ISSN 1178-2293 (Online)

University of Otago
Economics Discussion Papers
No. 1307

April 2013

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David Fielding
University of Otago

Address for correspondence:

David Fielding
Department of Economics
University of Otago
PO Box 56
Dunedin
NEW ZEALAND
Email: david.fielding@otago.ac.nz
Telephone: 64 3 479 8653

How Much Does Women's Empowerment Influence their Wellbeing? Evidence from Africa

David Fielding[§]

Abstract

One of the eight Millennium Development Goals is to 'promote gender equality and empower women.' However, only 1% of official foreign aid is currently spent on gender equality and human rights. Using individual-level survey data from 39 villages in northern Senegal, we model the effects that freedom within the home have on married women's subjective wellbeing. We find the direct effects on wellbeing to be of a similar magnitude to the direct effects of consumption, education and morbidity. These results suggest the need for a review of aid allocation priorities.

JEL classification: O15; J12; I15

Keywords: wellbeing; health; women's empowerment

§ Address for correspondence: Department of Economics, University of Otago, Dunedin 9054, New Zealand. E-mail david.fielding@otago.ac.nz; telephone +6434798653.

1. Introduction

International evidence suggests that the positive correlation between women's rights and other dimensions of human development at the macroeconomic level is driven by causal effects in both directions (Doepke *et al.*, 2012). In this sense, the empowerment of women is an integral part of the development process. Correspondingly, one of the eight Millennium Development Goals – MDG3 – is to 'promote gender equality and empower women.' However, progress towards this goal has been slow: according to the United Nations (2013), 'Gender inequality persists and women continue to face discrimination in access to education, work and economic assets.' Bilateral and multilateral donors have begun to allocate some foreign aid to the promotion of gender equality and human rights, but this type of aid still only makes up 1% of the total worldwide aid budget.[1]

In this paper, we use survey data from rural Senegal to model the effects on married women's subjective wellbeing of the amount of freedom they have in the home. Senegal has a democratically elected government which broadly supports human rights and women's empowerment, but this contrasts with conservative attitudes towards women in some traditional rural communities. Our data reveals substantial variation in the treatment of women, and we find the effect of this variation on women's wellbeing to be large when compared with the direct effects of more traditional development goals, such as raising consumption and education, or lowering morbidity. This result suggests a reassessment of the current allocation of foreign aid, with more emphasis to expenditure on women's empowerment, and more concern about the interaction of empowerment with other dimensions of development.[2] The next

[1] Figures in the OECD-DAC database (www.oecd.org/dac/stats) indicate that in 2011, total official aid to all recipients was $159bn, of which aid for human rights and women's equality organisations (sectors 15160 and 15170) was $1.58bn. The corresponding figures for Senegal are $913mn and $1.65mn.

[2] We do not mean to imply that women's rights are of value only to the extent that they contribute to women's utility: rights could also have an intrinsic value (Sen, 1991). But even if ones assumes that this intrinsic value is zero, our results still suggest that the overall value of women's rights is overlooked in current foreign aid allocations.

section reviews the literature on women's empowerment and wellbeing; this is followed by a discussion of the data, and then the econometric model.

2. Literature Review

If husbands and wives have different preferences, and if the husband is not entirely altruistic, then in a male-dominated society there is an incentive for the husband to impose his will on his wife (or wives). The ability of wives to resist this pressure will depend on their bargaining power. With more bargaining power, women will be able to negotiate an allocation of household resources that is better for them (or for their children) in terms of what they consume and how their time is spent. Women's empowerment might also affect the form that bargaining takes: for example, it might limit violent behavior by the husband. Evidence for the existence of intra-household bargaining in developing countries appears in numerous econometric studies, many of which are summarized in Doss (2013). Some authors use statistical analysis of survey data to measure the effect on households of natural experiments involving exogenous changes that can reasonably be assumed to have increased female bargaining power. Examples of such natural experiments include changes in marriage or inheritance laws (Deininger *et al.*, 2010; Rangel, 2006) and shocks to gender-specific income (Duflo, 2003; Qian, 2008). Positive shocks to female bargaining power are found to improve child education or child health, which suggests that on average mothers value their children more than fathers do. Other authors find similar results by using Instrumental Variables estimators to analyze changes in conditions which affect bargaining power but might not be exogenous (Brown, 2003; Doss, 2001; Duflo and Udry, 2004). There is also some evidence for intra-household bargaining effects from experimental studies. Field studies involving gender-specific cash transfer programs show that transfers to women are more beneficial to children, on average, than are transfers to men (Behrman and Hoddinott, 2005; Bobonis, 2009; Lim *et al.*, 2010; Maluccio and

Flores, 2005),[3] while experimental games between husbands and wives show that treatments changing one spouse's bargaining power can have a large effect on outcomes (Ashraf, 2009; Iversen *et al*., 2006).

In all of these studies (with the possible exception of the experimental games), women's empowerment is a latent variable that is not measured explicitly. It is therefore difficult to use the results to quantify the overall effect of empowerment on household outcomes and on women's wellbeing. However, there is an epidemiological literature in which empowerment is measured explicitly, and the effect of empowerment on health outcomes is estimated directly. Here, empowerment is measured using survey data on women's decision-making power within the home. Respondents – either husbands or wives, or both – indicate who has a say in a range of household choices, for example decisions about household purchases, or whether the wife goes to seek formal healthcare, or whether she is allowed to make visits to her relatives. Women are taken to be most empowered when they make these decisions alone, and least empowered when their husband makes these decisions alone. Several papers (for example Allendorf, 2007, 2010; Furuta and Salway, 2006; Lépine, 2012; Mistry *et al*., 2009) find strong evidence that these indicators of empowerment are positively correlated with health outcomes such as access to antenatal care, delivery of children in hospital, child nutrition, or vaccination against common infectious diseases. However, this evidence is mostly concentrated on the Indian subcontinent, and the focus of attention is entirely on specific health outcomes rather than on general wellbeing. Another strand of the literature incorporates a wider range of outcomes but focuses on a particular dimension of empowerment: the incidence of domestic violence. Here, there is strong evidence that violence leads to poor outcomes, where the outcome is either a specific physical health characteristic (Dunkle *et al*., 2004; Durevall and Lindskog, 2013; Miner *et al*., 2011) or mental health and subjective wellbeing (see the survey by Golding, 1999).

[3] Hidrobo and Fernald (2013) also show that under some circumstances cash transfers to women can reduce the incidence of domestic violence.

Most of this epidemiological research assumes that the empowerment variable is exogenous to the health outcome. We will not be assuming that empowerment is exogenous to our outcome variables, so the literature on the determinants of empowerment is also relevant. Empirical measures of empowerment might depend on a woman's wellbeing because wellbeing affects her ability to negotiate with her husband, or because it affects her choice of husband and therefore the magnitude of the difference between spouse preferences. (A husband might let his wife make choices either because she is intrinsically powerful, or because he knows that she shares his preferences: in models using survey data these two outcomes will be observationally equivalent.) There are a few studies which model the extent to which a woman has a say in household decision-making, captured by survey questions of the type discussed above, as a function of household characteristics. Anderson and Eswaran (2009) use Bangladeshi survey data estimate the effect of a range of household characteristics, including the education of the woman and her husband, their individual earnings and their unearned assets. A woman's earnings and assets are found to have a significantly positive effect on empowerment, but the role of education is marginal. Using Nepali survey data, Allendorf (2007) finds similar results with regard to income and assets, but also finds that a range of other characteristics have significant effects, including age, household size, and whether the couple is the most senior in the household.

In addition to these quantitative studies, there is also an ethnographic literature on women's empowerment. Of particular relevance to this paper is Perry (2005), who reports the results of ethnographic fieldwork in rural Senegal. Perry documents a trend towards greater empowerment resulting from the Senegalese structural adjustment programs of the 1980s and 1990s. Structural adjustment led to a removal of agricultural subsidies received by male household heads. This reduced their income relative to that of women in the household who were entitled to farm a certain amount of land independently, but who never received any subsidies. The subsequent rise in many women's intra-

household bargaining power was used to secure the right to travel alone to local markets and trade independently there, raising women's income and bargaining power even further. Conversations with both men and women suggest that the women benefitting most from this process have been those with the poorest husbands, and there is substantial inter-household variation in the degree of women's autonomy.

Our research is based on Senegalese survey data designed to capture this variation using explicit measures of empowerment, as in the epidemiological studies discussed above. However, we are interested in the effect of empowerment on broad measures of wellbeing, rather than specific healthcare and morbidity outcomes. The next section discusses the data used to construct our empowerment and wellbeing measures.

3. The Data

Our data come from the Senegalese household survey documented by Lépine (2009) and Lépine and Le Nestour (2013), and available through http://aurelialepine.weebly.com/access-the-data.html. This survey, conducted in May 2009 by a team of trained local interviewers speaking the local languages (Wolof and Peul), incorporates 990 adult men and 1,158 adult women living in 504 farming households in 39 villages located in the Senegal River valley in the north of the country.[4] The number of adults in each household ranges from two to 13; the households were randomly selected, but all adults in the selected households were surveyed. Many households constitute an extended family group of three generations, including both single adults and those who are married. Many marriages are polygamous – husbands have up to three wives – so the sample of married women has a nested structure: individuals within marital units (women with the same husband) within households within villages.

[4] The survey also includes responses to questions about children, which we will not use. Adults are defined as household members aged 18 or over; 18 is the legal age of majority in Senegal.

Of the 1,158 women in the sample, 859 are married, 182 have never been married, 89 are widowed and 28 are divorced or separated. Our main results pertain to the 668 married women who are cohabiting with their husband or with a male relative of their husband. The 191 other married women comprise 28 household heads, 147 who live with blood relatives and 16 who live in households with a female head who is not a blood relative. We exclude these 191 women from our main sample because they are a heterogeneous group who have a variety of relationships with their household head, and their intra-household bargaining problem is likely to be different from those living with their husband, or with a male in-law who stands in place of the husband while he is away.[5] The issue of sample selection bias will be discussed later.

The survey was originally designed to address questions about the extension of health insurance coverage in Senegal, so a large part of it relates to healthcare access. However, responses to other questions put to each individual permit the construction of the following variables related to the wellbeing of the married women in our sample, and to the determinants of their wellbeing.

(i) *Subjective measures of wellbeing*. All adults in the survey answered the following two questions about their wellbeing: *Do you feel anxious or depressed? Do you suffer from bodily pains?* The possible responses to these questions are: 'often' / 'rarely' / 'never'. The proportion of women answering 'never' to these questions is only about 10%, so for each woman in our sample we construct two binary variables as follows:

- ***Anxiety*** equals one if the response to the anxiety question is 'often', and equals zero otherwise.
- ***Pain*** equals one if the response to the physical pain question is 'often', and equals zero otherwise.

[5] Probably most of the absent husbands are working in the city.

A third question asks the respondents to rate their own general health on a 1-10 scale, with 10 representing the best health. We use the responses to this question as a third measure of subjective wellbeing, but transform the data so that a score of 10 represents the poorest health: in this way, all three measures are decreasing in the wellbeing of the respondent. The third measure is designated ***health-score***. These three measures capture women's subjective perception of their mental and physical wellbeing, which could depend on their level of empowerment through the amount of work they or their children have to do, their consumption level, or the degree of mental and physical duress exerted by their husband.[6]

The correlations between ***pain*** and the other two wellbeing indicators are quite high ($\rho = 0.63$ for ***anxiety*** and $\rho = 0.39$ for ***health-score***), but the correlation between ***anxiety*** and ***health-score*** is somewhat lower ($\rho = 0.20$). The three different variables represent distinct but connected measures of a woman's subjective perception of her level of wellbeing.

(ii) <u>*Measures of women's empowerment*</u>. The survey contains several different types of empowerment measure, the first of which is based on the following question to women in the household: *Can you go out without the permission of your husband?* The possible responses to this question are: 'yes' / 'it depends on the context' / 'no'. From these responses we construct a trivalent variable:

- ***Freedom*** equals two if the response is 'yes', equals one if the response is 'it depends', and equals zero otherwise.

Secondly, the survey contains a series of questions about decisions within the home, based on those of Allendorf (2007). Responses to four of these questions will be used in our model: *Who makes decisions*

[6] Our three wellbeing variables represent a subset of the subjective measures of wellbeing used in larger questionnaires such as the General Health Questionnaire and the Mental Health Inventory. See Das *et al*. (2008) for a discussion of alternative survey measures in developing countries.

concerning your health? Who makes decisions concerning daily expenditures? Who makes decisions concerning large expenditures? Who makes decisions concerning family visits? The alternative responses to this question are: 'me' / 'my husband' / 'someone else'. The correlations between the responses to these questions are very high. If one constructs a set of binary variables equal to one if the response is 'me' and equal to zero otherwise, the first principal component of the four variables (with weights of 0.51, 0.52, 0.51 and 0.46) explains 56% of their overall variation. Therefore, we summarize the four sets of responses by adding together the four binary variables. The resulting empowerment measure, designated ***decisions***, has a maximum value of four and a minimum value of zero.[7]

Thirdly, the survey contains the interviewer's record of how the husband behaved while the wife was being interviewed. In some cases the husband was not present at all, either because he was at home but chose not to listen to the interview, or because he was happy for the wife to be interviewed while he was out. In other cases the husband insisted on being present at the interview but remained passive. Finally, there were some cases in which the husband verbally intervened in the interview. From this information we construct a third empowerment variable:

- ***Intervene*** equals two if the husband intervened in the interview, equals one if he was present but passive, and equals zero otherwise.

We take higher values of this variable to indicate that the husband is more inclined to monitor and control his wife's behavior. Conditional on ***freedom*** and ***decisions***, an increase in ***intervene*** represents less empowerment.[8] However, although the correlation between ***freedom*** and ***decisions*** is quite high (ρ

[7] The survey also includes questions about decisions concerning the woman's children, but we do not use these, because whether the woman has children may be endogenous to her subjective wellbeing.

[8] It is also possible that the husband's behavior affects the wife's responses to the empowerment questions on which the variables ***freedom*** and ***decisions*** are based. If this is this case, and if empowerment affects wellbeing, then we should

= 0.41), there is almost no correlation between ***intervene*** and ***freedom*** (ρ = 0.00) or ***intervene*** and ***decisions*** (ρ = –0.01). One possible explanation for the lack of correlation is that that a low value of ***intervene*** indicates a high level of mutual trust between husband and wife that is consistent either with gender equality or with a reliably submissive wife. In this case, a high value of ***intervene*** indicates a lack of trust and more potential for conflict within the home, and although there is no information about domestic violence in the survey – this is too sensitive an issue – it is possible that ***intervene*** is positively correlated with the incidence of violence.[9]

(iii) *Other individual-specific covariates of wellbeing*. Responses to other survey questions provide information about the women's age, education, physical health and ethnicity, characteristics that have been found to affect subjective wellbeing in other developing countries (Das *et al*., 2008). Wellbeing could also depend on whether the woman is married to the household head or some more junior male.[10] The individual-specific covariates are as follows:

- ***Writing*** equals one if the woman can write a letter in French (which is the business language of Senegal), and equals zero otherwise.
- ***Enrolment*** is equal to the log of the highest school grade for which the woman was ever enrolled. (Using levels instead of logs makes very little difference to the final results.)
- ***Age*** is the woman's age in years.

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find that the interaction terms ***intervene*** × ***freedom*** and ***intervene*** × ***decisions*** are significant explanatory variables in the wellbeing regressions. This turns out not to be the case.

[9] The proportion of women in the sample for whom ***intervene*** > 0 is just over 30%, which is similar to the estimated incidence of domestic violence in Senegal (Integrated Regional Information Networks, 2008).

[10] There is also information about the seniority of each wife in the polygamous marriages, but adding a seniority variable to the wellbeing regression does not produce a significant coefficient, and has no noticeable effect on the size or significance levels of the other variables.

• ***Walking*** equals two if the woman can easily walk five kilometers, equals one if she can walk this distance with difficulty, and equals zero if she cannot walk this distance.[11]

• ***Illness*** equals one if the woman suffers from a chronic illness, and equals zero otherwise.

• ***In-law*** equals one if the woman is married to a male relative of the household head, and equals zero if she is married to the household head.

• ***Ethnicity*** equals two if the woman is neither Wolof nor Peul, equals one if she is Peul and equals zero if she is Wolof.

(iv) *Household-level covariates of wellbeing*.

In addition to the individual responses, the survey contains information about household characteristics provided by the household head. This allows us to measure the household's size and its level of material comfort, both of which have been found to affect individual wellbeing in other developing countries (Das *et al*., 2008):

• ***Consumption*** is the log of the total annual value of household consumption per adult, measured in CFA Francs.[12]

• ***Water*** equals one if the household has access to some improved water source (for example, a well or borehole), and equals zero if the household relies on river water.

• ***Toilet*** equals one if the household has some type of toilet, and equals zero otherwise.

• ***Adults*** equals the number of adults in the household.

[11] There are other measures of physical capacity in the survey, but these are highly correlated with ***walking***, and have no additional explanatory power in the wellbeing regressions.

[12] Survey responses also indicate the share of household expenditure controlled by the woman, but this share is highly correlated with the empowerment variables, and has no additional explanatory power in the wellbeing regressions.

There are three versions of our wellbeing model, one for each of the alternative wellbeing measures. In each model, the set of explanatory variables comprises the continuous variables listed above – ***enrolment***, ***age***, ***consumption*** and ***adults*** (***decisions*** is also treated as a continuous variable) – plus a set of indicator variables for all of the other individual and household characteristics – for example, *if* [***freedom*** = 2], *if* [***freedom*** = 1] and *if* [***water*** = 1]. Some of the 668 married and cohabiting women failed to respond to some of the survey questions, so our final sample comprises 627 women in the ***anxiety*** model, and 628 women in the other two models. Sample statistics for all of the variables appear in Table 1. (The table also includes some variables to be used as instruments for women's empowerment; these will be discussed later.) It can be seen that the women in the sample are roughly evenly split between those who are often anxious or depressed (***anxiety*** = 1) and those who are not, between those who often experience bodily pain (***pain*** = 1) and those who are not, and between those who have some freedom to leave the home (***freedom*** > 0) and those who do not. The standard deviations of the variables ***health-score*** and ***decisions*** are over half as large as their mean values. In this sense, there is substantial variation in both subjective wellbeing and empowerment. The next section presents the model used to explore how wellbeing and empowerment are connected.

[Table 1 here]

4. The Model

4.1 Results assuming the exogeneity of women's empowerment and sample selection

Because the data have a nested structure (individuals within marital units within households within villages), it is possible to model wellbeing using mixed-effects models, with parameters that capture the variance in the unobserved heterogeneity at each level of aggregation. However, it turns out that when such models are applied to our data, the estimated variances at the marital unit and village level are

insignificantly different from zero. Therefore, the results we discuss here are based on simple random-effects models of individuals within households.

We begin by discussing the results of models which assume that the empowerment variables and selection into the sample of married and cohabiting women are exogenous, and which are summarized in Table 2. For the binary wellbeing measures ***anxiety*** and ***pain*** we fit a random-effects probit model:

$$\mathrm{P}\left(anxiety_i = 1\right) = \Phi\left(\sum_k \beta_k \cdot x_{ik} + \varepsilon_j\right), \quad i \in j, \quad \varepsilon_j \sim \mathrm{N}\left(\mu_\varepsilon, \sigma_\varepsilon^2\right) \tag{1}$$

$$\mathrm{P}\left(pain_i = 1\right) = \Phi\left(\sum_k \gamma_k \cdot x_{ik} + \eta_j\right), \quad i \in j, \quad \eta_j \sim \mathrm{N}\left(\mu_\eta, \sigma_\eta^2\right) \tag{2}$$

For the ***health-score*** measure we fit a random-effects tobit model:

$$y_i = \sum_k \delta_k \cdot x_{ik} + \theta_j + \varphi_i, \quad i \in j, \quad \theta_j \sim \mathrm{N}\left(\mu_\theta, \sigma_\theta^2\right), \quad \varphi_i \sim \mathrm{N}\left(0, \sigma_\varphi^2\right) \tag{3}$$

$$health\ score_i = \max\left(1, \min\left(10, y_i\right)\right)$$

Here, $\Phi(.)$ is the cumulative normal density function, the β, γ and θ terms are parameters to be estimated, x_{ik} is the value of the k^{th} explanatory variable for the i^{th} woman, and ε_j, η_j and θ_j are random effects pertaining to the j^{th} household. (Although the random effects all have variances significantly greater than zero, the results from pooled probit and tobit models are very similar; see Appendix Table A1.) In Table 2, the A column in the ***anxiety*** panel includes the estimated values of the β parameters in equation (1), the A column in the ***pain*** panel includes the estimated values of the γ parameters in equation (2), and the A column in ***health-score*** panel includes the estimated values of the δ parameters in equation (3). The relevant t-ratios are also reported, along with the marginal effects (dP/d*x*) implicit in the β and γ estimates, evaluated at the mean values of P.

There is some similarity in the estimated effects of the empowerment variables across the three wellbeing measures. First of all, ***freedom*** and ***intervene*** are significant determinants of wellbeing, but

decisions is not. Because of the high correlation between ***freedom*** and ***decisions***, the t-ratio on the ***decisions*** coefficient could be biased downwards. For this reason, Table 2 also includes versions of each model in which either ***freedom*** or ***decisions*** is excluded: see columns B and C in each panel. It turns out that the exclusion of one variable does not make any substantial difference to the coefficient and t-ratio on the other, except in the ***health-score*** model, as discussed below.

The negative coefficients on *if* [***freedom*** = 1] and *if* [***freedom*** = 2] indicate that more freedom is better for wellbeing. The transition from ***freedom*** = 0 to ***freedom*** = 1 (giving the woman some say in whether she leaves the home) reduces the probability of her often feeling anxious or depressed by about 20 percentage points. The effect on the probability of often having bodily pains is very similar, and the effect on the health score is to improve it by just over half a point (in other words, by one third of the standard deviation of this variable). The transition from ***freedom*** = 0 to ***freedom*** = 2 (giving the woman complete autonomy) has no significant effect in the ***anxiety*** model, which is an anomalous result, but bear in mind that only 7% of women in the sample have complete autonomy. The transition to ***freedom*** = 2 does have a significant effect in the other two models, reducing the probability of often having bodily pains by over 30 percentage points and improving the health score by over half a point. The only case in which there is a significant coefficient on ***decisions*** is in the ***health-score*** model with ***freedom*** excluded: in this case, a unit rise in ***decisions*** is estimated to improve the health score by about 0.15 points. Overall, these results suggest that whether the woman is free to choose what to do with her time – and in particular whether she has some say in whether she can go out when she wants to – is a key determinant of her subjective wellbeing.

Table 2 also shows that ***intervene*** is a significant determinant of all measures of wellbeing. As noted above, this variable represents a dimension of women's empowerment that is quite distinct from ***freedom*** and ***decisions***. The positive coefficients on *if* [***intervene*** = 1] in the ***anxiety*** and ***pain*** models

indicate that women with husbands present at their interview have lower levels of wellbeing, on average: the probability of often feeling anxious or depressed is about 20 percentage points higher, and the probability of often feeling bodily pain is about 15 percentage points higher. (There is no significant effect in the ***health-score*** model.) The *if* [***intervene*** = 2] coefficients are larger still, indicating that women with husbands who intervene during the interview have especially low levels of wellbeing, on average: the probability of often feeling anxious or depressed is about 40 percentage points higher, as is the probability of often feeling bodily pain. These women's health score is also significantly worse: on average, the ***health-score*** variable is about half a point higher.

Of the other variables in the model, the ones with a significant and consistent effect across all three measures of wellbeing are those capturing the woman's age and physical condition. For every year of age, the probability of feeling anxious or depressed and the probability of feeling bodily pains both increase by about one percentage point; the health score worsens by about 0.025 points.[13] Similarly, having a chronic illness adds about 20-30 percentage points to the probability that a woman will often feel anxious or depressed or feel bodily pains, and worsens her subjective health score by about one point. The effects of not being able to walk five kilometers (compared with being able to walk this distance easily) are about the same. In other words, the effect on the wellbeing variables ***anxiety*** and ***pain*** of having a poor value of either ***freedom*** or ***intervene*** is similar in size to the effect of contracting a chronic illness, or becoming severely physically incapacitated, or aging by several decades. (For the ***health-score*** variable, the effects of ***freedom*** and ***intervene*** are slightly smaller in relative terms.)

Two other variables with a significant effect are ***enrolment*** (but only in the ***anxiety*** model) and consumption (but only in the ***health-score*** model). Combining the marginal effects in Table 2 with the

[13] Adding a quadratic term in ***age*** to the model produces a coefficient that is insignificantly different from zero. The effect of age is monotonic and approximately linear: people in a country as poor as Senegal do not have any reason to look forward to old age.

standard deviations in Table 1, a two standard deviation increase in the school enrolment variable (Δ***enrolment*** = 1.0) reduces the probability of feeling anxiety or depression by about 15 percentage points, and a two standard deviation increase in household consumption (Δ***consumption*** = 1.4) improves the health score by about three quarters of a point. In this sense, in the subset of cases in which the effects of education and consumption are statistically significant, their effects on wellbeing are of a magnitude similar to those of age, physical condition and empowerment. However, the estimated effects of education and consumption are not robust across all measures of wellbeing.

[Table 2 here]

4.2 Dealing with potential endogeneity and sample selection bias

It is possible that both the level of empowerment and selection into the sample of married and cohabiting women are endogenous to wellbeing.[14] In order to test for endogeneity, we first need to model empowerment and selection as a function of some set of instruments.

For empowerment – as captured by ***freedom*** and ***intervene*** – the extra instruments used to identify the model are measures of the husband's level of education. Here, the exclusion restriction is that conditional on the individual and household characteristics in lists (iii-iv) above, the husband's education affects his wife's wellbeing only through the effect it has on her level of empowerment. Given the wife's education level, more education for the husband might increase empowerment (by socializing

[14] It is also possible that consumption is endogenous, because consumption depends on income, income depends on the wife's labor productivity, and productivity depends on wellbeing. We also have an instrument for consumption: whether the water supply for the household's farm was affected by salt contamination in the last year. (Salt dissolves into water channels from the surrounding rock, but the local geology is so variable that it is impossible to predict when this will happen, so salt contamination is a genuinely random shock.) Salt contamination is a strong instrument with a significant effect on consumption ($p < 0.01$). We test for the endogeneity of consumption using this instrument, and find that it is not possible to reject the null hypothesis that consumption is exogenous to wellbeing. Further details are available on request.

the husband so that he has a preference for gender equality) or reduce it (by increasing his bargaining ability). We use survey data on the husband's highest level of school enrolment (designated ***husb-enrolment***) and also interact male and female literacy by constructing the following variables:

- ***Both*** equals one if both the husband and wife can write a letter in French, and equals zero otherwise.
- ***Only-husb*** equals one if only the husband can write a letter in French, and equals zero otherwise.
- ***Only-wife*** equals one if only the wife can write a letter in French, and equals zero otherwise.

Descriptive statistics for these four education variables appear in Table 1. We fit random-effects ordered probit models for ***freedom*** and ***intervene*** as a function of the four education variables plus the other regressors in lists (iii-iv), but omitting ***writing***, which is now superfluous. The regression equations are as follows:

$$\mathrm{P}\left(\mathit{freedom}_i = 0\right) = 1 - \Phi\left(\sum_k \zeta_k \cdot z_{ik} + \upsilon_j - \kappa_1\right), \quad i \in j, \quad \upsilon_j \sim \mathrm{N}\left(\mu_\upsilon, \sigma_\upsilon^2\right) \tag{4}$$

$$\mathrm{P}\left(\mathit{freedom}_i = 1\right) = \Phi\left(\sum_k \zeta_k \cdot z_{ik} + \upsilon_j - \kappa_1\right) - \Phi\left(\sum_k \zeta_k \cdot z_{ik} + \upsilon_j - \kappa_2\right)$$

$$\mathrm{P}\left(\mathit{freedom}_i = 2\right) = \Phi\left(\sum_k \zeta_k \cdot z_{ik} + \upsilon_j - \kappa_2\right)$$

$$\mathrm{P}\left(\mathit{intervene}_i = 0\right) = 1 - \Phi\left(\sum_k \xi_k \cdot z_{ik} + \omega_j - \lambda_1\right), \quad i \in j, \quad \omega_j \sim \mathrm{N}\left(\mu_\omega, \sigma_\omega^2\right) \tag{5}$$

$$\mathrm{P}\left(\mathit{intervene}_i = 1\right) = \Phi\left(\sum_k \xi_k \cdot z_{ik} + \omega_j - \lambda_1\right) - \Phi\left(\sum_k \xi_k \cdot z_{ik} + \omega_j - \lambda_2\right)$$

$$\mathrm{P}\left(\mathit{intervene}_i = 2\right) = \Phi\left(\sum_k \xi_k \cdot z_{ik} + \omega_j - \lambda_2\right)$$

Here, z_{ik} designates the value of the k^{th} instrument for individual i, υ_j and ω_j are household-level random effects, and the ζ, ξ, κ and λ terms represent parameters to be estimated. These models are similar to the

ones in Allendorf (2007) and Anderson and Eswaran (2009) discussed above, but with a larger set of explanatory variables.

Table 3 presents estimates of the ζ and ξ parameters in equations (4-5), along with the corresponding marginal effects for the transition from zero to one ('*m.e. 1'*) and from one to two ('*m.e. 2*'). It can be seen that ***both*** and ***only-husb*** are significant determinants of ***freedom***, while ***both*** is a significant determinant of ***intervene***. The estimates suggest that ***freedom*** is higher when the husband is literate in French, regardless of whether the wife is literate, but that ***intervene*** is lower only when both the husband and wife are literate in French. Nevertheless, the signs of these effects all imply that male literacy is beneficial for women's empowerment, as measured by a higher value of ***freedom*** or a lower value of ***intervene***. In contrast to these effects, women whose husbands have a higher level of school enrolment experience a lower level of ***freedom***, on average. One interpretation of this apparent contradiction is that (i) fluency is French is associated with the adoption of 'modern' values, including gender equality, but (ii) conditional on this effect, more education, which raises husbands' bargaining power within the home, tends to reduce women's empowerment.

Table 3 suggests three other noteworthy determinants of empowerment. Firstly, the negative and significant coefficient on the ***in-law*** variable in the ***intervene*** equation indicates that the household head is less likely to intervene in the interview of a woman who is not his wife. In this sense, marriage to a more senior man is associated with less empowerment, on average. Secondly, the negative and significant coefficient on ***adults*** in the ***freedom*** equation and the positive and significant coefficient in the ***intervene*** equation indicates that women in smaller households are more empowered. Thirdly, there is negative and significant coefficient on ***consumption*** in the ***freedom*** equation and a positive and significant coefficient in the ***intervene*** equation. This indicates that on average, and controlling for other factors, women in households with a higher *per capita* consumption have *less* empowerment, perhaps

because poverty is associated with lower male bargaining power. This result is consistent with the sentiments of the Wolof women interviewed by Perry (2005):

'Although her husband is the richest man in the village, Ndey proclaimed that she would rather be in her sister's marriage to a poor farmer than in her own to a rich man. Another woman observed, "Those without money [are] the ones who take best care of their wives."'

One characteristic of the random-effects estimates in Table 3 is that marginal effects for the second transition are insignificantly different from zero, which implies that the husband's education is not a strong instrument for *if* [***freedom*** = 2] or *if* [***intervene*** = 2]. (These are the most infrequent outcomes, representing less than 10% of the sample in each case.) The insignificance of these marginal effects arises from very imprecise random-effects estimates of the transition parameters κ_2 and λ_2, which is perhaps not surprising when there is such a small number of observations of ***freedom*** = 2 and ***intervene*** = 2, and an even smaller number of households where these values are observed. The estimate of the transition parameters becomes more precise if we set the variances of the random effects to zero and fit pooled ordered probit models, so pooled probit estimates are also shown in Table 3. Comparing the two sets of estimates, the ζ and ξ parameters are quite similar but the pooled probit marginal effects for the second transition are much larger and significantly different from zero. For this reason, we will consider two alternative forms of the empowerment variable endogeneity tests, one based on the random-effects estimates and one on the pooled estimates.

[Table 3 here]

It is also necessary to model selection into the sample of married and cohabiting women. Here, the model is identified by noting that the youngest and oldest women in the survey are much less likely to be married, as shown in Figure 1. Some women are not married until their late twenties, and some are

already widowed by their early fifties. In order to model the probability of being in the married and cohabiting sample, we first define the variable ***range*** as follows:[15]

- ***range*** = [***age*** – 50] if ***age*** > 50

  = [30 – ***age***] if ***age*** < 30

  = 0 otherwise.

Next we define an indicator variable for selection into the married and cohabiting sample:

- ***marco*** equals one if the woman is in the sample, and equals zero otherwise.

These two variables are constructed for the 1,060 women in the sample for whom observations of the variables in lists (iii-iv) above are also available.[16] We then fit the following random-effects probit model to the data:

$$\mathrm{P}\left(marco_i = 1\right) = \Phi\left(\sum_k \alpha_k \cdot z_{ik}^{/} + \varpi_j\right), \quad i \in j, \quad \varpi_j \sim \mathrm{N}\left(\mu_\varpi, \sigma_\varpi^2\right) \tag{6}$$

Here, $z_{ik}^{/}$ designates the value of the k^{th} instrument for individual i (the instrument set incorporating ***range*** plus all the variables in lists (iii-iv) except ***in-law***, which is not defined for unmarried women) and ϖ_j is a household-level random effect.

Table 4 shows the estimates of the α parameters, along with the corresponding estimates from a pooled probit model, which are very similar. The table shows that the three statistically significant determinants of the sample selection are ***range***, ***age*** and ***consumption***. As anticipated, the youngest and

[15] Using ***range*** to identify the sample selection relies on the assumption that the direct effect of age on wellbeing is monotonic. Our observations in footnote 13 provide support for this assumption.

[16] Of these 1,060 women, 642 are married and cohabiting: the 628 who make up the main sample plus 14 others for whom observations of the subjective wellbeing or empowerment variables are not available.

oldest women are significantly less likely to be married and cohabiting. Also, women who are married and cohabiting are more likely to be found in richer households.

[Figure 1 and Table 4 here]

Having modeled the empowerment variables and sample selection, it is possible to test whether they are endogenous to women's wellbeing. In order to do this, we use the models in Tables 3-4 to construct estimates of the following Inverse Mills Ratios (IMRs):

- $\pi_i = \mathrm{dP}\left(marco_i = 1\right)/\mathrm{P}\left(marco_i = 1\right)$ is the IMR for selection into the sample.
- $\tau_i^n = \mathrm{dP}\left(freedom_i \geq n\right)/\mathrm{P}\left(freedom_i \geq n\right)$, $n \in \{1,2\}$, is the IMR for each positive value of ***freedom***.
- $\psi_i^n = \mathrm{dP}\left(intervene_i \geq i\right)/\mathrm{P}\left(intervene_i \geq i\right)$, $n \in \{1,2\}$, is the IMR for each positive value of ***intervene***.

Two sets of IMRs are constructed, one using the random-effects estimates in Tables 3-4 and the other using the pooled estimates. We test for sample selection bias by adding the estimated values of π_i to equations (1-3). Similarly, we test for the endogeneity of ***freedom*** by adding the estimated values of τ_i^1 and τ_i^2 to equations (1-3), and for the endogeneity of ***intervene*** by adding the estimated values of ψ_i^1 and ψ_i^2 to equations (1-3). In each case, the null hypothesis is that there is no endogeneity bias. This null is tested against the alternative using a Likelihood Ratio test for the significance of the IMR terms. Table 5 reports two sets of p-values corresponding to these test statistics, one for the IMRs from the random-effects estimates of equations (4-6), and one for the IMRs from the pooled estimates. Table 5 shows that the π_i and τ_i^n terms are never statistically significant, so the null hypotheses that the sample

selection and the value of ***freedom*** are exogenous to wellbeing cannot be rejected. However, the ψ_i^n terms based on the pooled estimates of equation (5) are significant in the ***pain*** and ***health-score*** models, so there is evidence that ***intervene*** is endogenous to these two measures of wellbeing.

In light of the likely endogeneity of ***intervene*** to ***pain*** and ***health-score***, Table 6 reports parameter values from an augmented version of equations (2-3) that includes the pooled estimates of ψ_i^1 and ψ_i^2 as additional explanatory variables in order to correct for the endogeneity bias. The accompanying t-ratios are computed using a bootstrap with 1,000 replications. The figures in Table 6 correspond to those in the B columns of Table 2 (the model excluding ***decisions***).[17] In Table 6, the estimated effects of ***freedom*** and ***intervene*** on ***pain*** are slightly smaller than in Table 2, but still statistically significant. Estimates of the other parameters in the ***pain*** model are very similar, except that the ***age*** effect is smaller and no longer statistically significant. There is very little difference between Table 2 and Table 6 in the values of the parameters in the ***health-score*** model. In this sense, correcting for endogeneity makes little difference to our conclusions.

[Tables 5-6 here]

5. Discussion

Analysis of survey data from rural Senegal indicates that the effects of women's empowerment on their wellbeing – as measured by subjective indicators of psychological and physical health – are large. Differences in the level of empowerment matter as much as (or more than) differences in consumption, education and morbidity. This brings into question the relatively small effort that international donors

[17] The Table 6 estimates of the parameters in the ***pain*** model are based on a pooled probit regression. It was not possible to compute reliable t-ratios for the random-effects version of the model, because in many of the bootstrap replications the log-likelihood function was very flat (and much flatter than with the actual data), so the bootstrap parameter estimates were highly variable.

put into women's empowerment initiatives, compared with more traditional development goals. One possible justification of the focus on the traditional development goals is that improvements in other areas will lead to more women's empowerment in the long run, as suggested by the cross-country macroeconomic data. However, our micro-econometric analysis does not provide strong evidence for such effects. Firstly, the effect of education on women's empowerment is ambiguous. Some education outcomes such as male literacy are associated with more empowerment, which suggests that educating boys can improve their attitudes towards women. However, for a given literacy level more male education reduces women's empowerment, possibly because it raises men's bargaining power within the home. Secondly, women in poor households have more empowerment, *ceteris paribus*. This may again reflect a positive correlation between the overall level of development of the household and the bargaining power of its (male) head, to the detriment of rich men's wives.

There is a contradiction here between the cross-country macroeconomic evidence and our micro-econometric results. Understanding the reasons for this contradiction is work for the future, and the analysis of Senegalese data discussed in this paper has yet to be replicated for other parts of the developing world, so it is still not clear how widely applicable our results are. Nevertheless, our results shed doubt on whether general development initiatives within an individual country will improve the lot of its women, and there is reason to be concerned about the lack of attention currently given to women's empowerment by aid donors. In the absence of aid programs that specifically target empowerment, it is quite possible that development initiatives which are successful according to standard metrics (such as *per capita* consumption or education levels) will worsen the lives of half of the target population.

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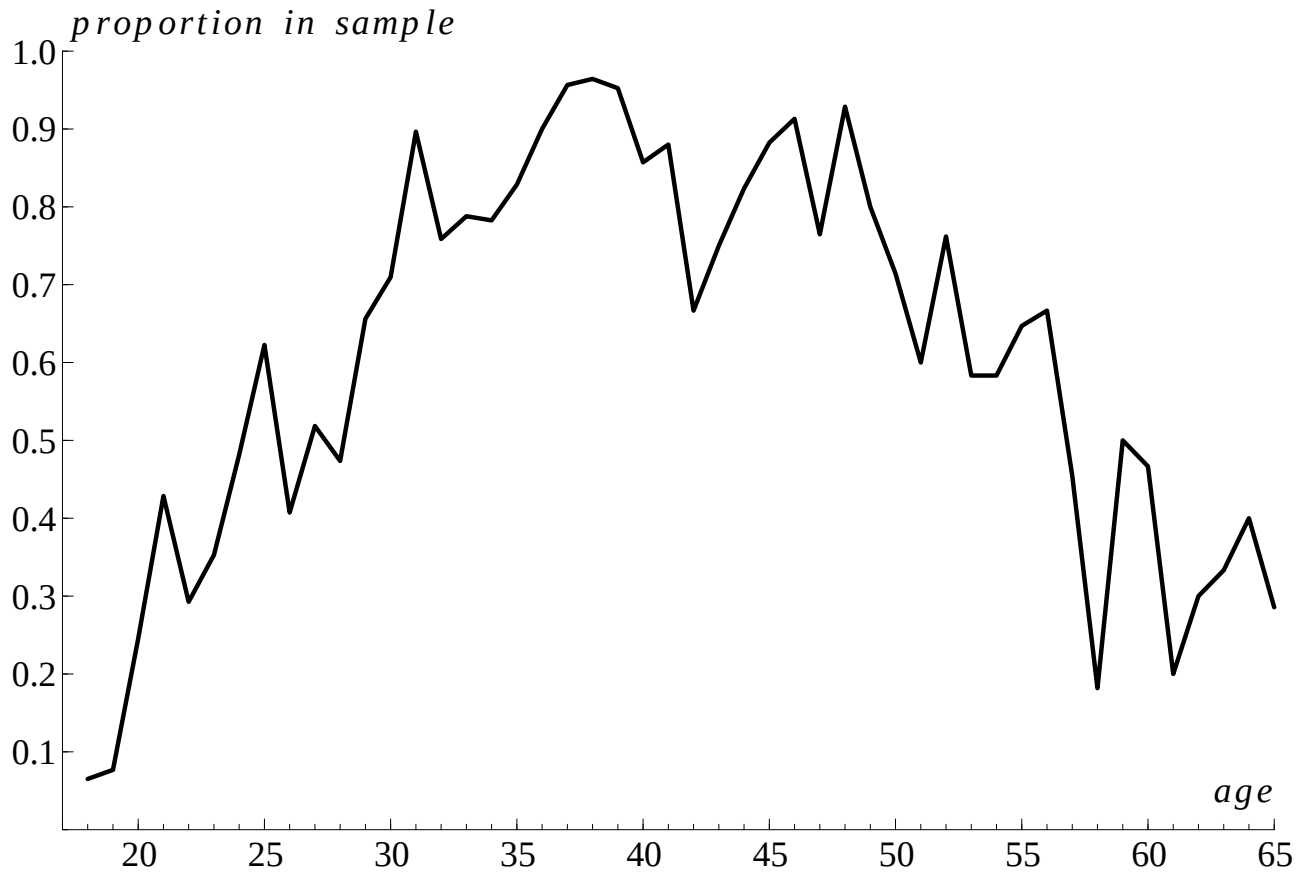

FIGURE 1. PROPORTION OF WOMEN WHO ARE MARRIED AND COHABITING, BY AGE

TABLE 1(i). PROPORTION OF INDICATOR VARIABLES EQUAL TO 1

if [*anxiety* = 1]	0.43	*if* [*only-wife* = 1]	0.07
if [*pain* = 1]	0.46	*if* [*walking* = 1]	0.30
if [*freedom* = 1]	0.42	*if* [*walking* = 2]	0.56
if [*freedom* = 2]	0.07	*if* [*illness* = 1]	0.25
if [*intervene* = 1]	0.22	*if* [*water* = 1]	0.24
if [*intervene* = 2]	0.10	*if* [*toilet* = 1]	0.92
if [*writing* = 1]	0.22	*if* [*in-law* = 1]	0.19
if [*both* = 1]	0.14	*if* [*ethnicity* = 1]	0.39
if [*only-husb* = 1]	0.34	*if* [*ethnicity* = 2]	0.02

TABLE 1(ii). DESCRIPTIVE STATISTICS FOR POLYCHOTOMOUS VARIABLES

	mean	*std. dev.*	*minimum*	*maximum*
decisions	1.71	1.45	0.00	4.00
health-score	4.11	1.57	1.00	10.0
enrolment	0.97	0.51	0.00	2.56
husb-enrolment	1.08	0.61	0.00	2.64
age	38.3	10.9	18.0	75.0
consumption	12.0	0.69	9.63	14.3
adults	5.01	2.33	2.00	13.0

TABLE 2(i): WELLBEING MODELS – RANDOM-EFFECTS REGRESSION COEFFICIENTS ON INDIVIDUAL-SPECIFIC VARIABLES

T-ratios are in italics; effects significant at the 5% level are in bold; m.e. = marginal effects.

	dependent variable = anxiety: probit						*dependent variable = pain: probit*						*d.v. = health-score: tobit*		
	A		**B**		**C**		**A**		**B**		**C**		**A**	**B**	**C**
	coeff.	*m.e.*	*coeff.*	*m.e.*	*coeff.*	*m.e.*	*coeff.*	*m.e.*	*coeff.*	*m.e.*	*coeff.*	*m.e.*	*coeff.*	*coeff.*	*coeff.*
if [*freedom* = 1]	**-0.627** ***-2.87***	**-0.201**	**-0.604** ***-3.01***	**-0.196**			**-0.677** ***-3.48***	**-0.237**	**-0.670** ***-3.69***	**-0.235**			**-0.526** ***-3.67***	**-0.619** ***-4.72***	
if [*freedom* = 2]	-0.150 *-0.43*	-0.055	-0.108 *-0.32*	-0.040			**-1.061** ***-3.19***	**-0.328**	**-1.035** ***-3.17***	**-0.323**			**-0.532** ***-2.25***	**-0.620** ***-2.70***	
decisions	0.018 *0.26*	0.007			-0.059 *-0.93*	-0.022	0.007 *0.12*	0.003			-0.092 *-1.65*	-0.036	-0.073 *-1.60*		**-0.145** ***-3.44***
if [*intervene* = 1]	**0.500** ***2.33***	**0.197**	**0.498** ***2.32***	**0.196**	**0.551** ***2.52***	**0.217**	**0.384** ***1.97***	**0.152**	**0.385** ***1.96***	**0.153**	**0.407** ***2.08***	**0.161**	-0.147 *-1.010*	-0.137 *-0.94*	-0.119 *-0.82*
if [*intervene* = 2]	**1.048** ***3.38***	**0.393**	**1.050** ***3.37***	**0.393**	**1.013** ***3.21***	**0.382**	**1.057** ***3.75***	**0.377**	**1.063** ***3.74***	**0.378**	**0.986** ***3.49***	**0.357**	**0.510** ***2.48***	**0.515** ***2.51***	**0.480** ***2.31***
if [*writing* = 1]	0.370 *1.31*	0.145	0.368 *1.30*	0.144	0.406 *1.44*	0.159	0.037 *0.15*	0.015	0.036 *0.14*	0.014	-0.015 *-0.06*	-0.006	0.138 *0.73*	0.140 *0.74*	0.129 *0.68*
enrolment	**-0.464** ***-2.04***	**-0.157**	**-0.466** ***-2.05***	**-0.158**	**-0.504** ***-2.20***	**-0.168**	-0.040 *-0.19*	-0.016	-0.043 *-0.21*	-0.017	-0.080 *-0.39*	-0.031	-0.256 *-1.70*	-0.255 *-1.69*	-0.289 *-1.91*
age	**0.020** ***2.20***	**0.008**	**0.021** ***2.29***	**0.008**	**0.021** ***2.25***	**0.008**	**0.030** ***3.46***	**0.012**	**0.030** ***3.55***	**0.012**	**0.030** ***3.44***	**0.012**	**0.025** ***4.06***	**0.023** ***3.86***	**0.025** ***4.11***
if [*walking* = 1]	**-0.542** ***-2.02***	**-0.179**	**-0.559** ***-2.09***	**-0.184**	-0.514 *-1.90*	-0.171	-0.247 *-1.05*	-0.095	-0.266 *-1.12*	-0.102	-0.215 *-0.91*	-0.083	**-0.380** ***-2.14***	**-0.400** ***-2.27***	**-0.361** ***-2.02***
if [*walking* = 2]	**-0.852** ***-3.20***	**-0.252**	**-0.869** ***-3.26***	**-0.256**	**-0.834** ***-3.10***	**-0.248**	**-1.174** ***-4.78***	**-0.348**	**-1.197** ***-4.86***	**-0.353**	**-1.139** ***-4.64***	**-0.343**	**-1.061** ***-6.25***	**-1.078** ***-6.38***	**-1.044** ***-6.10***
if [*illness* = 1]	**0.701** ***3.56***	**0.274**	**0.698** ***3.53***	**0.273**	**0.693** ***3.49***	**0.271**	**0.595** ***3.32***	**0.231**	**0.593** ***3.29***	**0.231**	**0.563** ***3.14***	**0.220**	**0.925** ***7.05***	**0.928** ***7.06***	**0.908** ***6.86***
if [*in-law* = 1]	-0.389 *-1.53*	-0.135	-0.375 *-1.48*	-0.131	-0.354 *-1.38*	-0.123	0.088 *0.39*	0.035	0.105 *0.47*	0.042	0.088 *0.39*	0.035	-0.134 *-0.80*	-0.126 *-0.76*	-0.104 *-0.62*
if [*ethnicity* = 1]	0.257 *1.24*	0.100	0.268 *1.29*	0.105	**0.424** ***2.04***	**0.167**	0.087 *0.48*	0.035	0.098 *0.54*	0.039	0.296 *1.64*	0.118	0.263 *1.88*	0.248 *1.78*	**0.412** ***3.02***
if [*ethnicity* = 2]	-1.094 *-1.62*	-0.294	-1.089 *-1.60*	-0.293	-1.086 *-1.56*	-0.292	-0.105 *-0.20*	-0.041	-0.099 *-0.19*	-0.039	-0.016 *-0.03*	-0.006	**-1.598** ***-3.72***	**-1.635** ***-3.81***	**-1.552** ***-3.56***

TABLE 2(ii): WELLBEING MODELS – RANDOM-EFFECTS REGRESSION COEFFICIENTS ON HOUSEHOLD-SPECIFIC VARIABLES

T-ratios are in italics; effects significant at the 5% level are in bold; m.e. = marginal effects.

	dependent variable = anxiety: probit						*dependent variable = pain: probit*						*d.v. = health-score: tobit*		
	A		**B**		**C**		**A**		**B**		**C**		**A**	**B**	**C**
	coeff.	*m.e.*	*coeff.*	*m.e.*	*coeff.*	*m.e.*	*coeff.*	*m.e.*	*coeff.*	*m.e.*	*coeff.*	*m.e.*	*coeff.*	*coeff.*	*coeff.*
consumption	0.109 *0.78*	0.042	0.107 *0.76*	0.041	0.127 *0.88*	0.049	0.197 *1.59*	0.078	0.197 *1.57*	0.078	0.232 *1.83*	0.092	**-0.506** ***-5.30***	**-0.496** ***-5.19***	**-0.488** ***-5.03***
if [*water* = 1]	0.126 *0.58*	0.048	0.123 *0.57*	0.048	0.102 *0.46*	0.039	-0.060 *-0.32*	-0.024	-0.065 *-0.34*	-0.025	-0.104 *-0.54*	-0.041	-0.136 *-0.93*	-0.138 *-0.94*	-0.166 *-1.11*
if [*toilet* = 1]	-0.248 *-0.71*	-0.089	-0.235 *-0.67*	-0.085	-0.218 *-0.61*	-0.079	-0.064 *-0.21*	-0.025	-0.055 *-0.18*	-0.022	-0.009 *-0.03*	-0.003	0.369 *1.57*	0.335 *1.43*	0.404 *1.69*
adults	-0.026 *-0.55*	-0.010	-0.027 *-0.58*	-0.010	-0.015 *-0.31*	-0.005	-0.054 *-1.31*	-0.021	-0.056 *-1.33*	-0.022	-0.030 *-0.73*	-0.012	-0.060 *-1.88*	-0.057 *-1.80*	-0.046 *-1.44*
random effect σ	**1.165** ***4.83***		**1.175** ***4.86***		**1.215** ***4.91***		**0.915** ***4.35***		**0.932** ***4.42***		**0.961** ***4.50***		**0.801** ***9.22***	**0.802** ***9.20***	**0.835** ***9.70***

TABLE 3(i): EMPOWERMENT MODELS – ORDERED PROBIT REGRESSION COEFFICIENTS ON INDIVIDUAL-SPECIFIC VARIABLES

T-ratios are in italics; effects significant at the 5% level are in bold; m.e. = marginal effects.

	dependent variable = freedom						*dependent variable = intervene*					
	pooled regression			*random effects regression*			*pooled regression*			*random effects regression*		
	coeff.	*m.e.1*	*m.e.2*	*coeff.*	*m.e.1*	*m.e.2*	*coeff.*	*m.e.1*	*m.e.2*	*coeff.*	*m.e.1*	*m.e.2*
if [*both* = 1]	**0.596** ***2.59***	**0.226**	**0.105**	**0.887** ***2.46***	**0.330**	0.009	**-0.579** ***-2.08***	**-0.162**	**-0.052**	**-1.138** ***-2.10***	**-0.094**	-0.000
if [*only-husb* = 1]	**0.405** ***2.90***	**0.158**	**0.062**	**0.691** ***2.77***	**0.266**	0.005	-0.079 *-0.51*	-0.027	-0.010	0.154 *0.41*	0.030	0.000
if [*only-wife* = 1]	0.254 *1.12*	0.100	0.035	0.754 *1.90*	0.287	0.006	0.002 *0.01*	0.001	0.000	-0.274 *-0.49*	-0.041	-0.000
husb-enrolment	**-0.346** ***-3.09***	**-0.135**	**-0.030**	**-0.659** ***-3.36***	**-0.230**	-0.001	-0.034 *-0.27*	-0.012	-0.005	-0.247 *-0.85*	-0.037	-0.000
enrolment	0.194 *1.40*	0.077	0.026	0.296 *1.34*	0.118	0.001	0.108 *0.68*	0.038	0.016	0.426 *1.27*	0.098	0.001
age	0.004 *0.68*	0.002	0.000	0.014 *1.40*	0.005	0.000	0.008 *1.32*	0.003	0.001	0.010 *0.75*	0.002	0.000
if [*walking* = 1]	-0.024 *-0.13*	-0.009	-0.003	0.063 *0.22*	0.025	0.000	0.151 *0.86*	0.054	0.023	-0.007 *-0.02*	-0.001	-0.000
if [*walking* = 2]	-0.005 *-0.03*	-0.002	-0.001	0.036 *0.13*	0.014	0.000	**0.348** ***2.09***	**0.129**	**0.062**	0.332 *0.79*	0.072	0.000
if [*illness* = 1]	0.083 *0.72*	0.033	0.010	0.269 *1.28*	0.107	0.001	-0.135 *-1.15*	-0.045	-0.017	-0.072 *-0.27*	-0.012	-0.000
if [*in-law* = 1]	-0.098 *-0.60*	-0.039	-0.010	-0.083 *-0.33*	-0.033	-0.000	**-0.823** ***-4.59***	**-0.207**	**-0.062**	**-1.829** ***-4.04***	**-0.101**	-0.000
if [*ethnicity* = 1]	**-0.727** ***-5.17***	**-0.263**	**-0.046**	**-1.491** ***-5.23***	**-0.388**	-0.001	0.230 *1.71*	0.083	0.038	**0.865** ***2.24***	**0.241**	0.003
if [*ethnicity* = 2]	-0.383 *-1.01*	-0.148	-0.032	-0.715 *-1.02*	-0.246	-0.001	**0.773** ***2.17***	**0.297**	**0.176**	**2.129** ***2.94***	**0.703**	0.075

TABLE 3(ii): EMPOWERMENT MODELS – ORDERED PROBIT REGRESSION COEFFICIENTS ON HOUSEHOLD-SPECIFIC VARIABLES

T-ratios are in italics; effects significant at the 5% level are in bold; m.e. = marginal effects.

	dependent variable = freedom						*dependent variable = intervene*					
	pooled regression			*random effects regression*			*pooled regression*			*random effects regression*		
	coeff.	*m.e.1*	*m.e.2*	*coeff.*	*m.e.1*	*m.e.2*	*coeff.*	*m.e.1*	*m.e.2*	*coeff.*	*m.e.1*	*m.e.2*
consumption	-0.154 *-1.62*	-0.061	-0.015	**-0.410** ***-2.41***	**-0.152**	-0.001	**0.249** ***2.66***	**0.091**	**0.041**	**0.792** ***2.74***	**0.215**	0.003
if [*water* = 1]	0.115 *0.85*	0.046	0.014	0.322 *1.21*	0.128	0.001	0.200 *1.41*	0.072	0.032	0.270 *0.78*	0.057	0.000
if [*toilet* = 1]	-0.166 *-0.65*	-0.066	-0.016	-0.116 *-0.29*	-0.045	-0.000	0.005 *0.02*	0.002	0.001	0.160 *0.33*	0.032	0.000
adults	**-0.108** ***-3.66***	**-0.043**	**-0.011**	**-0.224** ***-3.74***	**-0.086**	-0.000	0.047 *1.41*	0.016	0.007	**0.167** ***2.14***	**0.033**	0.000
random effect σ				**0.745** ***15.9***						**0.854** ***22.2***		

TABLE 4: SAMPLE SELECTION MODEL – PROBIT REGRESSION COEFFICIENTS

T-ratios are in italics; effects significant at the 5% level are in bold; m.e. = marginal effects.

	pooled regression		*random effects regression*	
	coeff.	*m.e.*	*coeff.*	*m.e.*
if [*writing* = 1]	-0.050 *-0.34*	-0.019	-0.057 *-0.33*	-0.021
enrolment	-0.054 *-0.76*	-0.021	-0.020 *-0.22*	-0.008
age	**0.009** ***2.27***	**0.003**	**0.011** ***2.66***	**0.004**
range	**-0.125** ***-12.99***	**-0.048**	**-0.147** ***-12.75***	**-0.056**
if [*walking* = 1]	0.157 *1.09*	0.059	0.324 *1.88*	0.113
if [*walking* = 2]	-0.044 *-0.32*	-0.017	0.055 *0.34*	0.020
if [*illness* = 1]	0.046 *0.45*	0.018	0.118 *0.90*	0.043
if [*ethnicity* = 1]	0.057 *0.53*	0.022	0.072 *0.58*	0.027
if [*ethnicity* = 2]	-0.403 *-1.07*	-0.159	-0.433 *-1.16*	-0.170
consumption	**0.215** ***2.96***	**0.083**	**0.244** ***2.72***	**0.087**
if [*water* = 1]	0.176 *1.52*	0.066	0.199 *1.42*	0.071
if [*toilet* = 1]	-0.057 *-0.33*	-0.022	-0.128 *-0.55*	-0.049
adults	0.003 *0.14*	0.001	-0.009 *-0.31*	-0.003
random effect σ			**0.295** ***4.57***	

TABLE 5: ENDOGENEITY TEST *P*-VALUES

significance tests	$\hat{\pi}, \hat{\tau}$ & $\hat{\psi}$ *from pooled regression*			$\hat{\pi}, \hat{\tau}$ & $\hat{\psi}$ *from random effects regression*		
	anxiety	*pain*	*health-score*	*anxiety*	*pain*	*health-score*
test for $\hat{\pi}_i$	0.52	0.44	0.71	0.75	0.17	0.70
test for $\hat{\tau}_i^1 \wedge \hat{\tau}_i^2$	0.38	0.44	0.34	0.48	0.57	0.35
test for $\hat{\psi}_i^1 \wedge \hat{\psi}_i^2$	0.22	0.03	0.01	0.62	0.48	0.12

$\hat{\pi}_i$ is the estimated inverse Mills ratio for selection into the sample.

$\hat{\tau}_i^n$ is the estimated inverse Mills ratio for each value of *freedom.*

$\hat{\psi}_i^n$ is the estimated inverse Mills ratio for each value of *intervene*.

TABLE 6: WELLBEING MODELS – ESTIMATES CONTROLLING FOR THE ENDOGENEITY OF *INTERVENE*

Bootstrap t-ratios are in italics; effects significant at the 5% level are in bold; m.e. = marginal effects.

	dependent variable = pain: pooled probit			*d.v. = health-score: r.e. tobit*	
	coeff.	*t ratio*	*m.e.*	*coeff.*	*t ratio*
if [*freedom* = 1]	**-0.494**	***-3.27***	**-0.182**	**-0.605**	***-3.42***
if [*freedom* = 2]	**-0.752**	***-3.18***	**-0.260**	**-0.680**	***-3.01***
if [*intervene* = 1]	0.292	*1.86*	0.116	-0.128	*-0.79*
if [*intervene* = 2]	**0.777**	***3.67***	**0.293**	**0.461**	***2.00***
if [*writing* = 1]	0.178	*0.58*	0.071	-0.029	*-0.10*
enrolment	-0.107	*-0.58*	-0.042	-0.245	*-1.28*
age	0.014	*1.60*	0.006	**0.022**	***2.67***
if [*walking* = 1]	-0.327	*-1.32*	-0.125	-0.362	*-1.45*
if [*walking* = 2]	**-1.216**	***-4.25***	**-0.360**	**-1.041**	***-3.43***
if [*illness* = 1]	**0.593**	***2.87***	**0.230**	**0.937**	***4.41***
if [*in-law* = 1]	0.606	*1.06*	0.234	-0.535	*-0.71*
if [*ethnicity* = 1]	-0.211	*-0.96*	-0.082	0.254	*1.08*
if [*ethnicity* = 2]	-0.980	*-1.18*	-0.316	**-1.856**	***-2.19***
consumption	-0.062	*-0.32*	-0.024	**-0.472**	***-2.63***
if [*water* = 1]	-0.243	*-1.24*	-0.094	-0.146	*-0.63*
if [*toilet* = 1]	0.026	*0.08*	0.010	0.370	*1.79*
adults	-0.092	*-1.91*	-0.036	-0.060	*-1.22*
$100 \times \hat{\psi}^1$	**0.147**	***2.10***	**0.059**	**0.173**	***2.62***
$100 \times \hat{\psi}^2$	**-0.138**	***-2.15***	**-0.054**	**-0.149**	***-2.51***
random effect σ				**0.775**	***12.5***

APPENDIX TABLE A1(i): WELLBEING MODELS – POOLED REGRESSION COEFFICIENTS ON INDIVIDUAL-SPECIFIC VARIABLES

T-ratios are in italics; effects significant at the 5% level are in bold; m.e. = marginal effects.

	dependent variable = anxiety: probit						*dependent variable = pain: probit*						*d.v. = health-score: tobit*		
	A		**B**		**C**		**A**		**B**		**C**		**A**	**B**	**C**
	coeff.	*m.e.*	*coeff.*	*m.e.*	*coeff.*	*m.e.*	*coeff.*	*m.e.*	*coeff.*	*m.e.*	*coeff.*	*m.e.*	*coeff.*	*coeff.*	*coeff.*
if [*freedom* = 1]	**-0.426** ***-2.87***	**-0.154**	**-0.414** ***-3.15***	**-0.150**			**-0.523** ***-3.60***	**-0.192**	**-0.509** ***-4.01***	**-0.188**			**-0.550** ***-3.38***	**-0.639** ***-4.47***	
if [*freedom* = 2]	0.003 *0.01*	0.001	0.042 *0.19*	0.017			**-0.760** ***-3.30***	**-0.263**	**-0.712** ***-3.13***	**-0.250**			**-0.550** ***-2.12***	**-0.624** ***-2.55***	
decisions	0.007 *0.14*	0.003			-0.047 *-1.17*	-0.018	0.008 *0.17*	0.003			-0.070 *-1.73*	-0.028	-0.065 *-1.37*		**-0.147** ***-3.50***
if [*intervene* = 1]	**0.380** ***2.63***	**0.151**	**0.377** ***2.61***	**0.149**	**0.410** ***2.88***	**0.163**	**0.292** ***2.11***	**0.116**	**0.289** ***2.09***	**0.115**	**0.300** ***2.22***	**0.119**	-0.149 *-1.06*	-0.140 *-1.00*	-0.119 *-0.83*
if [*intervene* = 2]	**0.770** ***4.12***	**0.296**	**0.769** ***4.12***	**0.295**	**0.729** ***3.91***	**0.282**	**0.846** ***4.35***	**0.314**	**0.842** ***4.33***	**0.313**	**0.762** ***3.79***	**0.287**	0.412 *1.88*	0.420 *1.94*	0.357 *1.55*
if [*writing* = 1]	0.277 *1.47*	0.110	0.273 *1.45*	0.108	0.316 *1.69*	0.125	-0.002 *-0.01*	-0.001	-0.007 *-0.03*	-0.003	-0.041 *-0.22*	-0.016	0.174 *0.82*	0.179 *0.84*	0.160 *0.73*
enrolment	**-0.094** ***-2.47***	**-0.036**	**-0.095** ***-2.50***	**-0.037**	**-0.102** ***-2.66***	**-0.039**	0.002 *0.05*	0.001	0.001 *0.02*	0.000	-0.007 *-0.19*	-0.003	-0.063 *-1.52*	-0.064 *-1.54*	-0.072 *-1.72*
age	**0.013** ***2.01***	**0.005**	**0.013** ***2.09***	**0.005**	**0.013** ***2.10***	**0.005**	**0.022** ***3.37***	**0.009**	**0.023** ***3.48***	**0.009**	**0.022** ***3.40***	**0.009**	**0.025** ***4.08***	**0.024** ***3.94***	**0.026** ***4.17***
if [*walking* = 1]	**-0.347** ***-1.99***	**-0.127**	**-0.360** ***-2.08***	**-0.132**	-0.322 *-1.85*	-0.119	-0.206 *-1.09*	-0.080	-0.222 *-1.18*	-0.086	-0.173 *-0.94*	-0.068	**-0.374** ***-2.10***	**-0.392** ***-2.21***	**-0.357** ***-2.03***
if [*walking* = 2]	**-0.534** ***-3.07***	**-0.187**	**-0.548** ***-3.17***	**-0.192**	**-0.512** ***-2.93***	**-0.181**	**-0.926** ***-5.30***	**-0.304**	**-0.942** ***-5.42***	**-0.308**	**-0.883** ***-5.26***	**-0.294**	**-1.086** ***-6.53***	**-1.098** ***-6.69***	**-1.075** ***-6.51***
if [*illness* = 1]	**0.516** ***3.95***	**0.203**	**0.510** ***3.90***	**0.201**	**0.514** ***3.96***	**0.203**	**0.468** ***3.55***	**0.184**	**0.460** ***3.49***	**0.181**	**0.438** ***3.39***	**0.172**	**0.910** ***6.99***	**0.911** ***6.97***	**0.896** ***7.00***
if [*in-law* = 1]	-0.170 *-0.97*	-0.065	-0.155 *-0.89*	-0.059	-0.138 *-0.79*	-0.053	0.111 *0.67*	0.044	0.129 *0.78*	0.051	0.123 *0.75*	0.049	-0.156 *-0.91*	-0.148 *-0.86*	-0.124 *-0.72*
if [*ethnicity* = 1]	0.144 *1.02*	0.057	0.153 *1.09*	0.060	0.247 *1.87*	0.098	0.017 *0.12*	0.007	0.028 *0.21*	0.011	0.171 *1.34*	0.068	**0.263** ***1.97***	0.249 *1.85*	**0.419** ***3.12***
if [*ethnicity* = 2]	-0.701 *-1.61*	-0.234	-0.695 *-1.61*	-0.233	-0.671 *-1.61*	-0.227	-0.060 *-0.15*	-0.024	-0.051 *-0.13*	-0.020	0.017 *0.05*	0.007	**-1.556** ***-4.50***	**-1.592** ***-4.60***	**-1.476** ***-4.18***

APPENDIX TABLE A1(ii): WELLBEING MODELS – POOLED REGRESSION COEFFICIENTS ON HOUSEHOLD-SPECIFIC VARIABLES

T-ratios are in italics; effects significant at the 5% level are in bold; m.e. = marginal effects.

	dependent variable = anxiety: probit						*dependent variable = pain: probit*						*d.v. = health-score: tobit*		
	A		**B**		**C**		**A**		**B**		**C**		**A**	**B**	**C**
	coeff.	*m.e.*	*coeff.*	*m.e.*	*coeff.*	*m.e.*	*coeff.*	*m.e.*	*coeff.*	*m.e.*	*coeff.*	*m.e.*	*coeff.*	*coeff.*	*coeff.*
consumption	0.069	0.027	0.067	0.026	0.073	0.029	0.157	0.062	0.154	0.061	0.172	0.068	**-0.486**	**-0.479**	**-0.472**
	0.74		*0.71*		*0.81*		*1.64*		*1.62*		*1.83*		***-5.36***	***-5.25***	***-5.20***
if [*water* = 1]	0.100	0.039	0.095	0.037	0.085	0.034	-0.050	-0.020	-0.055	-0.022	-0.084	-0.033	-0.181	-0.182	-0.213
	0.74		*0.71*		*0.63*		*-0.33*		*-0.37*		*-0.57*		*-1.20*	*-1.21*	*-1.39*
if [*toilet* = 1]	-0.105	-0.040	-0.094	-0.036	-0.076	-0.030	-0.012	-0.005	0.001	0.000	0.039	0.015	0.434	0.406	0.488
	-0.44		*-0.39*		*-0.31*		*-0.05*		*0.00*		*0.17*		*1.84*	*1.74*	*1.95*
adults	-0.028	-0.011	-0.029	-0.011	-0.022	-0.008	-0.043	-0.017	-0.044	-0.017	-0.024	-0.010	-0.053	-0.051	-0.038
	-0.86		*-0.89*		*-0.68*		*-1.30*		*-1.33*		*-0.73*		*-1.59*	*-1.54*	*-1.18*