

Modelling the economic impact of international movements in the health labour force

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ABSTRACT

Many developed countries are net recipients of skilled health professionals from developing countries. Potentially these movements provide major economic benefits to developed countries. The distribution of any benefits and any associated health and social costs, however, need investigation that is more systematic and thorough than has been documented thus far, especially the consequences to net donor countries. This paper proposes a model that can be adopted to examine systematically the impact of the international movement of health workers upon the health of populations (and health related institutions) affected by these movements.

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TABLE OF CONTENTS

Introduction	1
Modelling the economic impact of GATS: a review	3
Outline of the model	5
The conceptual schema	6
Hypotheses	6
Modelling global movements.....	7
Variables, sub-systems and measurement	7
Using the global model.....	8
Health, GDP and movements of health professionals.....	9
Discussion.....	10
References.....	12
Appendix 1	14

List of Figures

Figure 1 Relationships between global movements, health and wellbeing	15
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List of Tables

Box 1 Model to assess the effects of labour movements on health	16
Box 2 Feedback Loops	17

Modelling the economic impact of internal movements in the health labour force

Introduction

Many developed countries are net recipients of skilled health professionals from developing countries. Potentially these movements provide major economic benefits to these countries. The distribution of any benefits and any associated health and social costs, however, needs investigation that is more systematic and thorough than has been documented thus far. This paper proposes a model that can be adopted to examine systematically the impact of the international movement of health workers upon the health of populations (and health related institutions) affected by these movements, especially the consequences for the donor, less developed, countries. The model stresses the important link between health and long term economic growth, in a similar way to the link between education and economic growth (Alleyne & Cohen 2002).

The importance of trade resulting from persons who cross borders to provide services in another country has been recognised under the General Agreement on Trade in Services (GATS), and these services are dichotomised as arising from either temporary or permanent migration of individuals. The agreement divides trade in services into four modes: cross-border imports of telehealth services (mode 1); residents moving abroad for medical treatment (mode 2); inward investment from abroad in hospitals (mode 3); and the supply of a service when a person (as distinct from a company) moves temporarily into a foreign market (mode 4) - for instance, when health professionals cross national borders to deliver health services on a temporary basis. We are concerned with full time equivalent migrants where temporary services may, conceptually, be combined into full time equivalent.

The impact of health workers on health of populations depends on the stock available at any time and the distribution and the quality of skills they possess. Therefore the potential high turnover implied in the temporary nature of movement of workers may not impact on health directly as long as the stock remains constant, but there are economic costs involved with high turnover, such as transaction and training costs. Moreover the impact will vary according to whether a country is a net donor or recipient of health workers.

Health workers are almost immediately identified as skilled workers—doctors, nurses and allied health professionals. The *health industry*, however, requires many other workers, some of whom are highly skilled—managers, administrators, information technologists, accountants—and others less skilled—carers, attendants, cleaners, couriers and receptionists among others. The skill mix in health delivery may shift towards lesser skilled workers with the ageing of the population in developed countries and the relatively greater need for attendants and carers and technological and organisational innovation that contributes to the productivity of skilled labour. Thus in assessing the impact of migration of workers on health it is important to capture the mix of skills required of the future health workforce.

In developed countries the effect of importing skilled health professionals may be relatively small, for two reasons. First, since the total stock of medical professionals is relatively large the impact of a given inflow or outflow of health professionals will be relatively small in percentage terms. Conversely the same number of health professionals may represent a significant proportion of the total stock in a developing country. For instance, the Philippines lost, on average, over 5,000 nurses per annum from 1995 to 2000 (Francisco, 2003). Remittances from overseas health

professionals are unlikely to compensate for the loss of services in the donor country. The chief beneficial effect in developed countries may be the relative ease with which immigrant doctors and nurses may be channelled into areas of acute deprivation, where there may be shortages of domestic medical staff.

Second, the impact upon developing countries will be greater because of the greater importance of the services provided by a single health professional. Analyses of the impact of health professionals upon health invariably reveal 'diminishing returns' (Murray and Lopez, 1996). In a developing country a general practitioner, or equivalent health professional, may be a pivotal provider in a district hospital. In a developed country the equivalent ('marginal') provider may be primarily providing services to the 'worried well'. Other indirect effects upon health and GDP are possible.

Education typically has social returns. If educated workers move overseas, even temporarily, some of these benefits will be lost and the financial incentive for governments to provide public education declines accordingly. If, however, skilled workers are able to increase their private returns by working overseas or because they anticipate an increase in domestic wages as the country develops, the incentive for individuals to invest in education increases—individuals in developing countries may undertake training, and pay for it, specifically in order to obtain employment overseas. One suggestion to accommodate this would be compensatory remittances from developed to developing countries where education has occurred.

The potential effect on donor countries of the loss of more skilled personnel to developed countries is a matter of concern. Developing countries may not have a comparative advantage in exporting skilled personnel (Carzaniga, 2003). Additionally, a focus on the temporary movement of workers may lose some of the longer term effects. There is no clear definition of 'temporary' (Mattoo, 2003). Working visas in the UK, for example, are often extended for health personnel beyond the initial two year period to address shortages in certain areas of the National Health Service. In nursing, for example, there may also be revolving door provision, where vacancies are constantly filled by a stream of temporary workers. Because of the likely semi-permanent nature of any movement of skilled health workers, in the longer term there could be health and consequent economic problems for the populations left behind in the source countries.

Developing countries have made agreements to provide labour to developed countries only to realise somewhat later that costs outweigh the benefits. One example is the agreement between Jamaica and the UK and USA to supply school teachers to London and New York on a temporary basis. Five hundred left Jamaica, which represented three per cent of the teaching workforce, among whom those with the highest skill levels and most experience were over represented. The result was a shock to the Jamaican system. The country has no comparative advantage in training teachers, a process which takes four years. The Jamaican Government has since taken steps to stop the outflow (Brown, 2003).

Developing countries may benefit more from the provision of less skilled workers in which they have a comparative advantage (Winters, 2003). The evidence, however, is not totally convincing. In the area of skilled labour, developing countries have recognised that there could be long term problems if they become donor countries (Self and Zutshi, 2003). In health care, however, most movements are currently of skilled personnel—doctors and nurses—but this can change in the future because of accelerating demand for carers in developed countries. This may create longer term problems for donor countries, the implications of which are, at present, unknown (Winters, 2003).

Recipient countries are the initiators of commitments under GATS mode 4. Many of the economic and health effects for donor countries are mirrored in the host countries. Increased provision of unskilled labour from overseas in a context of labour shortages could contribute to economic

growth that would otherwise not occur. Such growth, all else equal, should flow through to increased funding for public and private health and education, as well as for infrastructure and lifestyle that may influence health.

To the extent that the cheaper imported unskilled labour is employed in the health industry, the costs of health provision in the recipient country should decline and help to improve access. However there are strong countervailing influences.

Winters (2003: 62) notes that ‘Trade reform is strongly re-distributional, both among producers, governments, and consumers, and within those groups there are likely to be short term hardships, and long term casualties cannot be ruled out’. In developing host countries migration is most likely to affect already low paid and unskilled workers and their families across the entire labour market. Increased competition should reduce wages for these workers and, unless there is more than commensurate reduction in the price, reduce their access to health services. To the extent that increased inequality in a society is associated with poorer health outcomes, there are likely to be countervailing effects to any aggregate improvement. These countervailing effects will be felt by the most vulnerable in the population.

An increase in the supply of one factor of production will influence returns to the other factors. In this case, a relative increase in the supply of labour in the recipient country in the context of increased economic growth should increase the returns to capital and land (Walmsley & Winters, 2002), which may further contribute to inequality.

Welfare benefits provide an increasing disincentive to work as they approach minimum wages. Any decline at the lower end of the wages distribution may create pressure for the reduction in welfare benefits—something that will compound the possible effects of migration on economic inequality and on overall health outcomes in developed countries.

Modelling the economic impact of GATS: a review

The relative importance of the four modes for trade in health services may reflect the broader pattern of trade in services—GATS modes 1 and 3 are each about 40 per percent of the world trade in services, Mode 2 is about 20 per cent and the contribution of mode 4 is negligible (Adlung & Carzaniga 2001). While classified under the same general heading, the movement of labour may have quite different effects in different sectors of the economy.

While many empirical studies have examined the economic impact of policies on goods traded, there are few investigating the impact of trade in services are few and there even less that explicitly consider mode 4. OECD (2003a) reviews studies of the economic impact of liberalising trade in services. The review contains some studies that model specific modes of service (mode 1 and 3) supply or specific sectors while others were more general and implicitly included all modes of supply. Most studies considered economy wide effects of deregulation in a global framework, which captured both the inter-sectoral effects within an economy and the international links among countries. The economic effects were assessed using some variant of the computable general equilibrium (CGE) model, an explanation of CGE models can be found in Appendix 1, and with a version of the Global Trade Analysis Project (GTAP) database¹. Structurally the models are essentially the same as those used to assess the liberalisation of trade in goods. They incorporate estimates of measures of service trade barriers either as revenue raising tariff equivalents or as cost raising measures.

¹ The GTAP database contains detailed economic information on most world economies. The database is used for policy related research such as evaluation of the recent Uruguay Round Trade Agreement and the Kyoto Agreement on carbon emissions. The GTAP database is available to any researcher at cost. It is updated every 18 months.

The simulations reported from modelling studies reviewed in OECD (2003a) suggest global net benefits from migration. The size of the effects, however, varied considerably across studies and regions. The review is cautious in accepting the results from these models because of the conceptual challenges in modelling trade in services and the specific data requirements. Data problems extend to the measurement of the barriers to trade in services, a critical input in the models for each country, because direct measures are unavailable. The problem for a developing country wishing to assess independently the impact of GATS on its economy are two fold—lack of good data, and lack of expertise to develop such models. Thus, the models may be able to provide useful baseline information for policy if better data are available for estimation, assumptions, such as full employment and perfect competition, made in some models can be relaxed and the structure allows for modelling different modes of service delivery. For migration, the important questions that require answers are:

- What is the magnitude of the TMNP (temporary movement of natural persons) needed to produce a given economic benefit?
- How important is the labour market in determining the net benefits of TMNP?
- How do these changes affect the health and social wellbeing of the population?

The models reviewed in OECD (2003a) do not address these issues.

In contrast, Winters *et al.* (2003) explicitly model the economic impact of GATS under mode 4². Moreover, they assess the movement of skilled and less skilled labour separately. Once again, a modified global CGE model, incorporating the temporary movements of persons is used to simulate the effects of policy changes. Movements of persons are used in the model instead of estimates of measures of service trade barriers. Their model assumes that factors of production (land, skilled and unskilled labour, capital and natural resources) depend on output and relative prices. Further, prices adjust so that demand equals supply in every sector, and therefore full employment exist in all regions.

The simulations reported in Winters *et al.* (2003) suggest that if the developed (mainly OECD) countries increase their labour force by three per cent through mobility of workers (8 million skilled and 8.4 million unskilled) from developing countries then the global welfare gain can be expected to be US\$156 billion or 0.6 per cent of initial world income. To their credit, the authors advice extreme caution in accepting these results too literally because of inadequacies of the data, the rather simplistic treatment of TMNP as mere change in the countries' labour endowments, the extreme nature of the modelling assumptions and, particularly, because of assumptions such as perfect competition and full employment. On the other hand they stress TMNP is different to international migration in the sense that it has none of the cultural, social or political dimensions associated with the latter. This can only be true if one takes a pure utilitarian viewpoint with workers as mere factors of production who do not interact with each other, the society they come from or the society in which they are supplying their labour.

Iregui (2003) also use a multi regional CGE model to simulate the global efficiency gains from the elimination of all restrictions on labour mobility. The model was developed to handle a segmented labour market (skilled and unskilled workers) and incorporates assumptions similar to those made in other models. The most basic model projects global welfare gains of the order of 67 per cent of world gross domestic product. This scenario involves 53 per cent of the developing world's labour endowment migrating to developed countries. As the basic model is modified by using more accurate wage rates across different countries, segmenting the labour market into skilled and

² The same model is described in Winters (2003)

unskilled workers and allowing transport and transaction costs, the gain in global GDP drops to one per cent and requires two per cent of the developing world's labour to migrate. As Rowthorn (2003) notes, the benefits could easily become negative if further modifications were made to allow for labour market rigidities in the receiving countries and for the social welfare effects of losing skilled professionals who provide public services in the developing countries.

In summary, previous work to assess the economic impact of GATS has largely used the technique of computable general equilibrium. Although the studies find benefits, the estimated gains are fragile and depend on a large number of simplifying assumptions. For example, it is assumed that there is full employment in the developed countries and that wages fall to preserve full employment when temporary workers arrive. Absorbing TMNP into employment is assumed to be frictionless. These assumptions are obviously unrealistic. Moreover, the assumption of uniformly higher productivity in developed countries than in developing countries, and therefore an automatic increase in global welfare if workers move from developing to developed countries, is misleading (Rowthorn, 2003). A nurse who is paid much more in the USA than in Nigeria is not necessarily more productive in the former country than the latter, when productivity is measured by the impact upon the quality and length of life³. They are paid more in the USA because the USA is a rich country and labour of all kinds is paid more there than in Nigeria. As Rowthorn (2003) points out, the nurse could indeed be more efficient at performing her duties in Nigeria than her USA counterpart and in Nigeria, where nurses are scarce, the social value of the work performed could be higher than in the USA where nurses are relatively more plentiful.

Outline of the model

We present here a model to assess the effects of the movements of health professionals on health and health related wellbeing. The model focuses on the international flows of doctors and nurses and their effect on the donor and recipient countries in the context of a more general model of health production. The justification for a new strand of modelling is that the CGE models do not account for the impact of health on GDP. Health depends inter alia on the stock of health workers, the absolute income and the distribution of income. These are not included in CGE models.

The model suggested here emphasises the importance of the linkages between health and long term economic growth. There is little doubt that health, like education, enhances economic growth (Alleyne & Cohen, 2002). Conversely, along with other important factors such as education, sanitation, safe water, lifestyle, employment, safe work place, environment and social relationships, income is an important determinant of health. This two-way relationship may therefore create 'a virtuous cycle'—improved health increases income, increased income improves health. The opposite may occur with 'a vicious cycle'. Without equitable distribution of economic gains, however, benefits for population health may be limited. Other things being equal, including average income, a group with a more equitable distribution of income has better average health (Alleyne & Cohen, 2002). Additionally, any measure that increases the incomes of poor countries relative to rich countries is likely to improve the average health across the globe. Therefore, in examining the economic impact of migration, it is important to look at its effect on health and equity.

The model incorporates several hypotheses:

³ It may be argued that productivity should be measured by the financial rate of return and that maximizing this allows the potential compensation of losers. The use of the potential compensation criterion, however, is problematic within a country and of even less relevance in cross national analysis.

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1. global movements of health professionals, technologies and ideas have a direct impact upon health;
 2. increased economic exchange between nations indirectly affects health, which in turn affects GDP;
 3. the size of the effects and the distribution of net benefits vary with the social, political, legal and economic environment of countries;
 4. health related changes have a direct effect on the subjective wellbeing (SWB) of a population; and global movements affect economic inequality, especially the distribution of health and health services.

The conceptual schema

Figure 1 provides an overview of the relationships between global movements, health and social welfare. Health related global movements include:

1. the transfer of technology;
2. the spread of ideas and knowledge;
3. the movement of health professionals; and
4. broader population movements.

Each of these aspects of global movement is affected by, and in turn affects the society, the economy, the health system and the stock of human and social capital. These sub systems influence one another and affect health and social wellbeing.

Box 1 provides a more detailed description of the conceptual schema. The twelve equations may be used as a summary of the various relationships which are hypothesised to exist between health, GDP, social welfare and the global economy. Alternatively the equations may be used as the basis for statistical and numerical modelling of the effects of migration and other key variables. The equations are used here for both of these purposes.

Hypotheses

Box 1 contains seven behavioural equations, each of which posits a multi variable explanation of the left hand side dependent variable. As discussed more fully below health is postulated to vary with the standard of living in a country as measured by per capita GDP. It also varies with the level of education; the stock of health practitioners; the distribution of income; and with variables measuring the effect of the environment and the health system. GDP, in turn, is affected by health. Of central interest in this paper is if GDP is affected by the exposure of the economy to the global movements of health professionals as depicted in Figure 1. Of particular interest here, it varies with the net level of migration and through this the addition to or subtraction from the human capital of a country. From equation (3) the level of migration itself varies with the GDP of a country relative to the GDP in the remainder of the world and particularly the GDP of countries which, for historical reasons, have had cultural and social links to the country of interest.

From equation (1) health is postulated to vary with the stock of health professionals which, from equation (4) depends upon the historical stock and the net inflow or outflow resulting from the migration of health professionals. This, in turn, depends upon a country's relative GDP and a range of social, cultural and legal variables (equation (5)). Along with the GDP the stock of health professionals has major impact upon the cost of health services in a country, a variable which

also depends upon the type of health system (compulsory government finances, voluntary fee-for-service, etc). In equation (6) it is postulated that cost will also depend upon a country's exposure to the global economy as it is through this mechanism that new and often expensive technologies flow into a country.

In recent years there has been mounting evidence of a direct link between the distribution of income and the average level of health. This relationship is included in equation (1) and the distribution of income, itself, is postulated to vary with the level of GDP and the net migration to or from a country. Income inequalities tend to be mitigated as GDP rises. There is some evidence that a net inflow of cheap labour associated with globalisation has, in some countries, an adverse effect upon the distribution of income. Similarly the distribution of health within a country varies with the absolute standard of living and the distribution of income. These hypotheses are incorporated in equation (9).

In addition to the behavioural relationships discussed above, Box 1 also includes as endogenous variables three indices of the achievement of social objectives. First, equation (10) postulates that subjective wellbeing (SWB) depends upon the level of health, GDP per capita and the distribution of national income. Second, while these relationships are well supported SWB is not the only social objective and in equation (11) it is postulated that both the distribution of income and the distribution of health affect equity, the two variables themselves being functions of other variables within the model (equations (8), (9)). Third, the social welfare function—the global index of the achievement of national objectives—is directly determined by health, SWB and equity and indirectly affected by GDP through its effect upon these variables.

Modelling global movements

The seven behavioural equations and the one identity in Box 1 represent a set of simultaneous equations which predict the level of GDP, population health, and social wellbeing. Unlike some of the models referred to earlier this set of equations are not intended to represent a general equilibrium model. There is no equilibrating factor analogous to the price level regulating the relationship between health, GDP, migration and social objectives. To the contrary, the model suggests a number of important feedback mechanisms or loops which, depending upon the model parameters, might perpetuate disequilibrium in the short-term.

These mechanisms are consequently of importance and represent one of the advantages of simultaneous equation modelling as it is very difficult to capture the effects of system feedback in simple 'one line' causal chains. Four of these feedbacks are summarised in Box 2. The first feedback exists between health and GDP. An increase in either of these directly affects the other generating either a virtuous or a vicious cycle of change. The second loop occurs because of the simultaneous effect of migration upon GDP and GDP upon migration. Thirdly, a flow of health professionals affects the national stock, which affects health and GDP, which affect the flow of health professionals. Fourthly, GDP and migration affect the distribution of income which effects health and GDP and thus the distribution of income. Each of these four feedback loops interact with one another in such a way that it is difficult to predict, qualitatively, what the eventual effect of an initial change will be.

Variables, sub-systems and measurement

The feasibility of the modelling discussed above clearly depends on the availability of reliable data and at the international level this is limited. In particular, time series (or panel) data are so scarce that sophisticated modelling through time is highly problematical. In contrast, cross

sectional data are relatively more abundant and, in particular, data relating to per capita GDP, migration and health. These are discussed further below.

Importantly, modelling with real data increases the complexity of the model as simple concepts do not always correspond with single unambiguous variables. Thus, for example, there is no variable that corresponds to the simple concept of 'health'. There are (a minimum of) two dimensions to health—the quality and 'quantity' of life. In this case cross national data do exist for both dimensions with various measures of mortality (generally infant mortality and life expectancy) representing the quantity of life while disability adjusted life expectancy and disability adjusted life year loss (the burden of disease) representing the combined effect of quality and quantity.

Likewise, the simple concept of migration must be decomposed to separately represent immigration and emigration. Net migration can often mask large scale inbound and outbound movements.. In the latter case there is a greater likelihood of a transfer of human capital and an impact upon the demographic structure of a country. Similarly, the flows need to be disaggregated by types of skill. The effect of an outflow of highly trained doctors is unlikely to be balanced by an inflow of the same number of nurses.

The obtaining of data for the remaining equations in Box 1 can be problematic. Quantification of cultural, legal, environmental and lifestyle variables are difficult although proxy variables may, in part, capture the relevant concepts. Thus, for example, data on obesity and smoking capture important aspects of lifestyle. Systematic evidence exists with respect to some elements of the environment. The pioneering work of the WHO reported in the World Health Report 2000 (WHO 2000) resulted in the publication of useful statistics, many based upon such (controversial) heroic assumptions that data are highly contestable for individual countries. Nevertheless the use of such methods is defensible for the purposes of broad modelling.

The most difficult data are those associated with social welfare as defined in equations (10)-(12). Limited cross-national research has been carried out with respect to SWB but the number of countries for which data exist is too small for modelling purposes. Both the measurement of equity and the numerical value of social welfare in equation (12) depend upon culture-specific values. The values of these variables are determined by assigning weights to variables on the right hand side. The weights are determined separately using decision-analytic procedures analogous to those used to determine utility weights in multi-attribute utility instruments. The weights are culture-specific and may be determined by modelling the results of utility surveys.⁴

Using the global model

The model outlined in Box 1 has a system of feedbacks which is almost impossible to achieve using any other approach. The model permits an examination of change in policy that directly or indirectly affect values of the independent variables. In particular, and the *raison d'être* for the construction of this model, the policy on the level of global exposure of a country to migration of health professionals may be varied and the consequences of this tracked through the model. Various policy scenarios may be explored in this way.

The 'what if' analysis described above may be useful for a number of purposes. First, predictions may be made with respect to the impact upon GDP, health and health sector costs. Estimates of the impact of policy changes on SWB, equity and social welfare could also be made. Second, the output from the model itself may be used as input into a larger national general equilibrium model.

⁴ Hawthorne et al. (2001) reviews a number of these instruments.

This increases the power of general equilibrium modelling significantly as it permits detailed and industry specific prediction of growth and employment disaggregated to the regional level.

Health, GDP and movements of health professionals

The most important relationships in the model are between health, GDP and the migration of health professionals. Global movements of these people affect health directly through changes in the stock of skilled labour available to provide health services and indirectly through the effect on GDP. These effects are likely to be greater on health in developing countries than in developed countries because the movement of a relatively small number of professionals has a relatively large impact on the stock and consequently on health in developing countries. In contrast, changes in the stock of health providers in developed countries and the resulting change in the number of medical services per capita are likely to have only a small impact on the total health of populations of developed countries. Factors such as lifestyle, education, and income have larger effects (Folland *et al.* 2004). The impact can be quite large on sub-populations of a developed country if migration redresses an existing uneven distribution of providers across regions.

The largest effect of global movements on health may be an indirect effect on GDP growth on health primarily through the effect on nutrition. This may be positive or negative. In developing countries nutrition has a positive effect upon the effectiveness of the human immune system. In developed countries the effect may be negative via the impact upon obesity which is rapidly becoming the major cause of ill health in wealthy countries. Analytical methods to estimate the relationship between changes in the determinants of health (such as income changes, education and lifestyle) and the level of health are available⁵ and may be applicable in the context of international panel data. Additionally, the WHO Global Burden of Disease study has provided cross sectional data on Disability Adjusted Life Years (DALYs) which combine both the quality and quantity of life for each disease in each country. These relationships may be used to estimate the impact of global movements on the health of different countries. Predicted health effects could subsequently be used in the GDP equation to determine the magnitude of the multiplier effect on health arising from the reciprocal relationship between health and GDP.

Ideal outcomes of modelling could include a:

- comprehensive and robust economic analysis of the relationship between health and the global movements which impact on it;
- description and quantification of the relative importance of global movements for health outcome;
- developing countries will be able to plug their own data into the models suggested here; and forecast the long term effects of movements in health personnel.

In the long run there can be international comparisons of country effects of movements of health personnel if data are reliable.

The problems of data on analysis of this nature are well documented (Hollingsworth & Wildman, 2003).

⁵ Hollingsworth and Wildman, 2003; van Doorslaer and Wagstaff, 1997; Wagstaff and van Doorslaer, 2000

Discussion

Movement of health workers has important potential implications for health outcomes. Much of its potential impact has not yet to be analysed. Member country commitments under GATS have so far focussed on other areas of service provision, possibly because delivery of health services is often viewed, at least in part, as a government responsibility. Mode 4 of GATS has attracted relatively little interest among member countries apart from the movement of skilled workers associated with developments in mode 3.

There is already substantial movement of temporary workers across national borders. This movement has been mainly regulated by bilateral and regional agreements outside any commitments under GATS mode 4, even if the nature of these agreements has been influenced by GATS (Self & Zutshi, 2003).

In the context of international labour movements, the health industry has principally been affected by the movement of health professionals from developing to developed countries. There are concerns about both the short term and longer term impact of these movements on health outcomes in developing countries, even if there are countervailing influences.

Health services, however, also involve many lesser skilled workers—attendants, carers, cleaners and so on. The longer term impact of migration on health services may be through the facilitation of the movement of these workers, an area in which there is perhaps less potential for detrimental effects to the health services of developing countries. If these flows involve large numbers of people, however, there could be social and labour market problems in both donor and recipient countries.

Modelling of the overall impact of GATS has suggested potentially large economic gains through the liberalisation of trade in services—although the models often involve unrealistic assumptions that, when relaxed, result in quite modest potential gains, especially in the context of the social disruption inherent in migration. Any economic gains for developing countries, however, may contribute to important improvements in health in those countries, especially since they are likely to reduce inequality within developing countries. Imprecision in the measurement of variables implies that the results of such aggregate modelling as discussed here should not be over sold and, as noted earlier, the results of models to date have been very sensitive to changes in the assumptions. Nevertheless, and for the reasons discussed above, modelling has the enormous advantage of allowing for system feedback which is almost impossible to achieve by any other approach.

Modelling the implications of migration of health workers for health services and the overall level of health outcomes is not straightforward. The model presented here is a template for future research in this area, but will no doubt require modification as research progresses.

Global modelling of the impact of migration on health outcomes, although providing important contextual information, is unlikely to capture the country-specific nature of the effects. Any country commitments are made in the context of certain types of health care systems, levels of training of health professionals and already existing bilateral or regional agreements on the temporary movement of workers between countries. Estimates of the likely effects of any commitments under mode 4 need to be determined for individual countries. Developing countries are often confronted with the twin problems of lack of skilled personnel to model the effects and reliable data with which to make such estimates.

In the short run, there may be a need for a global convention or explicit agreement concerning compensation for donor countries or restrictions upon the flow of locally trained health

professionals. In the longer run, it may imply the need for an expanded training programme and greater workforce self sufficiency in the developed world.

References

- Adlung, R and Carzaniga, A, 2001. Health services under the General Agreement on Trade in Services, *Bulletin of the World Health Organization*, 79(4) 352-364.
- Alleyne, G & Cohen, D, 2002, *Health, economic growth, and poverty reduction*, The Report of Working Group 1 of the Commission on Macroeconomics and Health, WHO, Geneva.
- Brown E, 2003, *The Jamaican experience with the movement of natural persons in the provision of services*, in Mattoo, A, Carzaniga, A eds., *Moving People to Deliver Services*, Oxford University Press and the World Bank, Washington.
- Carzaniga, A, 2003, *The GATS, Mode 4 and pattern of commitments* in Mattoo, A, Carzaniga, A eds., *Moving People to Deliver Services*, Oxford University Press and the World Bank, Washington.
- Folland, S, Goodman, A, Stano, M, 2004 *The Economics of Health and Health Care* Prentice Hall: New Jersey.
- Francisco J, 2003, *Barriers to the temporary migration of Filipino service providers*, in Mattoo, A, Carzaniga, A (eds), *Moving People to Deliver Services*, Oxford University Press and the World Bank, Washington.
- Hawthorne, G, Richardson, J and Day, N, 2001, A comparison of the assessment of quality of life (AQoL) with four other generic utility instruments, *Annals of Medicine*, 33(5) 358-370.
- Hollingsworth, B, and Wildman, J, 2003, The Efficiency of Health Production: Re-estimating the WHO Panel Data using Parametric and Nonparametric Approaches to Provide Additional Information, *Health Economics*, 12(6) 493-504.
- Iregui, A, 2003, *Efficiency Gains from the elimination of Global Restrictions on Labour Mobility*, Discussion Paper No. 2003/27, WIDER, United Nations University, Helsinki.
- Mattoo, A, 2003, *Introduction and Overview*, in Mattoo, A, Carzaniga, A (eds), *Moving People to Deliver Services*, Oxford University Press and the World Bank, Washington.
- Murray, C.J, & Lopez A.J, 1996, *Global Burden of Disease*, World Health Organisation: Geneva.
- OECD, 2003a, *Quantifying the Benefits of Liberalising the Trade in Services*, OECD, Paris.
- Rowthorn, R, 2003, *Development and Distribution in an Open World Economy: The moral Dilemmas of Immigration Policy* paper presented to Conference to launch the Monash Institute for the Study of Global Movements, Melbourne.
- Self, R and Zutshi, B, *Mode 4: Negotiating challenges and opportunities*, in Mattoo, A, Carzaniga, A (eds), *Moving People to Deliver Services*, Oxford University Press and the World Bank, Washington.
- van Doorslaer, E., A. Wagstaff, H. Bleichrodt et al., 1997 Income related inequalities in health: Some international comparisons, *Journal of Health Economics* 16 93-112.
- Wagstaff, A. & van Doorslaer, E., 2000, *Equity in health care finance and delivery*. In Culyer, A. and Newhouse, J., (eds.), *The Handbook of Health Economics*. Elsevier, Oxford.
- Winters, L.A. 2003, The economic implications of liberalizing Mode 4 trade, in Mattoo, A & Carzaniga A (eds.), *Moving people to deliver services*, World Bank and Oxford University Press, Washington, DC.

Winters, L A, Walmsley, T, Wang, Z and Grynberg, R, 2003, Liberalising Temporary Movement of Natural Persons: An Agenda for the Development Round, *The World Economy*, 26(8) 1137-1161.

World Health Organisation, 2000, *The World Health Report: Health Systems: Improving Performance*, World Health Organisation: Geneva, Switzerland.

Appendix 1

Computable general equilibrium (CGE) models

CGE models are a class of multi sector models that allow quantitative assessment of the overall economy wide impact of policy changes. They are a natural extension of the classical Input-Output models. The models are based on the general equilibrium theory which formalises the simple but basic observation that markets in real world economies are interdependent.

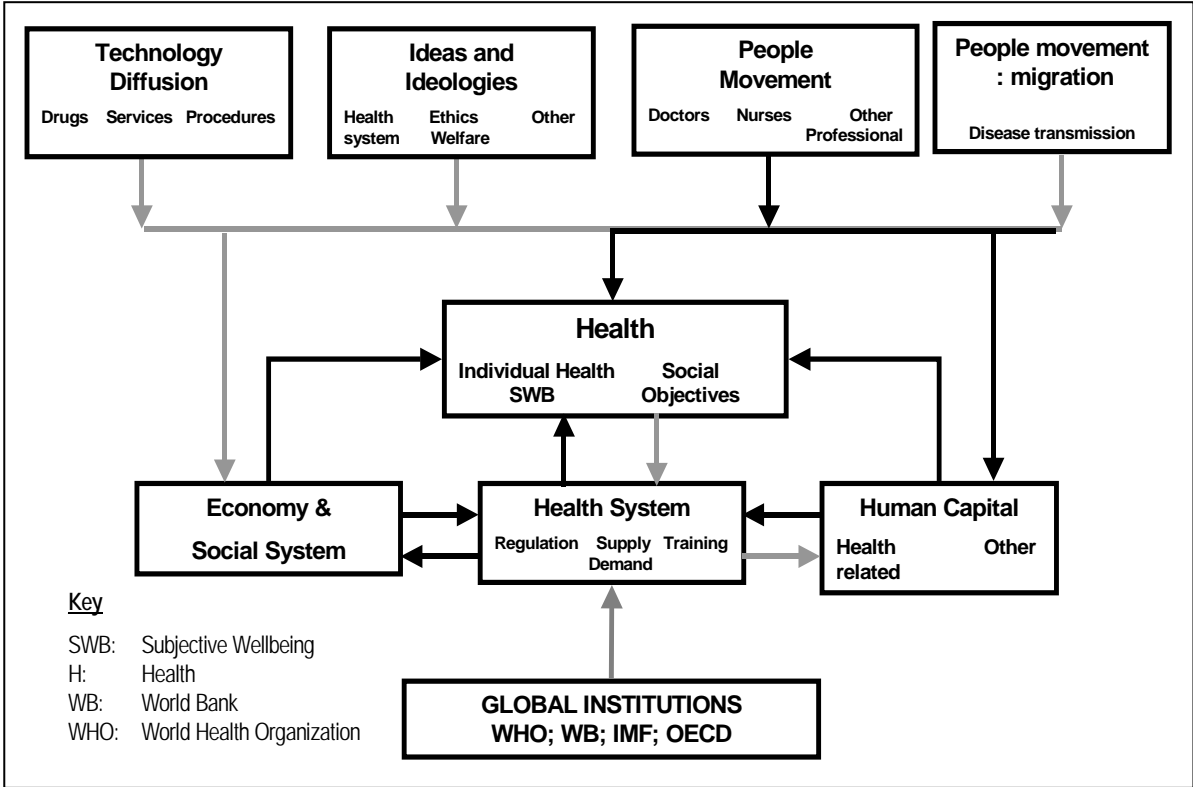
CGE models can be single country, multi country or global. Single-country models tend have more details of sectors and household types and are generally used to analyse domestic policy effects. Multi country and global models tend to have less specific sector detail and are more suited to analyse effects of policies such as proposed trade agreements.

The models use a complete specification of an economy, or region, including all production activities, factors and institutions. They also include models of all markets and macroeconomic components, such as investment and savings, balance of payments and government budget. The specification based on economic theory is usually in terms of a set of demand and supply constant elasticity of substitution (CES) functions that capture linkages between sectors and the behaviour of producers, consumers, foreigners, investors and the government.

The estimation of any CGE model relies on the availability of a large database constructed from combined national accounts and survey data which are compiled into social accounting matrices. Multi country and global models require bi lateral trade flow data linking the regions into global markets. Additionally estimates of elasticities, sourced from the literature, are required for primary factor substitution, import demand import source, domestic demand and the transformation of domestic supply into domestic and exported products.

A CGE model works by first providing an up to date structure of the economy by a series of multi period historical simulations. These simulations incorporate all policy changes already implemented. The purpose of this step is to calibrate the model so as to create a representation of the current structure of the economy and the accompanying database for its replication. Then by varying one or more variables the model can be 'shocked' to simulate the effect of policy changes such as changes in the tariffs regime.

Figure 1 Relationships between global movements, health and wellbeing



Box 1 Model to assess the effects of labour movements on health

\hat{Health}	$= f^1 [GDP, Ed, Stock, Dist. Inc, Lifestyle, Envir, System] + e_1$	... (1) **
\hat{GDP}	$= f^2 [\hat{Health}, \hat{Global}, \hat{Migration}] + e_2$	... (2) **
Migration	$= f [GDP, Migrate -1] + e_3$	... (3) °
\hat{Flow}	$= f^4 [GDP, SES, Migration, Legal, Global] + e_4$	... (4) °
\hat{Stock}	$= \hat{Stock} - 1 + \hat{Flow}$	... (5) °
Cost	$= f^6 [Stock, GDP, system, Lifestyle, Global] + e_6$	... (6) °
Equity	$= N [Dist. Inc]$	... (7) °
Dist. Inc	$= f^8 [GDP, Migration] + e_8$	... (8) °
Dist. H	$= f^9 [GDP, Dist. Inc, Flow, Dist. Inc, Dist. H-1] + e_9$	... (9) °
SWB	$= N^{10} [Health GDP, Dist. Inc]$	... (10) °
Goals	$= N^{11} [Dist. Inc, Dist. H, Responses, Others]$	... (11) °
SWF	$= N^{12} [H, SWB, Equity]$... (12) °	
Key:		
**	Relationships to be estimated initially	
°	Relationships estimated in full model	
e	error term; denotes stochastic relationship	
$\hat{}$	an endogenous variable	
f	stochastic function	
N	index function	
V-1	(time) lagged variable	
Cost	= Cost of health sector as percent of GDP	
Dist Inc	= Distribution of income	
Dist H	= Distribution of Health	
Ed	= Education status of the population	
Envir	= Environmental factors, eg sanitation, safe water	
Equity	= Indices of equity, social objectives relating to fairness (equity), responsiveness (access), other	
Flow. Med	= Inflow, outflow of doctors nurses technologies	
GDP	= Gross Domestic Product/capita	
Global	= Indices of the extent of globalisation	
Health (H)	= DALES, infant mortality, standardised mortality or life expectancy; prevalence of AIDS	
Legal	= Legal and regulatory characteristics	
Lifestyle	= Decisions made such as smoking, alcohol consumption	
Migration	= Total migration in, out of a country	
Others	= Other goals, including procedural justice	
Reponses	= Responsiveness of system	
SES	= Socio economic status	
SWF	= Social welfare function	
Stock	= Stock of nurses, doctors, technologies	
SWB	= Subjective wellbeing	
System	= Characteristics of the health system (universality, % private, etc)	

Box 2 Feedback Loops

- 1. Health → GDP → Health → ...
- 2. Migration → GDP → Migration → ...
- 3. Flow. Med → Stock → Health → GDP → Flow ...
- 4. GDP, Migration → Dist Inc → Health → GDP → Dist Inc ...

Key: as in Box 1