WPS3686

For Public Service or Money

Understanding Geographical Imbalances in the Health Workforce

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World Bank Policy Research Working Paper 3686, August 2005

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Abstract

Geographical imbalances in the health workforce have been a consistent feature of nearly all health systems, and especially in developing countries. In this paper we investigate the willingness to work in a rural area among final year nursing and medical students in Ethiopia. Analyzing data obtained from contingent valuation questions, we find that household consumption and the student's motivation to help the poor, which is our proxy for intrinsic motivation, are the main determinants of willingness to work in a rural area. We investigate who are willing to help the poor and find that women are significantly more likely to help than men. Other variables, including a rich set of psycho-social characteristics, are not significant. Finally, we carry out some simulations on how much it would cost to make the entire cohort of starting nurses and doctors choose to take up a rural post.

JEL classification: D1, J22, J64
Keywords: health care delivery, health workers, labour supply, public service

There is an obvious difference between rural and urban postings. Working in rural areas involves helping the poor... in urban areas, one can learn, have more income, have good schools for one's children.

--Health worker in Ethiopia

1. Introduction

Health services depend critically on the size, skills, and commitment of the health workforce. Human resources have been a long-standing policy concern in both developed and developing countries. A number of recent reports have pointed out that human resources comprise a fundamental constraint to improving health outcomes and reaching the Millennium Development Goals (Joint Learning Initiative, 2004; USAID, 2003; 2002; World Bank, 2004). While human resource challenges take many dimensions—shortages, geographic imbalances, international migration, low skills and inappropriate skills mix, poor performance and low motivation, etc.—this paper focuses on the specific issue of geographical imbalances. Geographic imbalances in the health workforce have been a persistent feature of nearly all health systems. Given the obvious relationship between the number of health workers and the capacity to deliver services—both in terms of volume and quality, the distribution of health professionals has implications for equity in access to health services. But the distribution of health professionals is also an efficiency issue: the under-provision of cost-effective interventions in some areas implies that overall health outcomes could be improved through a reallocation of resources.

Our analysis is based on a survey of final year nursing and medical students in Ethiopia. The survey included detailed questions on student background and characteristics, the use of contingent valuation methods to elicit monetary valuations of different types jobs in the health sector, and survey-based and experimental approaches to measuring intrinsic motivation. Together, these data shed new light on the factors that influence the willingness to work in rural areas among a new cohort of health workers.

Ultimately, the difficulties in attracting and retaining staff in rural facilities are rooted in the preferences and choices of health professionals. Evidence from various countries suggests that, while financial rewards are important, they are not the only consideration. In choosing where to work, other considerations come into play, including training opportunities, career development prospects, living conditions, workload, colleagues and working conditions, and social, family and security concerns, etc. (Hays, Veitch, Cheers, & Crossland, 1997; Kamien, 1998; Peters, Yazbeck, Sharma, Ramana, Pritchett, & Wagstaff, 2002; Shields, 2004). Hence, the general preference for work in urban and affluent areas is not surprising. Work in rural areas is often associated with reduced access to training, limited professional interaction with peers, reduced exposure to technical sophistication, heavy responsibilities and workload, social isolation, poor

social services, and, in some cases, limited opportunities for income-generation through a second job or other economic activity.

Countries have enlisted a wide range of strategies to redress geographical imbalances in the health workforce. The most direct approach—often referred to as compulsory service or bonding—is to mandate service on specific facilities or locations. This also ensures that public resources invested in the training of health professionals are recouped.[2] But this *dirigiste* approach has proven difficult to manage and enforce in practice. Many schemes have suffered from corruption and favoritism, and the possibility for well connected or better-off individuals to bypass the scheme has undermined their legitimacy (Wibulpolprasert & Pengpaibon, 2003). But even if these management problems can be overcome, compulsory service may render the health professions less attractive, with potential long-term implications for the workforce. In Indonesia, Sepowski (2004) found that health professionals who *choose* to work in a rural or underserved area, rather than doing so as part of a contractual obligation, are more likely to stay long-term.

A less direct, but arguably more efficient approach is to rely on economic—financial or non-financial—incentives. These incentives may take many forms, ranging from rural allowances or bonuses, subsidized housing, access to promotion or specialist training, choice of jobs, etc. Although the use of economic incentives is commonplace, experience shows that providing financial incentives on their own often has limited impact, and can be very expensive (Anderson & Rosenberg, 1990; Nigenda, 1997; Sempowski, 2004).

In recognition of these limitations, some countries have pursued strategies which recognize that health workers (or potential recruits to the health profession) are not homogeneous, and that preferences concerning rural and urban postings are malleable. They argue that due to differences in background, education, personality, and other factors, health workers differ in their views on the relative desirability of urban and rural postings. For example, the US (Rabinowitz, Diamond, Markham, & Hazelwood, 1999), Australia (Easterbrook, Godwin, Wilson, Hodgetts, Brown, Pong et al., 1999; Rolfe, Pearson, O'Connell, & Dickinson, 1995), Thailand (Wibulpolprasert & Pengpaibon, 2003), and Indonesia (Chomitz, Setiadi, Azwar, Ismail, & Widiyarti, 1998) make special efforts to recruit students with a strong commitment to rural service, and aim to expose students to work in rural areas through job rotation. Experience shows that students recruited from rural areas are more likely to return to rural areas, and that they are more responsive to incentives that encourage working in a rural area (Chomitz, Setiadi, Azwar et al., 1998; Kristiansen & Forde, 1992; Laven & Wilkinson, 2003).

[2] For example, Thailand used compulsory service linked to scholarships for many years, with severe fines for breach of contract (Wibulpolprasert, 1999). A similar approach has been used in Indonesia, South Africa, and some former socialist countries. As discussed further below, Ethiopia also has a a bonding system in place.

Although of considerable interest, international experiences with strategies to redress geographical workforce imbalances provides limited operational guidance. What level of financial incentives is needed to convince health workers to accept rural postings? What is the relative importance of different individual characteristics on the willingness to accept a rural job? The existing literature has little to offer with respect to these questions. In trying to fill this gap, we have to address two methodological questions.

First, how can we elicit information about monetary valuations? In seeking to understand the labor market choice of health workers and their willingness to work in a rural area, it is natural to look at actual choices. This has been the approach of a number of studies (Bolduc, Fortin, & Fournier, 1996; Hurley, 1990; Kristiansen & Forde, 1992). Yet, the approach has important limitations. In many cases the government plays an important role in the allocation of health workers, and actual salaries do not reflect personal valuations. In addition, there is usually limited variation in the actual compensation of health workers, especially when the public sector dominates health service provision. Finally, even when there is a market, or the possibility of creating one, market prices or wages will not reflect non-pecuniary benefits, like access to training etc. Situations such as these have led researchers to rely on contingent valuation and other stated preference methods. The use of contingent valuation has a long tradition in economics, going back to Ciriacy-Wantrup and Schelling . Its aim is to place a monetary value on a good for which there is no market and, therefore, demand is unobservable. Although contingent valuation methods have been used extensively in areas such as environmental policy (Lockwood, 1998)[3], its use in the field of human resources in health is rare.[4] One important exception is the study by Chomitz et al. (Chomitz, Setiadi, Azwar et al., 1998), which uses a stated-preference approach to elicit information about the preferences of medical students in Indonesia. They find that moderately remote areas can be staffed using modest cash incentives, but that financial incentives would be prohibitively expensive for staffing very remote facilities. They also find that doctors who were recruited to medical school from the Outer Islands of Indonesia are more willing to serve in remote areas than their counterparts from Java, and that they required a lower financial incentive to accept a remote posting.

[3] Typical examples can be found in environmental economics: without a monetary value of pollution it is impossible to implement, for instance, Pigouvian taxes or find the optimal level of pollution; the cost-benefit analysis of a new park requires some monetary value for it; payment of restitutions by Exxon following the Exxon Valdes oil spill implies the knowledge of the valuation of the negative environmental effect of the spill.

[4] Some studies have used contingent valuation methods to assess willingness to pay for health services (Donaldson, Shackley, & Abdalla, 1997; Luchini, Protiere, & Moatti, 2003; Mataria, Donaldson, Luchini, & Moatti, 2004).

Second, while past studies have focused on individual characteristics such as rural background, education, age, and gender, they have not addressed the role of individual motivation and personal norms. Yet, different strands of the literature indicate that such factors may have an important effect on career choice. Deci (1975) was one of the first to recognize the role of professional commitment, or intrinsic motivation, while Dixit (1997; 2001) and Wilson (1989) emphasize its role in organizations and its importance for public service delivery. Benabou and Tirole also attribute a central role to intrinsic motivation and contrast it with motivation triggered by extrinsic incentives. [5] Studies applied to the health sector also underline the importance of worker motivation . In recognition of these findings, we will analyze and discuss the effect of individual motivation on the willingness to work in a rural area.

The remainder of the paper is organized as follows. Section 2 presents the basic characteristics of the data, how we collected the contingent valuation data and details of the survey. Section 3 discusses the econometric strategy, while section 4 reports the results. In section 5 we discuss the policy implications and carry out a simulation exercise. Section 6 concludes.

2. The Ethiopian Context and the Cohort Survey

The cohort survey was implemented in Ethiopia, a country with some of the worst health outcomes in the world.[6] With the majority of the population living in rural areas , and with substantial urban-rural disparities in living standards - the Household Income and Expenditure Survey (2000) indicates that average annual household expenditure in urban areas is almost twice that in rural areas (CSA & ORC Macro, 2001) - the health challenges are particularly severe in the rural areas. Endeavours to meet these challenges are hampered by the limited nature of health resources. Public spending is very low: in a recent report per capita health expenditures are estimated at around 4 USD or 25 USD PPP, which is significantly lower than the Sub-Sahara Africa average of 42 USD or 89 USD PPP.[7] Moreover, Ethiopia not only has a very low number of health workers per capita - on average 11 nurses and 2 physcians per 100,000 inhabitants, which is low even

[5] They define intrinsic motivation as the desire to perform a task for its own sake, while extrinsic motivation refers to rewards that are contingent on behaviour or outcomes. Their work can be seen as a refinement of Kreps (1997), who suggested that in many cases what is referred to as intrinsic incentives may in fact be workers' response fuzzy extrinsic motivators, such as fears of discharge, although he also acknowledged an important role for 'genuine' intrinsic motivation

[6] Respiratory infection, diarrhea, malnutrition, and malaria contribute to high levels of infant and child mortality (estimated at 113 and 171 respectively for 2002, below regional averages for Sub-Saharan Africa) (UNICEF, 2003). Limited access to family planning and maternity care, as well as poor quality of these services also contribute to high levels of maternal mortality. For a detailed discussion of health outcomes and the Ethiopian health system more broadly, see World Bank .

[7] This is the estimated average for the 1990s World Bank (2004).

for African standards - but also a distribution of health workers that is biased towards urban areas.[8]

Health workers in Ethiopia face a labor market with specific characteristics. Most important is the central role of the government. Wages are set by policy makers and therefore may not reflect the market value of labor. The government also plays a direct role in the allocation of health workers.[9] Students who have been funded by the government – which is the vast majority - have an obligation to serve time working for the funding government agency (regional or federal) and are randomly allocated to posts through a lottery, with those funded by a regional government allocated to a post in that region.[10] Although the allocated job cannot be changed in principle, we find evidence that students bend the rules.[11] Only after having served the obligatory term in a government facility can health workers receive a release certificate from the public sector. This certificate is legally required to work in the private health sector. Private facilities at the clinic level are now common place, but only in urban areas. In general, the Ethiopian health sector is dominated by the public sector - except for the pharmacies and drug shops. [12]

Our analysis is based on a survey with final year nursing and medical students in their last year of study. The sample includes 219 nursing and 90 medical students, sampled from eight clinical nursing schools and three medical faculties all over the country.[13] The nursing students were in the final year of their training while the medical students were about to enter their internship. Our sample of medical students represents 49% of the 2003/4 cohort, while our sample of nursing students represents an estimated 16% of the 2003/4 cohort. The statistical analysis is based on data from three sources: (i) a self-administered (supervised) questionnaire which included contingent valuation questions; (ii) a medical knowledge test; and, (iii) data from two behavioral games.[14] As set out in the introduction, two major challenges are to measure the willingness to work

[8] There are no detailed figures available for the urban – rural distribution, but from partial analysis it is clear that the distribution is biased in favour of urban areas . Data from the survey used in this paper suggests indeed that 67% of nursing students and 92% of doctors prefer to work in an urban area in the long term. In the context of Ethiopia this implies a strong preference for Addis Ababa.

[9] The role of the public sector, both for wage setting and in the allocation of health workers also motivate the use contingent valuation in the Ethiopian context.

[10] Students from private schools formally do not have an obligation. But private for profit schools are a very new phenomon (Only one school is listed to transfer from pre-accredition to full license; the school is part of ths sample- all the others remain pre-accredited), and students from non-profit schools often partcipate in the lottery.

[11] Close to sixty percent state that they can get their first posting changed; about seventy percent will swap their posting, and over twenty percent would consider to pay for a swap. None of these activities are legal.

[12] Seventy-one percent of hospitals, 94 % of health centers, 82 % percent of health stations and all health posts are currently run by the government. In contrast 80% of pharmacies, drug shops and rural drug vendors are privately owned.

[13]Details on the sampling strategy are provided in the appendix. We focus on clinical nurses and midwifes who attended 2 years of nursing school.

[14] Detailed information on the survey and the survey instruments can be found in Serneels et al (2005).

in a rural area and individual motivation. In the remainder of this section, we focus on the contingent valuation questions and the measurement of motivation.

In the past there has been controversy over how to measure contingent valuations properly.[15] For this reason a committee of experts, appointed by the National Oceanic and Atmospheric Administration (NOAA), following the Exxon Valdes incident, was asked to produce a report on best practice for reliable contingent valuation.[16] The basic conclusions of the NOAA Committee can be summarized as follows: (i) use probability sampling; (ii) avoid mail surveys; (iii) interview people in a place that is related to the question analyzed in the contingent valuation survey; (iv) formulate the question in a specific and realistic context; and (v) use closed-end questions or a variant thereof. In writing our instruments we follow NOAA recommendations as close as possible. First, although the schools are selected by convenience sampling, the students in each school were selected randomly. Second, the questionnaires were administered in the schools, and were filled out in the presence of members of the team. Third, the contingent valuation question was specific and the context was realistic. The salary of reference is the actual salary of health workers when they start their career. In addition since students are close to their graduation, it is very likely that they have already thought about the issue before participating in the survey. Finally, since the sample size is small we use a "payment card" type of question.[17] The question is the following:

> *Imagine that when you finish your studies you get two jobs as a health worker in the public sector, one in Addis Ababa and one in a rural area 500 km from Addis Ababa. Both contracts are for at least 3 years. Your monthly salary for the job in Addis Ababa would be 700 Birr. Which job would you choose if your monthly salary for the rural job would be $ amount.*[18]

[15] Diamond and Hausman argue that contingent valuation responses are often not consistent with economic theory. However, as pointed out by Hanemann , most of these criticisms are the consequence of an improperly designed survey.

[16] The committee was co-chaired by Arrow and Solow and included Leamer, Portney, Radner and Schuman. Portney presents a complete description of the basic recommendations of the NOAA Committee.

[17] Contingent valuation questions can take three basic forms: open-ended, closed-ended (also called referendum) and "payment card". The typical open-end question take the form "What is the most you would be willing to pay for ...?". However, experimental evidence has shown that this formulation has a high hypothetical bias . Closed-ended questions ask individuals for their willingness to pay a particular amount of money (*x* dollars). In general respondents are presented with a random value and have to answer yes or no. If there is only one question, this is called a single-bound closed-ended question. More sophisticated versions use a follow up question phrased in the same terms but offering a higher (or lower) amount depending on the answer of the individual (this is called double bound) . The "payment card" goes one step further and asks the individual to answer yes or no for a list of different amounts.

[18] One Birr is approximately 0.125 USD.

This question is repeated for a range of salaries, with *$* taking the value of 600, 700, 800, 900, 1000 and 1200 respectively, and is asked both for a rural (200 km from Addis Ababa) and remote postings (500 km from Addis Ababa). For medical students the basic salaries are 1200, 1300, 1500, 1700, 1900 and 2100. Figure 1 plots the cumulative distribution for the contingent valuation of the choice of rural versus urban posting for alternative wages for nurses. As expected the cumulative distribution for a rural post (200 km from Addis Ababa) dominates the distribution for a remote post (500 km away from Addis Ababa). Focusing on the contingent valuation wages for the remote area, 500km from Addis Ababa, the graph illustrates that at the current monthly wage of 700 Birr, about one-third of the starting nurses are willing to work in a remote area. As the rural wage increases, the number of nurses willing to work in a remote area rises, but not in a linear way. Beyond 1,000 Birr, marginal take up decreases. Figure 2 plots the density function of the reservation wage to work in a rural area for nursing and medical students separately. The distribution for nurses is bimodal, that for medical students heavily skewed to the left. [19]

Another methodological challenge concerns the measurement of personal motivation. Although it has received increasing attention from a theoretical point of view, there is no clear agreement on how to measure it. Even when we focus on health work, the multi dimensional nature of motivation implies difficulties to agree on a compact measure (see Franco, Bennett, & Kanfer, 2002). With this in mind, we take a pragmatic approach focusing on the context of the medical profession and rural posting. In this context we expect the motivation to help the poor – equivalent to healing the most severely ill patients since health and income poverty are strongly related - to play an important role. [20] The variable we use is based on a pre-coded survey question about the relative importance of different job attributes. All listed attributes are at least partially driven by extrinsic motivation (career concerns, salary, etc.), with the exception of 'opportunity to help the poor'. The intrinsic motivation variable is then constructed as a dummy variable indicating that 'opportunity to help the poor' is ranked highest. Because our analysis indicates that this variable is an important determinant of willingness to work in a rural area, we also look at what determines an individual's willingness to serve the poor and endeavor to explore the extent to which it might be possible to influence such motivations.

[19] The validity of the reservation wages obtained from contingent valuation is supported by two additional results. To capture the long term preference and expectation of the students with respect to urban or rural posting, we asked two more questions: whether the long term preference is to work in an urban or rural area; and what they think their employment situation will be in five years. The answers to both questions are highly corelated with the reservation wages obtained from contingent valuation with as correlation coefficients -0.43 and -0.83 respectively.

[20] Agreement on the importance of this norm is of course best reflected in the Hyppocratic Oath: 'treat the sick to the best of one's ability'.

3. Econometric Methods

The econometric analysis of contingent valuation data depends on the chosen formulation of the question. The choice between closed-ended questions or "payment cards" depends on several factors. Because of its specific nature closed-ended questionnaires "eat up" a lot of data. Since the identification of an effect rests on the random amounts offered to different individuals, one needs a large sample to achieve statistically significant effects. For similar reasons, the results are more likely to be misleading when a single closed-ended question approach is applied to a small sample.[21]

When an open ended question is used, the result is usually analyzed by regressing the contingent valuation on a set of explanatory variables using OLS. We will use this approach as a benchmark. To analyze the answers from closed-ended questions, researchers initially used to run a simple logit or probit model where the explanatory variable was the offer, or the log of the offer. However Cameron and James (1987) show that there is an important difference between the traditional logit/probit model and the dichotomous choice generated by a closed-ended questionnaire. In particular, while in the traditional logit (probit), the $\beta's$ and the σ cannot be identified separately, this is possible in the statistical model generated by the closed-ended contingent valuation model. The reason is the following. Imagine that we ask individuals to report their willingness to pay an amount of taxes T in order to enjoy a new national park. If they accept to pay that amount then $I = 1$. Otherwise $I = 0$. Then

$$I_i = 1 \Rightarrow \Pr\left(T_i^* > T_i \mid x_i\right) \tag{1.1}$$

where T_i^* is the unobserved upper limit of the willingness-to-pay of individual i. The willingness to pay is function of some variables which we can group under x_i.

$$T_i^* = x_i'\beta + u_i \tag{1.2}$$

where u_i follows a normal distribution. By the usual reasoning in probit models then

$$\Pr\left(T_i^* > T_i \mid x_i\right) = \Pr\left(x_i'\beta + u_i > T_i\right) = \Pr\left[\frac{u_i}{\sigma} > \frac{T_i - x_i'\beta}{\sigma}\right] = 1 - \Phi\left[\frac{T_i - x_i'\beta}{\sigma}\right] \tag{1.3}$$

[21] Cameron and Huppert use a simulation to generate single closed-ended responses from a "payment card" questionnaire. They conclude that the results from single threshold open-ended questions are substantially different from to the ones obtained from using all the information from the "payment card". Their evidence suggests that if using a single closed ended question, a very large sample is required to achieve the level of accuracy obtained by the "payment card" method.

Since T_i is the value of the offer, we can identify the parameter of T_i as -1 / σ and the parameters of the *x*'s as β / σ. Since invariance is one of the properties of the ML estimator we can transform the coefficients to obtain the parameters we are interested in. The calculation of the standard deviation of the parameters β is a little more convoluted. There are basically two alternative approaches: either one can estimate a simple probit and use the Delta method to calculate the standard error of the transformed coefficients; or one can program the likelihood function and use a non-linear maximization routine to obtain estimates of β and the standard deviation σ [22].

Below we develop a framework for analyzing our particular case. For each row in the payment card – or each salary w_1, the individual can choose between accepting the offer to go to a rural post, *rp* = 1, or not accepting the offer, *rp* = 0. Assuming that the indirect utility function is $v(rp, w; x)$ where w is the salary offered and x represents other variables that shift the function. For nurses, who have reference salary of 700, we therefore get

$$\Pr\left(rp = 1 \mid x\right) = \Pr\left(v\left(1, w_1; x\right) - v\left(0, 700; x\right) > \zeta_0 - \zeta_1\right) = F\left(-\Delta v\right) = F\left(\Delta w; \beta\right) \qquad (1.4)$$

Where ζ_0 and ζ_1 are error terms. For simplicity we further assume that the function reflecting the difference in indirect utility has a log-linear specification,

$$\Delta v = \delta \ln\left(\Delta w\right) + x'\beta \qquad (1.5)$$

where *x* includes variables like age, education, income, etc. However in the payment card type of question an individual can choose the threshold that represents an offer exceeding the reservation salary from many different options. Therefore the probability that the willingness to accept the offer lies in the interval $[w_m, w_{m+1})$ is given by

$$\begin{aligned} \Pr(rp_m = 1) &= \Pr\left(v\left(1, w_m; x\right) - v\left(0, 700; x\right) > \zeta_0 - \zeta_1\right) - \Pr\left(v\left(1, w_{m-1}; x\right) - v\left(0, 700; x\right) > \zeta_0 - \zeta_1\right) \\ &= F\left(w_m; \beta\right) - F\left(w_{m-1}; \beta\right) \qquad (1.6) \end{aligned}$$

[22]Depending on the nonlinear optimization one can use the evaluation of the Hessian or the evaluation of the product of the gradients as a consistent estimator of the information matrix.

When we do this for each row (salary), we get a recursive probit model. The parameters of this model can be estimated using maximum likelihood, where the log-likelihood function is

$$\ln L(\delta,\beta)=\sum_{i=1}^{N}\left\{I_i^0\left[F(w_1;\delta,\beta)\right]+\sum_{m=2}^{M-1}I_i^m\left[F(w_{m+1};\beta)-F(w_m;\beta)\right]+I_i^M\left[1-F(w_M;\delta,\beta)\right]\right\} \tag{1.7}$$

With the indicator variable I_i^m taking the value 1 if individual i accepts salary m but not salary m-1. The advantage of this estimation method is that it uses all the information provided by the "payment cards" and thus gives more robust results, and robustness can be verified since σ is estimated individually.

4. Empirical Results

Before considering the estimation of the econometric specification of the previous section we present the results of OLS estimation that takes the reservation wage at which a post in a rural area is accepted as the dependent variable. The independent variables include those normally included in a wage regression, like age, gender, a proxy for other household income, cognitive skills, as well as individual characteristics that possibly affect the willingness to work in a rural area like familiarity with rural areas, willingness to help the poor, ethnicity and religion.[23] We run the following the regression:

$$\begin{aligned}\ln rw_i = x_i'\beta + u_i = {} & \beta_0+\beta_1 AGE_i+\beta_2 FEMALE_i+\beta_3 EXP_i+\beta_4 TSCORE \\ & +\beta_5 ADDIS_i+\beta_6 DIST_i+\beta_7 HELPPOOR_i+\beta_8 TIGRAY_i \\ & +\beta_9 CATHOL_i+\beta_{10} PROTEST_i+\beta_{11} DOCTOR_i+u_i\end{aligned} \tag{1.8}$$

where *EXP* is the expenditure of the household, *TSCORE* is the score in the medical tests (in percentage points), *ADDIS* is a dummy variable that takes value 1 if the student has a permanent address in the capital, *DIST* is the distance walking to primary school at age six, *HELPPOOR* is our proxy for intrinsic motivation, and *TIGRAY, CATHOL* and *PROTEST* are dummy variables that characterize the ethnicity and religion of the student. The descriptive statistics for these variables are reported in Table 1.

Since our subjects are students, 90% of whom have never worked before, we use an estimate of expenditures of the parental household, *EXP*, as a proxy for other

[23] The inclusion of motivational variables in a wage regression is currently the focus of increased attention .

household income.[24] We use the method suggested by Grosh and Baker and Ahmed and Bouis to predict parental household expenditure. In our questionnaire we included questions on asset ownership drawn from the Household Income Expenditure and Welfare Monitoring Survey (HICE/WMS) 2000, a nationally representative survey, conducted by the Central Statistical Authority (CSA), which collects detailed data on household consumption and expenditures. By regressing household consumption on household assets, we obtained coefficients to predict household consumption for the parental household of our subjects. We run the weighted regression $EXP_i = \sum_{a=1}^{p} \alpha^a D_i^a + u_i$ on the HICE/WMS 2000 data to obtain estimates of $\hat{\alpha}^a$, the coefficient for each asset, which we then use to predict $\widehat{EXP}_i$ for our own sample.[25] The regression has an R^2 of 0.17. The average student comes from a household with predicted annual expenditures of 6,606 Birr (777 USD), which corresponds to monthly expenditures of 550 Birr (65 USD) or daily expenditures of 18 Birr (2 USD). The mean estimated household expenditure for our sample is slightly higher than the mean for the entire population, which is 5,403 Birr (635 USD) per year.

To get an insight whether poorer qualified health students are more likely to serve in a rural area, we conducted a medical knowledge test. The variable *TSCORE* is the score on this test, expressed as a percentage.[26] *ADDIS* and *DIST* capture the individual's familiarity with rural areas. Students who grew up or whose parents are still living in a rural area may be more likely to go back.

As set out in section 2, the variable willingness to help the poor is our proxy for intrinsic motivation. It is an indicator variable for ranking 'opportunity to help the poor' as the most important characteristic. Using this definition, we find that 26 percent of the health workers has high intrinsic motivation (see Table 1)

[24] We also considered a variable for own current expenditures, constructed as the first component from principal component analysis on the students' ownership of assets like watch, radio, tv, bicycle, refrigerator, etc, but this variable had no statistically significant effect in any of the estimations.

[25] Where D_i represents a dummy variable that the asset is present in the household. The regression uses population weights as calculated by the Central Statistical Authority. Since the estimates of the coefficients are quite sensitive to outliers, we exclude the richest 10% of households in our prediction and only consider household with expenditures equal or below 10,000 Birr (1,176 USD) per year.

[26] We would like to thank Agnes Soucat, Gebreselassie Okubaghzi and the team of health professionals from Addis Ababa University who designed the test. The tests are different for the nursing and medical students – with some overlap – and contained 52 multiple choice questions to be answered in 30 minutes. The test contains two parts: (i) knowledge of evidence based medicine; and (ii) technical knowledge on how to deliver medical interventions. In the first part they are asked to identify the effectiveness of specific interventions on a) child mortality, b) maternal mortality, c) malaria, and d) illness due to HIV and tuberculosis in Ethiopia. In the second part they are asked knowledge questions about medical facts and interventions. Each correct answer was given the same weight, and the final score is the sum of the correct replies, expressed as a percentage.

Table 2 shows the results of a simple OLS regression of the log of reservation wages to work in a remote area (500 km from Addis) on individual characteristics. [27] The first two columns show the results for nursing students only, while columns three and four report the results for nursing and medical students together. The results in the first two columns indicate that the reservation wage is lower the older the individual and the higher his intrinsic motivation. In contrast, coming from a wealthier family and having a permanent address in Addis Ababa imply a higher reservation wage, although significance of the latter is unstable. [28] Being catholic tends to lower reservation wages, but the result is also unstable. Columns 3 and 4 show that the estimation results for the sample including both nursing and medical students are very similar.[29] The dummy for doctors is significantly different from zero indicating that doctors have a significant higher reservation wage to accept a post in rural areas.

Table 3 reports the results of the maximum likelihood estimation of the payment cards as set out in equation (1.7).[30] Columns 1 and 2 show the results for nursing students only, and columns 3 and 4 for nursing and medical students together. Two variables are highly significant (1% level): expenditures of the parents' household (*EXP*) and willingness to help the poor (*HELPPOOR*), our proxy for intrinsic motivation. The first indicates that students coming from better off households are less likely to want to work in a rural area presumably because they can afford to be more choosy about a job, not facing a binding budget constraint. The second result suggests that students who have higher intrinsic motivation are more likely to work in a rural area.

A further interesting result is that although women tend to be less likely to want to work in a rural area – a fact usually explained as being related to personal safety concerns of women in rural and isolated areas – the effect is not significant when controlling for other characteristics.

We find no evidence that less skilled health workers - those with lower test results- self-select into working in rural areas. However, being more familiar with rural areas increases one's willingness to work there, but only weakly: having a permanent personal address in Addis Ababa decreases the reservation wage to work in a rural area

[27] The model passes tests for homoscedasticity and omitted variable. When we include interaction terms of each variable with medical student, none of them is significant.
[28] To see whether the left and right censoring of our data affects the results we also run a Tobit model, a Censored Least Absoulte Deviation (CLAD) model and trimming models confirm the results of the least squares estimation.
[29] Additional estimations results (not shown in table 2) point out that the coefficients of the explanatory variables are not different for doctors and nurses with the exception of the dummy variable and, in some cases, the age. Results are available upon request.
[30] Estimation was performed using nonlinear routiunes in TSP 4.5. We tried including interaction terms between each of the variables and medical student, but none of them is significant.

and is significant at the 10% level; and distance from school at age 12 does not show up significant.

Tigray tend to be less likely to work in rural areas, but the coefficient is not significant.[31] Catholics are more likely to have a preference for working in rural areas, but, as we will see later, this may be because they attend a (catholic) NGO nursing school that encourages them to do so. Other religions have no effect.

As pointed out earlier, one of the advantages of maximum likelihood estimation of the payment cards is that the standard deviation σ is estimated separately. It is interesting to note that the estimate of σ is very stable across specifications, also indicating that the results are robust.

To summarize, the results indicate that household expenditures and intrinsic motivation are the most important explanatory factors of health students' preferences for a rural posting, and that medical students have a stronger preference for urban jobs compared to nursing students.

Who wants to serve the poor?

How do we interpret the importance of wanting to help the poor, our proxy for intrinsic motivation, and what are the policy implications? The question of interest is whether intrinsic motivation is predetermined or whether it can be shaped: Is motivation malleable and a result of socialization? And if it is, at what stage does socialization have an impact: during childhood or professional training? Although our data are by no means rich enough to address this question in a conclusive way, they give some indications. We analyze how our proxy for intrinsic motivation is related to a number of psycho-social individual characteristics, using the following specification.

$$HELPPOOR_i = \Phi(AGE_i, FEMALE_i, CATHOL_i, DIST_i, CHILDHW_i, PARENT_i, INTEGRITY_i, TRUST2_i, INITIAT_i, RECIPR_i, JUDGFAIR_i, DOCTOR_i; \zeta_i) \quad (1.9)$$

The variables that are not listed in Table 1 are described in Table 4, which also reports their descriptive statistic. The variable *CHILDHW* is a variable indicating

[31] The likely explanation is that we surveyed schools outside Tigray, and the Tigray attending these schools may be more likely to be sent to a rural area outside their home region, where the population speaks a different language and a Tigray health worker is thus more isolated.

whether the child wanted become a health worker at age 12 or not, while *PARENT* indicates whether the parents had an influence on the decision to become a health worker.

To investigate the importance psychosocial characteristics, we also included several psychosocial characteristics captured by series of questions during the survey. The variables and reliability of the scales constructed for the student responses are listed in Table 5. The first construct, *INTEGRITY*, reflects the extent to which the students disapprove of individuals accepting pay for more hours than they worked or reimbursement for more than actual expenses.[32] Table 5 shows that with a Cronbach-Alpha of 0.70, the scale is quite reliable. Somewhat less reliable is the variable based on past trusting behaviour. We use the measure suggested by Glaeser, Liabson, Scheinkman and Soutter . The Cronbach-Alpha for *TRUST1* is 0.42. If we reduce the items to the first two we obtain *TRUST2*, for which the Cronbach-Alpha raises to 0.51. To measure initiative we calculate the interitem correlation of three questions. The items for *INITIAT* also show a moderate level of reliability (Cronbach-Alpha=0.47).

Another approach to investigate the importance of psychosocial characteristics is to measure the individual's behavior in a game. We played two behavioral games with the subjects: a generalized trust game and a third party punishment game. The first measures generalised trust while the second measures the individual's judgement of fairness. The games are explained in detail in the appendix.[33] In the first game the subject receives an amount *x* from player A and passes any portion of this amount on to Player C. The student's behavior in the game reflects trustworthiness to an unknown party or what is called *generalized reciprocity*. There is strong evidence for the role of reciprocity in labor market choices and performance, both from lab experiments as well as from combining survey and experimental data . The game was selected because the extent to which the students respond positively to being entrusted with resources in the game may be a predictor of their response to being entrusted with public resources in real life. Thus, it might act as a proxy for their preference for or behavior in public service. We therefore expect that individuals with higher intrinsic motivation behave more reciprocal in the generalized trust game.

The second game is the Third Party Punishment Game as set out by Fehr and Fischbacher . In this game Player 1 can give any share of a received amount to Player 2; while Player 3 can impose a fine on Player 1 when she judges his behavior to be unfair. How much Player 3 is willing to pay to punish Player 1 is a direct measure of the strength of their

[32] The items were taken from the California Psychological Inventory (CPI) which has been used in research activities during the last 40 years and is very appropriate to use with students (see http://www.cps.nova.edu/rcpphelp/CPI.html)

[33] The games are anonymous and follow the standard procedures of experimental economics (they are played in a classroom, for real money, and follow a precise script).

negative reaction to an act of unfairness. Our sample of health students played the role of Player 3. We expect that the judgement of (un)fairness is positively related to intrinsic motivation: those who have a strong judgement about distributional fairness, are more likely to help the poor.

The results of estimating the probit model in equation (1.9) are reported in Table 6. Columns 1 and 2 report the result for nursing students only, while columns 3 and 4 include both nursing and medical students. One result stands out: women have higher levels of intrinsic motivation. Those of catholic religion also tend to have higher intrinsic motivation, but the significance of the result is not robust and it seems to be driven by their attendance of an NGO nursing school. However, this effect is not robust, especially when limiting our sample to the nursing students, which are the only ones who have a choice to attend an NGO school or not.[34] *JUDGFAIR* has a positive effect, but is only significant at the 10% level and becomes insignificant when we control for the NGO school. This suggests that NGO schools influence their students in their adherence to norms of fairness and distributive justice, which leads them to want to help the poor.

Our data do not allow us to further unravel the effect of *FEMALE*, and determine in how far this effect is due to inherent characteristics, or whether it is the result of gender socialization. Other variables that are related to the individual's identity like *AGE* and *CHIDLHW*, are insignificant[35], as are variables related to the social environment where the individual grew up, like *DIST* and *PARENT* or received professional training (*SCHOOLNGO*). Our psycho-social constructs and behavioural measures also show up insignificant in the probit. Neither initiative or integrity nor trust seems to help explaining willingness to help the poor. Generalized reciprocity is also not significant, while the relationship between judgement of fairness and willingness to help the poor is sometimes weakly significant (10%), but the result is not robust. This suggests that more reciprocal individuals do not necessarily have higher intrinsic motivation, while those with higher judgment of fairness may have higher intrinsic motivation. We find no evidence that nurses are more willing to help the poor than doctors. [36]

[34] All medical faculties are state owned. If the effect of NGO school would be stronger, it would trigger the question whether the school socializes the students to higher intrinsic motivation or whether the most motivated students self-select into this school. Unfortunately the data does not allow us to draw any conclusion on this.

[35] Identity can be defined as a person's sense of self through identification with a group. Akerlof and Kranton illustrate how identity can affect interactions with others as well as career decisions.

[36] Since in both games we use the strategy method, we obtain a reciprocity function and punishment function for each individual. We use the median of this function to proxy reciprocal and fining behaviour. We tried different summary measures, but all give a similar result; i.e. none is robustly significant, although the fining measures tend to perform better than the reciprocity measures. However, the use of experimental measures combined with surveys is young and therefore it remains hypothetical which conclusions we can draw from the lack of signficnace in relationship. An alternative interpretation is that the measures obtained from the behavioural game are rather imprecise, i.e. they have a high standard error. This is explored further in separate work

Summarized the results underline the importance of gender for willingness to help the poor, our proxy for intrinsic motivation.

The preference for an urban job

As set out in the introduction, we find that about two-thirds of the nursing and 90 percent of the medical students prefer to work in an urban area in the long run. So far we have concentrated on the individual characteristics that determine why new health workers do or do not want to work in a rural area and we have paid little attention to the job attributes associated with an urban or rural posting. What job attributes make the urban sector so attractive? To see this we model the premium to work in a rural area (reservation wage – the reference wage) on variables indicating the rank of the job characteristics by each individual. [37] Since the choice is between two public sector jobs, job stability and salary are the same (by design) and do not enter the equation. We focus on the individual evaluation of the following job characteristics: promotion opportunities (*PROMO*), access to other income opportunities (*OTHINC*), access to good education for children (*EDU*), access to good health care (*HEALTHC*), physical conditions of the work place (*WORKPL*), and access to further training (*TRAINING*). Table 1 reports the descriptive statistics for these variables. The model we use is very simple:

$$P_i = \beta_0 + \beta_1 PROMO + \beta_2 OTHINC + \beta_3 EDU + \beta_4 HEALTHC + \beta_5 WORKPL + \beta_6 TRAINING + \beta_7 DOCTOR + X_i + u_i \quad (1.10)$$

The explanation and descriptive statistics for the job attributes are listed in Table 1. *P* is the premium required by an individual to work in a rural area. *X* are the individual characteristics included in the model described by equation (1.9). The premium follows the same distribution as the reservation wage, plotted in Figure 2. About one-third of nursing students are willing to work in a rural area at the reference wage (premium zero), while two-thirds require a premium; while only a small minority of the medical students are ready to work in a rural area at a wage below the reference wage.

Table 7 shows the results for estimation of equation (1.10). The first column reports the results from OLS estimation for nurses only[38], while column two reports the results for both doctors and nurses. Because the variables are not measured in absolute

[37] The information on job characteristics comes from two questions. We asked students to rank a set of reasons why they would prefer to work in an urban or rual area; we also use the questions where we ask to rank job attributes in general.

[38] Estimation by 2-sided tobit gives similar results

units, the usual coefficients have no interpretation; we therefore report the x-standardized coefficients. A large x-standardized coefficient indicates a high relative importance of the underlying variable.

The individual evaluations of three attributes are significant: access to education for children, promotion opportunities, and access to training, although the latter is only significant when including medical students. Access to education for children has the highest significance and the highest x-standardized coefficient, indicating that it is the most important attribute. 'Opportunities for promotion' has the second highest coefficient for nursing students, and comes third when including doctors, but it remains highly significant. Access to training seems especially relvant for medical students. The results confirm those from qualitative research reporting that health workers 'fear to get stuck in a rural area', but it also shows that reasons beyond professional isolation are important, namely the living conditions for their families.

5. Policy Implications and Simulation

In this section we carry out a simple simulation to quantify how much it would cost to get a target number of health workers in rural areas. In the introduction we saw that Ethiopia has one of the lowest health worker / population ratios. The government is well aware of this and has invested substantially in human resources for health over the last years. The number of nurses has increased from 4,744 in 1998 to 12,838 in 2002, while the number of physicians has increased from 1,415 to 1,888 over the same period.[39] Data on the urban-rural distribution of different categories of health workers are limited, but a recent report suggests a strong imbalance in favor of urban areas. We carry out some simulations. First we determine how much premium health workers have to be paid to take up a post in a rural area. Then we calculate how much it would cost to make the entire current cohort of starting nurses and doctors choose to work in a rural area. Finally we calculate how much it would cost to make all starting nurses and doctors take up a rural posting when doubling the health work force over five years. [40]

We make two assumptions. First, that health workers can choose freely where to work; they are offered the choice between two contracts: work in an urban area and earn the base salary (contract U), or work in a rural area and earn a higher salary (base salary + premium, contract R). We also assume that our sample reflects the distribution

[39] The figure for nurses includes all categories of nurses, including junior nurses with one year of education.

[40] It is usefull to keep in mind that we only look at clinical nurse students (incl midwifes) with at least two year professional training, and medical students at the start of their internship. This excludes nurses with one year of training and health officers. The figures on the increase in nurses contains all categories of nurses, including junior nurses with one year of education.

of characteristics of the entire cohort of health workers (in household background, intrinsic motivation, etc.), which seems realsitic given our sampling approach.

The simulation has of course many limitations, and its aim is to illustrate the implications of our findings rather than providing precise policy advice. It is for example usefull to keep in mind that our anlaysis is restricted to clinical nursing students (including midwives) with at least two years of professional training and medical students at the start of their internship. Nurses with one year of training and health officers are excluded from the analysis. Also, the contingent valuation is for 500 km from Addis Ababa, while remote postings may be further away (although they are often closer to regional capital).

We saw in Figure 1 that at the current monthly wage of 700 Birr, about one-third of the starting nurses are willing to work in a remote area. Using equation (1.8) to predict the reservation wage, we find that to get 100% of the starting nurses in rural areas, a salary of 1,019 Birr per month is needed, while to get all new doctors take up a rural post, they need to be paid a salary of 2,296 Birr per month. This would imply an salary increase of 319 Birr per month, or 31%, for nurses and 896 Birr per month, or 39%, for doctors, relative to the reference salary used in the contingent valuation.

To get the entire current cohort of nurses and doctors (1,378 nurses and 192 doctors) choose contract R, i.e. work in a rural area, the health budget has to increase with 7,337,454 Birr per year, or 863,230 USD per year, an increase of 0.9% per annum.

What would it cost to get all starting nurses and doctors work in a rural area when doubling the health workforce over a period of five years, i.e. increase the number of nurses and doctors from the current 8,572 nurses and 1,888 doctors to 17,144 nurses and 3,776 doctors? For simplicity we assume that the salary remains constant over the first five years. We find that the health budget has to increase in total with 7.9% per year, of which 5.2% per year to cover the basic salary for the extra work force, and 2.7% per year to cover the premium to make them take up a rural posting.

In column 2 of Table 8 we carry out the same thought experiments, but now assuming that all nurses and doctors have high intrinsic motivation, i.e. want to help the poor. We find that the budget increase needed to get the current cohort of nurses and doctors working in rural areas reduces to 0.7%. To make all starting nurses and doctors take up a rural post while doubling the work force over five years, one needs a budget increase of 2% when all health workers are highly motivated.

Increasing the number of female health workers (to 75% of nurses and 50% of doctors female), while keeping the above assumptions, is slightly more expensive, as shown in column 3 of Table 8. (The cost reducing effect of womens' higher intrinsic

motivation is compensated by the cost increasing effect of women requiring higher reservation wages to work in a rural area.)

Attracting more students from rural areas, would also reduce the required budget increase slightly, as reported in column 4 of Table 8.

6. Conclusion

This paper analyzes the willingness to work in a rural area of final year nursing and medical students in Ethiopia. We use contingent valuation data, obtained from "payment cards" questions. We find that there are two main determinants of the willingness to work in a rural area: the income of the parents' household and the students' willingness to help the poor. The first result is in line with results from labor economics which show that income from other household members affects labor decisions (Mroz, 1987). The second result indicates that a health worker's intrinsic motivation has a strong influence on her preference for a rural posting. We also find that medical students are less likely than nursing students to prefer to work in a rural area. The results are very robust: they are very similar when using OLS estimation or when using maximum likelihood estimation that uses the full information of the "payment card". The latter method also allows a direct estimate of the standard deviation, which appears to be constant across different specifications, a further sign of the robustness of the results.

Given the high significance of the variable, we attempt to further unravel who is motivated to help the poor. Behind it is the question whether intrinsic motivation is predetermined or whether it can be shaped - i.e. whether motivated health workers are a result of socialization or selection. If intrinsic motivation is an internalization of norms, as argued by Deci (1975) a central question for public policy is when internalization takes place: before they enter the profession or after. Our data are by no means rich enough to address this question in a conclusive way, but give some indication. The key result is that women are significantly more likely to want to help the poor than men, but we cannot determine whether this is due to inherent differences or has come about through socialization. Having attended an NGO school also has an effect, although this is less significant. It may suggest that health students attending an NGO school are socialized towards helping the poor or that the prospective health students with high intrinsic motivation self-select into NGO schools. Other psycho-social characteristics seem to have limited effect.

Since two-thirds of the nursing students and 90 percent of the medical students want to work in an urban area in the long run, we investigate what makes an urban job so attractive. Analyzing the premium to work in a rural area, we find that this is explained especially by access to education for children and promotion opportunities. For doctors

access to further training seems to play an important role as well. This confirms results from qualitative research reporting that health workers 'fear to get stuck in a rural area', but also indicates that reasons related to the living conditions of health workers' families are important. It also points at potential alternative strategies for the government to attract health workers to rural areas. Instead of raising salaries, improving access to further training may increase health workers' willingness to take up a rural posting. Currently, there exists virtually no training or continued education for health professionals in Ethiopia (International Council of Nurses, 2002).

To make the policy implications explicit we carry out a simple thought experiment, where starting nurses and doctors can choose between two contracts: an urban post with basic salary or a rural post where they receive basic salary plus premium. The main message of this simulation is that it does not have to be very expensive to get all starting health workers to take up a rural post, even when the aim is to double the health workforce. This suggests an alternative approach to the current job 'lottery', where health workers are officially not able to choose, but where some seem to manage better than others to influence the outcome of the 'lottery'.

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Table and Figures

Figure 1: Cumulative distribution for reservation wage for rural (200km) and remote (500 km) post

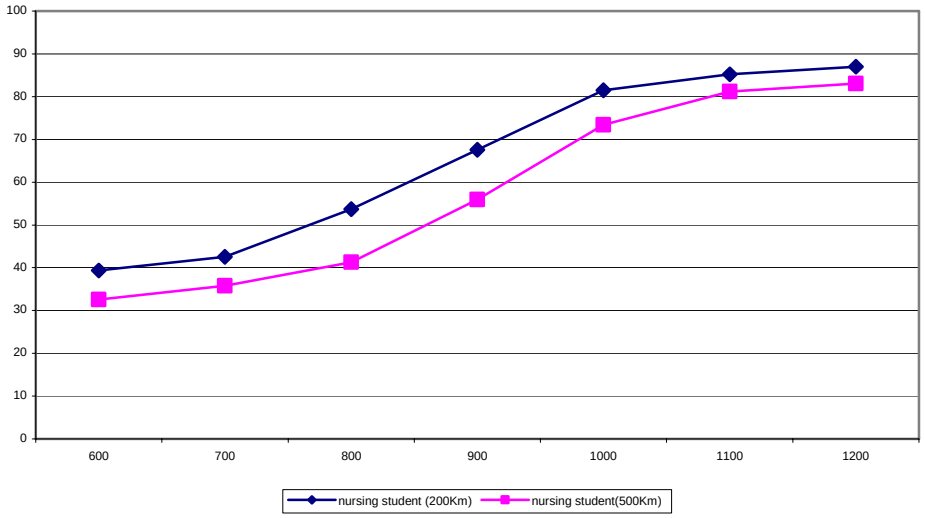

Figure 2: Density function of reservation wages to work in a rural post

(a) nursing students (b) medical students

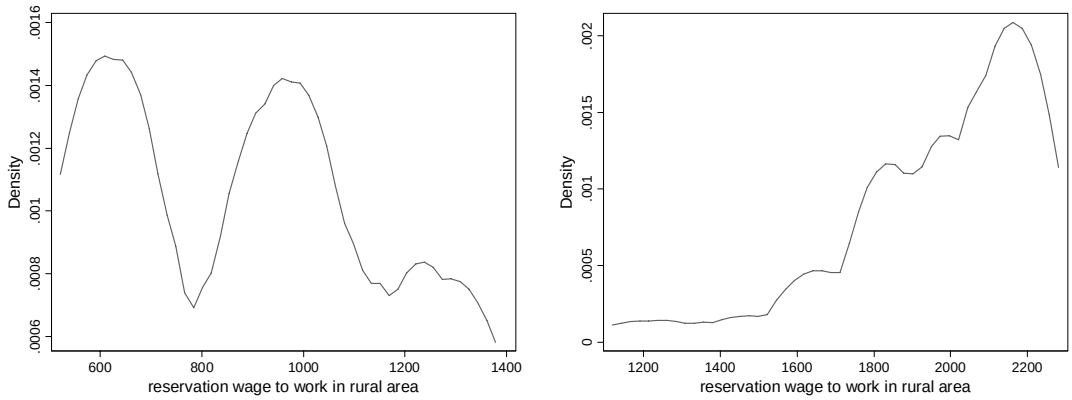

Table 1: Descriptive statistics

Variable	Description	Mean
Individual characteristic:		
AGE	Age of the individual	23
FEMALE	Dummy variable indicating whether the individual is female	0.36
EXP	Predicted annual household consumption of parental hh	6,606 Birr*
ADDIS	Indicator variable for living in Addis Ababa	0.25
DIST	Distance walking to primary school at age 6 (in minutes)	30
TSCORE	Score on medical knowledge test	0.49
HELPPOOR	Indicator variable that 'opportunity to help the poor' is most important job characteristic	0.26
TIGRAY	Dummy variable indicating ethnicity is Tigray	0.06
CATHOL	Dummy variable indicating individual is of catholic religion	0.10
PROTEST	Dummy variable indicating individual is of protestant religion	0.21
DOCTOR	Dummy variable indicating individual is medical student	0.29
Job attributes:		
PROMO	Dummy variable indicating promotion opportunities is the most important reason to prefer to work in rural or urban area	0.27
OTHINC	Dummy variable indicating that access to other income opportunities is the most important reason to prefer to work in rural or urban area	0.11
EDU	Dummy variable indicating that access to good education for children is the most important reason to prefer to work in rural or urban area	0.10
HEALTHC	Dummy variable indicating access to good health care is the most important reason to prefer to work in rural or urban area	0.12
WORKPL	Dummy variable indicating good physical conditions of workplace is the most important job characteristic	0.09
TRAINING	Dummy variable indicating access to further training is the most important job characteristic	0.32

* or 777 USD ** maximum score is by construction 48

Table 2: Least squares estimation of the log of the reservation wage to work in a rural area

	Nursing students		Medical students	
AGE	-0.02	-0.02	-0.02	-0.01
	(2.81)**	(2.23)*	(2.94)**	(2.08)*
FEMALE	0.03	0.03	0.03	0.03
	(0.60)	(0.63)	(0.69)	(0.82)
EXP (in 000)	0.04	0.04	0.03	0.03
	(3.00)**	(2.96)**	(2.84)**	(2.74)**
TSCORE	-0.21	-0.12	-0.16	-0.11
	(0.85)	(0.48)	(0.79)	(0.54)
ADDIS	0.11	0.11	0.07	0.07
	(1.89)+	(1.96)+	(1.91)+	(1.91)+
DIST (in 000)	-0.06	-0.16	-0.13	-0.24
	(0.07)	(0.21)	(0.21)	(0.41)
HELPPOOR	-0.17	-0.14	-0.14	-0.12
	(3.65)**	(2.84)**	(3.93)**	(3.14)**
TIGRAY		0.11		0.09
		(1.12)		(1.34)
CATHOL		-0.12		-0.14
		(1.81)+		(2.44)*
PROTEST		0.07		0.04
		(1.35)		(1.00)
DOCTOR			0.83	0.80
			(16.22)**	(15.75)**
Constant	7.03	6.91	7.03	6.92
	(33.57)**	(32.77)**	(40.39)**	(39.59)**
Observations	158	158	220	220
R-squared	0.20	0.24	0.75	0.76

Note: Absolute value of t statistics in parentheses. + significant at 10%; * significant at 5%; ** significant at 1%

Table 3: Maximum likelihood estimation of the payment cards.

	Nursing students		Medical students	
AGE	-0.01	-0.01	-0.01	-0.01
	(-2.43)	(-1.77)	(-2.52)	(-1.62)
FEMALE	0.02	0.01	0.02	0.02
	(0.33)	(0.19)	(0.51)	(0.57)
EXP (in 000)	**0.05**	**0.05**	**0.04**	**0.04**
	(3.29)	**(3.24)**	**(3.12)**	**(3.06)**
TSCORE	-0.38	-0.31	-0.28	-0.25
	(-1.26)	(-0.99)	(-1.20)	(-1.04)
ADDIS	**0.13**	**0.15**	**0.11**	**0.10**
	(1.76)	**(1.87)**	**(2.17)**	**(2.07)**
DIST (in 000)	-0.01	-0.01	-0.01	-0.03
	(-0.06)	(-0.17)	(-0.16)	(-0.38)
HELPPOOR	**-0.20**	**-0.14**	**-0.17**	**-0.12**
	(-3.04)	**(-2.04)**	**(-3.20)**	**(-2.30)**
TIGRAY		0.17		0.15
		(1.63)		(2.00)
CATHOL		-0.23		-0.21
		(-2.32)		(-2.73)
PROTEST		0.06		0.06
		(1.07)		(1.26)
DOCTOR			0.88	0.86
			(13.70)	(13.30)
Constant	6.58	6.52	6.77	6.69
	(18.20)	(17.58)	(23.46)	(22.85)
σ	0.28	0.27	0.25	0.24
	(11.81)	(11.98)	(14.63)	(14.82)

Table 4: Descriptive statistics for psycho-social variables related to intrinsic motivation (HELPPOOR)

Variable	Description	Mean
CHILDHW	Dummy variable indicating individual wanted to become health worker as a child	0.66
PARENT	Dummy variable indicating whether parents had influence on decision to become hw[a]	0.63
INTEGRITY	Interitem correlation of answers to Q71 , Q72	4.01
TRUST2	Interitem correlation of answers to Q73, Q74	2.79
INITIAT	Interitem correlation of answers to Q64, Q65, Q67	2.08
RECIPR	Experimental measure from generalised trust game	26
FINING	Experimental measure from third party punishment game	3
SCHOOLNGO	Dummy variable indicating whether school is private NGO	0.18

a. Constructed from a question where they had to indicate agreement on a five point Likert scale with the statement *My parents had a big influence on my decision to become a health worker* .

Table 5: Reliability of psychosocial constructs

Construct	# Items	Items[a]	α
INTEGRITY	2	Q71 One should never allow oneself to be paid for more hours than worked Q72 One should never allow oneself to be reimbursed for more money than one actually spent on expenses	0.70
TRUST1	3	Q73 How often do you lend money to your friends? Q74 How often do you lend personal possessions to your friends (e.g. music, clothes, bicycle, etc.)? Q75 How often do you intentionally leave the entrance door of the place where you live unlocked?	0.42
TRUST2	2	Q73,Q74	0.51
INITIAT	3	Q64 I use any opportunity to participate actively when there is something to do Q65 When I do a task, I normally do more than I am asked to do Q67 If there is anything to do I usually take the initiative, even if others do not	0.47

a. For Q64 – Q72 the respondent was presented with a 5-point LIkert scale containing *disagree, disagree, neither agree nor disagree, agree, and strongly agree*; for Q73-74, the respondent could choose from five frequencies: m*ore than once a week, about once a week, about once a month, once a year* and *never*; for Q75 he could choose between *very often, often, sometimes, rarely* and *never*.

Table 6: Probit intrinsic motivation on characteristics of individual and her environment
(marginal effects)

	Nursing students		Nursing and medical students	
AGE	0.01	0.01	0.01	0.00
	(1.17)	(0.68)	(1.05)	(0.41)
FEMALE	**0.19**	**0.19**	**0.15**	**0.15**
	(2.52)*	**(2.52)***	**(2.37)***	**(2.42)***
CATHOL	0.25	0.12	0.20	0.05
	(2.04)*	(0.83)	(1.91)+	(0.43)
SCHOOLNGO		0.20		0.26
		(1.74)+		(2.39)*
DIST	-0.00	-0.00	-0.00	-0.00
	(0.78)	(0.58)	(0.79)	(0.55)
CHILDHW	0.03	0.03	0.02	0.01
	(0.38)	(0.32)	(0.33)	(0.23)
PARENT	0.01	-0.02	-0.03	-0.04
	(0.08)	(0.18)	(0.41)	(0.66)
INTEGRITY	0.04	0.03	0.02	0.01
	(0.99)	(0.73)	(0.59)	(0.30)
TRUST2	0.05	0.04	0.00	-0.00
	(1.30)	(1.08)	(0.12)	(0.06)
INITIAT	-0.07	-0.08	-0.07	-0.07
	(1.36)	(1.48)	(1.53)	(1.68)+
RECIPR	-0.00	-0.00	-0.00	-0.00
	(0.38)	(0.57)	(0.17)	(0.45)
JUDGFAIR	0.03	0.03	0.02	0.02
	(1.82)+	(1.61)	(1.44)	(1.22)
DOCTOR			-0.09	-0.04
			(1.33)	(0.63)

Note: Absolute value of z statistics in parentheses
+ significant at 10%; * significant at 5%; ** significant at 1%.

Table 7: The relationship premium - job characteristics: nurses

	Nursing students	Nursing and medical students
PROMO	**49.35**	**43.06**
	(2.61)**	**(2.66)****
OTHINC	19.72	13.70
	(1.11)	(0.84)
EDU	**61.87**	**51.65**
	(3.52)**	**(3.33)****
HEALTHC	-12.84	-8.29
	(0.65)	(-0.50)
WORKPL	-3.67	-3.27
	(-0.19)	(-0.20)
TRAINING	**29.18**	**43.13**
	(1.45)**	**(2.55)***
R-squared	0.38	0.55

Note: The reported coefficients are X-standardized coefficients; the coefficient for the constant is not reported. The regression includes aqll control variables included in the model in Table 3
Absolute value of t statistics in parentheses. + significant at 10%; * significant at 5%; ** significant at 1%.

Table 8: Costing simulations

	Current distribution	Simulation 1: All health workers are intrinsically motivated	Simulation 2: More female health workers	Simulation 3: Less health workers from Addis Ababa
Proportion that is female	44% of nurses 18% of doctors	44% of nurses 18% of doctors	75% of nurses 50% of doctors	44% of nurses 18% of doctors
Proportion coming from Addis Ababa	20% of doctors 40% of nurses	20% of doctors 40% of nurses	20% of doctors 40% of nurses	10% of doctors 10% of nurses
Proportion that has high intrinsic motivation	29% of nurses 18% of doctors	100% of nurses 100% of doctors	34% of nurses 19% of doctors	29% of nurses 18% of doctors
Salary to get 100% of current cohort of nurses in rural area	1019	841	1046	1019
Base salary for nurses (in Birr)	700	700	700	700
Premium to make 100% of current cohort of nurses choose to work in a rural area (in Birr)	319	141	346	319
Premium as % of salary to make 100% of current cohort of nurses choose to work in a rural area (in % of base salary)	31%	20%	33%	31%
Salary to get 100% of current cohort of doctors in rural area	2,296	1,863	2,242	2,108
Base salary for nurses (in Birr)	1,400	1,400	1,400	1,400
Premium to get 100% of current cohort of doctors choose to work in a rural area (in Birr)	896	463	842	708
Premium as % of salary to make 100% of current cohort of doctors choose to work in a rural area (in % of base salary)	39%	33%	38%	34%
Required rise in annual health budget to make 100% of current cohort of nurses and doctors choose to work in a rural area (in Birr)	7,337,454	5,589,942	7,659,348	6,904,302
Required rise in annual health budget to make 100% of current cohort of nurses and doctors choose to work in a rural area (in USD)	863,230	657,640	901,100	812,271
Required rise in annual health budget to make 100% of current cohort of nurses and doctors choose to work in a rural areas (in % of current health budget)	0.9%	0.7%	1%	0.9%
Required rise in annual health budget to make 100% of current cohort of nurses and doctors choose to work in rural areas to reach doubling of number of nurses and doctors in 5 years (in % of current health budget)	2.7 %	2.0 %	2.7 %	2.5 %
Required rise in annual health budget to pay the basic salary when doubling the number of nurses an doctors in 5 years (in % of current health budget)	5.2%	5.2%	5.2%	5.2%

Appendix

Sampling Procedure and Survey Methodology

Sampling procedure

We collected data from 219 nursing and 90 medical students sampled from eight clinical nursing schools and three medical faculties all over the country. Clinical nurses represent about 67 % of the total number of nurses .[41] All medical faculties and their nursing school are selected. The remaining sampled nursing schools, listed in Table 1, are selected from a complete list of twenty clinical nursing schools in four regions: Addis Ababa, Amhara, Oromiya and SNNPR. We included at least one school per regions and per type of ownership. We distinguish four types of ownership: (i) public schools funded by the Federal Government; (ii) public schools funded by the Regional Health Bureau; (iii) private NGO schools and (iv) private for profit schools. The nursing schools related to a medical faculty fall in the first category and are all (three) selected. Since the other schools have a similar profile within each category, the selection in each category is on the basis of convenience.

Table 9: Students and schools by ownership and region

	Surveyed Nursing students	Surveyed Medical students	School Ownership	Region	2003/4 final nursing students	2003/4 medical students year before they enter internship
Addis Ababa University	32	30	Public-Federal	Addis Ababa	136	67
Gonder College	30	30	Public-Federal	Amhara	55	53
Jimma University	20	30	Public-Federal	Oromiya	45	72
Asella Nursing School	30		Public-Regional	Oromiya	101	
Yirgalem School of Nursing	30		Public-Regional	SNNPR	90	
Selihom Nursing School	27		NGO	SNNPR	30	
St. Lukes Catholic College	20		NGO	Oromiya	27	
Medco BioMedical College	30		Private	Addis Ababa	107	
Total	**219**	**90**			**551**	**192**

Survey Instruments

The survey contains three instruments: a survey questionnaire, a medical knowledge test and two behavioural game.

[41] We only survey nurses attending the two year diploma programme, and exclude the 1-year programme leading to a certificate in nursing because it is relatively recent and already being phased out on the basis that the technical specialization is insufficient (MOH, 2004). The category of *clinical* nurse is also less well defined for certificate level nurses.

The designed in English and translated by a professional translator into Amharic; both versions were adapted after the pilot. All students were presented with the option to take the Amharic or the English version of the questionnaire.

The test was prepared by a team of health professionals from Addis Ababa University under supervision of Gebreselassie Okubaghzi and Agnes Soucat to ensure that it takes both the curriculum and Ethiopian conditions into account. On their advice, and after a pilot, the medical test was conducted in English.

The English script for the game was translated into Amharic by a professional translator and then back translated to check for any alteration in meaning. The game was explained in Amharic. In each school only two sessions of the game were run, and to avoid contamination, they were implemented back-to-back so that students could not obtain information about the test or game on before hand. In each school, three rooms were used so that people who played different roles in the games did not get to see each other (which might bias results). For more details see

Games

Two games were played: The Generalized Trust Game and the Tird Party Punishment Game.

Generalized trust game

The Generalized Trust Game involves two types of players, Proposers and Responders. Every player is allocated 40 Birr.[42] First, every Proposer is invited to send between zero and 40 Birr to the Responder. Whatever the Proposers send is tripled before being passed on to the Responders. Every Responder is then invited to send some part of that tripled amount to the Proposer. In the version we played, the Proposer who originally sends the money is different from the Proposer who receives money from the Responder.[43] All students play the role of Responder. In that role they are asked to pass resources that have been entrusted to them, to a third party. This role has some of the characteristics of the health worker role that the students will fulfill when they start their careers. The extent to which the students respond positively to being entrusted with resources in the game may be a predictor of their response to being entrusted with public resources in real life. Thus, it might act as a proxy for their preference for or their behaviour in public service. Note that the students were asked to give a response for every scenario. Before carrying out their task they had to write down how much they would pass on in each case: if they would receive 15 Birr, 30 Birr, 45 Birr, etc. This gives us several observations for each student and allows us to draw a *response function* for each of the students.

Third Party Punishment Game

[42] We only provide a brief description of the games here. Further details can be obtained from the authors.

[43] More precisely: Every Proposer is matched with two Responders, one to which they may send money during the game, and one from which they may receive money during the game. Similarly, every Responder is matched with two Proposers, one from which they may receive money during the game, and one to which they may send money during the game.

A second game we play is the Third Party Punishment Game. This game involves three players, A, B, and C. Players A and B are allotted 50 Birr between them. Player A has to decide how this money is to be divided between himself and Player B. Player B receives whatever Player A allocates to them. Player C receives 25 Birr. Player C is informed of Player A's decision and is then given the opportunity to pay zero, 5 Birr or 10 Birr to inflict punishment on Player A. For every 5 Birr that Player C pays, 15 Birr are taken away from Player A. Play is anonymous. All students play the role of Player C. In this role, they are asked to pass judgment on what Player A has done and then to 'put their money where there mouth is'. How much they are willing to pay to see Player A punished when they make low allocations to Player B is a direct measure of the strength of their negative reaction to an act of unfairness. As with the Generalized Trust Game we asked the students to write down the actions they would take before they received the information about A's behaviour. Again, this gives several observations for each student and enables us to draw a *fining function* for each student.