

Relaxing the Restrictions on the Temporary Movement of Natural Persons: A Simulation Analysis

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Abstract

While the liberalisation of trade has been at the forefront of the global agenda for many decades, the movement of natural persons remains heavily guarded. Nevertheless restrictions on the movement of natural persons across regions impose a cost on developing and developed economies that far exceeds that of trade restrictions on goods. This paper uses a global CGE model to investigate the extent of these costs, by examining the effects of an increase in developed countries' quotas on both skilled and unskilled temporary labour equivalent to 3% of their labour forces. The results confirm that restrictions on the movement of natural persons impose significant costs on nearly all countries (over \$150 billion in all), and that those on unskilled labour are more burdensome than those on skilled labour.

- **JEL Classifications:** J61, C68
- **Key words:** Applied general equilibrium modeling, Temporary Movement of natural persons, GATS Mode 4, Skill, Welfare

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I. Introduction

While there has been an upsurge in bilateral and global agreements on trade in goods, the liberalisation of services and labour markets have proceeded much more slowly. Nearly twenty years ago Hamilton and Whalley (1984) suggested that the liberalisation of world labour markets could double world income and imply proportionately even larger gains for the developing countries. Thus allowing labour to move between countries would seem to be an important tool for growth and development. Far from seeking to exploit such opportunities, however, the developed world became less open to both migration and to temporary labour flows.

Recently, however, the temporary movement of workers has moved back onto the agenda. It was recognised as one of four modes of delivering services abroad by the Uruguay Round's General Agreement on Trade in Services (GATS), where it became known as 'Mode 4' liberalisation – the Temporary Movement of Natural Persons (TMNP). A small number of liberalisations were recorded in the Uruguay Round and subsequently during negotiations for the accession to WTO by new members. These, however, mainly aimed to establish the right of intra-corporate transferees and business visitors from developed countries to move temporarily to developing countries to pursue their careers and business opportunities.

Even more recently, however, developed economies have begun to realise that they suffer from shortages of both skilled and unskilled labour, and have started, *de facto* or *de jure*, to relax their entry restrictions on foreign labour. In the USA, illegal immigrants from Mexico are an important source of unskilled labour and have slowed the decline in the supply of unskilled labour in the USA considerably (Borjas, 2000). And the services sectors, facing severe shortages of specific skills, have been urging reforms that would allow more temporary workers to enter the country. Developing countries, as the largest potential suppliers of temporary labour, are intensely interested in the effects of such reforms on their own welfare.

Of course, agreements concluded under Mode 4 of the GATS relate only to the service sector, where restrictions on the movement of persons is seen as a barrier to exports, rather than an issue of migration *per se*. Moreover, all the developments refer explicitly to temporary movement to provide specific services rather than to permanent migration and entry into the labour market. These are important distinctions when it comes to framing policy proposals: where permanent migration raises fears about social assimilation, cultural identity, and burdens on

the public purse, and, for sending countries, the loss of talent in a brain drain, TMNP is largely free of such difficulties. The distinction between permanent and temporary mobility is less significant, however, in the analysis of the effects of mobility on purely economic variables such as income, output and employment. TMNP shifts workers from one country to another, and thus to a first approximation may be viewed as inducing changes in labour endowments accompanied by some income transfers. Moreover, given that agreements under the GATS will be bound, the jobs created will be permanent even if the incumbents are not - what we might call “revolving door” mobility.

This paper conducts such an analysis in order to see who might benefit from increasing the temporary movement of natural persons, and by how much.¹ A very simple computable model, based on the GTAP Model (Hertel, 1997), is developed to examine the effects of an increase in TMNP between developing and developed countries, on wages, remittances, income and welfare, amongst other things, taking account of differences in the productivities of the temporary workers and the resident workers. These latter differences, which are reflected in the different wages earned by the two types of workers, can have a significant impact on the effects of liberalising such flows.

We estimate that by increasing developed economies’ quotas on inward movements of both skilled and unskilled labour by just 3% of their labour forces, world welfare would rise by \$US156 billion – about 0.6% of world income. This figure is half as large again as the gains expected from the liberalisation of all remaining goods trade restrictions² (\$US104 billion). In general, developing countries gain most from the increase in quotas, with higher gains from the increase in quotas on unskilled labour than on skilled labour. Developed economies generally experience falling wages, but their returns to capital and overall welfare increase in most cases. The relaxation of restrictions on unskilled labour is also found to be the more important component of TMNP for the developed economies. This is because it has widespread positive effects on production and hence on real GDP, whereas the benefits from skilled labour movements are felt primarily in specific service sectors.

As a global exercise designed to produce aggregate conclusions in an area in

¹Companion papers, Winters, Walmsley, Wang and Grynberg (2002a, b), discuss a broader set of issues, including what exactly the GATS covers and how to frame reform proposals within it.

²Including tariffs and export subsidies as quantified in the GTAP database.

which there is virtually no previous research, our model and data necessarily make a number of simplifying assumptions. These help us to get a feel for the orders of magnitude involved, but one should clearly not be taken too literally. Besides, by making them explicit we make it possible for readers to propose alternatives where they wish. First, although every effort was made to collect quality data on the flows of temporary labour, data are scarce and of questionable quality and assumptions had to be made to fill in the gaps. On the model, first, we decided to assume that outward migration is not selective. In practice permanent migrants are often among the most talented of their home generations--Borjas, 2000--and although this is probably less true for temporary migrants, if it does still apply here, we will underestimate the losses that are expected to accrue to the permanent residents in the developing countries losing labour. In the absence of quantitative estimates of the average selectivity bias among temporary migrants, it seems best to assume parity. Second, we model temporary mobility directly in terms of labour movement rather than in terms of changes in actual policies pertaining to it. This is justified because (a) there is excess supply of migrants so that small relaxations in policies will certainly be followed by increasing mobility, and (b) no one knows how to translate changes in policies into actual movement, which is what counts on the ground. We strongly believe that this is the appropriate strategy, leaving the challenge of (b) for later research.

Following this introduction, sections 2 and 3 provide an overview of the model and data and define some of the terms used to distinguish between the different types of workers. Following this the various experiments are outlined in section 4 and the results analysed in section 5. Finally in section 6, the paper is summarised and concluded.³

II. Model

In this section we outline the model used to investigate the effects of the movement of natural persons.⁴ Showing how to operationalise the mobility of labour (for partial rather than complete mobility as in Hamilton and Whalley,

³We do not rehearse the economics of migration *per se* here, not because they are uninteresting--indeed, on the contrary--but because the aim of this paper is to model and quantify well-established theory rather than to establish new theory or empirical tests.

⁴Further details on the model and data are available in Walmsley (2001).

1984) is one of our objectives, and besides, only by spelling out what we have done, can we hope to persuade readers of the plausibility of our results. The model and data are based on the GTAP model and database.

The GTAP model, developed by Hertel (1997), is a standard applied general equilibrium model. It assumes perfect competition and hence there are no scale or clustering effects, which often figure in the literature on skilled migration. In each region, a single regional household allocates income across private and government consumption, and saving according to a Cobb Douglas utility function, and firms supply commodities to both the domestic and export markets, while minimising the costs of production. Notable features of the GTAP model include:

- the use of the Constant Difference Elasticity (CDE) system for allocating private consumption across commodities;
- trade flows by commodity, source and destination based on Armington assumptions; and
- international transportation margins.

A number of significant changes had to be made to the GTAP model and database to incorporate the movement of natural persons, but before describing them, we define the terms used to distinguish between the various groups within the population and the labour force (Table 1). We distinguish between temporary migrants and temporary workers. Each mobile person is a temporary migrant of one region and a temporary worker in another but the terminological distinction is useful if tracking these guest workers.⁵ The basic idea is that once temporary migrants cross the border into the host region they become temporary workers.

Table 1. Definitions used

Term	Definition
Home	Permanent Residence. Supplier/exporters of temporary workers.
Host	Temporary Residence. Demanders/importers of temporary workers.
Temporary Migrant	Permanent residents of the home region who work abroad.
Temporary Labour/Worker	Temporary residents of the host regions.
Permanent Labour/Worker	A person who is working/living in their home region

⁵In a limited number of cases, the term guest worker may also be used if neither temporary worker nor temporary migrant is appropriate. For example if we are referring to guest workers in general, not by their home or host region.

The alterations made to the GTAP model can be divided into six distinct features: productivity, allocation methods, income, welfare, sectoral allocation and balancing equations. We refer to the new model as GMig.

A. Productivity

The differences between the productivities of permanent labour and temporary labour are a significant factor that could potentially affect the expected benefits of relaxing the restrictions on TMNP. In GMig we define both the number of temporary migrants and the equivalent number of average temporary migrants, given their home productivity relative to that of the average temporary migrant.⁶ The equivalent number of temporary migrants ($QTM_{i,r}^*$) is found by multiplying the number of temporary migrants ($QTM_{i,r}$) by their base-level productivity ($A_{i,r}$; Equation 1), where i is the set of labour types (skilled and unskilled labour) and r is the set of regions (defined in column I of Table 2).

$$QTM_{i,r}^* = QTM_{i,r} \times A_{i,r} \quad (1)$$

Estimates of base productivity ($A_{i,r}$) are obtained from the wage data in the GTAP database.⁷ We assume that wage differentials in the 1997 database reflect productivity differences between workers from these regions, part of which will arise due to the fact that there are quotas on the movement of labour. The purpose of calculating temporary migrant equivalents is to ensure that remittances sent back to the home region and welfare calculations are adjusted to reflect the fact that these temporary migrants may have higher/lower productivities than the average migrant (prior to moving into the host region) and that their wages and remittances reflect this.

We do not have data on bilateral flows of labour. Hence, when temporary labour is allocated across host regions, it is assumed to have the same productivity as the average temporary migrant (ATM^{Av}_i). This average productivity depends on the home regions of the temporary migrants and hence might change with the

⁶These productivities are determined relative to the productivity of the average temporary migrant in the initial data. The productivity of an average temporary migrant was set equal to 1 and the productivities of permanent residents from particular regions set relative to this. Thus if wages in the USA were 3 times that of the average temporary migrant then their productivity was 3 times that of the average temporary migrant.

⁷ $A_{i,r}$ are parameters of the model, not outcomes. Wages and actual productivity, however, are outcomes, linked to the level of employment in any sector.

Table 2. Regions

I All Regions	II Labour Importers	III Labour Exporters	IV European Union	V European Union Part- ners ^a	VI North America ^b	VII North American Partners ^c
USA	✓				✓	
Canada	✓				✓	
Mexico		✓				✓
UK	✓		✓			
Germany	✓		✓			
Rest of EU	✓		✓			
Rest of Europe	✓					
Eastern Europe		✓		✓		
Former Soviet Union		✓		✓		
Australia-New Zealand	✓					
China		✓				✓
Japan	✓					
Rest of East Asia		✓				✓
South East Asia		✓				✓
India		✓		✓		✓
Rest of South Asia		✓		✓		✓
Brazil		✓				✓
Rest of Latin America		✓				✓
Middle East and Northern Africa		✓		✓		
South Africa		✓		✓		
Rest of World		✓				

a. EU Partners are the group of countries/regions where most of the temporary labour in the EU currently comes from.

b. Developed North American countries.

c. North American Partners are the group of countries/regions where most of the temporary labour in North America currently comes from.

composition of temporary flows. For example, if more temporary migrants come from home regions with lower productivities the average productivity of the temporary migrant will decline.⁸ Thus

⁸This has been occurring in the United States over the last two decades, as more workers from Mexico have entered, replacing the foreign workers from Europe. Since the productivity of a Mexican worker is lower than that of a European worker, the productivity and hence the relative wage of the average migrant worker has fallen (Borjas, 2000).

$$ATM_i^{Av} = \sum_r \left(\frac{QTM_{i,r}}{QTM_i} \right) \times A_{i,r} \quad (2)$$

Once working in the host region, temporary labour will acquire some of the productivity of the host region. For example a worker from the USA, who goes to work temporarily in Mexico cannot be expected to be as productive as she would have been in the USA, so her productivity is adjusted downwards to reflect the productivity of the workers in Mexico. Likewise an Indian worker entering the UK would increase his/her productivity to reflect the higher productivity in the UK. Equation 3 expresses the productivity of the temporary labour ($ATL_{i,r}$) as the average productivity (ATM_i^{Av}) of a temporary migrant plus a proportion (β) of the difference between the host region's productivity ($A_{i,r}$) and the average temporary migrants productivity (ATM_i^{Av}). We fix β as 0.5 for most of our experiments, but do experiment with alternatives.

$$ATL_{i,r} = ATM_i^{Av} + \beta \times (A_{i,r} - ATM_i^{Av}) \quad (3)$$

This productivity is then used to determine the equivalent, productivity weighted, quantity of temporary labour which enters the labour force of the labour importing region (Equation 4). The equivalent quantity of temporary workers ($QTL_{i,r}^*$) is given by the actual quantity ($QTL_{i,r}$) multiplied by the productivity of the temporary labour ($ATL_{i,r}$).

$$QTL_{i,r}^* = QTL_{i,r} \times ATL_{i,r} \quad (4)$$

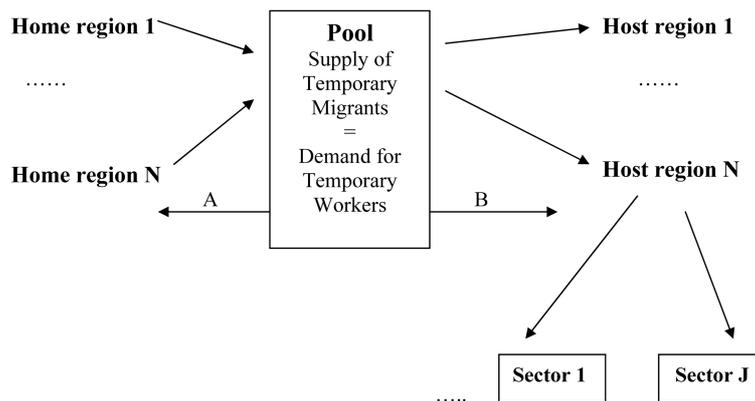
Two assumptions in this sub-section are uncomfortable, but, we believe unavoidable. First, if we had data on bilateral flows of temporary labour, the productivity effects and remittance behaviour could be flow-specific and more convincing. Unfortunately, however, we can locate no such bilateral-flow-specific data. Second, the catch-up parameter is obviously crude, but in the absence of information we do not have a better estimate. Borjas (2000) reports eventual catch-up of over 100% for permanent migrants (i.e., overtaking local wages), but for temporary workers the catch-up will inevitably be significantly smaller. On the other hand, many environmental and complementary factors in the developed host country will allow even entirely unreconstructed developing country service workers to increase their output when they move. We guess that assuming a value of one-half is fairly conservative, but have no empirical estimates on which to base our work.

B. Allocation Methods

Since data on bilateral flows of guest workers between regions are generally unavailable or of dubious quality, the movement of natural persons has been incorporated into the model in such a way as to minimise the amount of data required. Figure 1 illustrates the method used. The model postulates a global labour pool, which collects temporary migrants from their home region, mixes them together and then allocates them across host regions. The temporary workers are then added to the supply of labour in the host region and allocated across sectors within the region according to labour demand. In the host country temporary workers' wages are related to their productivity. Part of the wage is sent back to the home region via the global pool as remittances (Figure 2), while the remaining income is added to the income of the host population where it is then allocated across consumption, saving and government spending to maximise utility.⁹

Allocation can occur in two ways: across host regions (B in Figure 1) or across home regions (A in Figure 1). In this paper we assume an excess demand for temporary work places in developed countries and examine the case where quotas on such workers are exogenously increased by 3% of those countries' current skilled and unskilled labour forces. Our problem, therefore, is to determine where these additional workers come from, i.e. their home regions (A in Figure 1).

Figure 1. Allocation of Migrant Workers to the Host Region and Sector

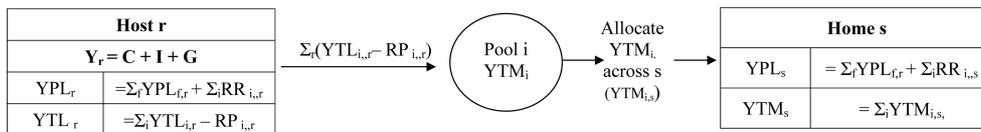


⁹Again restrictions on the availability of data preclude us from allocating the income of the temporary worker across consumption, saving and government spending separately. See Walmsley (2002) for an example of how this could be incorporated using a number of simplifying assumptions and an extensive calibration procedure.

Figure 2. Remittances



Figure 3. Income



Temporary workers are allocated across home countries ($QTM_{i,r}$) by labour force shares ($L_{i,r} / L_i$) (Equation 5).

$$QTM_{i,r} / QTM_i = L_{i,r} / L_i \tag{5}$$

This is clearly not precisely true, but in the absence of information on which to base a more sophisticated allocation it seems the least arbitrary assumption to make. We do vary it below in the sensitivity tests and could easily alter the assumption further to explore allocations of specific policy interest.

C. Income

Separate calculations are made for income earned by permanent labour, temporary labour and temporary migrants (Figure 3). Total income earned in the host region, by permanent and temporary labour, is also calculated for the purposes of allocating income across private and government consumption and saving to maximise utility.

In the standard GTAP model, income includes all factor incomes ($Y_{f,r}$, where f is the source of income: skilled and unskilled labour, land, capital and natural resources) less depreciation (D_r), plus taxes (T_r). In GMig factor incomes include income earned on factors owned by temporary and permanent labour ($Y_{f,r} = YPL_{f,r} + YTL_{f,r}$, where $YPL_{f,r}$ is the income from factor f , earned by permanent labour and $YTL_{f,r}$ is the income from factor f earned by temporary labour¹⁰). In addition, we must also take account of net remittances ($NR_{i,r}$, where i is the two labour types: skilled and unskilled labour). Net remittances ($NR_{i,r}$) equal remittances received

¹⁰ $YTL_{f,r}$ is non-zero only for skilled and unskilled labour. Temporary labour does not earn income from other factors of production.

($RR_{i,r}$) from temporary migrants less remittances paid ($RP_{i,r}$) by temporary labour.

$$Y_r = \sum_f Y_{f,r} - D_r + T_r + \sum_i NR_{i,r} \quad (6)$$

Remittances paid are assumed to be a fixed proportion of wages, as observed in the base data. They vary by host country and average 20% across all hosts. Thus remittances paid by temporary workers reflect changes in the number of equivalent temporary workers ($QTL^*_{i,r}$) and the wages they receive. These remittances paid were then summed and allocated across home regions as remittances received (Figure 2). Remittances received from temporary migrants by a home region are assumed to reflect their numbers of temporary migrant equivalents and average remittances.¹¹ The latter reflect wages and hence productivities, and since productivities vary with both the home and host country composition of temporary movement, so too will average remittances.¹²

Remittance flows hardly affect the global benefits of temporary migration, but they do affect its distribution between countries. It is well understood that temporary migrants tend to remit more heavily than permanent migrants and we could have assumed that marginal remittance rates were higher than average observed rates. In the absence of hard evidence of what the increase should be, however, we chose not to over-ride actual data. An increase in remittance rates would shift welfare from the migrants to the residents back home—having hardly any effect on our welfare estimates by home country but twisting those by host country in favour of developing countries.¹³

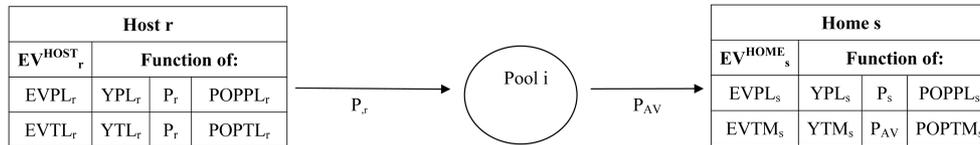
As stated previously, regional income is the sum of the incomes earned by temporary and by permanent labour. For the welfare calculations we treat these incomes separately. The income of temporary labour is assumed to include the income from labour ($YTL_{i,r}$: i is skilled and unskilled labour) less remittances sent home ($RP_{i,r}$: Equation 7); all other income, including income on land, capital etc,

¹¹In the absence of data on bilateral flows of temporary workers we are obliged to assume that all remittances vary proportionately with the average.

¹²The average productivity of migrants reflects their origins, while the extent of productivity catch-up reflects their allocation over host countries.

¹³It has been suggested to us that we should model the responsiveness of remittances to real exchange rates. We choose not to, however: the long-run changes in real exchange rates implied by relatively small changes in temporary migration are too small to be significant, and the short-term fluctuations observed in the real world merely affect timing not the hypothetical steady-state with which we can deal.

Figure 4. Welfare



taxes and remittances received are earned by permanent labour.

$$YTL_r = \sum_f (YTL_{i,r} - RP_{i,r}) \tag{7}$$

The income of temporary migrants by home region is discussed in section 2.4 as part of the calculation of welfare of temporary migrants.

D. Welfare

In the standard GTAP model the measure of welfare change used is the Equivalent Variation (EV), which is obtained from the income and utility function of each regional household.¹⁴ In GMig, however, the EV of the host region has to be divided into two components, as with income: the EVs for permanent (EVPL_r) and temporary (EVTL_r) workers. The calculation of welfare for the various agents is illustrated in Figure 4.

In any situation, the welfare of permanent labour, excluding any temporary migrants that are temporarily working abroad, (EVPL_r) is a function of the utility derived from the income of the permanent workers (YPL_r), which includes remittances received from workers abroad. The utility of permanent residents is a function of their (total) income, numbers and the prices of goods they purchase with this income (Figure 4). Given this utility with and without the policy changes under analysis, we can then calculate the EV for permanent workers.

The welfare of temporary labour (EVTL_r) is found similarly. Their welfare is a function of the utility derived from the income of the temporary residents (YTL_r), from which remittances paid have already been subtracted. Their utility is a

¹⁴Note that in GMig, the income of permanent residents and temporary workers is added together (Figure 3) and then allocated across private and government consumption and saving. This means that the utility derived in the standard GTAP model is for a regional household, which is made up of permanent residents and temporary labour. Note that remittances paid are removed from the income of temporary labour and remittances received are included in the income of permanent residents prior to this aggregation. The purpose of this aggregation is to ensure that income is allocated across spending in the region in which it is spent.

function of their (total) income, numbers and the price level in the host region (Figure 4), and from these EVs can be calculated.

The welfare change for a region as host (EV_r^{HOST}), can now be found by summing the parts for permanent and temporary labour (Figure 4). The total EV of all temporary workers (EVTL) is then equal to the sum across regions of the EVs of all the temporary workers (EVTL_r, Equation 9).

$$EV_r^{HOST} = EVPL_r + EVTL_r \quad (8)$$

$$EVTL = \sum_r EVTL_r \quad (9)$$

The income of the temporary labour by host region and labour type is aggregated across host regions (Equation 10) and distributed across home regions to find the income attributable to temporary migrants from each region (Equation 11: Figure 3). The distribution of total income by all temporary labour (YTM_i) across home regions depends on the equivalent quantities of temporary migrants (QTM*_{i,r}) from the home region relative to the total (QTM*_i).

$$YTM_i = \sum_r (YTL_{i,r} - RP_{i,r}) \quad (10)$$

$$YTM_r = \frac{QTM_{t,r}^*}{QTM_i^*} \times YTM_i \quad (11)$$

This income is then used to determine the utility and EV of the temporary migrants (Figure 4). An average price has to be used to determine utility of temporary migrants - the average price for goods paid by temporary labour in their host regions.¹⁵

Once the EV of temporary migrants is determined, the welfare change by home region (EV_r^{HOME} , Equation 12), regardless of temporary residence (Figure 4), and the world welfare change (WEV, Equation 13) can also be calculated by simply summing the relevant regional figures.

$$EV_r^{HOME} = EVTM_r + EVPL_r \quad (12)$$

$$WEV = \sum_r EV_r^{home} = \sum_r EV_r^{host} \quad (13)$$

¹⁵Another method would have been to aggregate the EV of all temporary labour across host regions and then allocate this welfare across home regions according to the shares. This would have avoided the need to determine an average price. However this method would not have allowed us to take into account differences in the supply of skilled and unskilled labour across home regions.

E. Sectoral Allocation

The last issue to be examined relates to what industries the temporary labour will be employed in or what sectors the temporary migrants will come from. In the standard GTAP model, labour moves across sectors to equalise the wage - thus labour moves to the sectors with the highest demand. This is also the standard closure for GMig. On the other hand, since Mode 4 is restricted to services and since particular service sectors in the developed economies, e.g. the computing sector in the USA, are interested in obtaining skilled temporary workers, it is interesting to think what happens if labour is restricted to specific sectors.

This is achieved in the model by dividing the sectors into two groups: one group of sectors which employ temporary labour (A); and a second group of sectors which do not (B). The supply of labour to each group must equal its demand, and labour can flow freely within each group but not between them. All temporary labour flows are supplied to the group of sectors which accept temporary labour (A), while the supply of labour to the other group (B) is held fixed. This approach also has implications for permanent labour. In order that the inflow of temporary labour not just be off-set by outflows of permanent labour, we have to fix supplies of permanent labour in each group. Hence labour is not perfectly mobile, except between sectors of the same group, and wages differ between the two groups. We note that Borjas and Freeman (1992) found that permanent residents do tend, in fact, to move out of geographical areas in which there has been an influx of foreign workers, leaving the total labour force unchanged, so our assumption of the opposite for TMNP should be considered rather carefully.

F. Balancing Equation

Finally, in all our exercises the total number of temporary migrants (QTM_i) from all home regions equals the total number of temporary labour (QTL_i) in all host regions.¹⁶

$$QTM_i = QTL_i \quad (14)$$

III. Data

The primary database used to support the GMig model is version 5 of the GTAP

¹⁶The share allocation method ensures this equality holds, although other methods may not.

Database (Dimaranan *et al.*, 2001). Version 5 of the GTAP database contains 66 countries/regions and 57 sectors. The GTAP database was supplemented with additional data on the labour force, numbers of temporary migrants and workers, and their remittances and wages. In this section we provide the sources for this additional data, outlining the assumptions made for filling in any missing data, the calculation of wage data and the calibration procedure used.

The additional data were collected at the country level for 211 countries and then aggregated into the 66 regions identified in version 5 of the GTAP database. The new data include information on population, labour force, numbers of skilled and unskilled labour, the number of temporary workers by skill level located in each region, the number of temporary migrants by skill level from each region and the value of remittances entering and leaving the region. Data were found for as many countries as possible, using the International Labour Organisation's International Labour Migration Database,¹⁷ and missing values were then filled to get estimates for all 211 countries.

The filling process involved using data on the numbers of temporary migrants and of temporary labour to estimate remittances in and out respectively or alternatively using remittance data to obtain estimates of numbers of temporary migrants and/or labour. Where data on neither remittances nor the number of people were available, the values were assumed be zero. This was the case for temporary migrants from the United States, Canada, UK and Germany and for temporary labour working in Mexico.

In a limited number of cases the ILO International Migration database also included estimates of the skill level of the temporary labour. These estimates were used wherever possible to obtain a split between skilled and unskilled workers. In the other regions, the skill levels of migrants were assumed to reflect those of their home labour force, while the skill levels of temporary workers were assumed to reflect the overall skill breakdown of the temporary migrants.

Once the numbers of workers were obtained, these were used to find the wages earned by the temporary workers. A measure of the productivity of a worker, relative to the average migrant worker was estimated based on the wage per

¹⁷A handful of these numbers were altered if other evidence suggested that the number provided by the ILO International Migration Database was a significant underestimate. For example the number of temporary migrants from the Philippines and the number of temporary workers in the USA were revised upwards to reflect other data collected by Walmsley (1999). The revisions to temporary workers in the USA reflect estimates of the number of illegal temporary workers in the USA.

worker in each region. A temporary worker entering the host region was assumed to have the average wage of a temporary migrant plus a portion of the difference between the average wage of a temporary migrant and the wage obtained by a permanent resident of the host region (Related to Equation 3). This reflects the fact that the temporary worker's productivity will partially adjust to reflect the productivity in the host region. For example, the productivity of an African entering the UK will increase relative to his productivity at home as he/she will now have more productive tools. However, it will not increase to the same level as a permanent resident as foreigners do not have all the specific tools required for the UK, e.g. language, UK education etc. Borjas (2000) examined the case of permanent migrants entering the USA and found that they received 80-90% of the wages of a permanent resident initially.¹⁸ This proportion increases as the migrant's time in the country increases and additional USA specific skills were gathered.¹⁹ As our workers are temporary, they do not have time to adapt and a temporary migrant is unlikely to have the same entrepreneurial characteristics as a permanent migrant. Hence we expect that temporary migrants would have a smaller degree of convergence to the permanent residents' wage. In this paper we generally assume that temporary labour acquires 50% of the difference in productivities, but we also experiment with values of 25% and 75% (Equation 3).

Remittances are an important source of income for many labour exporting regions, such as Thailand and the Philippines. The inclusion of remittances in the income of the region means that income is now defined as income earned on land, labour and capital located in the region plus taxes plus net remittances received. The GTAP database (which ignores remittances) must be altered to reflect this new definition and to ensure that this new definition of income is consistent with aggregate spending.

To ensure that income equals spending in GMig, one of the GTAP components of spending must be altered. We choose to reduce saving by the value of the net

¹⁸Whether the average migrant received 80% or 90% depends on the skills of the migrant worker. In the 1970s migrants to the USA earned 90% of the wage of a USA worker, as many of them were from Europe and had higher skills. More recently, with the increase in immigrants from Latin America, skills and hence wages, have declined.

¹⁹In fact Borjas (2000) found that as time progressed migrants' wages increased to 10% more than the average native wage. He suggested that this may be the result of self-selection, i.e. a migrant who chooses to move permanently may be more entrepreneurial than the average worker in his/her home country.

remittances paid, because:

- In the construction of the GTAP database, Private Consumption and Government consumption are adjusted to ensure that they are consistent with other sources, such as World Bank. Therefore in the GTAP database, it is saving which adjusts to take account of the fact that GTAP takes no account of remittances. Hence if we wish to include remittances, saving should be adjusted back again.
- The use of saving minimises the re-calibration required. The only restriction pertaining to saving in the GTAP database is that global saving equals global investment. Since global remittances received equal global remittances paid, the global saving – investment identity is automatically satisfied when these remittances are added to or subtracted from saving.

Finally the data were aggregated into 21 regions and 22 sectors for undertaking the analysis. A list of the regions and the commodities can be found in column I of Table 2 and the stub of Figure 3, respectively.

IV. Simulations

A number of simulations were undertaken using the GMig model to examine how relaxing the restrictions on the temporary movement of natural persons (TMNP) is likely to affect developed and developing countries. The paper commences by focusing on a single simulation of an increase in developed country quotas on the numbers of skilled and unskilled temporary workers. Following this the effects of other issues, such as sectoral allocation, the size of the shock and the choice of labour importing and exporting regions, are examined.

Quotas on the temporary movement of natural persons are assumed to increase in a number of traditionally labour importing regions, and to be filled by labour from a number of traditionally labour exporting countries according to their labour force shares. Table 2 divides the regions used in this analysis in to labour importing and labour exporting regions (columns II and III respectively).²⁰ The quotas are increased by an amount which would allow the quantity of both skilled and

²⁰The decision of whether a region was a labour exporter or importer was based on wage rates (high wages were expected in labour importing countries and low wages in labour exporters), data on the quantities of temporary migrants relative to temporary workers and the level of development.

Table 3A. Changes in the Movement of Skilled Natural Persons ('000s of people)

I Region	II Skilled Tempo- rary Workers prior to increase in quotas 1997	III Skilled Tempo- rary Migrants prior to increase in quotas 1997	IV Skilled Tempo- rary Workers after to increase in quotas	V Skilled Tempo- rary Migrants after to increase in quotas
USA	767	0	3169	0
Canada	41	0	308	0
Mexico	0	204	0	428
UK	183	0	742	0
Germany	804	0	1624	0
Rest of EU	747	3945	3061	3945
Rest of Europe	355	232	471	232
Eastern Europe	5	53	5	413
Former Soviet Union	12	74	12	1122
Australia and New Zealand	33	0	256	0
China	61	38	61	528
Japan	68	324	1374	324
Rest of East Asia	55	30	55	422
South East Asia	647	972	647	1962
India	3	49	3	1265
Rest of South Asia	12	60	12	240
Brazil	108	127	108	497
Rest of Latin America	465	273	465	1050
Middle East and Northern Africa	2603	600	2603	1320
Southern Africa	160	95	160	1036
Rest of World	21	73	21	371
Total	7150	7150	15156	15156

Source: Authors' shocks and simulations

unskilled labour supplied in the host (or labour importing) countries to increase by 3%.²¹ Table 3 describes the initial number of temporary workers (by host) and temporary migrants (by home) and their numbers after the change in quotas. For example, in the case of the USA, the number of skilled temporary workers

²¹By this we mean the number of workers (actual bodies) increases by 3% of the labour force. Note that since relative productivities differ this may not mean that the labour force increases by 3%, since the labour force increases by the number of equivalent workers. For example the USA may allow in 3% more workers but if their productivity is half that of the typical USA worker, the labour force will increase by much less than 3%.

Table 3B. Changes in the Movement of Unskilled Natural Persons ('000s of people)

I Region	II Unskilled Tempo- rary Workers prior to increase in quotas 1997	III Unskilled Tem- porary Migrants prior to increase in quotas 1997	IV Unskilled Tem- porary Workers after to increase in quotas	V Unskilled Tem- porary Migrants after to increase in quotas
USA	4140	0	6903	0
Canada	222	0	528	0
Mexico	0	2529	0	2681
UK	989	0	1564	0
Germany	4339	0	5184	0
Rest of EU	3526	4060	5925	4060
Rest of Europe	1919	238	2038	238
Eastern Europe	27	474	27	652
Former Soviet Union	65	670	65	1186
Australia and New Zealand	176	0	389	0
China	128	593	128	3019
Japan	366	324	1671	324
Rest of East Asia	299	139	299	257
South East Asia	1696	7100	1696	7819
India	16	1198	16	2826
Rest of South Asia	174	2907	174	3389
Brazil	584	1789	584	2074
Rest of Latin America	1055	3087	1055	3450
Middle East and Northern Africa	13542	7130	13542	7669
Southern Africa	866	1266	866	2136
Rest of World	78	703	78	952
Total	34207	34207	42731	42731

Source: Authors' shocks and simulations

increases from 0.77 million to 3.2 million (table 3A) while unskilled numbers increase from 4.1 million to 6.9 million (table 3B). For China the numbers of skilled temporary migrants increases from 0.038 million to 0.5 million, while that for the unskilled increases from 0.6 million to 3 million.

Because the skills mix of the increased labour flow is proportional to developed countries' endowments, it does not affect their labour proportions (although, of course, it increases their labour/capital ratio). In developing countries, on the other hand, it reduces the skilled/unskilled ratio strongly, with consequential strong effects on the wage gap.

V. The Results

A. Macroeconomic Effects

Table 4 presents the principal results of the main simulation. For each region, it reports changes in the welfare of temporary workers (column II), temporary migrants (III) and permanent residents (IV). The first two refer to the same people, first by their country of work and second by country of origin (permanent residence). These columns refer both to the workers newly mobile as a result of the liberalisation, and to the temporary workers (migrants) already identified in the

Table 4. Welfare of Agents^a

I Regions	II Welfare of temporary workers	III Welfare of temporary Migrants	IV Welfare of permanent residents	V Welfare by home region III + IV	VI Welfare by host region II + IV
USA	73079	0	-2956	-2956	70123
Canada	5596	0	1050	1050	6646
Mexico	0	5515	-1429	4086	-1429
UK	12641	0	851	851	13492
Germany	15994	0	2454	2454	18448
Rest of EU	36611	53525	34	53559	36645
Rest of Europe	2920	6921	631	7552	3551
Eastern Europe	-7	3745	-1404	2341	-1412
Former Soviet Union	-18	8766	-3587	5180	-3605
Australia-New Zealand	3900	0	376	376	4276
China	-54	9681	-2136	7546	-2190
Japan	25219	8131	4542	12673	29761
Rest of East Asia	-87	11402	-7475	3927	-7563
South East Asia	-621	8564	-2581	5983	-3202
India	-3	2639	16027	18666	16024
Rest of South Asia	-50	1519	350	1869	301
Brazil	-210	13400	-7253	6147	-7463
Rest of Latin America	-508	12065	-3775	8290	-4283
Middle East and Northern Africa	-3236	17296	-7504	9792	-10740
South Africa	-208	4392	82	4474	-126
Rest of World	-25	3143	-923	2220	-948
TOTAL	170932	170704	-14626	156078	156306

a. \$US millions

Source: Authors' simulations

base run. The table also presents the results for each region as a “home” country (V) - permanent residents plus temporary migrants (in SNA terms a “national” concept) - and “host” country - permanent resident plus temporary workers (a “domestic” concept).

The increase in the developed countries’ quotas of both skilled and unskilled temporary labour increases world welfare by an estimated \$US156 billion – about 0.6% of initial income. The gain, which arises from increasing quotas by only 3% of the labour force of the developed economies, is considerable, and is around 1.5 times that expected from the liberalisation of all remaining trade restrictions (\$US104 billion).

The labour exporting (or developing) economies gain most from the increase in quotas on the movement of labour (Column V in Table 4). Most of this increase is the result of higher incomes earned by the temporary migrants themselves (Column III). Despite the higher remittances received from temporary workers, the permanent residents of the developing countries generally lose as a result of the outflow of temporary migrants (Column IV): the decrease in labour endowments dramatically raises the wages of skilled workers (Column II of Table 5), but has mixed effects on unskilled wages (Column III). Real GDP (Column V) and the returns to other factors such as capital (Column IV) fall. In the few cases in which the income and welfare of permanent residents rise, India, the rest of South Asia and South Africa, they do so because increased remittances outweigh the declines in capital income. In India, remittances increase strongly by 4% of the initial level of income. This increases the demand for domestic goods because India is relatively closed, reduces the decline in production in the economy, and raises local prices, which, in turn, generates a large terms of trade gain. Real wages for both skilled and unskilled workers rise²² (Columns II and III in Table 5). With the exception of Brazil, developing economies experience an improvement in their terms of trade (Column VI): shifting factors from developing to developed countries reduces the relative supply of developing country output and hence raises its price relative to that of the developed countries.

²²There may be a case for modelling India to have a pool of unemployed unskilled workers who will become employed in India as a result of the outflow of temporary migrants. While in this case the quantity of unskilled workers would rise, the real wages of unskilled workers would remain fixed. Total earnings would rise as there would be fewer people in the informal or unproductive sectors and so the overall welfare effect would not be very different from that reported with flexible wages. This is examined in section 5.7.

Table 5. Percentage Changes^a in Real Wages of Skilled and Unskilled Workers

I Regions	II % change in Real Wage of Skilled Labour	III % change in Real Wage of Unskilled Labour	IV % Change in Rental Price of Capital	V % Change in Real GDP ^b	VI % Change in Terms of Trade
USA	-0.79	-0.56	0.82	1.07	-0.35
Canada	-1.27	-0.61	0.86	1.12	0.04
Mexico	4.53	-0.05	-0.37	-0.56	0.27
UK	-0.86	-0.48	0.87	1.16	-0.08
Germany	-1.02	-0.62	0.74	0.97	-0.05
Rest of EU	-1.29	-0.7	0.71	1.03	-0.13
Rest of Europe	-0.64	-0.4	0.71	0.88	0.06
Eastern Europe	4.58	-0.2	-0.47	-0.9	0.27
Former Soviet Union	4.34	-0.58	-0.87	-1.12	0.12
Australia-New Zealand	-1.3	-0.71	0.76	1.05	-0.09
China	4.68	-0.02	-0.33	-0.79	0.37
Japan	-0.95	-0.63	0.76	1.07	-0.39
Rest of East Asia	4.01	-0.45	-0.9	-1.23	0.21
South East Asia	5.43	0.21	-0.37	-0.72	0.21
India	6.12	0.71	0.86	-0.44	5.81
Rest of South Asia	4.6	0.22	-0.23	-0.62	0.69
Brazil	4.47	-0.29	-0.79	-1.05	-0.34
Rest of Latin America	4.8	-0.22	-0.59	-0.86	0.35
Middle East and Northern Africa	6.48	0.38	-1.26	-1.63	0.27
South Africa	5.19	0.08	-0.62	-0.98	0.55
Rest of World	4.59	-0.12	-0.39	-0.76	0.48

a. Percentage changes in variable from base case.

b. Readers are reminded that Real GDP is not a measure of welfare. Real GDP is a measure of production, while welfare is a measure of the utility achieved from consumption. In this model differences in sign between Real GDP and welfare are very likely, due to the fact that income is affected by remittances received and production is affected by temporary labour.

Source: Authors' simulations

While the developing (labour exporting) countries are the main beneficiaries of the increase in quotas, permanent residents of most of the developed (labour importing) countries also gain in welfare (column IV in table 4) from the higher returns to capital (column IV in table 5) and the increase in taxes collected. The gains are not particularly large, however, for precisely the reason discussed by Borjas (1995) for the USA. In fact, in our study the results for the USA are

contaminated by data failures which make them absurd.²³ Real GDP increases substantially in all of the labour importing (developed) economies (Column V in Table 5) as a result of the increase in skilled and unskilled labour endowments, and in most cases the terms of trade decline, as the output of local varieties grows. The terms of trade decline is the same effect as Davis and Weinstein (2002) use to argue that factor mobility is harmful to developed countries. They assumed equiproportionate increases in all factors, so that the (negative) size effect was all that remained, whereas we have changes in developed countries' factor mixes.²⁴

One number of note in table 4 is the strong positive effects on developed countries' temporary migrants – i.e. those who leave a developed country to work abroad. This reflects the fact that over half of the stock of skilled temporary migrants identified in our database comes from the 'Rest of the EU' region (EU less than UK and Germany). The distribution of total welfare of temporary workers across temporary migrants is made on the assumption that all temporary migrants are mobile and can fill the new jobs created by increasing quotas in the labour importing regions. This includes the temporary migrants from 'Rest of EU'. Even though wages in the labour importing regions fall as a result of the inflow of labour, the average wages of temporary workers rise strongly. This is because the increase in quotas is restricted to developed economies, where wages are higher, so that the mix of the world's supply of temporary jobs becomes much more favourable, and, as a result, welfare increases strongly for temporary migrants as a group.²⁵ Given our unavoidable assumption of a global pool of temporary workers, the benefits of this gain are distributed to all regions which report some temporary migrants.

²³There is no tax information for the USA economy in the GTAP data base, reflecting the fact that no tax information was provided in the initial IO table. As a result net indirect taxes reflect only subsidies and the increase in output increases subsidies and hence distortion. If data on taxes were available, welfare would increase in the USA, as it has in the other developed economies. Assuming taxes of 4% on private consumption and 1.5% on output (based on tax rates in other developed countries) and adjusting other US data compatibly, the USA gains \$1.61 billion in the exercise above.

²⁴Related to terms-of-trade changes, but not reported are real exchange rate changes as temporary labour flows affect the relative prices of traded and non-traded goods.

²⁵Of the initial temporary jobs, 7.1 million are skilled, of which 3 million (42%) are in developed countries; and 34.2 million unskilled, with 1.6 million (45.8%) in developed countries. Our assumed quota increases the developed country shares of temporary jobs to 73% and 57% respectively. At initial wage levels the changes in the composition of these jobs raises the average skilled temporary worker wage from 10.9 to 11.4 and from 7.8 to 8.8 for unskilled workers.

At first blush the assumption that all temporary migrants are mobile and can move to fill the new quotas in the labour importing regions seems strange, but in fact is not at all unreasonable. Although the jobs that migrants do are quasi-permanent, migration is temporary, and the stock of temporary workers is constantly turning over. Even if the same individuals were involved through time they would be obliged to circulate among host countries.²⁶

Finally, the increase in the rental price of capital raises the current rate of return - defined as the rental price relative to the cost of capital net of depreciation. The high current rate of return leads to higher levels of investment in the developed economies, which increases final demand in proportion to the base-year investment vector.²⁷

B. Sectoral Output

Figures 3 and 4 illustrate the effect of the increase in quotas on domestic production in a selection of labour importing and labour exporting regions.

Agriculture is the least affected of all the sectors in both the developed and developing economies. Private consumption of agriculture has a low income elasticity of demand, there is little intermediate demand from other sectors, and agriculture is very land intensive in developing countries and capital intensive in developed countries. Conversely, the skilled labour intensive sectors experience the largest shocks. In the developed economies, services, particularly trade, business services and other services, and most of the manufacturing sectors are positively affected, while in developing (labour exporting) countries the opposite is true.

India, again, shows a slightly different pattern, with production in some services and agricultural sectors increasing. These sectors benefit from the additional income received as remittances: a high proportion (approximately 97%) of their output is supplied to the domestic market, and, with the exception of construction, these sectors are very capital or land intensive, rather than labour intensive. In the case of construction, the increase in output is primarily due to an increase in

²⁶An alternative assumption in which the initial temporary jobs in the database are presumed not to change the nationality of their incumbents, and thus in which temporary migrants from developed areas are not eligible to take up the new positions in the developed economies would lead to a different distribution of welfare gains. It involves lower gains for developed countries and higher gains for developing countries, and is discussed in more detail in Appendix 1.

²⁷In the long run, higher investment will reduce rates of return and increase output, but in our static model only the final demand element is modelled.

investment resulting from an increase in the return to capital.

C. Skilled v. Unskilled Quotas

Most current discussions under GATS concern skilled labour – see Winters et al

Table 6. Welfare^a – Decomposed according to effects of increasing Skilled and Unskilled Quotas

I	II Welfare of permanent workers (unskilled ^b)	III Welfare of permanent residents (skilled ^c)	IV Welfare of temporary migrants (unskilled ^b)	V Welfare of temporary migrants (skilled ^c)	VI Welfare of home region (unskilled ^b) II + IV	VII Welfare of home region (skilled ^c) III + V
USA	-1282	-1674	0	0	-1282	-1674
Canada	668	382	0	0	668	382
Mexico	155	-1583	3013	2502	3168	918
UK	565	286	0	0	565	286
Germany	1540	914	0	0	1540	914
Rest of EU	2273	-2239	39451	14074	41724	11835
Rest of Europe	560	71	5020	1901	5580	1972
Eastern Europe	3	-1408	1256	2489	1259	1082
Former Soviet Union	202	-3788	2162	6605	2363	2816
Australia-New Zealand	244	132	0	0	244	132
China	2953	-5088	2839	6843	5791	1754
Japan	2294	2248	6116	2015	8410	4263
Rest of East Asia	-641	-6834	2448	8954	1807	2120
South East Asia	20	-2601	4271	4293	4291	1692
India	8615	7412	1024	1615	9639	9027
Rest of South Asia	680	-329	765	754	1444	425
Brazil	-505	-6748	4719	8681	4214	1933
Rest of Latin America	192	-3967	5484	6581	5677	2614
Middle East and Northern Africa	384	-7888	8367	8929	8751	1041
South Africa	1041	-959	1328	3064	2368	2106
Rest of World	225	-1148	1083	2060	1308	913
Total	20181	-34807	89346	81358	109527	46551

a. \$US millions

b. This is the welfare of the whole population when only quotas on unskilled workers are relaxed.

c. This is the welfare of the whole population when only quotas on skilled workers are relaxed.

Source: Authors' simulations

(2002). In this section we apply the increases in quotas separately to examine how much of the gains come from increasing skilled labour quotas and how much from increasing unskilled labour quotas.

Both the developed and developing countries would benefit more from the liberalisation of restrictions on unskilled labour than on skilled labour. While the skilled temporary migrants may earn considerably more overseas than they would in their home regions, the negative effect of their departure on their home economies is considerable. Eastern Europe, the Former Soviet Union and East Asia are cases in which skilled workers obtain greater benefits from working overseas (Column V of Table 6), than do their unskilled counterparts (Column IV), but in which the difference is more than offset by the larger losses among permanent residents from skilled worker mobility (Columns II and III). The reason for this is that skilled labour is scarce in developing countries, so its loss has more detrimental effects on production than does the loss of unskilled labour (Column V of table 7).

For the developed (labour importing) regions relaxing the restrictions on unskilled labour is also more beneficial in terms of welfare (columns VI and VII in Table 6) and Real GDP (compare column V in Table 7), than is relaxing them on skilled workers. The increased supply of unskilled labour reduces unskilled wages (column III in Table 7), and stimulates most sectors (agricultural and manufactures and some services), whereas the benefits of increasing skilled labour supplies are concentrated in a few services sectors. Even though skilled labour is an important input into the production in most commodities in the developed countries, unskilled labour is generally more important. The returns to capital and other inputs (natural resources and land) are increased more as a result of the increase in unskilled labour quotas, than of those for skilled labour (column IV in Table 7).

Of course, the relative benefits of skilled and unskilled quota relaxations depend on how far the respective quotas are relaxed. But our results are remarkable in that we have assumed, based on real data, almost equal increments of skilled and unskilled labour (8.0 and 8.5 million respectively). It is also interesting that while developing countries receive a higher share of the benefits of skilled mobility (59 % of \$46 billion), they receive absolutely more from unskilled mobility (46 % of \$110 billion).

D. Services Sectors

The GATS concerns only the services sectors. Hence we now assume that all

Table 7. Percentage Changes^a in Real Wages of Skilled and Unskilled Workers – Decomposed according to effects of increasing Skilled and Unskilled Quotas

I Regions	II % Change in Real Wage of Skilled Labour		III % Change in Real Wage of Unskilled Labour		IV % Change in Rental Price of Capital		V % Change in Real GDP ^d	
	Unski- lled ^b	Skilled ^c	Unski- lled ^b	Skilled ^c	Unski- lled ^b	Skilled ^c	Unski- lled ^b	Skilled ^c
USA	0.25	-1.34	-1.02	0.15	0.31	0.2	0.58	0.49
Canada	0.39	-1.72	-0.9	0.23	0.51	0.29	0.69	0.43
Mexico	0.04	4.69	0.24	-0.1	0	-0.19	-0.07	-0.49
UK	0.43	-1.36	-0.83	0.28	0.46	0.33	0.61	0.55
Germany	0.44	-1.32	-0.76	0.28	0.53	0.35	0.51	0.46
Rest of EU	0.37	-1.77	-0.98	0.17	0.4	0.19	0.53	0.5
Rest of Europe	0.31	-0.96	-0.62	0.21	0.42	0.27	0.47	0.41
Eastern Europe	0.02	4.79	0.24	-0.22	0	-0.24	-0.12	-0.78
Former Soviet Union	0.02	4.93	0.18	-0.18	-0.03	-0.26	-0.12	-1
Australia-New Zealand	0.29	-1.81	-1.05	0.13	0.33	0.21	0.53	0.52
China	0.2	4.78	0.4	-0.14	0.09	-0.13	-0.12	-0.67
Japan	0.14	-1.33	-1.03	0.16	0.27	0.25	0.6	0.48
Rest of East Asia	-0.09	4.36	0.16	-0.36	-0.1	-0.56	-0.13	-1.1
South East Asia	0.06	5.61	0.53	-0.1	0.02	-0.18	-0.15	-0.57
India	3.99	8.56	3.64	3.18	3.52	3.45	-0.08	-0.36
Rest of South Asia	0.8	4.75	0.98	0.14	0.59	0.08	-0.13	-0.5
Brazil	-0.21	4.41	0.06	-0.61	-0.25	-0.81	-0.13	-0.92
Rest of Latin America	0.05	5.23	0.36	-0.13	0.01	-0.16	-0.13	-0.73
Middle East and Northern Africa	-0.04	6.91	1.3	-0.56	-0.14	-0.76	-0.52	-1.11
South Africa	0.5	5.58	0.73	0.19	0.24	-0.03	-0.17	-0.81
Rest of World	0.19	4.86	0.4	-0.08	0.14	-0.09	-0.1	-0.66

a. Percentage changes in variable from base case.

b. This is the welfare of the whole population when only quotas on unskilled workers are relaxed.

c. This is the welfare of the whole population when only quotas on skilled workers are relaxed.

d. Readers are reminded that Real GDP is not a measure of welfare. Real GDP is a measure of production, while welfare is a measure of the utility achieved from consumption. In this model differences in sign between Real GDP and welfare are very likely, due to the fact that income is affected by remittances received and production is affected by temporary labour.

Source: Authors' simulations

additional temporary workers are allocated to the services sectors in the labour importing region. For this to change any of the above results, we need to assume that it does not cause a corresponding outflow of permanent resident workers to other sectors. Thus the additional labour supply is now restricted to the services sectors. We do not restrict the sectors of origin of the workers in the sending countries.

Restricting the increase in labour supply to the services sector results in a larger expansion in the services sectors of the developed economies at the expense of the expansions in other sectors. In the services sectors the wages of skilled and unskilled labour decline (between 1 to 2%), whereas in the other sectors wages increase quite substantially (between 1 to 3%). The prices of services decline in the developed economies while the prices of other goods and the general cost of living rise. In addition, capital is replaced with the cheaper skilled labour within the services sector and therefore moves to other sectors in the economy – agriculture and manufacturing. In most cases, the increase in real income and welfare in the developed economies is slightly reduced by restricting temporary labour to the services sectors (Column IV in Table 8 compared to Column V in Table 4), although not in Canada, Germany and the Rest of Europe.

Developing countries accommodate the changes in the developed economies. Their services sectors decline further than previously and the non-services sectors by less; in fact, some even expand (e.g. textiles and wearing apparel). The real incomes and welfare of permanent residents of the developing home countries decline by more (Column II in Table 8), and those of temporary migrants rise by less than previously (Column III) as a result of being restricted to the services sectors in host countries where, of course, wages fall.

We also considered restricting entry to a narrower set of services with similar results. Overall the global welfare benefits fall very slightly as a result of restricting inward mobility to services (\$152 billion compared with \$156 billion), but the results by country show a little more variation. Large importers of services (e.g. Japan, Germany, China) benefit from the concentration on those sectors, while producers lose.

While restricting the sectors in which temporary migrants are permitted to work is common, assuming that permanent labour does not move in compensation seems doubtful. Borjas and Freeman (1992) for example documents how nationals accommodate inflows of foreign migrants in different states of the USA. Rather, permanent labour seems likely to move if wages in the services sector became too

Table 8. Results for allocation of Temporary Labour to Services Sectors

I Region	II Welfare of Per- manent residents ^a (Services ^b)	III Welfare of tempo- rary Migrants ^a (Services ^b)	IV Welfare of home region ^a (Services ^b) II + III	V % Change in Real GDP ^d (Services)
USA	-3616	0	-3616	1.06
Canada	1176	0	1176	1.12
Mexico	-1530	5398	3868	-0.56
UK	347	0	347	1.14
Germany	3196	0	3196	0.94
Rest of EU	-934	51718	50784	1
Rest of Europe	887	6688	7575	0.87
Eastern Europe	-1472	3706	2233	-0.9
Former Soviet Union	-3530	8697	5167	-1.12
Australia-New Zealand	240	0	240	1.02
China	-1835	9615	7780	-0.78
Japan	6233	7855	14088	1.05
Rest of East Asia	-7181	11315	4134	-1.22
South East Asia	-2699	8403	5704	-0.71
India	15828	2618	18446	-0.43
Rest of South Asia	307	1495	1802	-0.61
Brazil	-6969	13219	6250	-1.04
Rest of Latin America	-3990	11869	7879	-0.87
Middle East and Northern Africa	-8047	16966	8919	-1.64
Southern Africa	9	4354	4362	-0.97
Rest of World	-970	3109	2139	-0.77
Total	-14553	167024	152470	

a. \$US millions

b. services as defined in Column II of Table 4

c. Percentage change in real GDP from base case. Readers are reminded that Real GDP is not a measure of welfare. Real GDP is a measure of production, while welfare is a measure of the utility achieved from consumption. In this model differences in sign between Real GDP and welfare are very likely, due to the fact that income is affected by remittances received and production is affected by temporary labour.

Source: Authors' simulations

low-in which case all that changes relative to our main exercise is the composition of the work-force between permanent and temporary.

E. Linking Labour Importing and Exporting Regions

Altering the home countries from which labour importing regions obtain their

temporary labour may also affect the results somewhat, so we now consider restricting mobility to ‘traditional’ pairs labour importing and exporting regions. Thus we relax EU and US quotas in turn (by the same amounts as previously), but restrict the sourcing to their ‘traditional’ labour suppliers – see Table 2.

From the perspective of both North America and the EU, taking temporary migrants only from their traditional partner countries, reduces the welfare benefits of relaxing quotas.²⁸ The reason is that the partner countries tend to have lower productivities than the average sending countries so that the increment to production is less.²⁹

The partner countries, however, generally do better when they are the only suppliers of temporary labour. Although the gains to the temporary migrants as a whole are slightly smaller, due to their lower productivities, there are fewer partner regions to share them. The losses to the permanent residents of the traditional partner regions are greater as more skilled and unskilled labour move abroad to fill the quotas. However, overall, taking both the permanent residents and the temporary migrants into account, the home regions generally gain from the change (Table 9).

In terms of the non-partners, the welfare losses of the permanent residents are smaller than previously as they are no longer losing any labour. However, they are also missing out on the higher incomes and remittances of the temporary labour. In general, the welfare of the non-partner regions is lower than when they supply labour – although the extent of the loss depends on the level of development.

F. Quotas increased as a portion of Current Temporary Workers

So far, the shock to the quantity of temporary labour has been equal to 3% of the labour force of each labour importing region. To test how sensitive the results are

²⁸Note that when comparing the welfare of the EU as the importing region when all regions supply temporary labour with the case where only the partners supply temporary labour (table 9) it appears as though welfare increases by more in the partner case. This is because the welfare gain in the partner case includes a big gain to temporary migrants from the Rest of Europe. If this is removed the results are consistent with the statement made above.

²⁹In the case of North America, this is mainly because the outflow of workers from the EU is included in “all” but excluded from “partners”. Likewise, in the case of the EU, North America is included in “all” but excluded from “partners”. If these developed economies are not included in “all”, productivity is still lower for “partners” in the EU, since East Asia is not a traditional partners. East Asia has very high productivity compared to the other labour exporters. In North America, the results would not be significantly different.

Table 9. Welfare^a Results for Alternative Labour Importing and Exporting Regions

I Region	II Importing Region: European Union		III Importing Region: North America	
	Exporting Region:		Exporting Region:	
	Partners	All	Partners	All
Importing Region ^b	26395	17773	-355	129
Partners ^c	20421	10933	28555	17856
Non-Partners ^d	8306	5558	37107	38703
Total	55121	34265	65307	56688

a. \$US millions

b. Importing region depends on experiment – In EU simulations it includes UK, Germany. In North American simulations it includes the USA and Canada.

c. Partner regions depend on experiment – EU partner regions are given in Column V of Table 2. North American partners are given in Column VII in Table 2.

d. Non-Partner regions are all regions except the importing and Partner regions – again these differ depending on the simulation.

Source: Authors' simulations

to this allocation across labour importing regions, we now allocate the same total of workers proportionately not to the labour force, but to the number of current temporaries in the database.

Overall the total benefits to the world economy were virtually unchanged, but the distribution changes quite dramatically. Thus, for example, the Rest of Europe receives a much larger increase in the labour supply than previously (1.043 million rather than 0.118 million unskilled and 0.95 million rather than 0.115 million skilled) and gains correspondingly more. Temporary labour and the home regions also appear to gain a little from moving to regions where other temporary labour were already located. Current guest workers go to those regions where wages/productivity are highest. Hence if new temporaries are allocated pro rata to current temporaries, they have higher productivity than if they allocate according to labour force shares.

G. Endogenous supply of Unskilled labour in the Developing Countries

Finally, we examine the impact of postulating that the developing, labour-exporting, regions have surpluses of unskilled labour, which could be drawn on to replace the loss of workers due to temporary migration with no increase in real wages. The results are as expected. In those developing economies where the loss of unskilled labour formerly caused real wages to rise – e.g. India and South East

Table 10. Endogenous Supply of Unskilled Labour in Developing Countries^a

I Region	II Welfare of Permanent Workers	III Welfare of Home region
USA	-2924	-2924
Mexico	-1494	4020
UK	862	862
Germany	2490	2490
Rest of EU	110	53626
Eastern Europe	-1792	1952
Former Soviet Union	-6538	2219
China	-2281	7400
Japan	4587	12717
Rest of East Asia	-9485	1910
South East Asia	-2144	6421
India	17140	19783
Rest of South Asia	476	1995
Brazil	-8744	4650
Rest of Latin America	-4691	7370
Southern Africa	260	4653
Rest of World	-1087	2055
Total	-18636	152038

a. \$US millions

Source: Authors' simulations

Asia – endogenising the labour supply leads to higher unskilled employment and aggregate incomes. As a result the welfare of permanent workers falls by less (or rises further: Table 10). In the countries where real wages fell in Table 5, the supply of unskilled labour falls further, as permanent workers join the pool of unemployed, and welfare falls. Overall the world welfare increase is slightly smaller in this case than previously.

H. Sensitivity Analysis

Finally we examine how sensitive the results are to changes in the shocks and the parameters. We analyse four cases.

First, if the shock to quotas is doubled to 6% then the gains also approximately double (Row V in Table 11). This assumes, of course, that people will want to move and that the quotas are still binding. Thus within this bound, the model is pretty linear so that scaling the above results is perfectly legitimate to get at different size shocks.

Second, we change the proportion of the wage or productivity gained by the

Table 11. Welfare^a Results for Sensitivity Analysis

		Labour Import- ing Developed Countries	Labour Export- ing developing countries	Total	% of Standard Simulation (Row I)
I	Standard ^b	75558	80521	156078	100
II	25% of productivity gained	120931	114614	235545	151
III	75% of productivity gained	30128	46237	76365	49
IV	% of current temporaries	85407	72330	157738	101
V	6% shock	138921	168356	307278	197
VI	Trade Liberalisation	45052	59241	104293	67

a. \$US millions

b. Shock is equal to 3% of labour and assumes temporary workers gain 50% of host regions productivity.

Source: Authors' simulations

temporary labour (b in Equation 3). Currently we assume that 50% of the difference between the productivity of a host worker and the average productivity of a temporary migrant is made up by the temporary worker when working in the host region. Now we change this to 25% and 75%. An increase in $\hat{\alpha}$ increases global welfare (Row II in Table 11) because we have higher world output. The increase is felt by both the developed and developing economies. Developed (or labour importing) economies gain because labour is more productive when it enters the region. As a result the effective labour-force and production are higher, and labour costs are lower. The return on capital rises further and the output and welfare of the host region rises. Temporary labour also gains as a result of gaining more productivity and hence receiving higher wages.

The developing (labour exporting) countries can be split into two groups – those with significant skilled-labour intensive production and those which rely more on unskilled workers. The higher incomes in the developed economies due to the higher productivity lead to higher demand for developing countries exports, and the higher remittances cause developing countries' domestic demand to increase as well. However, because developed country output has increased so strongly, these increases in demand are satisfied through increased imports, so output falls and the wages of unskilled and skilled labour rise by less than previously. In the unskilled labour intensive regions, higher remittances off-set the relatively modest production falls and income and welfare are higher. In regions that use skilled labour more intensively, and hence whose output bundles are closer to those of the

Table 12. Sensitivity Analysis^a

I Region	II Mean	III Standard Devaton
USA	-2315	1637
Mexico	4035	141
UK	966	282
Germany	2753	862
Rest of EU	54010	1116
Eastern Europe	2191	363
Former Soviet Union	5014	459
China	7375	440
Japan	13189	1463
Rest of East Asia	3779	409
South East Asia	5809	456
India	18635	70
Rest of South Asia	1847	52
Brazil	5876	734
Rest of Latin America	8062	597
Southern Africa	4343	341
Rest of World	2155	167
Total	155906	1126

a. With respect to the elasticity of substitution between value added. Range of elasticities tested was from 0 times the current elasticity (i.e. no substitution) to double the current elasticity (Stroud method used – 46 runs). [Needs reference.]

Source: Authors' simulations

developed countries, the decline in the wage of skilled labour outweighs the gain in remittances and hence income and welfare fall. Reducing the productivity parameters has symmetric effects.

Next we examined how sensitive the results were to the elasticity of substitution between different parts of value-added (skilled and unskilled labour, land and capital etc).³⁰ Table 13 gives the means and standard deviations of the welfare estimates from a series of 46 simulations with different elasticities of substitution. The latter were selected from a triangular distribution, where the minimum elasticity was zero and the maximum was double the current value on the GTAP database. The table shows that, with the exception of the USA, the welfare results were fairly robust (i.e. of consistent size and with relatively small standard errors)

³⁰Similar results were also found when we examined the sensitivity of results to the elasticities of substitution between domestic and imported goods.

to changes in the elasticity of substitution. In the case of the USA, we cannot be confident of the sign of the effect but as noted above this is almost certainly because of the idiosyncracies of the US data.

Welfare varies with the elasticity of substitution within value-added because the latter affects the magnitude (but not necessarily the direction) of the return on value-added. For example, with greater substitution smaller increases in the rental price of capital are required to absorb the given increases in labour. This, in turn, leads to smaller increases in income and welfare. Likewise, when the elasticities are reduced, the rental price of capital rises more strongly. The effect of these changes in the elasticity of substitution between elements of value-added are greatest in the developed economies, where factor shares are more balanced and hence substitutability between them is of greater importance than in developing economies, where the main factor of production is unskilled labour.

Finally, the average portions of wages sent home as remittances are determined by the remittance data collected and are assumed to be constant. In the initial data an average of 20% of wages was sent home. Here we investigate how different the results would be if 40% of wages were sent home.³¹ World welfare does not alter as a result of the increase in remittances, but there are two important implications for their distribution. First, the transfer of income to permanent residents of the labour exporting regions raises their welfare, although at the expense of that of the temporary migrants. Overall the welfare of the developing economies stays the same or rises. Second, the welfare of the developed economies falls, as less income is spent in these countries.

IV. Conclusion

Restrictions on the movement of natural persons are increasingly being recognised as a severe impediment to trade in services. The relaxation of these restrictions could result in important benefits to the world as a whole and in particular to the suppliers of this labour. In this paper a model was developed to analyse the effect of relaxing these restrictions on the movement of labour.

The model takes into account a number of important issues related to the movement of labour, including:

³¹This was achieved by assuming that our initial data on remittances were inaccurate and did not take account of all remittances sent home. Remittances were therefore doubled and the base data recalibrated.

- a) differences in the productivities of temporary and permanent labour;
 - b) the importance of remittances on home country income;
 - c) the calculation of income and welfare of permanent and temporary labour;
- and
- d) the movement of labour into particular sectors in the host region.

We have treated the temporary movement of natural persons as a shift in labour services to the host regions rather than as a question of exporting services as is implied by the institutional framework in which such liberalisations are likely to take place. Although temporary mobility is not a migration issue, temporary workers are assumed to produce, earn wages, pay taxes and consume in the host country, as well as send remittances back to their home countries. Moreover, we assume that the jobs so created are permanent even though the incumbents are not.

In our main exercise, quotas on the number of temporary workers permitted into the developed economies are increased by 3% of the developed economies' labour forces. The increase in world welfare is substantial and far exceeds the benefits expected from any remaining trade liberalisation. Overall, the developing countries gain most from the increase in quotas, highlighting again that this is an important issue for development. The developed economies also experience gains in welfare, however, so the liberalisation would be no mere act of charity: their real wages fall, but increases in the returns to capital and other factors more than offset this, leaving net gains overall. It is also interesting to note that while most of the progress in policy discussions have concerned increasing the mobility of skilled labour, it is the relaxation of quotas on unskilled labour that generates the most benefits. This is the case for both the developed and developing economies.

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Appendix 1

In this appendix we show an alternative distribution of welfare gains across temporary migrants. In this alternative scenario it is assumed that the initial temporary migrants in the data base are not allowed to move to take up quota places in the labour exporting region.

Under this assumption the total change in income of all temporary workers (initial³² or new³³) is determined as in the main exercise. Following this the income of the initial temporary migrants is found by assuming that their wage falls with the general fall in wages in their host regions. The income of the initial temporary migrants is then subtracted from the total income of all temporary migrants to determine the income of the new temporary migrants. This income is then divided across the home regions of the new temporary migrants according to their shares in that flow. The relevant income and the average price in the host regions is then used to determine the change in welfare of the initial and new temporary migrants.

Table A1.1 shows that the welfare of temporary workers (II), permanent residents (IV) and of the host region (VI) has not changed as a result of this alternative distribution,³⁴ and that neither has the total welfare of temporary migrants. However, the distribution of this latter welfare has altered significantly (compare column III in Table 4 with column III in Table A1.1). In the 'Rest of EU' and the other labour importing regions the welfare of the temporary migrants has fallen by \$US13billion as a result of a lower average wage in their host regions as compared to previous when welfare rose by \$US53billion. Thus under this assumption the 'Rest of EU' as a home region loses. This result offers an additional reason to question the assumption made here. The losses made by these mobile temporary migrants will be significant enough at least to prompt them to consider moving to take up the new quota places hence undermining the assumption made here and validating that in the main text.

³²Initial temporary migrants are defined as those migrants in the labour exporting economies who lived abroad prior to the new shocks. I.e. the temporary migrants in the initial data base. Unfortunately the method used is crude and it was not possible to include those current temporaries in the labour exporting regions.

³³New temporary migrants are those workers from the labour exporting regions who move as a result of the increase in quotas in the labour importing regions.

³⁴In fact nothing has changed other than the welfare of the temporary migrants by home region. This is simply a different distribution method.

In the labour exporting regions, welfare (Column III of Table A1.1) has increased further as the temporary migrants now corner all the new (high wage) jobs created by the increases in quotas. The welfare by home region therefore also increases (Column VI of Table A1.1).

The assumptions made about the allocation method can therefore significantly effect the distribution of welfare across temporary migrants and home countries. Unfortunately, without bilateral data on the number of workers by both home and host region there is no accurate method for determining the true allocation of welfare. It is only when the region to which these temporary migrants move is known, that we can obtain a more accurate estimate of the changes in their wages and productivity and hence their welfare.

Table A1.1. Alternative Distribution of Temporary Migrant Welfare

I	II	III	IV	V	VI
Regions	Welfare of temporary workers	Welfare of temporary Migrants	Welfare of permanent residents	Welfare by home region	Welfare by host region
				III + IV	II + IV
USA	73079	0	-2956	-2956	70123
Canada	5596	0	1050	1050	6646
Mexico	0	13711	-1429	12282	-1429
UK	12641	0	851	851	13492
Germany	15994	0	2454	2454	18448
Rest of EU	36611	-13350	34	-13316	36645
Rest of Europe	2920	-1729	631	-1098	3551
Eastern Europe	-7	5961	-1404	4557	-1411
Former Soviet Union	-18	12138	-3587	8551	-3605
Australia-New Zealand	3900	0	376	376	4276
China	-54	12487	-2136	10351	-2190
Japan	25219	-2024	4542	2518	29761
Rest of East Asia	-87	15482	-7475	8007	-7562
South East Asia	-621	19754	-2581	17173	-3202
India	-3	3656	16027	19683	16024
Rest of South Asia	-50	3108	350	3458	300
Brazil	-210	24790	-7253	17537	-7463
Rest of Latin America	-508	24982	-3775	21207	-4283
Middle East and Northern Africa	-3236	40203	-7504	32699	-10740
South Africa	-208	6361	82	6443	-126
Rest of World	-25	5174	-923	4251	-948
TOTAL	170933	170704	-14626	156078	156307