What affects the career choices of health workers?

Four essays on preferences, incentives and career choices in a low-income context

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Abstract

The geographical imbalance of the health workforce in Tanzania represents a serious problem when it comes to delivering crucial health services to a large share of the population. The Tanzanian health system, like many others in low-income countries, needs better incentive systems to attract dedicated workers to the health sector, to bring more qualified health workers to rural areas, and to induce them to use their knowledge and skills efficiently. However, creating better incentive and recruitment systems requires thorough knowledge of health workers' motivations and preferences, as well as the relative valuations of different job attributes. The aim of this Ph.D. project has been to contribute to the base of knowledge about health workers' individual motivations and preference structures. It has also been an important goal to examine how jobs with different characteristics can be matched with these preferences in order to provide high-quality health services on a larger scale.

The first essay, *'How to make rural jobs more attractive to health workers: findings from a discrete choice experiment in Tanzania'*, published in 'Health Economics' (2010), provides new quantitative information about how health authorities can make jobs in rural areas more attractive to newly educated clinical officers. A data set stemming from a discrete choice experiment with clinical officer finalists in Tanzania is applied. The results show that offering additional education after a certain period of service is one of the most powerful recruitment instruments the authorities have available. Increased salaries and hardship allowances are also likely to substantially increase recruitment in rural areas. Offers of decent housing and good infrastructure, including the provision of equipment, can also increase recruitment to rural remote areas but not as much as higher wages and offers of education.

In the second essay, *'Mixed logit estimation of willingness to pay distributions: a comparison of models in preference and WTP space using data from a health-related choice experiment'*, co-authored with Arne Risa Hole, different approaches to modelling the distribution of WTP are compared using mixed logit models and the same data set as in essay 1. The standard approach of specifying the distributions of the coefficients and deriving WTP as the ratio of two coefficients (estimation in preference space) is compared to specifying the distributions for WTP directly at the estimation stage (estimation in WTP space). The results suggest that sensitivity testing using a variety of model specifications, including estimation in WTP space,

is highly recommended when using mixed logit models to estimate willingness to pay distributions.

In the third essay, *'How does additional education affect willingness to work in rural remote areas?: an application to health workers in a low-income context'*, the main objective is to evaluate the effect of offering education opportunities as a strategy to recruit health workers to rural areas. A dataset capturing stated job preferences among freshly educated Tanzanian health workers with basic and more advanced clinical education is applied in order to investigate how additional education as an incentive mechanism affects the willingness to work in rural areas. In order to control for selection effects into the additional education scheme, the two cadres are matched on propensity scores. It turns out that the health workers with advanced clinical education would have been more likely to prefer a job in a rural remote area had they not received the advanced clinical education. The result goes a long way in suggesting that a policy aiming at recruiting health personnel with basic clinical education to rural remote areas by offering jobs that include possibilities of upgrading after a certain period of service, may be a temporary measure only.

The fourth essay, *"Pro-social preferences and self-selection into the public health sector: evidence from economic experiments"* co-authored with Ida K. Lindkvist, studies the extent to which differences in pro-social preferences are related to career choices. We test whether preferences vary systematically between Tanzanian health worker students who prefer to work in the private health sector and those who prefer to work in the public health sector. Despite its important policy implications, this issue has received hardly any attention to date. By combining data from a questionnaire and two economic experiments, we find that students who prefer to work in the public health sector have stronger pro-social preferences than those who prefer to work in the private sector. We also show that the extent to which these students care about others can be conditional and linked to inequality aversion. A systematic self-selection of pro-socially motivated health workers into the public sector suggests that it is a good idea to have two sectors providing health services: this can ensure efficient matching of individuals and sectors by allowing employers in the two sectors to use different payment mechanisms tailored to attract and promote good performance from different types of health workers.

Contents

Chapter 1

Introduction and overview

What affects the career choices of health workers?

Four essays on preferences, incentives and career choices in a low-income context

1. Introduction

Low-income countries, in particular those situated in sub-Saharan Africa, are in desperate need of more available and higher-quality health services (WHO, 2006). Human resources for health (HRH) are perhaps the single most important input to the health sector in low-income countries (Hongoro and McPake, 2004), and shortage of health personnel and poor health worker performance are among the most pressing problems for health systems in those countries (Chen et al., 2004, WHO, 2006). Recent reports have pointed out that human resources constitute a fundamental constraint to improving health outcomes and reaching the Millennium Development Goals (Joint Learning Initiative, 2004, World Bank, 2004). Wyss (2004) deepens this claim, stating that lack of skilled personnel poses a threat to the success of recent global initiatives such as the Global Fund to Fight AIDS, Tuberculosis and Malaria, as well as other programmes intended to scale up health services in order to reach the Millennium Development Goals.

Availability of health personnel is crucial for the performance of health systems, as it is closely related to a population's health outcomes (Anand and Barnighausen, 2004). In the 2006 World Health Report, the World Health Organization (WHO) commented in particular on the critical necessity of having enough competent health personnel for better health system performance, identifying 57 countries whose number of health workers was below the critical level of 2.5 qualified health professionals per 1,000 of the population (WHO, 2006). Most of these countries were in sub-Saharan Africa. This thesis focuses on Tanzania, one of these highly burdened countries. According to the Joint Learning Initiative (2004), the number of health workers in Tanzania is as low as 0.4 per 1,000 citizens. Between 1994/95 and 2001/02, Tanzania experienced a

sharp decline in number of health workers: the active health workforce per capita declined by 40% over this period (Mæstad, 2006). The decline was caused in part by a reform aimed at decreasing use of poorly qualified cadres at health facilities, but also by years of relatively strict structural adjustment programmes. Shortages are expected to increase sharply in coming years, primarily due to the huge personnel requirements for care and treatment of people living with HIV/AIDS (Mæstad, 2006). It has been estimated that in order to implement the set of priority interventions implied in the Millennium Development Goals, the number of health workers in Tanzania would need to increase manifold (Kurowski et al., 2004).

A strong urban bias on the part of the health workforce (Munga and Mæstad, 2009) further deepens problems for the large rural population. Geographic imbalance in the health workforce is a persistent feature of nearly all health systems, but the situation is often more acute, and the consequences more severe, in low-income countries. In a policy research working paper from the World Bank, Gauri (2001) points out regional imbalance as one of four key problems in the health care systems of low-income countries. Furthermore, the most comprehensive overview of available evidence on the HRH situation in Tanzania, Dominick and Kurowski (2005), identifies geographical imbalance as one of five main problems, pointing out the severe information gaps on this area. According to Dominick and Kurowski, migration rates from rural to urban districts and between public and private facilities are unknown, and a thorough analysis of the causes of geographical imbalance is lacking. More specifically, there is no quantitative evidence on what motivates Tanzanian health workers to work in rural districts. Lack of such evidence makes prioritising between different policies aimed at correcting geographical imbalance very difficult and arbitrary, and the consequences of less efficient allocation of scarce resources may be severe.

However, the problem of human resources in the Tanzanian health sector does not consist only in personnel shortages and urban bias; worker motivation and performance there have also been described as poor (Leonard et al., 2005, Manzi et al., 2004), and several researchers and policymakers such as Kurowski et al. (2004) argue that the need for more personnel could be considerably reduced by improving health worker performance. In the Health Sector Strategic Plan for 2009-2015, the

Tanzanian government suggests that public-private partnerships, decentralisation, and promotion of more pay-for-performance incentive schemes are areas of priority for the coming years. It is true that, though salary levels are comparable, the private and public sectors in Tanzania have different incentive schemes. Studies of clinical quality have found that private organisations more frequently hold workers responsible for performance and that they provide better services (Mliga, 2003, Leonard et al., 2007). This is important for many reasons: for one, health services in the rural areas of Tanzania are serviced mainly by private not-for-profit organisations and the public sector, while in urban areas health services are provided mainly by the public sector and the private for-profit sector; the latter is practically absent in rural areas. Health workers that prefer to deliver care to those who need it most are thus more likely to apply for jobs in the public sector or the private not-for-profit sector, since private for-profit facilities do not service this group. Hence, it is not clear that implementation in the public sector of incentive systems inspired by the private sector will yield the intended results; we need more information about health workers' preferences and reactions to the same incentives before we can draw such conclusions. Unfortunately, there is no available source of systematic data on this question, and overall evidence on staff morale, satisfaction and motivation is scarce (Mæstad, 2006, Chopra et al., 2008). Data on health worker availability in the private sector are particularly difficult to find.

The Tanzanian health system, like many others in low-income countries, needs better incentive systems to attract dedicated workers to the health sector, to bring more qualified health workers to rural areas, and to induce them to use their knowledge and skills efficiently. However, creating better incentive systems requires thorough knowledge of health workers' motivations and preferences, as well as the relative valuations of different job attributes. There is also a need to know whether and why they prefer to work in the private or the public sector. In essence, there is a need to know more about the mechanisms behind the career choices of existing and potential health workers in Tanzania.

The aim of this Ph.D. project is to contribute to the base of knowledge about health workers' individual motivations and preference structures. It is also an important goal

to examine how jobs with different characteristics can be matched with these preferences in order to provide high-quality health services on a larger scale.

The thesis focuses on two related but somewhat different areas. The first three essays are based on different parts of the same data set and are concerned mainly with the geographical imbalance of the health personnel. The fourth is based on another data set and focuses on the selection of different types of health workers in the public and private health sectors. The two applied data sets were collected especially for this PhD project and are described and discussed in section 2. Section 3 provides brief summaries of the four included essays; finally, section 4 offers a synthesis of the main contributions of this thesis and suggestions for future research avenues.

2. Discussion of the applied data and data collection methods

Revealed versus stated preferences

In economics, a common approach to studying career choices and trends in the labour market is to use data on actual choices. Tastes or preferences are then said to be revealed through these real-world choices (Train, 2003). In this type of data set, individuals do not have the chance or incentives to manipulate the results, since we discuss real behaviour with real consequences. However, choices will be restricted to real choices between existing goods or jobs and to situations where there is actual variation in the attributes of interest. On the particular question of location decisions, there are several studies of preferences revealed through actual choices conducted in high-income countries (see e.g. Antonazzo et al., 2003, Kristiansen and Forde, 1992, Shields, 2004). However, there have been few attempts to systematically collect longitudinal data on the labour market of health personnel in low-income countries, and there is no such available data set for Tanzania. Collecting data of this kind is typically very expensive and demands continued updating over a long period of time; consequently, it is unlikely that there will be available longitudinal data on the labour market of health workers in Tanzania in the near future.

Even if there were available data on the actual career choices of Tanzanian health workers, there would likely be little natural variation in revealed preferences for a

very important factor: wage level. Wages are more or less the same throughout Tanzania,[1] and there is a problem of vacant positions in rural districts. All else being equal, this means the researcher may have difficulties estimating an accurate and significant coefficient for the wage variable when using data on actual choices.[2] The problem of variation could thus lead researchers to conclude wrongly that wage is not important for career choices.

Moreover, underlying other-regarding preferences are extremely difficult, if not impossible, to single out by studying actual behaviour in the market, where many factors may be confounded. It was therefore necessary to collect exclusive data for all four essays in this study. Both collected data sets are classified as stated preference data, or data collected in experimental or survey situations where respondents are presented with hypothetical choice situations. The term refers to the fact that the respondents state what their choices would be in hypothetical situations (Train, 2003). With these data sets, it is possible to expand the focus to areas outside the existing reality, exploring preferences for non-existing policies (*e.g.*, to provide jobs with education possibilities after some time of service), and to attributes with litle natural variation, such as wages in the Tanzanian public health sector.

The first three essays are based on a data set that includes answers to an extensive survey and on participation in a discrete choice experiment, while the fourth essay is based on responses to a similar questionnaire and on participation in two economic lab experiments. The two data sets are described below, followed by a discussion of the strengths and weaknesses of the respective data collection methods.

[1] Health workers of the same cadre and with the same level of experience earn roughly the same salary whether they work in a public or private facility, or in a rural or urban area.

[2] In regression analysis, in addition to the size of the estimated coefficient, the variance is of vital practical importance: a larger variance means a less precise estimator, which translates into larger confidence intervals and less accurate hypothesis testing (Wooldridge, 2006). There are, in principle, at least two important factors that affect the variance of an estimated coefficient: variance of the error term and total sample variation. When the total sample variation for the independent variable of interest is small, variation of the estimated coefficient can become very large.

Data set 1: Discrete choice experiment & survey

The first data set was collected in autumn 2007. Some 320 clinical officer (CO)[3] students and 120 assistant medical officer (AMO)[4] students in the final year of their education responded to an extensive questionnaire capturing their demographic, socioeconomic and cultural backgrounds, as well as their thoughts about their careers and motivational factors. They also participated in a discrete choice experiment (DCE). In all, 13 randomly selected CO training centres and 3 AMO training centres were visited, and we ended up with participation from around 60% of the 2007-2008 cohort of COs and 80% of the 2007-2008 cohort of AMOs. Participation was voluntary and participants were not compensated in any way, although due to the complexity of the task and the time they had to spend with the researchers they were offered a soft drink and a snack.

DCE is, in short, a quantitative method that allows the researcher to derive the relative importance of different attributes of a good or service. The idea, following Lancaster (Lancaster, 1966), is that a preference for a good or service is in fact a preference for the combination of attributes that form it. By studying the choices between different goods or services, the relative preferences for the attributes can be derived. In practice, the participants in a DCE choose between hypothetical goods or services, which are constructed as bundles of attributes; it is assumed that respondents choose the bundle that offers them the highest utility. The data stemming from DCEs are consequently consistent with the use of random utility models, as proposed by McFadden (1974).

In the DCE applied in this study, respondents chose between pairs of constructed hypothetical jobs. The aim of the experiment was to elicit preference information considered important for policy making. With this in mind, results from in-depth interviews conducted with CO and AMO students in March 2007, combined with economic theory and reviews of existing empirical literature, led to inclusion of the

[3] Clinical officers are health workers between the status of nurse and medical doctor. They have more or less the same amount of education as nurses, but their training is more clinically oriented; in fact, clinical officers often function as medical doctors in rural areas.
[4] An assistant medical officer is a CO with two years of additional education who is able to perform simple surgery.

following attributes toward defining of the jobs: 1) working location; 2) salary and allowances; 3) possibilities of further education; 4) workload; 5) offer of decent housing; 6) availability of equipment and drugs at the institution; and 7) infrastructure. A D-efficient computerised design allowing for interaction effects was applied in order to combine the attributes into hypothetical jobs and choice pairs,[5] resulting in a design with 32 choices between pairs of non-labelled jobs. The 32 choice sets were randomly divided into two blocks so as not to exhaust respondents. Each respondent thus made 16 binary choices. Two versions of each block were made, where the order of choices was varied in order to correct for the possible effects of learning or exhaustion.[6] The DCE was tested in a pilot with 30 students at Kilosa Clinical Officer Training Centre, after which the formulation of certain attribute levels was changed and some of the questions were reformulated. The experiment is described in more detail in essay 1; an example of a choice set and a copy of the instructions given to the respondents are provided in its appendix.

DCE has been applied extensively within the fields of environmental economics and marketing research (see e.g. Adamowicz et al., 1998, Kuhfeld et al., 1994); thus, most of the development and debate around the method and related techniques have been within these fields (Carson et al., 2001, Green et al., 2001, Portney, 1994) rather than in health or labour economics. Although the method has been increasingly applied in health economics, very few DCEs are applied on health issues in low-income countries; to my knowledge there are only four other studies applying a DCE to issues concerning human resources for health in low-income countries. Two are conducted with nurses in Malawi and South Africa, respectively (Mangham, 2006, Penn-Kakana et al., 2005), one with doctors in Indonesia (Chomitz et al., 1998), and one with both cadres in Ethiopia (Hanson and Jack, 2008). Moreover, there are no available quantitative studies on preferences of mid-cadres like COs and AMOs in low-income countries. Generally, this suggests that few studies apply DCEs in low-income settings. The few exceptions include studies from other types of health service research (Hanson et al., 2005, Baltussen et al., 2006, Baltussen et al., 2007) or from fields other than economics (see e.g. Hope and Garrod, 2004, Baidu-Forson et al.,

[5] For an introduction to D-efficient designs, see Kuhfeld et al. (1994).
[6] No systematic differences between answers to the four versions were detected; it was thus concluded that the results were not affected by responder exhaustion.

1997, Tano et al., 2003). For an informative review of the use and potential contributions of DCEs to policy making in HRH issues, see (Lagarde and Blaauw, 2009). For a discussion of DCE implementation in low-income settings, see (Mangham et al., 2009). Finally, for a discussion of particular challenges related to the application of DCEs in health economics, see (Ryan and Gerard, 2003).

A DCE has many strengths: for one, it provides valuable information about preferences for attributes or goods for which there is no market (Louviere et al., 2000), which is important when considering whether to introduce a new good or when implementing a policy that creates previously unavailable jobs. Also, when real-life attributes always appear simultaneously, such as a rural remote location and bad infrastructure in health worker jobs in Tanzania, an analysis based on revealed preferences will have difficulty disentangling preferences for location and infrastructure, but a DCE will not (Louviere et al., 2000). Finally, when there is very litle variation in revealed preference data, as is the case for rural and urban public salaries in Tanzania, a DCE can still help the researcher elicit relative preferences for the wage attribute. A somewhat different argument in favour of the DCE is that, compared to other types of stated preference studies, it allows for particularly policy-relevant analyses deriving the relative importance of different relevant attributes (Lagarde and Blaauw, 2009). Moreover, regression coefficients from econometric analysis can easily be used to estimate willingness to pay for different characteristics (for an example of this, see the first essay in this thesis; for a discussion of methods for estimating willingness to pay from a DCE, see the second essay).

A non-ignorable drawback of DCEs compared to other stated preference methods[7] is that they demand competence in a number of areas; the method involves qualitative studies, literature review, development of relatively complex statistically efficient designs, and insight into quantitative methods of analysis. A number of available resources can guide such work (Witt et al., 2008, Hensher et al., 2005, Louviere et al., 2000, Train, 2003) but it is critical that each step of a DCE's development be properly addressed for the inference of the resulting analysis to be valid.

[7] For alternative stated preference methods, see *e.g.* (Ryan, 2004, Ryan et al., 2004, Özdemir et al., 2009).

When applying a DCE to a research problem, there are some crucial steps involved, all of which have related challenges. Some involve the inclusion of attributes and the assignment of levels thereto (Coast and Horrocks, 2007, Lagarde and Blaauw, 2009). As mentioned, information derived from the DCE will depend greatly on how the experiment is designed; though there are a number of practical guides and studies available (Hensher et al., 2005, Louviere et al., 2000, Street and Burgess, 2007), there will always be some trade-off between realistic and statistically efficient choice alternatives (Louviere et al., 2005). Piloting is also crucial in order to ensure that the hypothetical alternatives are well defined and that respondents understand the task and do not adopt heuristic rules when they make their choices (Ryan and Bate, 2001, Scott, 2002). Piloting can be particularly important in low-income contexts, where the research is still scarce and the cultural context is often somewhat unfamiliar to the researchers (Mangham et al., 2009).[8] The last critical step is analysis of the results. For an excellent introduction to choice modelling see (Train, 2003). A number of random utility models have been applied to analyse DCEs; it is established that estimates of relative preferences may vary according to the method chosen (see *e.g.* Hole, 2008). The ability to capture taste variation in particular differentiates the applied models (Chesher and Santos Silva, 2002).

Data set 2: Economic lab experiments & survey

The second data set applied in this thesis was collected in autumn 2008. Some 40 medical degree students and 40 nursing students from the Muhimbili University for Health and Allied Sciences (MUHAS) filled out a survey similar to the one in the first data set before participating in two economic lab experiments: a dictator game and a trust game. Posters at the college invited students to send a text message to the researchers if interested in participating in a social science research project aimed at learning more about health worker motivation. Participants were not compensated in any way, although they were told that it was possible to earn up to 20,000 TSH.

[8] It is an unfortunate fact that most DCEs in low-income countries are conducted by researchers from high-income countries.

In economics it has been, and still often is, routinely assumed that economic actors are driven by self-interest. However, the literature is not ignorant of the fact that people may care for others, which may influence their behaviour (see e.g. Arrow, 1983, Becker, 1974, Samuelson, 1993, Sen, 1995). Evidence from economic experiments from the last two decades indicates that a substantial percentage of people are strongly motivated by other-regarding preferences[9] and that concerns for the well-being of others cannot be ignored in social interactions (Fehr and Schmidt, 2005). Economic experiments are well suited to the investigation of how other-regarding preferences affect behaviour; Fehr and Smith (2005) argue that the simplistic nature of economic experiments makes the trade-off between self-interest and concern for others more salient and easier to understand, and that inference is consequently more reliable than inference from analyses of other-regarding preferences based on field data.

The dictator game is frequently used to study how willing people are to share instead of maximising their own material benefit (Camerer, 2003); it is thus often said to measure altruism and norms of sharing (Levitt and List, 2007). In a standard dictator game, the dictator redistributes his endowment between himself and another player. He has the power to redistribute nothing, something, or the whole endowment. Our game had a slightly different setup, with dictators sharing their endowment between themselves and four other students, and some of them having the opportunity to send anonymous feedback. The game was originally designed for a purpose other than the analysis presented in essay 4, but as the data was analysed an interesting pattern of selection into public and private health facilities emerged.

Trust games are simple models of contracting with moral hazard and without contractual enforcement (Camerer, 2003), and have the potential to give additional information about how pro-social preferences affect behaviour in interaction among players. In the trust game, player 1 could chose to send none, some, or all of his endowment to player 2; on the way to player 2, the sending was tripled, so that if player 1 sent 1,000 THS, player 2 received 3,000 TSH. Player 2 then had to decide whether to return nothing, something, or everything to player 1. Player 1's decision is

[9] By other-regarding preferences we mean preferences regarding the welfare of others.

often said to measure trust, while that of player 2 is said to measure trustworthiness (Camerer, 2003). The latter decision is in many aspects similar to the decision made in the dictator game (there is no uncertainty involved and the main task is to distribute an endowment between oneself and another person), but it is also affected by the fact that the endowment results from interaction with others. More information about the particularities of the two games can be found in essay 4.

The use of economic experiments has increased manifold the last couple of decades (Falk and Heckman, 2009), particularly in high-income contexts, and is now a well-established method in economics. There are, however, comparatively few economic lab experiments conducted in low-income contexts (for a not fully updated, but extensive overview of lab experiments conducted in low-income countries, see Cardenas and Carpenter, 2005). As explicitly shown by Henrich et al. (2005, , 2006), cultures and settings can to a large degree explain behaviour in economic experiments, making it important to study experiments from the setting one is interested in rather than extrapolating results from general experiments. To my knowledge, only one other lab experiment has been conducted with (prospective) health workers in a low-income context (Serra et al., 2010); this work is very recent and was developed parallel to ours, but outside our knowledge. However, a few experiments have been conducted in Tanzania: Danielson and Holm (2005) exposed undergraduates in Tanzania to one trust game, one dictator game, and a standard set of survey questions related to trust; in a later study, they contrasted results from a trust game conducted with members of a congregation in Dar es Salaam with results from the trust game conducted among undergraduate students (Danielson and Holm, 2007).

Although lab experiments have become a well-established method in economics, there is a lively debate as to how much insight they can give us into the real grounds for behaviour. Falk and Heckman (2009) sum up the critique of experiments: 1) the subject pool is biased (the sample is too small and/or is not representative); 2) stakes are too low; and 3) experiments have little value outside the economic experiment setting, *i.e.* the external validity is low. I will briefly address each critique below.

The samples in economic experiments are often small compared to, for example, longitudinal labour market data. There are methods developed to make statistically efficient estimates and generate inferences from small samples (Falk and Heckman, 2009); that said, there are also several economic experiments conducted with relatively many participants (Falk and Heckman, 2009). In our case, students signed up to participate in the experiment, and may thus be a selected group. Levitt and List (2007) mention this kind of selection as an important hindrance to generalisability of results for economic experiments, arguing that students prone to voluntary participation in an experiment may well be more socially oriented than are students who do not bother to sign up. In our case, however, the possibility for students of earning money was quite high (up to two days' decent salary); it is thus not so likely that our sample was biased by a high share of students with pro-social preferences relative to the whole MUHAS student population. Another point related to the subject pool is that all essays in this thesis are based on data from students: an important consideration is therefore the extent to which students are representative. In general, the majority of economic experiments have been conducted with students, so there is little evidence as to whether results from student experiments are qualitatively and quantitatively different from those conducted with participants from the general population. However, this kind of generalisability is not particularly important for our study. We deliberately chose students as our subject pool, as they represent the future of the Tanzanian health system and, in the case of recruitment to rural areas, are regarded as more mobile than well-established health workers and thus easier to recruit. It is thus both interesting and important to study this group's preferences for job attributes and its possible pro-social preferences.

Another important critique summarised by Falk and Heckman (2009) and posited by several others (*e.g.* Levitt and List, 2007) is that the stakes may change the results, in particular that the stakes are often too low. The stakes in our experiments, endowments between 4,000 and 10,000 TSH, with the possibility to earn up to 10,000 TSH in one game and 12,000 TSH in the other, were not particularly low. In comparison, a freshly educated clinical officer earned approximately 200,000 TSH per month at the time the experiments were conducted. Moreover, the evidence on the importance of stakes is mixed (Levitt and List, 2007, Camerer, 2003).

The external validity of lab experiments can be low for a number of reasons. It has, for example, been argued that participants interpret the one-shot dictator and trust games as multi-stage games (see discussion between Binmore (2005) and Gintis (2006)). There is also the question of the extent to which scrutiny in the lab situation affects behaviour in an experiment; though donations are anonymous, participants are aware of being part of an experiment and may act in a manner congruent with what they see as the organisers' expectations. Levitt and List (2007, p159) formulate the consequences of this very precisely: '*the nature of scrutiny inherent in the lab is rarely encountered in the field, and represents an important aspect of the situation that needs to be accounted for when generalising laboratory results*'. For a more thorough discussion of external validity in the context of our experiments, see essay 4.

An important and general lesson emerging from much of the critique of economic lab experiments is that the researcher should be very careful about claiming universal knowledge based on results from the experiments. We must be particularly careful when extrapolating results to other populations, professions or cultures. There is also no final agreement on whether it is valid to extrapolate results to situations outside the lab. The more closely the decisions made in an experiment can be related to actual situations, however, the more valid an extrapolation to that kind of real-life situation is likely to be. However, this type of experimental set-up may come at the cost of more general insights. The researcher will always have to make a trade-off based on the purposes of the study.

3. Summaries of the four essays

Essay 1 - How to make rural jobs more attractive to health workers: findings from a discrete choice experiment in Tanzania

Single-authored, published in *Health Economics* (2010)

The first essay provides new quantitative information about how policy makers can make jobs in rural areas more attractive to newly educated clinical officers (COs). The aim has been to understand more about the preference structure of Tanzanian health workers and to answer the following question: which are the most important

determinants for health workers appraising the possibility of working and living in different parts of Tanzania? Furthermore, the government and health authorities of Tanzania need more information about the possible effects of policy interventions aimed at recruiting health workers to rural and remote areas; an important aim of the study is thus to shed light on the effects of different policies on the probability of choosing employment in a rural remote district.

Data from a DCE with CO finalists in Tanzania are applied. Although DCEs have become a common method for identifying preferences in health economics, few attempts at applying them to health personnel in developing countries have been undertaken. Chomitz et al. (1998) used a variant of a stated preference method with doctors in Indonesia; Mangham (2006) conducted a DCE with nurses in Malawi; Penn-Kakana et al. (2005) conducted one with nurses in South Africa; and most recently a DCE with both doctors and nurses was conducted in Ethiopia (Hanson and Jack, 2008). However, as far as I am aware, the preference structure of Tanzanian health personnel has not yet been identified by a DCE or similar quantitative exercise. In addition, the preferences of mid-cadres like COs have not yet been investigated properly.

The DCE consisted of 32 choices between pairs of hypothetical jobs. The resulting data were analysed with binary logit regressions, based on which willingness to pay measures for changes in job attributes were calculated in order to explore the relative valuations of job attributes. Marginal rates of substitution between job attributes were also calculated for different subgroups.

The results show that offering additional education after a certain service period can be a powerful recruitment instrument compared to other relevant policy alternatives available to authorities. Increased salaries and hardship allowances will probably also substantially increase recruitment to rural areas. Offers of decent housing and good infrastructure, including provision of equipment, are furthermore likely to increase recruitment to rural remote areas, but not as much as higher wages and offers of education. Women are less responsive to pecuniary incentives and are more concerned with factors that directly allow them to do a good job, while those with parents living in remote rural areas are generally less responsive to the proposed

policies. When willingness to help other people is a strong motivating force, policies that improve the conditions for doing so appear particularly effective.

Essay 2 - Mixed logit estimation of willingness to pay distributions: a comparison of models in preference and WTP space using data from a health-related choice experiment

Co-authored with Arne Risa Hole, submitted (October 2009)

The second essay focuses on the implications of the chosen method applied to estimate willingness to pay (WTP) measures. We do this by comparing two different approaches to modelling the distribution of WTP.

The stated preference data on Tanzanian CO job choices applied in the first essay were applied also in this analysis. In this second essay, the analysis from essay 1 is developed by using mixed logit, a state-of-the-art method for the analysis of discrete choices. Mixed logit models make it possible to account for heterogeneity in preferences unrelated to observed characteristics. When estimating the mixed logit model, the researcher specifies that the distribution of preferences follows a particular distribution, such as a normal distribution. The parameters of this distribution, such as the mean and the standard deviation in the case of a normal distribution, are then estimated using either classical or Bayesian estimation techniques. Since the WTP for an attribute is given by the ratio of the attribute coefficient to the price coefficient, the WTP from a mixed logit model is given by the ratio of two randomly distributed terms. Depending on the choice of distributions for the coefficients, this can lead to WTP distributions that are heavily skewed and that may not even have defined moments. In this essay, we compare the standard approach of first specifying the distributions of the coefficients and then deriving the WTP as the ratio of two coefficients (estimation in preference space) to specifying the distributions for WTP directly at the estimation stage (estimation in WTP space).

Qualitatively, the results are in line with those reported in the first essay, though the exact size of WTP measures varies somewhat. The models in preference space fit the data better than do the corresponding models in WTP space, although the difference

between the best-fitting models in the two estimation regimes is minimal. Moreover, the WTP estimates derived from the preference space models turn out to be unrealistically high for many job attributes. The results suggest that sensitivity testing using a variety of model specifications, including estimation in WTP space, is advisable when using mixed logit models to estimate WTP distributions.

Essay 3 - How does additional education affect willingness to work in rural remote areas?: An application to health workers in a low-income context

Single-authored

The first essay in this thesis suggests that rural remote jobs can be made more attractive by offering COs the chance to obtain more education after a certain period of service. However, it has been argued that attainment of higher-level education tends to open up new opportunities in the labour market (McCormick, 1997), and that the long-term effects of the proposed policy will depend on where these opportunities are located. Knowing that jobs requiring higher education often are located in more central areas, such new opportunities may lead to movement toward central areas,[10] making recruitment and retention of AMOs even more difficult than recruitment and retention of COs.

Consequently, the main objective of the third essay is to evaluate the effect of offering education opportunities as a strategy to recruit health workers to rural areas. In particular, the focus is on gaining increased knowledge of the effect of advanced clinical education on willingness to work in rural remote areas; the relationship between a broad range of personal characteristics and willingness to work in rural remote areas is investigated as well.

A slightly different data set from that used in essays 1 and 2 is applied. The analysis is based on data from a questionnaire given to all students before they participated in the DCEs, capturing demographic information, motivational issues and stated job

[10] Note that there are no formal differences in the wages of AMOs with the same level of experience employed in urban and rural areas, respectively.

preferences of both COs and AMOs. The clinical officers in this data set are thus identical to those used in the first two essays.

The effect of additional education as an incentive mechanism and willingness to work in rural areas are investigated using two main techniques: first, standard regression analysis is applied; secondly, in an attempt to control for selection effects in the advanced clinical education programme, the two cadres are matched on propensity scores. Average treatment effects on the AMOs (the difference between what the AMOs would prefer if they were COs and what they report that they actually prefer) are then estimated.

It turns out that obtaining advanced clinical education has a significantly negative effect on willingness to work in rural remote areas. The average effect of becoming an AMO on preference to work in rural remote areas is negative and substantial, both with simple regressions and via the more sophisticated propensity score method.[11]

Depending on specifications and method, becoming an AMO decreases the likelihood of preferring a job in a rural remote area by between 12.9 and 20.1 percentage points. Consequently, again depending on the specification, AMOs' predicted probability of preferring a job in a rural remote area is 15.9% and lower. Knowing that 21.5% of AMO students came from CO jobs in rural remote districts, this goes a long way in suggesting that a policy aimed at recruiting health personnel with basic clinical education to rural remote areas by offering jobs that include possibilities of upgrading after a certain period of service may be temporary measures only. The current situation, where AMOs are relatively much more unequally distributed between rural and urban districts than COs are, is likely to be reinforced if such a policy is implemented. Hence, if the goal of the policy makers is to ensure the presence of health workers with basic clinical skills in rural remote areas at any point of time, offering additional education opportunities after a certain service period may be reasonably successful. If, on the other hand, the goal is to ensure first recruitment and then retention, it may not be the best policy.

[11] Note that the effects in the straightforward regression analysis are the ATEs, while those in the matching analysis are ATTs. They are therefore not directly comparable.

Essay 4 - Pro-social preferences and self-selection in the public health sector: evidence from economic experiments

Co-authored with Ida Kristine Lindkvist, submitted (April 2010)

There is growing interest in the role of pro-social motivation in public service delivery. In general, economists no longer question whether people have other-regarding preferences, but ask how and when such preferences will influence their economic and social decisions. Apart from revealing that individuals on average share and cooperate even when such actions lower their own material payoff, economic experiments have documented substantial individual heterogeneity in the strength and structure of social preferences. In this paper we study the extent to which these differences relate to career choices.

The first three essays, in particular essays 1 and 3, were concerned with how soon-to-be health workers are attracted to different job attributes; however, one factor not considered in those analyses is ownership of the health facilities. In this last essay of the thesis, we test whether preferences vary systematically between Tanzanian health worker students who prefer to work in the private and public health sectors, respectively.

A new data set is applied in this essay; 40 medical degree students and 40 nursing students responded to a questionnaire and participated in two types of economic experiments, a dictator game and a trust game. We combine data from the three sources in our analysis. The survey and dictator game both indicate that students who prefer to work in the public health sector have stronger pro-social preferences than do students who prefer to work in the private sector. We also show that even though students who prefer to work in the public sector donate more in the dictator game and score higher on survey questions measuring pro-social preferences, they return less in the trust game than do the students who prefer to work in the private sector. We suggest that a possible explanation for this apparent anomaly is that students who prefer to work in the public sector are more inequality-averse than are students who prefer to work in the private sector.

We proceed by discussing how our findings could affect payment mechanisms and who should provide public health services. Differences in pro-social preferences between students who prefer to work in the public sector and those who prefer to work in the private sector can imply that different payment schemes will be effective in the public and private sectors, respectively. If workers with pro-social preferences are more prevalent in the public sector, managers in that sector should be careful with importing payment schemes that have worked effectively in the private for-profit sector: for the reasons given in the paper, these schemes may be less effective in the public sector. We conclude that it may be a good idea to have two sectors providing health services; this can ensure an efficient matching of individuals and sectors by allowing employers in the two sectors to use different payment mechanisms tailored to attract and promote good performance from different types of health workers.

4. Contributions of the thesis and future research avenues

The health sector crisis in sub-Saharan countries is often referred to in strongly negative terms; the situation seems challenging at best and hopeless at worst. However, the chapters in this thesis all show that in the midst of this health workers do have other-regarding preferences, and that they are likely to respond to incentives. The challenge for policy makers is to gather relevant and robust evidence to act on, and then to make informed decisions about what policies to implement. In this light, my thesis has three main contributions:

1) Investigation of long-term consequences of offering additional education

The relationship between education and mobility of health personnel in low-income contexts has not been investigated before. In economics, education is normally considered a positive good with possible positive externalities. The first essay shows that education is highly valued and that education possibilities are a very important factor in job choice for freshly educated COs; however, the third essay follows up by pointing out that offering COs jobs with education opportunities after a certain period of service is likely to reduce their willingness to work in rural areas. This is important knowledge for policy makers, and should be included in any kind of cost-benefit

analysis performed before deciding to attract health workers to rural remote areas by offering education opportunities after the mandatory service period.

However, before we can conclude that additional education will lead to a movement toward central areas, or that it would have the potential to recruit COs to rural remote areas to begin with, this conclusion will have to be confirmed in reality. An interesting follow-up would thus be to trace the paths of DCE respondents and compare their preferences revealed by actual job choices with the stated preferences applied in this thesis. Another interesting follow-up would be to implement a randomised controlled trial, where COs are recruited to rural remote areas and where, after a certain period of service, a random sample of them are offered opportunities to upgrade. Given that the sample is random and representative, it would eventually be possible to observe the effect of additional education on willingness to work in rural remote areas. There are surely many ways to do such a trial, and the method has severe challenges that would have to be addressed, but that is not within the scope of this thesis.

2) Demonstration of the usefulness of scarcely applied data collection methods

A problem with doing quantitative research in low-income countries is the limited number of available data sources. This hinders both researchers and policy makers in providing reliable analyses that can inform highly needed reforms in a number of areas. This thesis has shown that a number of relatively cheap and quick tools are available for collecting data: these tools can be used as a first step on the way to a better understanding of essential mechanisms of, for example, motivation and career choices among health workers. Since these methods are designed to collect stated preference data, the external validity of data emerging from these methods can never be scrutinised too much.

3) Methodological insight

The calculation of WTP for a good or service (or for the attributes of a good or service) is widely applied in health economics and other fields where we are interested in relative valuations. Policy makers are interested in these measures as useful inputs in cost-benefit analyses and other evaluations of policies or decision-making. However, in light of this, there is a need for more discussion of how

researchers estimate the relative valuation measures, in particular within the field of health economics. We have shown substantial heterogeneity in preferences, which should be accounted for in order to achieve a good fit with the data. Moreover, even though the data are the same, the method chosen to estimate WTP measures matters, and we have demonstrated that sensitivity testing using a variety of model specifications, including a relatively unknown approach in the field of health economics, is important.

A final note of caution: this thesis contributes to policy making by estimating and discussing the effects of various policy alternatives. However, in order to undertake a thorough comparison and valuation of such alternatives, it will be necessary to provide reliable cost-estimates of the various policies as well. This will be an important avenue for further research.

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Chapter 2

How to make rural jobs more attractive to health workers. Findings from a discrete choice experiment in Tanzania