypothesis, we would expect γ'' to be negative.

Our third methodological problem is that life-satisfaction is recorded as a categorical variable. Modeling it as a discrete (ordered) outcome would, therefore, appear to be the most appropriate approach. However, such approach would not easily lend itself to controlling for those time invariant unobservables that we have argued are of great relevance in the determination of life satisfaction. To address this issue Ferrer-i Carbonell and Frijters (2004) develop a conditional estimator for the fixed effects logit model. Their findings show that

"it makes virtually no difference whether one assumes ordinality or cardinality of happiness answers, whilst allowing for fixed effects does change results substantially" (Ferrer-i Carbonell and Frijters, 2004). We hence feel justified in assuming cardinality for our life satisfaction indicator and in using the corresponding estimators.

Fourth, issues of reverse causality may arise in the analysis. High levels of life satisfaction may help individuals earn higher incomes or reduce their income vulnerability. Such effects may again bias the estimated coefficients β and γ.
In order to fully address this problem, we would be required to specify an FE-IV regression approach. However, our vulnerability variable has already been constructed through manipulation of the predicted values of an earning function and it would hence not be advisable to instrument it. Furthermore, doubts are often raised about the validity of the instruments proposed by the authors who have attempted the IV or FE-IV approach for income such as Knight (2008); Powdthavee (2010). Hence, we do not attempt to instrument vulnerability.

As the last step in our analysis, we explore the interactions between vulnerability and attitudes to risk in generating happiness. Ceteris paribus, we would expect more risk averse people to experience lower life satisfaction when faced with a higher likelihood of poverty in the future. In order to explore this question, we augment the model as follows:

$$h_{it} = \alpha_{it} + \beta ln y_{it} + \gamma ln \nu_{it} + \rho(ln \nu_{it} * r_i) + \delta X_i t + e_{it} \tag{12}$$

where r_i is the experimental measure of risk-aversion described above. We estimate (12) using FE and first differences. If vulnerability is indeed affecting happiness through risk-aversion we would expect ρ to be positive.[4]

[4] Throughout the analysis, we will treat risk-aversion as a time-invariant individual characteristic that is innate or acquired early in life. Evidence for this hypothesis exists, but we are aware of the potentially important issues of reverse causality (from vulnerability to risk-attitudes) that may confound our results. Data-limitations hinder our current ability to deal with this issue, which will receive further attention in our future research, as new experimental data becomes available.

5 Results

5.1 Vulnerability

Detailed results from the four estimation steps described above are presented in the empirical appendix. It should first be highlighted that while earnings regressions (Step 1 and 3) show a relatively high predictive power, trying to predict the variance of earnings proves to be a much more challenging exercise. This is to be expected, given that part of what appears to be true variation in earnings may in fact be due to random measurement error. Second, we should briefly comment on our choice of regressors. The components of X_{it} (earnings determinants) are grounded in the long-established literature on mincerian earnings regressions (see Rankin, Sandefur, and Teal (2010) for an application on Ghana using the GHUPS dataset). In addition, we identify two worker characteristics that we believe should drive the degree of variation in their earnings *over and above* their average income, hence allowing us to identify income variation (adding those variables to X_{it}, we obtain our vector K_{it}). The first one is *ethnicity*, following the idea that social networks provide an important buffer against negative shocks and can 'insulate' one's earnings through several channels (e.g. informal lending to cover variable business costs). The strength of one's network largely depends on his family ties, which in the african context are highly intertwined with tribal and ethnic background. Second, we include respondents' *marital status* in the variance model since we have several reasons to believe that being married will change the degree of income uncertainty a person faces. For instance, forming a family is likely to changes the risk-management strategies of income earners as they become responsible for a larger group of people.

Figure 3 and 4 below plot the cumulative distribution of the estimated levels of vulnerability by poverty status and by quarter of the income distribution. We set the poverty line,

z, at approximately 45 USD per month in 2006.[5] Vulnerability is obviously lower among the currently non-poor, but still considerable, indicating that the risk of falling into poverty between periods is widespread across the labour market (50% of the currently poor face a likelihood of 50% or higher to be poor next period; the same level of risk is faced by approximately 20% of the currently non-poor).

Figure 3: Vulnerability and Poverty

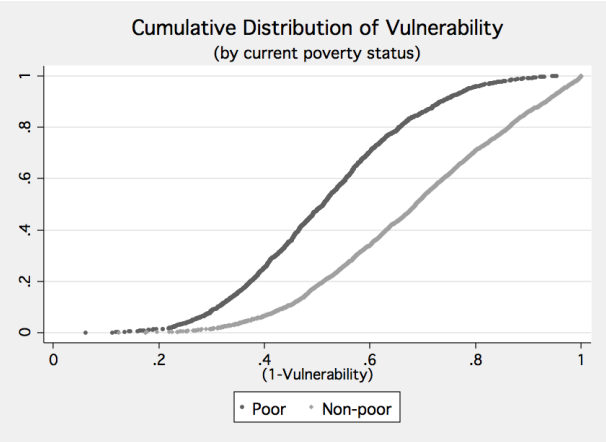
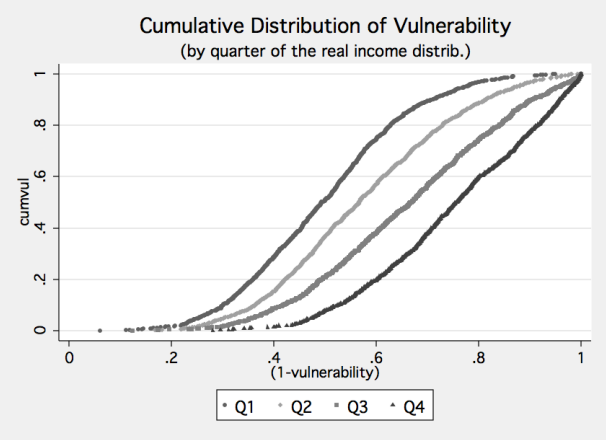


Figure 4: Vulnerability and Income



[5] To be precise, since our entire analysis is conducted in terms of real income, we set z equal to 10 Cedis per month in 1997 (the base year of our deflator series). This amounts to approximately 42.5, 45.3, 55.01, 47.6 9 (nominal) USD in 2005, 2006, 2008 and 2009 respectively. Due to a lack of reliable inflation data at the time of our first draft, the rate of urban inflation between 2008 and 2009 is assumed to be the same as between 2007 and 2008. The data will shortly be updated to reflect new deflator series, though our results should be largely unaffected.

5.2 Happiness

Moving on to analyse the determinants of life-satisfaction, we begin by plotting the same histogram of happiness responses we presented above after splitting the sample by poverty and estimated vulnerability. Figure 5 shows prima-facie evidence for the link between poverty and happiness, with people who are above the poverty line more likely to report to be "satisfied" with their life. There also appears to exist a negative relationship between happiness and income vulnerability. This is evidenced in figure 6, where we plot the histogram of happiness for each quarter of (the opposite of) the vulnerability distribution. These raw findings are the starting point of our analysis.

Figure 5: Happiness and Poverty

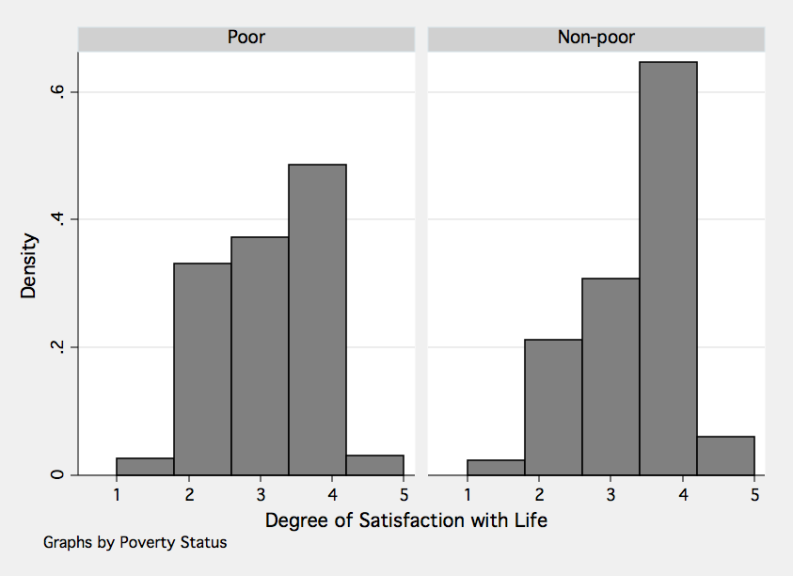
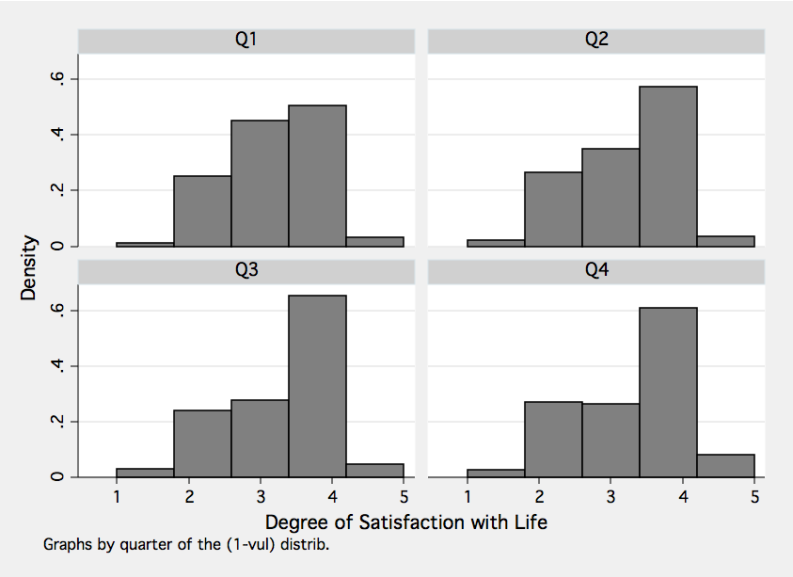


Table 1 reports the results from estimating our basic happiness model (equation 10) using first OLS (col 1-2) and then controlling for fixed effects by means of a 'Within Group' (col 3-4) and a 'First Difference' transformation (col 5-6).

Our first result is a positive and significant effect of absolute income on life-satisfaction, in line with the existing literature (De Neve and Cooper, 1998). This relationship is evident in OLS and, rather strikingly, it does not change significantly once we control for fixed

Figure 6: Happiness and Vulnerability



effects. It appears, therefore, that time-invariant unobservables correlated with earnings are not confounding the effect of income on happiness. This constitutes evidence against the hypothesis that individuals who are 'naturally' more positive and optimistic (and hence tend to be 'naturally happier') tend to achieve higher earnings. Interestingly, the size of the estimated coefficient on the log of income under WG - 0.017- is remarkably close to that estimated by Powdthavee (2010) using data from the Britsh Households Panel Survey and a fixed-effect estimator- 0.019.

On the other hand, individual fixed effects appear to play a crucial role in the relationship between vulnerability and life-satisfaction. Our most important finding is a strong negative effect of vulnerability *over and above* the income effect (notice that in the regression tables this is reported as a positive relationship between the *opposite of vulnerability* and happiness). Such effect is absent in OLS, where we record an insignificant coefficient of negative sign, but it becomes strong and significant once fixed effects are controlled for. This is a clear indication that unobserved time-invariant worker characteristics that drive life-satisfaction are also playing a role in determining vulnerability. Natural inclination for

happiness makes it more likely for a person to find a secure job or, alternatively, to manage his/her work in a way that minimises his/her vulnerability. It should be remarked how the estimated effect of vulnerability grows larger as we move from the WG to the FD estimator. This is at least partly due to the well known downward bias that affects WG estimators (the well-known 'Nickell Bias', see Nickell (1981)). However, the fact that both estimation strategies deliver a considerably large and significant vulnerability effect is a per se important indication that vulnerability plays an important role in driving happiness. The size of this effect is remarkable. In the FD model, the coefficient on vulnerability is *ten times* higher than the one on income. The downside risk of low future income seems to be stinkingly more relevant to the determination of life satisfaction for urban Ghanaians than the level of current income.

Our estimation includes controls for work satisfaction (proxying changes in working conditions), income quartile, age and its square and marital status. Work satisfaction is closely correlated with life satisfaction and shows by far the biggest positive coefficient in the life satisfaction regression. On the other hand, the income quartile the respondent belongs to does not show a significant effect (see Col 2,4 and 6 in Table 1).[6] Furthermore, absolute income remains a significant driver of happiness and the strong role of vulnerability changes negligibly. The result suggests that it is not a respondent's rank in the income distribution, but rather his/her level of earnings what really matters for life-satisfaction. This contradicts some of the established evidence on the role of relative income for life satisfaction. However, it should be remarked that the relevant reference group may be a subset of the whole sample of individuals we observe. Urban Ghanaians may compare their income to that of people in the same neighborhood, social class or ethnicity. If so, the position in the overall distribution may not matter significantly.

We next return to the entire sample and estimate our WG-model with lagged income and

[6] In addition to what is reported in the table, we experimented with finer quantile disaggregation (quintiles and deciles) and the main results outlined above do not change

vulnerability. Our purpose is to test whether mechanisms of income or vulnerability aspiration adaption can explain previous findings. Table 2 reports our results. First, we discard the hypothesis of adapting vulnerability aspirations as the coefficient on lagged vulnerability is never of the expected sign (negative) nor significant. On the other hand, we observe a negative and significant effect of lagged income. Third, the interaction between past income and current vulnerability is not significant (col 3). Our evidence supports the income adaptation hypothesis- a negative effect of lagged income on life satisfaction- while our strong estimated effect of vulnerability does not appear to be based on an aspiration mechanism.

What drives the vulnerability effect? A credible hypothesis is that risk aversion plays a crucial role in generating happiness. If that was true, we would expect that for positive values of risk-aversion, higher income-uncertainty should be conducive to lower life-satisfaction. Prima-facie evidence for this mechanism is the estimated distribution of risk-aversion coefficients reported in figure 2, where the large majority of our sample appeared to be in the range of positive risk-aversion values. By including an interaction term between risk-aversion and vulnerability in our happiness model (eq. 12), we can directly test whether individuals with higher risk-aversion undergo heavier happiness losses for a given increase in vulnerability. Our results are reported in table 3. The interaction effect is negative and not statistically significant in OLS (col 1), where unaccounted fixed effects are presumably playing a similar confounding role as in our previous estimation. In fact, once we control for fixed effects (col 2), the coefficient on the interaction term becomes positive and significant at the 10% level, indicating that people with stronger aversion to risk enjoy, *ceteris paribus*, higher utility gains from lower vulnerability. In col 3, we estimate the same model in first-differences. The interaction term retains a positive sign and it grows in magnitude compared to WG (as one would expect), but it loses significance. This is not surprising given the heavy reduction in sample-size caused by the FD transformation. Upon introducing the interaction term, the direct effect of vulnerability disappears, while

the income effect remains statistically significant and similar in magnitude to our previous results on the entire sample. Although the reduced sample-size limits the strength of our conclusions, these results lend direct support to our hypothesis: income vulnerability negatively impacts life-satisfaction through agents' aversion to risk. However, it should be remarked that a similar analysis may be carried out using measures of loss-aversion rather than risk-aversion, which may be arguably more relevant if happiness is driven by fear of *downside* risk. Using the experimental data to construct a measure of loss-aversion remains an open alley for future research.

Table 1: Life-Satisfaction

	OLS1	OLS2	WG1	WG2	FD1	FD2
	(1)	(2)	(3)	(4)	(5)	(6)
Ln(1-Vul)	-.012	.001	.065	.121	.201	.222
	(.015)	(.018)	(.030)**	(.046)***	(.061)***	(.069)***
LnRealEarn	.019	.021	.017	.021	.021	.020
	(.005)***	(.005)***	(.008)**	(.009)**	(.011)*	(.012)*
LnWorkSatis	.601	.600	.591	.591	.568	.567
	(.013)***	(.013)***	(.026)***	(.025)***	(.026)***	(.026)***
Married		.031		.024		.019
		(.010)***		(.020)		(.031)
Age		-.007		-.035		-.079
		(.003)**		(.018)*		(.091)
Age2		.00009		.0004		.0005
		(.00004)**		(.0002)*		(.0006)
EarnQuart=2		.021		.016		-.015
		(.012)*		(.019)		(.026)
EarnQuart=3		-.006		-.015		-.017
		(.012)		(.019)		(.025)
EarnQuart=4		-.009		-.018		-.006
		(.013)		(.019)		(.026)
Const.	.420	.544	.474	1.190	-.034	.008
	(.022)***	(.067)***	(.039)***	(.391)***	(.013)**	(.090)
Obs.	2814	2814	2814	2814	830	830
R^2	.441	.444	.424	.427	.385	.387

Confidence: *** ↔ 99%, ** ↔ 95%, * ↔ 90%; Robust standard errors in parentheses;

Table 2: Happiness with Lagged Income and Vulnerability

	WG1	WG2	WG3
	(1)	(2)	(3)
Ln(1-Vul)	.121	.060	.189
	(.046)***	(.081)	(.114)*
LnRealEarn	.021	.026	.027
	(.009)**	(.015)*	(.015)*
L.lnvul		.023	.024
		(.071)	(.071)
L.lnrearn		-.036	-.065
		(.015)**	(.025)***
Lagearn-vul			-.059
			(.040)
LnWorkSatis	.591	.577	.571
	(.025)***	(.039)***	(.039)***
Married	.024	-.013	-.010
	(.020)	(.042)	(.042)
Age	-.035	-.018	-.022
	(.018)*	(.037)	(.037)
Age2	.0004	.00005	.0001
	(.0002)*	(.0004)	(.0004)
EarnQuart=2	.016	.033	.030
	(.019)	(.034)	(.034)
EarnQuart=3	-.015	-.024	-.021
	(.019)	(.035)	(.034)
EarnQuart=4	-.018	-.022	-.020
	(.019)	(.033)	(.032)
Const.	1.190	1.163	1.287
	(.391)***	(.816)	(.815)
Obs.	2814	1246	1246
R^2	.427	.462	.464

Confidence: *** $\leftrightarrow$ 99%, ** $\leftrightarrow$ 95%, * $\leftrightarrow$ 90%; Robust standard errors in parentheses;

Table 3: Happiness Regressions with Risk Aversion

	OLS	WG	FD
	(1)	(2)	(3)
Ln(1-Vul)	-.051	-.114	-.122
	(.046)	(.125)	(.220)
LnRealEarn	.038	.059	.056
	(.014)***	(.022)***	(.029)*
RA*Ln(1-Vul)	.003	.174	.268
	(.035)	(.098)*	(.311)
LnWorkSatis	.620	.640	.544
	(.033)***	(.059)***	(.065)***
Married	.077	.101	.085
	(.025)***	(.037)***	(.080)
Age	.003	-.004	-.450
	(.009)	(.047)	(.277)
Age2	-.00007	-.0002	-.0004
	(.0001)	(.0005)	(.002)
EarnQuart=2	.023	.025	-.053
	(.032)	(.045)	(.068)
EarnQuart=3	.0002	.006	-.009
	(.031)	(.046)	(.061)
EarnQuart=4	-.026	-.049	-.070
	(.033)	(.042)	(.063)
Const.	.283	.544	.446
	(.184)	(1.003)	(.270)*
Obs.	421	421	130
R^2	.502	.526	.453

Confidence: *** $\leftrightarrow$ 99%, ** $\leftrightarrow$ 95%, * $\leftrightarrow$ 90%; Robust standard errors in parentheses;

6 Conclusions

This paper explored the *missing link* between vulnerability to poverty and happiness, in the context of the urban Ghanaian labour market. Using longitudinal data, we are able to estimate a measure of vulnerability at the level of the individual and we explore its relationship with life-satisfaction. After controlling for unobservable individual fixed effects, work-satisfaction, relative income and for a set of worker characteristics, we find a sizeable impact of vulnerability on life-satisfaction, 3 to 10 times higher than the sheer income effect.

Next, we set out to explore potential 'structural' explanations for our findings. First, we test whether 'adaptive aspirations' may drive our results. We find that while aspiration adaptation to current income may be driving the estimated income effect, there is no evidence that adaptation to current vulnerability is behind the estimated impact of vulnerabiliity.

We then explore the 'risk-aversion channel', testing whether individuals with higher risk-aversion suffer more, ceteris paribus, for a give increase in vulnerability. Using a direct measure of risk-aversion obtained from field-experiments, we find evidence in support of that hypothesis. We conclude that vulnerability may be affecting life-satisfaction through agents' aversion to risk.

Aside the scientific value of our finding for documenting an *often assumed, but never previously tested link*, our results bear important policy-implications. In particular, they lend support to policy interventions that aim to reduce vulnerability to poverty, as we expect such policies to have a direct impact on agents' life-satisfaction. Moreover, our evidence suggests that non-Rawlsian models growth whereby "someone is left behind" may fail to enhance general welfare if the risk of falling behind is high enough and sufficiently widespread among the population, as our results indicate.

Several leads for future research emerge from this work. First, further refinements in our analysis should aim to disentangle the 'risk-aversion' from the 'loss-aversion' channel through which vulnerability may be affecting happiness. This is particularly important as both established evidence and casual observation suggest that downside and upside risks may be weighed differently in workers' minds. Second, the time-series properties of the mechanisms under scrutiny will need to be formally analysed and the modeling framework adjusted accordingly. Third, collecting data on income-expectations should both allow us to assess how aware agents are of their level of vulnerability and to test the robustness of the vulnerability model.

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EMPIRICAL APPENDIX

Table 4: Summary Statistics

Variable	Mean	(Std. Dev.)	Min.	Max.
Age	35.727	(11.033)	14.102	81.400
Educ	8.19	(3.951)	0	19.5
Male	0.438	(0.496)	0	1
Self employed with no employees	0.48	(0.5)	0	1
Self employed with one or more employee	0.129	(0.335)	0	1
Priv Wage	0.319	(0.466)	0	1
Civil or Pubent	0.073	(0.261)	0	1
Ln(employees)	0.14	(0.406)	0	5.017
Ln(firmsize)	0.865	(1.488)	0	5.011
Years since started current job	8.651	(8.984)	0	65.583
Married	0.5	(0.5)	0	1
Akan	0.579	(0.494)	0	1
Ga-Dangme	0.165	(0.371)	0	1
Ewe	0.073	(0.261)	0	1
Mole-Dagbani and Hausa	0.098	(0.298)	0	1
Other ethnicity	0.084	(0.278)	0	1
N		2814		

Table 5: Earnings Regression (STEP1)

	Y2004	Y2005	Y2006	Y2008	Y2009
	(1)	(2)	(3)	(4)	(5)
Age	.064	.079	.100	.107	.097
	(.022)***	(.016)***	(.015)***	(.024)***	(.023)***
Age2	-.0008	-.0008	-.001	-.001	-.001
	(.0003)***	(.0002)***	(.0002)***	(.0003)***	(.0003)***
Educ	-.058	-.026	-.052	-.021	-.031
	(.025)**	(.020)	(.020)**	(.031)	(.030)
Educ2	.005	.005	.006	.005	.005
	(.002)***	(.001)***	(.002)***	(.002)**	(.002)**
Male	.223	.281	.264	.373	.442
	(.069)***	(.061)***	(.059)***	(.091)***	(.089)***
Priv Wage	-.157	-.258	-.186	-.164	-.161
	(.109)	(.098)***	(.092)**	(.144)	(.154)
Civil or Pubent	.304	.242	.446	.310	.338
	(.138)**	(.134)*	(.117)***	(.174)*	(.156)**
Ln(employees)	.441	.180	.271	.262	.280
	(.113)***	(.072)**	(.096)***	(.104)**	(.088)***
Ln(firmsize)	.154	.134	.122	.146	.111
	(.030)***	(.028)***	(.030)***	(.041)***	(.045)**
Years since started current job	.011	.008	.023	.015	.018
	(.005)**	(.004)**	(.004)***	(.006)**	(.006)***
Const.	.898	.331	.291	.147	.389
	(.388)**	(.299)	(.280)	(.462)	(.444)
Obs.	619	826	1007	593	614
R^2	.212	.261	.243	.208	.188

Confidence: *** $\leftrightarrow$ 99%, ** $\leftrightarrow$ 95%, * $\leftrightarrow$ 90%

Table 6: Residual Regression (STEP2)

	Y2004	Y2005	Y2006	Y2008	Y2009
	(1)	(2)	(3)	(4)	(5)
Age	-.049	-.030	-.056	.008	.020
	(.028)*	(.019)	(.023)**	(.037)	(.038)
Age2	.0007	.0003	.0007	.0001	-.0003
	(.0004)*	(.0002)	(.0003)**	(.0005)	(.0005)
Educ	.071	-.012	-.030	-.126	-.060
	(.030)**	(.023)	(.030)	(.046)***	(.050)
Educ2	-.004	.001	.002	.010	.004
	(.002)*	(.002)	(.002)	(.003)***	(.004)
Male	.087	.024	-.049	-.030	.151
	(.083)	(.068)	(.083)	(.134)	(.146)
Priv Wage	-.324	-.110	-.474	-.820	-.788
	(.131)**	(.108)	(.129)***	(.213)***	(.249)***
Civil or Pubent	-.347	-.387	-.317	-.611	-.546
	(.165)**	(.146)***	(.167)*	(.255)**	(.255)**
Ln(employees)	-.070	-.138	-.098	-.043	.218
	(.135)	(.080)*	(.133)	(.152)	(.141)
Ln(firmsize)	-.028	.002	.002	-.019	.029
	(.036)	(.030)	(.043)	(.061)	(.073)
Years since started current job	.003	.004	-.006	-.017	-.005
	(.006)	(.004)	(.006)	(.009)*	(.009)
Married	-.180	.033	.126	-.127	-.126
	(.088)**	(.069)	(.084)	(.136)	(.145)
Ga-Dangme	.232	-.084	.060	-.243	-.143
	(.110)**	(.089)	(.106)	(.168)	(.165)
Ewe	.408	.245	.170	.097	.098
	(.151)***	(.133)*	(.155)	(.209)	(.245)
Mole-Dagbani and Hausa	-.006	-.048	.358	-.168	-.550
	(.150)	(.111)	(.130)***	(.201)	(.268)**
Other ethnicity	.255	-.048	.160	-.088	-.029
	(.138)*	(.104)	(.132)	(.286)	(.286)
Const.	1.279	1.300	1.993	1.282	1.079
	(.478)***	(.346)***	(.420)***	(.716)*	(.738)
Obs.	617	813	852	591	595
R^2	.069	.028	.07	.106	.059

Confidence: *** $\leftrightarrow$ 99%, ** $\leftrightarrow$ 95%, * $\leftrightarrow$ 90%

Table 7: Weighted Residual Regression (STEP3)

	Y2004	Y2005	Y2006	Y2008	Y2009
	(1)	(2)	(3)	(4)	(5)
Age	-.056	-.024	-.047	.005	-.010
	(.026)**	(.019)	(.021)**	(.026)	(.032)
Age2	.0007	.0002	.0006	.0001	.0001
	(.0003)**	(.0002)	(.0003)**	(.0003)	(.0004)
Educ	.067	-.016	-.035	-.137	-.024
	(.022)***	(.022)	(.029)	(.040)***	(.047)
Educ2	-.003	.001	.002	.010	.003
	(.002)*	(.002)	(.002)	(.003)***	(.003)
Male	.080	.026	-.022	.022	.098
	(.067)	(.064)	(.070)	(.099)	(.127)
Priv Wage	-.199	-.132	-.448	-.819	-.687
	(.098)**	(.098)	(.088)***	(.146)***	(.183)***
Civil or Pubent	-.273	-.342	-.239	-.643	-.549
	(.127)**	(.111)***	(.102)**	(.206)***	(.209)***
Ln(employees)	-.023	-.124	-.117	.027	.123
	(.117)	(.068)*	(.128)	(.153)	(.168)
Ln(firmsize)	-.047	.004	-.0002	.021	.046
	(.024)*	(.025)	(.029)	(.034)	(.052)
Years since started current job	-.0001	.001	-.004	-.012	.004
	(.005)	(.004)	(.005)	(.007)*	(.008)
Married	-.127	.018	.061	-.054	.003
	(.076)*	(.064)	(.071)	(.103)	(.129)
Ga-Dangme	.195	-.089	.067	-.209	-.064
	(.105)*	(.078)	(.088)	(.100)**	(.139)
Ewe	.287	.201	.127	.103	.160
	(.162)*	(.148)	(.148)	(.172)	(.253)
Mole-Dagbani and Hausa	.073	-.013	.324	-.056	-.213
	(.108)	(.107)	(.137)**	(.109)	(.179)
Other ethnicity	.186	-.060	.188	-.172	-.068
	(.133)	(.099)	(.125)	(.204)	(.265)
-con	1.406	1.216	1.861	1.386	1.308
	(.441)***	(.345)***	(.381)***	(.487)***	(.624)**
Obs.	614	813	851	588	591
R^2	.114	.03	.101	.173	.051

Confidence: *** $\leftrightarrow$ 99%, ** $\leftrightarrow$ 95%, * $\leftrightarrow$ 90%

Table 8: Weighted Earnings Regression (STEP4)

	Y2004	Y2005	Y2006	Y2008	Y2009
	(1)	(2)	(3)	(4)	(5)
Age	.068	.079	.099	.099	.095
	(.022)***	(.017)***	(.017)***	(.022)***	(.022)***
Age2	-.0009	-.0008	-.001	-.001	-.001
	(.0003)***	(.0002)***	(.0002)***	(.0003)***	(.0003)***
Educ	-.050	-.024	-.055	-.037	-.034
	(.024)**	(.020)	(.024)**	(.032)	(.030)
Educ2	.005	.005	.007	.006	.005
	(.002)***	(.001)***	(.002)***	(.002)***	(.002)**
Male	.233	.290	.233	.351	.427
	(.067)***	(.061)***	(.063)***	(.084)***	(.089)***
Priv Wage	-.138	-.214	-.155	-.178	-.139
	(.104)	(.095)**	(.092)*	(.124)	(.142)
Civil or Pubent	.311	.265	.435	.310	.317
	(.130)**	(.121)**	(.121)***	(.160)*	(.149)**
Ln(employees)	.437	.147	.277	.254	.297
	(.110)***	(.068)**	(.105)***	(.108)**	(.096)***
Ln(firmsize)	.149	.116	.112	.143	.105
	(.027)***	(.026)***	(.030)***	(.035)***	(.042)**
Years since started current job	.011	.007	.022	.014	.018
	(.005)**	(.004)**	(.004)***	(.006)**	(.006)***
Const.	.805	.324	.271	.341	.413
	(.392)**	(.304)	(.318)	(.427)	(.440)
Obs.	614	813	851	588	591
R^2	.254	.271	.242	.229	.193

Confidence: *** $\leftrightarrow$ 99%, ** $\leftrightarrow$ 95%, * $\leftrightarrow$ 90%