

Measuring the Impact of the Movement of Labour Using a Model of Bilateral Migration Flows

Terrie L. Walmsley¹, L. Alan Winters², S. Amer Ahmed³ and Christopher R. Parsons⁴

Abstract

The economics literature increasingly recognizes the importance of migration and its ties with many other aspects of development and policy. Examples include the role of international remittances (Harrison et al 2003) or those immigrant-links underpinning the migration-trade nexus (Gould 1994). More recently Walmsley and Winters (2005) demonstrated utilising their Global Migration model (GMig) that lifting restrictions on the movement of natural persons would significantly increase global welfare with the majority of benefits accruing to developing countries. Although an important result, the lack of bilateral labour migration data forced Walmsley and Winters (2005) to make approximations in important areas and naturally precluded their tracking bilateral migration agreements.

In this paper we incorporate bilateral labour flows into the GMig model developed by Walmsley and Winters (2005) to examine the impact of liberalizing the temporary movement of natural persons. Quotas on both skilled and unskilled temporary labour in the developed economies are increased by 3% of their labour forces. This additional labour is supplied by the developing economies. The results confirm that restrictions on the movement of natural persons impose significant costs on nearly all countries, and that those on unskilled labour are more burdensome than those on skilled labour.

Developed economies increasing their skilled and unskilled labour forces by 3% would raise the welfare of their permanent residents by an average \$US382 per person. Most of those gains (\$US227 per person) arise from the lifting of quotas on unskilled labour. On average the permanent residents of developing countries also gain \$US4.60 per person in welfare from sending unskilled labour, but lose \$US1.35 per person from skilled labour. While results differ across developing economies, most gain as a result of the higher remittances sent home.

The new skilled and unskilled migrants gain in real terms by \$US8K and \$US6.5K per worker, respectively. Existing migrants in the developed economies lose in terms of real income as real wages fall with the increased labour supply, while those in developing countries gain as real wages rise.

Keywords: Applied general equilibrium modelling, GATS Mode 4, labour mobility, skill, welfare, migration

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1. Introduction

The WTO's Uruguay round heralded a new wave of optimism for developing country members as the first discussions on the '*temporary mobility of natural persons* (Mode 4)' took place under the General Agreement on Trade on Services (GATS). Developing countries hoped at last to capitalise on their abundant labour. But despite a backdrop of years of capital and goods market liberalisation, policy makers on both sides of the GATS Mode 4 negotiations remain largely cautious and defensive, resulting in little progress being made (Winters, 2005a). This contrasts strongly with the evidence that the welfare benefits from the future services liberalisation are likely to far outstrip the returns from additional goods market liberalisation. Hertel et al (2004) suggest that \$300bn will accrue from a 40% liberalisation of the services sector, compared to only \$70bn for an equivalent relaxation in both agriculture and manufacturing.

Winters (2001) argues that if individuals moving from a developing to a developed country make up a quarter of the wage gap between the two nations, a 5% increase in industrialised countries populations would yield a global welfare gain of approximately \$300bn. A similar back-of-the-envelope calculation estimates that liberalisation equivalent to a 3% rise in 'rich' countries' labour forces supplied by 'poor' countries on a temporary and rolling basis, with each individual residing abroad for between 3 and 5 years, would raise developing countries annual welfare by \$200bn (Rodrik, 2004). More systematic approaches based on various modelling scenarios corroborate these computations.

Walmsley and Winters (2005) find that liberalisation of the quotas of the flows of both skilled and unskilled labour from developing to developed nations equivalent to 3% of the latter's labour force would yield a global welfare gain of \$150bn at 1997 prices. Indeed, simulations from subsequent models based on bilateral migration flows (as opposed to from a global migrant pool) show that a similar lifting of quotas would produce approximately double these gains (van der Mensbrughe, 2005).

Although all of these estimations should be viewed with a degree of caution – not least because even relatively minor alterations to any of the crucial underlying assumptions can impact heavily upon the results – the orders of magnitude are astonishing, especially in comparison to the total annual ODA budget. Moreover, these benefits represent only static gains. They fail to account for any dynamic effects, such as those associated with ‘brain circulation’. Service providers are likely to return with greater levels of experience, in part through learning from doing abroad. Spillover and indirect effects of increased service provision may also increase welfare benefits (Winters 2003). On the other hand, increased migration does also imply challenges – of integration, of family separation and of labour market shocks in host countries.

In this paper we develop a bilateral global migration model, based on the GTAP model (Hertel, 1997) and similar to model developed by Walmsley and Winters (2005), which takes into account bilateral labour flows. This model is then used to examine the impact of liberalizing the temporary movement of natural persons. Quotas on both skilled and unskilled temporary labour in the developed economies are increased by 3% of their labour forces, with the additional labour being supplied by the developing economies. Following the introduction, the current situation with regard to Mode 4 negotiations is examined. In section 3 the model and data are outlined and in section 4 we examine the calculation of welfare and its decomposition in greater detail. Section 5 discusses the experiments undertaken. Then in section 6 the results are examined and conclusions drawn in section 7.

2. GATS Mode 4 and the need for skill

In December 1988, at the Mid-Term Ministerial meeting in Montreal, WTO members finally decided to include labour mobility in the Uruguay round of GATS. Prior to this developed countries had strongly objected because of a failure to agree on a suitable definition of ‘temporary’ and a belief that GATS Mode 4 impinged on their sovereignty to determine their own immigration policies. Eventually it was agreed that GATS Mode 4 is *not* migration but merely the temporary migration of service providers. As such, many of the arguments commonly cited against migration including the erosion of cultural traditions, excessive drains on the public purse and anxieties relating to assimilation, are less relevant in the case of GATS Mode 4 than for longer-term migration (Winters, 2003, 2005b). Nor are concerns about ‘brain drain’ so pressing since (at least theoretically)

workers return home. It is also an advantage that a high proportion of income earned on temporary schemes tends to return to the country of origin through one means or another.

Despite the inclusion of the cross-border movement of natural persons in the negotiations, little progress was achieved during the Uruguay round. Where headway was made, it was largely in the area of 'commercial presence abroad'. Developing countries secured little or no market access for less skilled workers from developed countries while conceding market access for skilled workers from the richer nations. This reflects both the fact that developed countries generally consider GATS Mode 4 to relate to only skilled workers, and the 'North's' superior bargaining power. In fact GATS Mode 4 is a binding, non-discriminatory⁵, multilateral agreement, neither limited to any particular skill level nor able to influence the national immigration policies of individual members. For example it does not prohibit countries imposing stricter regimes for visas for nationals from particular countries. Nor is GATS Mode 4 restricted simply to 'North-South' cross-border service provision though this is what we confine our attentions to here since this is the key area in which previous offers have taken place.

This movement of skilled workers from developing to developed countries, the so-called 'brain drain', has quite justifiably received significant attention from policy makers. The outflow of skilled workers tends to both widen wage gaps and lower the average level of skill, thus reducing total output and the already dwindling tax base. The consequences of the 'brain drain' however remain far from certain. It is quite plausible that workers abroad increase their productivity to such an extent that when they return this more than compensates for their loss, the so-called 'beneficial brain drain' (Winters, 2003). This does of course rely on the fact that migrants return, and a migrants' propensity to return varies widely across regions. In this paper we do not consider these potential brain gains from returning migrants. We assume that the changes in labour forces in both the developed labour importing and the developing labour exporting countries are permanent, although the people filling those positions may be temporary. In the next section the model and data, including the assumptions made, are outlined.

⁵ Under GATS Mode 4 commitments are 'horizontal' and as such apply equally across all sectors. This does not preclude the possibility of the selective deepening of commitments in certain sectors however (Chaudhuri et al 2004)

3. Model and Data

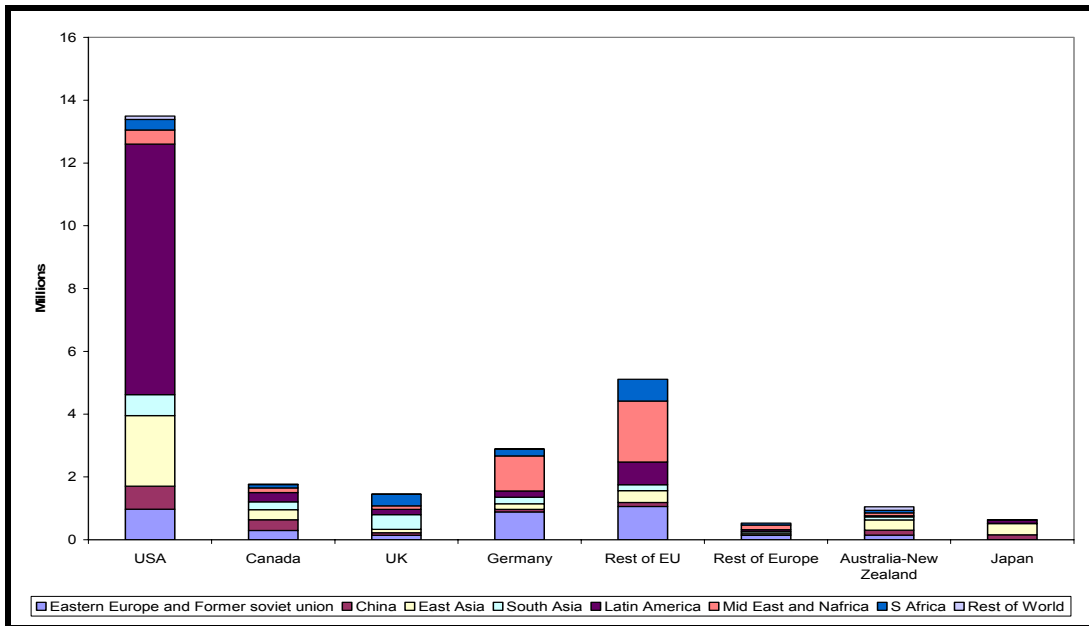
GATS Mode 4 can be modelled at either extreme from which it can be viewed, i.e. from a perspective of pure labour migration or as being analogous to greater trade in goods. Here we choose to consider it as an increase in the labor force/population.

We use a standard global applied general equilibrium model (GTAP, Hertel, 1997) which has been adjusted to take into account bilateral labour flows. The model, termed GMig2, is based on the model used in Walmsley and Winters (2005). In that model, Walmsley and Winters had to hypothesize a global pool of labour to intermediate the flow of labour between receiving and sending countries in order to circumvent the lack of bilateral data on migration between individual countries. As a result of Parsons, Skeldon, Walmsley and Winters (2005), however, we now have a data base for the bilateral stocks of migrants (defined as foreign born), which the GMig2 model exploits to allow us to track labor movements between particular countries.

The data base used with the Bilateral Labor Migration Model (GMig2 – Walmsley, Ahmed and Parsons, 2005) is based on the GTAP 6 Data Base (Dimaranan and McDougall, 2005)⁶ and is augmented with the bilateral migration data base developed by Parsons et al (2005) and remittance data from the World Bank (Ratha, 2003). These resulting aggregated data used in this paper are depicted below: bilateral labour (Figure 1), remittances (Figure 2) and wages (Figure 3 and 4).

⁶ Note that the Walmsley and Winters (2005) paper is based on version 5 data with reference year 1997. The version 6 data base is based on 2001.

Figure 1: Foreign Workers by Host Region

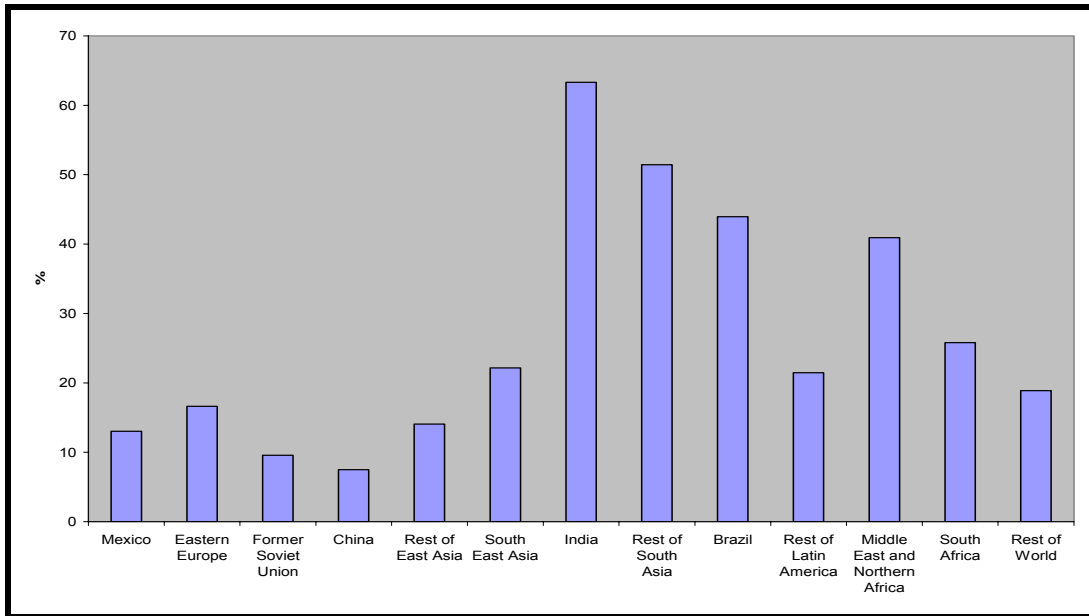


Source: Parsons, Skeldon, Walmsley and Winters (2005)

Figure 1 show the current (approximately 2000-2002) stocks of foreign workers by home region in the eight host countries investigated in this paper. The USA has by far the highest number of foreign workers, although relative to the size of the population only 10% are foreign born. Figure 1 also demonstrates the well know fact that migration is regional, with most foreign workers in the USA coming from Latin America and Mexico, while foreign workers in Europe are from Eastern Europe and the Middle east/Northern Africa. The exceptions are Canada where there does not appear to be a dominant source for migrants; and the UK, where the origins of migrants appears to be at least partially related to its historical ties with the Commonwealth countries, for example its ties to South Asia.

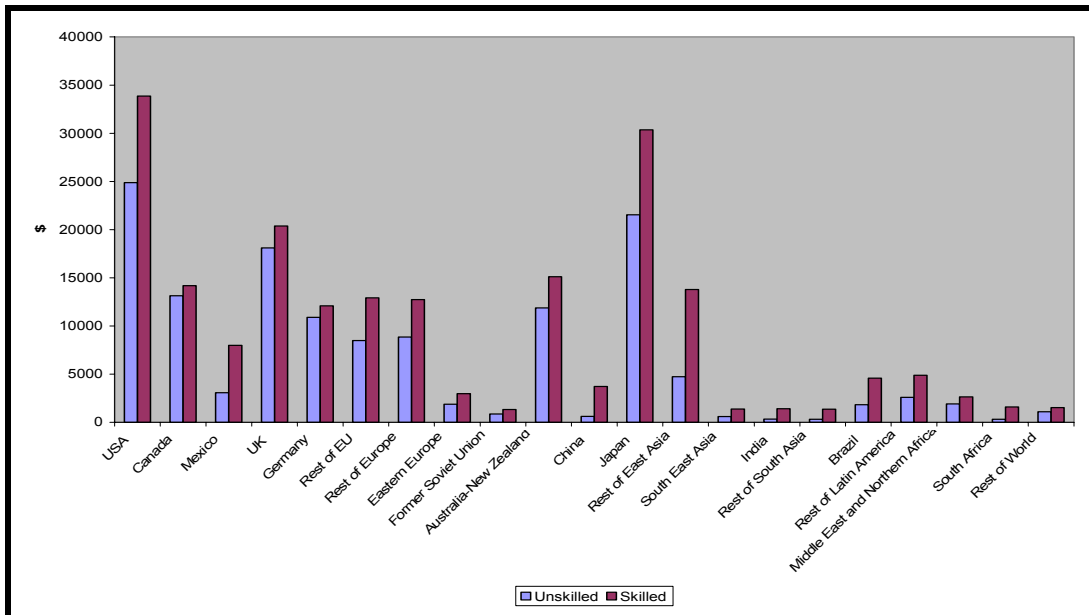
The proportion of remittances to income sent home by migrants is depicted in Figure 2. South Asia and South East Asia have particularly high remittance rates as a share of income and therefore permanent residents are likely to gain considerably remittances as a result of allowing more migration. Chinese on the other hand send only a small share of their income home. The developed economies also have low remittance rates as their workers abroad send few remittances back home.

Figure 2: Ratio of Remittances to Labour Income sent home by Migrants from each Region in the initial Data Base (%)



Figures 3 and 4 depict the average nominal and real wages of permanent residents by skill level in each region in the base data. Real wages are the nominal wages adjusted using purchasing power indices depicted in Figure 5 supplied by the World Bank. As expected skilled workers earn more than unskilled workers and wages are higher in developed economies for both skilled and unskilled workers. The United States has by far the highest wages for both skilled and unskilled. When we examine real wages however the differences between developed and developing are smaller although still evident in most of the countries.

Figure 3: Average Wages of Permanent Residents by Region in the base data



Source: World Bank

Figure 4: Average Real Wages of Permanent Residents by Region in the base data

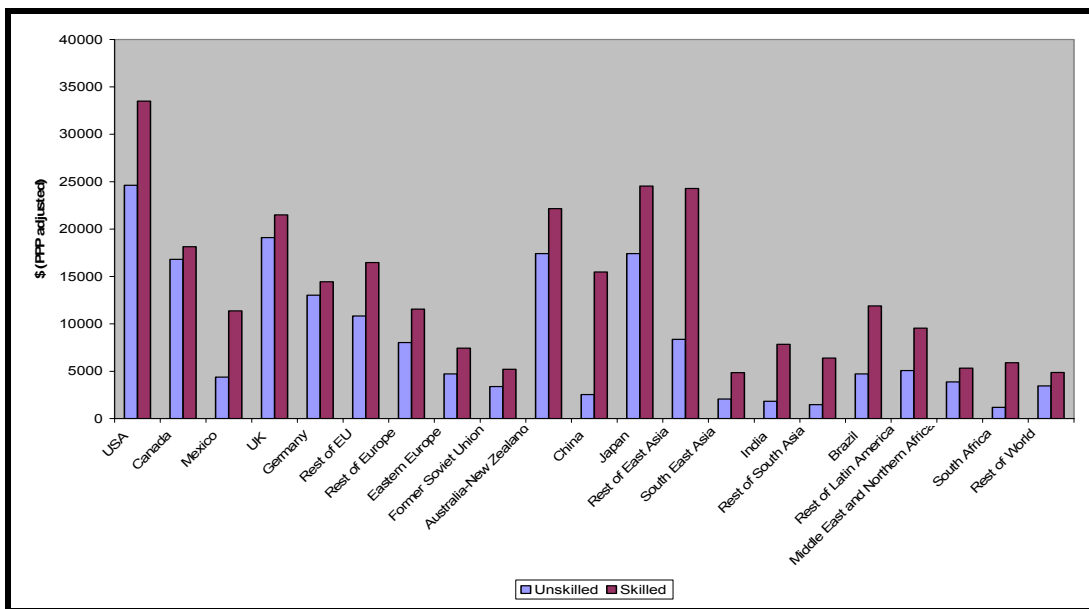
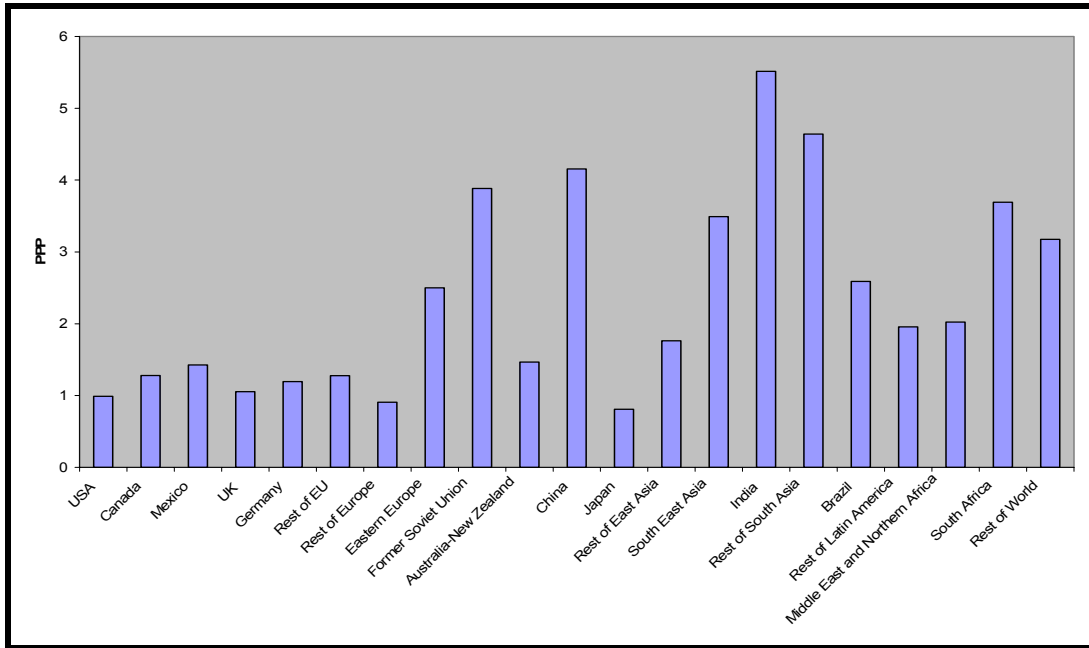


Figure 5: Purchasing Power Parity Indices



A number of assumptions are made in creating the GMig2 data base and in the GMig2 model itself, which are outlined in Box 1 below.

Changes in migration are modeled by ‘shocking’ the number of migrant workers in the model (point i, box 1). This shock then reduces the number of workers in the developing labor supplying regions and increases the labor force of the developed labor importing region, in our case by 3%. It is assumed that there is excess demand for quotas and hence the quota is completely filled (point j). The population of the home and host regions also changes, reflecting the change in the labor force (point a, box 1).

$$LF_{i,r} = \sum_c LF_{i,c,r} \quad (1)$$

Migrant workers are assumed to gain a portion of the difference between their nominal wages at home and the nominal wages in the host region (Equation (3), box 1), reflecting the fact that their productivities have also changed.

The labour force is then allocated across sectors so as to equalize the percentage change in the wage earned by all workers (domestic and foreign, point h, box 1). In the developed labour importing economies this increased labor force allows production to increase, while wages fall with the larger supply of labor. Returns to capital increase as

production rises and capital becomes relatively scarce. In the developing countries production and returns to capital fall, while wages rise with the decreased labor force.

Box1: Assumptions of the GMig2 Model and Data Base

- a. Migrant participation rates are the same as in their home region in the initial data base reflecting the fact that the underlying data are foreign born. In the model however new migrants (resulting from ‘shocking’ the model) are assumed not to take their families abroad, as in the base data.

$$LF_{r,c}/POP_{r,c} = LF_r/POP_r \quad (B1)$$

where: r is the home region and c is the host region, LF is labor force and POP is population.

- b. Migrant labor is divided into skilled and unskilled using data on the education levels obtained from Docquier (2004) for the OECD countries.
- c. Wages of migrants ($W_{i,r,c}$) in the base data are equal to the home wage ($W_{i,r,r}$) plus a proportion (BETA) of the difference between host ($W_{i,c,c}$) and home wage ($W_{i,r,r}$):

$$W_{i,r,c} = W_{i,r,r} + BETA \times (W_{i,c,c} - W_{i,r,r}) \quad (B2)$$

where: BETA is the proportion of the difference obtained by a person of labor type i migrating from region r to region c (= 0.75 in most of our applications).

Note that the wages of migrants and permanent residents are solved simultaneously while ensuring that total wage payments within a region remain constant.

- d. A constant remittance to income ratio is used to determine bilateral remittances in the data base (in the model we assume that remittances remain a constant proportion of income);

$$\frac{RM_{r,c}}{YS_{r,c}} = \frac{RM_r}{YS_r} \quad (B3)$$

where: RM are remittances, YS is income earned by permanent residents of r temporarily residing in c (or aggregated across all locations c).

- e. All other income (from capital, land etc) is assumed to accrue to permanent residents.
- f. Tax is paid by both foreign-born and domestic residents. Tax revenues accrue to the regional household following the standard GTAP model and are included in the income of the permanent residents.
- g. With the inclusion of remittances flows saving must be adjusted in the GTAP 6 Data Base to ensure that all income is allocated or spent.
- h. Foreign and domestic labor are assumed to be perfect substitutes (although their wages and hence marginal products are not equal). Labour is allocated across sectors to equate wages across sectors (in percentage changes).

- i. The quantity of skilled and unskilled labor within a region is fixed and only changes with the exogenously determined movement of labor from one region to another.
- j. There is excess demand for the quota spaces and hence any change in quotas will be filled by labor exporting regions.
- k. In each country incomes earned by both domestic and foreign-born residents are aggregated and allocated across consumption, government and saving. i.e. migrants adopt their host countries' consumption patterns.
- l. Temporary labor movement is treated as a revolving door, where temporary workers continually enter and return to their home countries. Unless explicitly included no changes in productivities are assumed upon their return home.

The income of migrant workers ($YS_{r,c}$, Equation (2)) depends on the income from labour ($YS_{i,r,c}$ where $i \in$ skilled and unskilled labour), less a portion of this income sent home as remittances (RM) (Equation (B4), box 1). Workers spend the rest of their income in the host economy (point k, box 1). Income on all other factors (land, natural resources and capital, point e, box 1) and tax revenue (T) accrues only to the permanent resident household ($YS_{r,r}$, Equation (3)). Remittances (RM) sent back supplement the income of the permanent workers at home.

$$YS_{r,c} = \sum_{l \in LAB} YS_{l,r,c} - \sum_{l \in LAB} RM_{l,r,c} \quad (2)$$

$$YS_{r,r} = \sum_{f \in ENDW} YS_{f,r,r} - D_r + T_r + \sum_{l \in LAB} \sum_{c \in REG} RM_{l,r,c} \quad (3)$$

The results are the comparative static short run impacts of these policies. That is, they show how much better (or worse) off the residents of each region are in the short run, before capital has had time to respond to changes in the rates of return. The shock to the labour forces of the home and host regions are permanent in that the host country labour force is now higher and the home country labour force is lower. However the people filling those positions change through time: this is the revolving door approach mentioned in point l, box 1.

As well as distinguishing between changes in the real incomes of persons from home regions r , living in region s ⁷, the model also separates the changes in real incomes into

⁷ In order to maintain consistency the subscripts are ordered according to where the labor is from (home region) and then where the labor is currently located (host region). Hence $ys_{r,s}$ is the percentage change in

those for the existing migrants and those for the new migrants. This is done by tracking the incomes of people by both their home and host region and the changes in the prices they face. For existing migrants and permanent residents price changes reflect the changes in prices experienced within the economy as a result of the policy. Income and prices faced by the new migrants however, change as a result of moving between countries which have different underlying wages and price levels. The change in real income (in host country prices) of the new migrant from r in c ($\Delta RYS_{r,c}^{NM}$, Equation (4)) is their new real income of new migrants from r in c ($\frac{YS_{r,c}^{NM}}{P_c}$) less the price adjusted income those new migrants earned at home in r ($\frac{Y_r^{NM}}{P_r}$)⁸. Prices adjustments are undertaken using PPP estimates supplied by the World Bank.⁹

$$\Delta RYS_{r,c}^{NM} = \frac{YS_{r,c}^{NM}}{P_c} - \frac{Y_r^{NM}}{P_r} \quad (4)$$

4. Welfare and the Decomposition of Welfare

In addition to real incomes we also determine changes in welfare and changes in welfare per person for the permanent residents (EVperm) and existing migrants (EVemigs).

The regional household's equivalent variation (EV) associated with a perturbation to the GTAP model is the difference between the expenditure required to obtain the new (post-simulation) level of utility at initial prices (Y_{EV}) and that available initially (Y) (McDougall, 2002).

$$EV = Y_{EV} - Y \quad (5)$$

Differentiating we obtain:

$$\partial EV = 0.01 Y_{EV} \times y_{EV} \quad (6)$$

income earned by labor from r , living in s ; and $\text{remit}_{r,s}$ is the percentage change in remittances earned by labor from r living in s , hence the remittances flow from region s to region r . Note also that lower case denotes percentage change relative to the base case, while upper case denotes levels.

⁸ Note that "S" in "YS" is used to show that income depends on the location of the labor. So Y_S is the income of all persons from region r (aggregated over all actual locations), while Y_r is the income of all persons located in r , regardless of where they are from.

⁹ We are grateful to van der Mensbrugge from the World Bank and the Global Economics Perspectives (2005) for suggesting this approach. Note that we do not measure the welfare change of new migrants instead we examine the impact of their movement on these new migrants in terms of changes in their real incomes. We do this because we do not track their preferences and hence we cannot take account of the impact on their welfare of the changes in those preferences.

Where y_{EV} is the percentage change in Y_{EV} and can be broken into a percentage change in population (n) and the percentage change in per capita expenditure (x)¹⁰.

$$y_{EV} = n + x_{EV} \quad (7)$$

One of McDougall's (2002) contributions to the new regional demand system for the GTAP model was to introduce the elasticity of expenditure with respect to utility, Φ , which captures the impact of non-homothetic preferences for private consumption on per capita regional utility (see also Hanslow, 2001). MacDougall shows that the percentage changes in per capita expenditure are related to percentage changes in prices (p) and per capita utility (u). Holding prices constant at initial levels we obtain the per capita change associated with the EV measure:

$$\begin{aligned} x_{EV} &= p + \Phi_{EV} u \\ &= \Phi_{EV} u \end{aligned} \quad (8)$$

Plugging (8) into (7) and the result into (6), we have the following expression for the change in regional welfare (EV):

$$\begin{aligned} dEV &= 0.01 \times Y_{EV} (n + \Phi_{EV} u) \\ &= 0.01 \times Y_{EV} n + 0.01 \times Y_{EV} \Phi_{EV} u \end{aligned} \quad (9)$$

Given that the percentage change in per capita utility is $u = \Phi^{-1}(y - p - n)$, and multiplying and dividing the second term by Y , we get:

$$dEV = 0.01 \times \left[1 - \frac{\Phi_{EV}}{\Phi} \right] Y_{EV} n + 0.01 \times \frac{\Phi_{EV}}{\Phi} \frac{Y_{EV}}{Y} Y (y - p) \quad (9)$$

This is used in the standard model to obtain welfare changes for all residents of a region. In the GMig2 model we use the same derivation but split the changes in EV between the

¹⁰ X is the EV required to achieve new *per capita* utility at initial prices.

permanent residents and existing migrants¹¹. Hence changes in welfare of the permanent residents (dEV^{PERM}) is given by¹²:

$$dEV^{PERM} = 0.01 \times \left[1 - \frac{\Phi_{EV}}{\Phi} \right] Y_{EV}^{PERM} n + 0.01 \times \frac{\Phi_{EV}}{\Phi} \frac{Y_{EV}}{Y} Y^{PERM} (y^{PERM} - p) \quad (10)$$

For existing migrants (dEV^{EMIGS}):

$$dEV^{EMIGS} = 0.01 \times \left[1 - \frac{\Phi_{EV}}{\Phi} \right] Y_{EV}^{EMIGS} n + 0.01 \times \frac{\Phi_{EV}}{\Phi} \frac{Y_{EV}}{Y} Y^{EMIGS} (y^{EMIGS} - p) \quad (11)$$

The welfare of permanent residents and existing migrants by host region can then be decomposed into a number of components. We use and extend the decomposition initially outlined in Huff and Hertel (2001), and then extended by Hanslow (2000) and McDougall (2002) to decompose welfare into 9 categories. The first 7 of these are the same as those currently used in the GTAP model. The final two are pertinent to the GMig2 model. The 9 components of the welfare decomposition are outlined in Box 2.

¹¹ This method is different to the one used in Walmsley and Winters (2005). In that paper, changes in welfare by location were provided. There were a number of problems with that method which could not be resolved. The main problem was that this measure included persons moving between countries who are also likely to experience changes in preferences which would impact their utility and welfare. For these reasons we choose to depict real incomes (income divided by the price index of the country of relevance) and break out the real incomes of the individual agents and only examine the welfare changes of those who remain in the same region/country.

¹² Note that we assume that $\frac{Y_{EV}^{PERM}}{Y^{PERM}} = \frac{Y_{EV}^{EMIGS}}{Y^{EMIGS}} = \frac{Y_{EV}}{Y}$ since all residents are assumed to have the same preferences and are subject to the same price changes.

Box2: Welfare Decomposition of permanent and existing migrants

1. **Allocative efficiency** – this is the gain or loss in welfare due to the re-allocation of resources. A welfare gain (loss) is the result of a more (less) efficient allocation of resources.
2. **Endowment effect** – this is the gain or loss in welfare due to changes in the supply of endowments. In GMig2 the changes in labour supply resulting from the movement of persons will result in changes in welfare due to this endowment effect.
3. **Technology effect** – this is the gain or loss due to any technological changes imposed. In this paper we do not consider changes in technology and hence this effect is zero for all countries).
4. **Population effect** – this is the gain or loss due to changes in the population. Again the movement of labour across countries is likely to have a significant impact on the population which will affect this part of the welfare decomposition.
5. **Terms of trade effect** – this is the gain or loss due to changes in the relative prices of exports and imports. The movement of labour and hence changes in the labour supply and wages are expected to affect the relative prices of exports and imports across regions.
6. **Capital goods effect** – this is the gain or loss due to changes in the relative price of saving to the cost of producing capital goods. This is a type of terms of trade effect and is generally small.
7. **Preference effect** – this is the gain or loss due to changes in preferences. In the GMig2 model incomes of permanent residents and migrants are aggregated and then allocated across private consumption, saving and government spending. Hence existing migrants are assumed to have the same preferences as permanent residents. Since these preferences are not altered there is no change in welfare due to changes in preferences. More information on this aspect of the welfare decomposition can be found in McDougall (2002).
8. **Remittances effect** – this is the gain or loss due to the flow of remittances in and out of region r. This is a new component of the welfare decomposition and allows us to take account of the fact that increased remittance flows ($REMIT_{r,s}$) due to the increased movement of labour will increase the welfare of permanent residents back home. $Popnm$ is the percentage change in the population of non-movers.

$$CNTremits_r = 0.01 \times EVSCALFACT_r \times \left[\sum_{s \in REG} [REMIT_{r,s} * [remits_{r,s} - popnm_r]] - REMIT_{r,s} * [remits_{s,r} - popnm_r] \right] \quad (B1)$$

EVSCALFACT relates to the elasticity of substitution (ϕ) and Y_{EV} and Y used in equations 10 and 11.

9. **New Migrants effect** – this is the real income ($Ynmigs_{r,s}/P_r$) which the new migrants earn and does not add to the welfare of the permanent residents and existing migrants.

$$CNTnmigs_r = -0.01 \times EVSCALFACT_r \times \left[\sum_{s \in REG} 100 \times \Delta Ynmigs_{s,r} - Ynmigs_{s,r} \times p_r \right] \quad (B2)$$

5. Experiments

A number of simulations were undertaken using the GMig2 model to examine how relaxing the restrictions on the temporary movement of natural persons (TMNP) is likely to affect developed and developing countries. The rest of 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 changing the sectoral allocation and the size of the shock, are examined.

Quotas on the temporary movement of natural persons are assumed to increase in a number of traditionally developed labour-importing regions, and to be filled by labour from a number of traditionally developing labour-exporting countries according to the current shares of migrants in the host countries labour force¹³. Table 1 divides the regions used in this analysis into developed labour-importing and developing labour-exporting regions (columns II and III respectively)¹⁴. The numbers in Table 1 represent the percentage of the labour force which are foreign (II) and the percentage of the labour force which work abroad (III). Hence nearly 20% of Australia/New Zealand's labour force are foreign born, while only 1% of Japan's labour force is foreign born. Just over 9% of Mexican's work abroad while only 0.5% of Chinese work abroad (Parsons, et al., 2005).

¹³ This is the critical difference from the Walmsley and Winters (2005), where we had to allocate the 'new' immigration places proportionately to developing (home) countries labour forces emigration stocks. Thus lots of Mexcians went to Europe and Morroccans to the USA.

¹⁴ The 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 1: Regions

I All Regions	II Share of Labour force born abroad^a	III Share of population living abroad^b
USA	10.95%	0.88%
Canada	16.57%	4.79%
Mexico	0.58%	9.25%
UK	7.73%	7.11%
Germany	10.74%	5.33%
Rest of EU	7.55%	5.76%
Rest of Europe	9.91%	12.27%
Eastern Europe	3.13%	6.91%
Former Soviet Union	9.65%	11.07%
Australia-New Zealand	19.61%	5.00%
China	0.23%	0.49%
Japan	0.99%	0.69%
Rest of East Asia	0.62%	2.71%
South East Asia	0.92%	1.87%
India	0.65%	0.88%
Rest of South Asia	1.91%	4.17%
Brazil	0.32%	0.55%
Rest of Latin America	2.07%	5.93%
Middle East and Northern Africa	6.08%	4.96%
South Africa	2.18%	2.53%
Rest of World	3.82%	7.41%

a. Percentage of the labour force in the initial data base which are foreign.

Shaded figures represent the labour importers.

b. Percentage of the labour force in the initial data base which work abroad.

Shaded figures represent the labour exporters.

Tables 2A and 2B depict the changes in the number of temporary foreign workers assumed in our experiment by home and host. It is assumed that the host regions increase their labour force by 3% and that these are supplied by the home regions in the same proportions as current foreign workers. Hence the USA increases the number of skilled and unskilled workers by 1.5m and 3m respectively and these are primarily supplied by Mexico and Latin America¹⁵.

¹⁵ Note that the home regions of the new skilled and unskilled foreign workers may differ due to the fact that the initial data base may indicate that a host country obtains foreign skilled workers from different counties than they obtained unskilled workers e.g. the USA obtains most of its unskilled workers from Mexico but gets more skilled workers from East Asia.

Table 2B: Changes in the number of Skilled workers by home and host regions (Millions)

Home Country	Host Countries								Total skilled labour lost	Total Unskilled labour lost as share of labour force
	USA	Canada	UK	Germany	Rest of EU	Rest of Europe	Australia-New Zealand	Japan		
Mexico	0.57	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.59	8.60%
Eastern Europe	0.04	0.02	0.03	0.07	0.18	0.03	0.01	0.00	0.39	3.20%
Former Soviet Union	0.04	0.01	0.01	0.07	0.06	0.01	0.00	0.00	0.20	0.92%
China	0.09	0.03	0.03	0.02	0.03	0.01	0.02	0.15	0.37	1.11%
Rest of East Asia	0.08	0.01	0.00	0.01	0.02	0.00	0.01	0.26	0.39	5.09%
South East Asia	0.18	0.02	0.03	0.04	0.09	0.01	0.04	0.08	0.48	1.32%
India	0.05	0.01	0.05	0.02	0.02	0.01	0.01	0.00	0.17	0.53%
Rest of South Asia	0.01	0.01	0.03	0.03	0.02	0.01	0.01	0.01	0.13	1.44%
Brazil	0.01	0.00	0.00	0.00	0.02	0.00	0.00	0.09	0.13	0.86%
Rest of Latin America	0.36	0.02	0.03	0.05	0.15	0.01	0.00	0.02	0.64	3.05%
Middle East and Northern Africa	0.05	0.01	0.03	0.10	0.25	0.02	0.01	0.00	0.48	1.41%
South Africa	0.04	0.01	0.11	0.04	0.17	0.02	0.01	0.00	0.39	2.13%
Rest of World	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.02	1.91%
Total Skilled workers gained	1.53	0.16	0.35	0.45	1.02	0.13	0.13	0.62	4.38	31.57%
Total Skilled labour gained as share of labour force	3%	3%	3%	3%	3%	3%	3%	3%	3%	

6. The Results

The increase in the quotas of the developed labour-importing economies, equivalent to 3% of their labour forces, is found to have an overall positive impact on world income as people move from low to high productivity locations. In the first section the macro impact of the movement of labour on real GDP, the terms of trade, imports, exports, factor returns etc by region is investigated. Next the sectoral implications of the movement of labour in both the labour-importing and labour-exporting regions are examined. In the third sub-section changes in the real income of the permanent residents; and the existing and new migrants is investigated. In the fourth section we examine the impact on the welfare of permanent residents and existing migrants and examine the welfare decomposition. Finally, we undertake some sensitivity analysis with respect to our choice of beta and the size of the shock, amongst others.

6.1. Macroeconomic Effects

Table 3 depicts some of the macro results from the increased quotas. The labour-importing developed economies experience increases in real GDP as a result of the increase in supply of labour which can be used in production. The increased supply of labour also causes a fall in the returns to labour while in most cases the increases in output (which if differentiated by place of production) results in losses in the terms of trade and real exchange rate¹⁶. This depreciation in the real exchange rate causes exports to increase. Imports also rise due to the increase in incomes and numbers of consumers.

These results show that an increase of 3% of the labour force, which is equivalent to a rise in the number of migrants of 27% in the USA, raises exports by 2.5% and imports by only 0.12%. These estimates are likely to underestimate the impact of the movement of people on trade for two reasons: a) it is assumed that migrants have the same preferences for domestic and imported goods and hence the same purchasing patterns as local permanent residents; and b) the model does not take into account the fact that migrants have country specific information and links which may result in increased trade between the two countries. Jansen and Piermartini (2004) used econometrics to estimate the

¹⁶ In some cases the rise in the price of capital may offset the decline in wages and hence the real exchange rate and terms of trade may not change or increase slightly.

impact of the movement of labour under Mode 4 on exports and imports. They found that a 10% increase in the number of migrants from another country in the USA increased imports from the home country by 3% and exports by 1.8-2.7%, far higher than the estimates presented here.

The trade balance of the labour-importing developed economies tends to rise as the decrease in prices and resulting increase in demand for exports outweighs the increase in demand for imports. The current account on the other hand, which takes into account remittance flows, tends to decline as more remittances leave the country. Returns to capital increase as greater labour supply and demand for goods increase the demand for capital. This increased return for capital causes investment to increase, in the long-term this would result (not modelled here) in even higher capital stocks and production.

In the labour-exporting developing economies the reverse is often true. As the supply of labour falls, the real exchange rate rises and the trade balance falls. This is offset by the remittances which cause the current account balance to rise.

Table 3: Macroeconomic Results (Difference from base) due to the unskilled and skilled movement of labour

	Real GDP (%)		Terms of Trade (%)		Change in Trade Balance (\$US Millions)		Change in Current Account Balance (\$US Millions)		Exports (%)		Imports (%)		Investment (%)		Real wages of unskilled non-migrants ¹⁷ (%)		Real wages of skilled non-migrants (%)		Real return to capital (%)	
	Unsk	Skill	Unsk	Skill	Unsk	Skill	Unsk	Skill	Unsk	Skill	Unsk	Skill	Unsk	Skill	Unsk	Skill	Unsk	Skill	Unsk	Skill
USA	0.99	0.71	-0.30	-0.24	8265.84	5604.88	-4574.01	-2772.52	1.62	1.08	0.27	0.13	0.63	0.35	-1.51	0.46	0.63	-1.68	0.77	0.57
Canada	1.08	0.53	0.02	0.05	253.66	424.05	-675.12	11.65	1.18	0.62	1.22	0.56	1.33	0.34	-1.45	0.29	0.71	-1.86	0.86	0.36
Mexico	-0.47	-0.92	0.31	0.31	-97.10	-536.20	2043.35	1587.01	-0.58	-1.05	-0.26	-0.48	-1.64	-1.35	1.37	-0.50	-0.11	7.89	-0.30	-0.61
UK	1.01	0.71	-0.11	-0.11	1383.37	821.37	-1486.48	-996.97	1.40	0.88	0.78	0.47	0.82	0.53	-1.37	0.43	0.68	-1.69	0.75	0.50
Germany	0.93	0.60	-0.07	-0.06	-1251.54	75.31	-2628.22	-962.92	0.81	0.58	1.03	0.57	1.31	0.57	-1.58	0.34	0.57	-1.77	0.72	0.40
Rest of EU	0.84	0.57	-0.09	-0.06	3957.73	2947.57	-474.01	169.74	1.09	0.67	0.77	0.43	0.50	0.22	-1.57	0.32	0.52	-1.81	0.58	0.37
Rest of Europe	1.21	0.73	0.04	0.01	-362.85	-229.58	-1015.61	-616.60	0.83	0.51	1.23	0.74	1.98	1.19	-1.76	0.41	0.72	-1.73	0.92	0.53
E. Europe	-0.65	-0.49	0.20	0.14	216.25	-14.44	1845.60	998.81	-0.66	-0.46	-0.51	-0.28	-1.79	-0.95	1.05	-0.26	-0.31	2.70	-0.40	-0.27
F Soviet Union	-0.11	-0.10	0.09	0.08	975.86	443.71	1438.32	777.75	0.34	0.13	-0.22	-0.08	-1.52	-0.78	-0.05	-0.15	-0.20	0.60	-0.21	-0.11
Australia-New Zealand	0.93	0.66	0.00	0.00	252.54	237.60	-283.65	-142.52	1.01	0.65	0.77	0.41	0.87	0.44	-1.60	0.34	0.54	-1.91	0.73	0.48
China	-0.04	-0.13	-0.02	0.02	1995.60	992.25	2968.19	1654.94	0.31	0.05	-0.14	-0.17	-0.61	-0.41	-0.01	-0.09	-0.08	0.79	-0.09	-0.11
Japan	1.04	0.63	-0.03	0.00	-6500.45	-5156.53	-11548.20	-8286.11	-0.32	-0.39	1.18	0.80	1.64	1.14	-1.41	0.33	0.56	-1.62	0.78	0.46
Rest of East Asia	-0.68	-0.96	0.07	0.10	518.54	490.52	2330.44	1670.72	-0.48	-0.59	-0.65	-0.75	-1.74	-1.51	1.07	-0.58	-0.38	3.67	-0.50	-0.76
S. East Asia	-0.10	-0.13	0.13	0.10	-1015.08	-874.54	2273.50	1453.49	-0.58	-0.49	-0.26	-0.23	-0.87	-0.53	0.22	-0.07	0.08	1.08	-0.08	-0.09
India	-0.01	-0.05	0.38	0.32	-1456.49	-1114.14	1501.03	940.12	-2.18	-1.70	0.50	0.37	-0.68	-0.38	-0.01	-0.04	0.13	0.54	-0.14	-0.10
Rest of South Asia	-0.02	-0.12	0.86	0.45	-1618.79	-734.29	661.40	344.08	-4.94	-2.34	1.24	0.52	-0.49	-0.38	0.17	-0.03	0.47	1.24	-0.06	-0.10
Brazil	-0.13	-0.16	0.24	0.22	-526.68	-461.30	1580.04	928.00	-0.94	-0.74	0.05	0.13	-1.28	-0.73	0.32	0.00	0.20	0.84	-0.24	-0.19
Rest of Latin America	-0.50	-0.43	0.52	0.32	-2493.77	-1347.59	2490.90	1427.01	-1.84	-1.04	0.04	0.01	-1.32	-0.75	1.02	-0.21	-0.05	2.64	-0.37	-0.30
Middle East and N. Africa	-0.40	-0.17	0.43	0.23	-1500.09	-686.24	2763.16	1270.09	-0.91	-0.37	-0.02	0.07	-1.08	-0.43	0.86	-0.06	-0.08	1.11	-0.26	-0.07
South Africa	-0.07	-0.24	0.34	0.27	-811.46	-789.95	815.98	562.16	-0.81	-0.82	0.27	0.17	-0.96	-0.67	0.17	-0.07	0.18	1.72	-0.06	-0.13
Rest of World	-0.51	-0.22	0.91	0.46	-185.04	-92.44	-26.57	-17.93	-3.26	-1.47	0.48	0.33	0.00	0.10	1.87	0.11	0.51	1.79	0.18	0.12

¹⁷ Non-Migrants include permanent residents of the region and exiting migrants who have not moved countries as a result of the simulation.

6.2. Sectoral Effects

Table 5 shows the output gains per new migrant from the new unskilled and skilled migrants. The relative size of the sectoral output gains from increased unskilled and skilled workers depends on the relative use of skilled and unskilled labour by the sector. Hence there is a tendency for agricultural and light manufacturing sectors to gain more from unskilled migrants than skilled (see gray shading) and for services and manufacturing to gain more from skilled labour per new migrant worker in the labour-importing developed economies.

The sectoral results for the developing labour-exporting economies are depicted in Table 6. Again the loss of unskilled labour has a greater impact on those sectors which use unskilled labour most intensively and likewise for skilled. While output does decline in most sectors, China and India in particular experience some considerable gains in sectoral output. While it may seem counter intuitive that loss of labour would result in sectoral expansion, there is an expansion of domestic and foreign demand which is occurring with the increased migration. As a result of the higher income at home from remittances, there is a greater demand for certain commodities both by private households and firms. In the case of India, increases in remittances are coming from the higher numbers of unskilled migrants overseas. India therefore sees massive sectoral output gains in household utilities and other services, while China experiences output increases in the textiles and business services sectors, due to increased demand from foreigners.

Table 5: Sectoral Results of Developed Labour-Importers: Changes in output¹⁸ per new migrant as a result of increase in unskilled and skilled quotas respectively

	USA		Canada		UK		Germany		Rest of EU		Rest of Europe		Australia-New Zealand		Japan	
	Unskilled	Skilled	unskilled	Skilled	unskilled	skilled	unskilled	skilled	unskilled	skilled	unskilled	skilled	unskilled	Skilled	unskilled	Skilled
Crops	299.20	189.03	347.33	292.95	211.55	125.10	305.39	183.84	669.37	468.90	158.74	65.72	742.27	443.19	385.92	274.36
Livestock	127.73	115.31	102.72	67.71	82.40	56.34	36.37	26.95	93.78	86.78	42.91	40.21	444.99	329.06	26.31	28.36
Meat	745.81	690.10	468.29	335.39	659.29	576.48	407.17	362.59	656.56	670.58	418.90	429.05	802.39	742.28	186.71	212.88
Dairy	363.86	401.10	319.43	271.70	441.29	383.44	325.91	248.25	446.08	464.37	344.66	332.61	798.88	554.85	182.16	207.89
Food	1692.26	1893.95	1040.48	891.83	1746.12	1558.61	1122.57	1149.98	1288.75	1472.36	1028.60	1090.23	1120.57	1135.53	2012.39	2353.96
Other Primary	299.49	280.42	671.59	713.60	91.26	87.98	92.60	64.36	156.01	141.31	163.36	134.55	555.25	527.57	168.14	148.96
Wood and paper	2263.93	2608.63	2331.30	1954.11	1792.49	1791.36	1417.83	1363.90	1295.48	1688.72	1208.03	1741.46	1130.14	1359.14	1383.17	2016.53
Textiles and wearing apparel	1905.91	1423.33	1259.68	750.55	1432.21	897.52	1158.48	914.64	1610.02	1501.47	561.08	396.91	668.42	699.03	980.87	714.57
Chemicals and Minerals	3728.82	4336.53	1909.60	1791.83	3426.65	3163.01	3666.26	4270.67	3021.23	3966.37	1647.59	2066.80	1463.50	1769.47	2762.54	3593.49
Metals	2653.12	2810.67	1862.74	1336.92	2339.91	1914.08	2402.10	2336.43	1745.26	2083.76	1743.72	2062.93	1052.37	1397.38	1786.43	2671.50
Autos	1809.42	1947.72	2251.37	2619.45	1096.70	902.40	2097.39	2109.42	1090.22	1314.96	841.70	1038.67	469.62	491.78	1090.89	2003.95
Electronics	1917.80	3189.38	1169.85	1691.12	1292.68	1399.04	2176.01	2721.20	921.16	1437.33	524.38	757.03	245.62	333.49	1775.71	1978.54
Other manufactures	4697.80	6752.47	2803.44	3165.06	4836.82	4086.04	4545.96	5229.85	2160.35	2706.80	2330.88	3492.84	1295.00	1413.51	1442.90	1464.63
Household Utilities	2323.52	2952.56	1954.60	1977.08	1753.67	1980.93	755.49	921.76	1170.24	1703.50	2357.68	2455.82	1619.44	1859.47	2734.95	4023.86
Construction	3516.29	3905.42	3359.88	2052.93	3214.43	3182.81	3416.94	2745.28	1517.59	1736.03	3395.63	4025.83	1759.05	1691.77	6987.89	11217.16
Trade	9091.82	9300.23	4068.54	3475.93	7380.04	6463.59	4327.75	4050.56	3247.25	4041.66	4230.73	5267.93	4944.30	5345.85	7638.27	11182.72
Transport	2735.95	2737.46	3772.06	3147.84	3001.74	2816.40	1560.35	1584.90	1662.01	2203.24	1757.51	2572.75	2094.60	2456.89	2939.37	4243.18
Communications	1082.65	1743.01	783.57	909.22	972.02	1197.40	544.31	674.04	499.46	880.08	684.83	734.00	775.51	1018.66	847.91	1209.89
Financial Services	3148.09	5509.99	804.23	802.41	2299.84	2671.42	372.36	577.99	1164.70	1884.03	1601.95	1521.60	898.45	1195.85	1438.67	2016.38
Insurance	1215.90	2615.90	489.51	622.60	1133.13	1485.57	500.67	653.67	288.09	563.65	581.47	618.32	527.72	758.15	574.12	849.13
Business services	6008.45	9003.19	2930.89	2994.51	6150.22	7580.33	1388.80	1477.26	2741.33	4558.22	2519.28	2585.32	3604.23	4645.56	4745.52	6796.34
Other service	10773.87	18573.61	5060.87	9695.49	5410.75	9599.86	11672.61	15214.13	5815.91	12457.96	6933.96	8923.62	4289.68	9370.37	9790.01	13756.83

¹⁸ Change in output is the change in output valued at current prices (i.e. the value of output multiplied by the percentage change in output divided by 100).

Table 6: Sectoral Results of Developing Labour-Exporters: Changes in output¹⁹ per new migrant as a result of increase in unskilled and skilled quotas respectively

	Mexico		Eastern Europe		China		Rest of East Asia		India		Rest of South Asia		Rest of Latin America		South Africa	
	Unskill	Skill	Unskill	Skill	Unskill	Skill	Unskill	Skill	Unskill	Skill	Unskill	Skill	Unskill	Skill	Unskill	Skill
Crops	-3,800	68	-10,372	-704	182,608	9,424	-4,526	-52	72,033	5,245	-14,598	-597	-18,465	-110	5,368	1,720
Livestock	-465	4	-1,200	-75	18,926	1,564	-935	-239	9,595	846	7,047	398	-4,427	-912	26,694	1,434
Meat	-7,248	-1,738	-10,815	-1,458	-18,108	-2,322	-7,974	-2,268	45,790	3,511	21,051	1,283	-11,479	-2,037	18,897	948
Dairy	-1,707	-334	-5,890	-1,062	622	159	-2,028	-627	296,725	24,333	32,073	1,894	-6,005	-1,158	-4,540	-471
Food	-8,596	-2,969	-18,248	-4,123	80,235	-2,309	-14,177	-5,117	128,541	8,741	55,173	3,191	-24,188	-6,194	62,613	2,450
Other Primary	3,621	246	-1,370	71	226,088	3,811	-409	27	-1,816	-3,116	15,597	564	-4,481	-1,416	45,785	357
Wood and paper	-14,362	-3,419	-25,053	-6,361	-43,650	-10,167	-15,488	-6,619	-66,315	-6,138	-11,498	-1,132	-32,604	-9,406	-49,422	-5,132
Textiles and wearing apparel	-15,483	-2,901	-27,260	-1,920	1,023,859	72,003	-23,830	-337	-611,088	-51,439	-593,160	-37,358	-58,746	-11,807	-36,514	-3,869
Chemicals and Minerals	-26,072	-8,862	-49,266	-16,692	-241,800	-59,693	-57,311	-22,888	-452,418	-46,461	-66,135	-5,561	-87,088	-26,910	-86,270	-10,142
Metals	-35,690	-7,113	-54,421	-13,160	-714,989	-55,465	-59,670	-16,276	-865,589	-73,899	-66,710	-5,285	-91,649	-21,456	-233,806	-17,894
Autos	-23,022	-5,705	-17,550	-5,072	-160,608	-13,296	-30,965	-9,857	-116,258	-9,236	-8,223	-718	-20,024	-5,867	-41,265	-3,728
Electronics	-18,097	-7,970	-18,955	-9,228	600	-38,918	-37,787	-24,538	-139,909	-13,160	-10,484	-895	-17,552	-5,959	-22,484	-2,328
Other manufactures	-48,268	-13,945	-79,045	-27,890	-1,413,069	-147,595	-106,658	-39,575	-1,207,463	-111,643	-108,858	-8,791	-79,066	-24,110	-247,979	-22,936
Household Utilities	-2,138	-847	-11,173	-4,641	-11,649	-9,859	-22,259	-14,023	229,919	16,331	75,611	3,980	-17,155	-5,156	-7,380	-3,406
Construction	-51,341	-9,275	-55,001	-16,930	-1,864,720	-108,542	-73,098	-24,293	-471,334	-33,002	-33,790	-4,311	-68,138	-19,549	-101,520	-8,085
Trade	-28,853	-11,237	-24,130	-7,523	34,590	-26,207	-49,556	-25,101	70,000	3,066	20,067	-501	-28,325	-10,739	17,086	-2,876
Transport	-14,254	-6,278	-21,440	-5,454	81,532	-12,368	-16,152	-6,896	13,156	-1,426	42,921	1,112	-44,346	-13,137	-21,470	-4,128
Communications	-1,269	-1,753	-4,213	-2,807	-23,129	-6,270	-8,484	-5,573	3,879	-211	-1,241	-453	-4,885	-4,189	4,055	-869
Financial Services	-2,248	-2,014	-5,211	-2,883	4,877	-8,734	-18,489	-11,342	-12,864	-3,109	-742	-482	-10,220	-5,826	9,742	-1,756
Insurance	-2,318	-2,890	-2,155	-1,182	4,254	-2,116	-5,551	-3,773	-31,196	-3,417	-7,755	-902	-4,135	-3,359	-2,766	-1,490
Business services	-5,370	-3,603	-18,544	-12,774	175,693	-8,867	-27,606	-18,053	-35,317	-14,317	15	-814	-21,942	-11,932	-12,888	-5,669
Other service	-4,830	-23,497	-17,204	-27,133	67,485	-46,467	-52,655	-58,764	572,019	30,191	130,907	3,278	-4,191	-48,742	141,320	-6,164

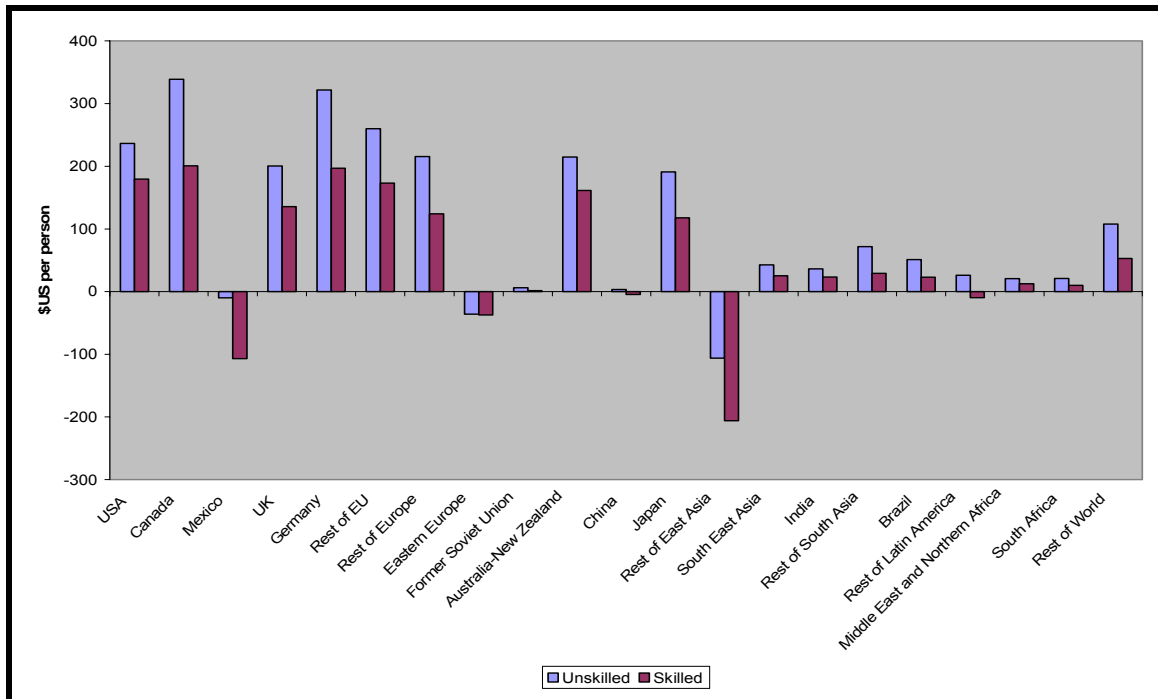
¹⁹ Change in output is the change in output valued at current prices (i.e. the value of output multiplied by the percentage change in output divided by 100).

6.3. Real Incomes

The model tracks the incomes of permanent residents by region and of existing and new migrants by home and host region. In this section we examine all three.

Most permanent residents of the labour-importing developed and labour-exporting developing countries (or country groups) gain in terms of real incomes, with most of the gains accruing from the increased quotas on unskilled labour (Figure 6). In only 4 (Mexico, Eastern Europe, China and Rest of East Asia) of 13 developing labour-exporting countries or blocs are losses made. With the exception of China, these countries also experienced the largest losses in their skilled labour forces as a percentage of their skilled labour forces (Table 2B) and the largest losses in returns to capital (Table 3). Remittances, which are amongst the lowest as a share of the migrant's incomes in these countries, were also insufficient to offset these losses in returns to factors.

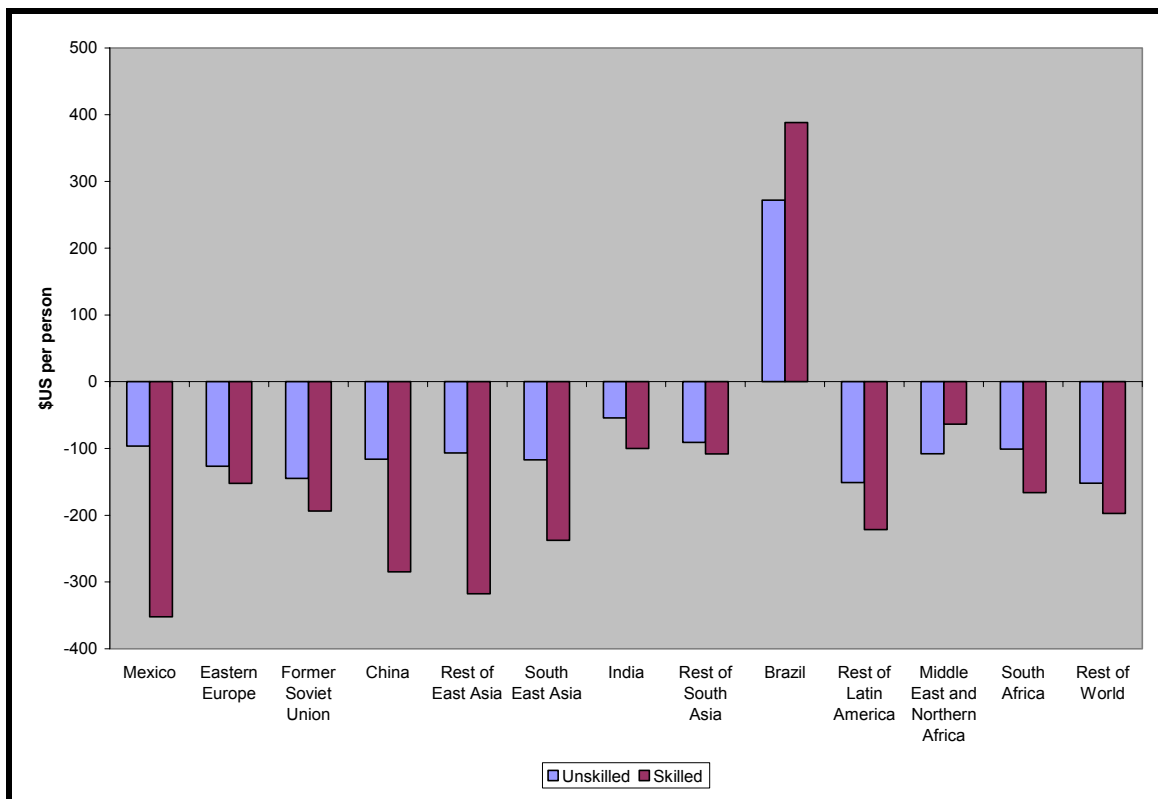
Figure 6: Changes in Real Income of Permanent Residents due to unskilled and skilled migration respectively per permanent worker



With the assumption of perfect substitutability, the wages of existing migrants are affected in the same way as those of permanent resident workers. For example the

existing migrants in developed economies experience the same declines in their wages as permanent residents; however they do not get the benefits (or losses) of increased (decreased) returns to capital; which are assumed to be owned by the permanent residents in this data base and model. As a result the per capita real incomes of the average existing migrants in the developed labour-importing economies declines (Figure 7). The average existing migrants in the developing economies gain as the supply of labour falls and wages rise. Some of these increases in wages are significant (e.g. Mexico and Rest of East Asia) where the loss of labour is greatest.

Figure 7: Changes in Welfare of Existing Migrants (by host) due to unskilled and skilled migration respectively per Existing migrant worker



Finally we consider the impact of the increased quotas on the new migrants. We measure the impact of the policy on the new migrants by examining the change in their real incomes (Equation (4)) after remittances.

All the new unskilled migrant workers gain in terms of real income with the largest gains being made by those new migrants who move to the USA, followed by the United Kingdom, Australia-New Zealand and Canada (Table 7A and 7B). This is due to the fact that real wages are highest in the USA, followed by these other economies (Figure 4).

Not all new skilled migrant workers on the other hand gain in terms of real income. This is due to the combination of two factors:

a) Real wage differentials between the home and host regions may be small and in some cases the real wages may even be lower at home than they are abroad. For example, real wages in Rest of East Asia are as high as in Japan and exceed most of Europe (Figure 4) hence the real incomes of new migrants from East Asia moving to Europe decline substantially.

b) Remittances are now sent back home. This lowers the real income of the migrants even further and in many cases real incomes fall, particularly for new migrants from South Asia, India and the rest of world (Figure 2) which send very large portions of their income back home as remittances. It could be argued that remittances should not be taken out of the real incomes of new migrants since these migrants do gain in terms of utility from sending these remittances. Furthermore prior to moving the same proportion of their income may have been used to support their families.

A significant difference between these results and those obtained in Walmsley and Winters (2005) is the larger gains to the permanent residents and the smaller gains to the actual migrants themselves. Most of this can be attributed to the fact that we are using remittances data from Ratha (2005) which are substantially higher than those used in the previous study; which were obtained from IMF data.

Table 7A: Change in Real Income of new migrants by Home and Host Regions as a result of the movement of unskilled workers

Home Region	Host Region							
	USA	Canada	UK	Germany	Rest of EU	Rest of Europe	Australia-New Zealand	Japan
Mexico	14,903	8,840	10,715	5,916	3,997	5,825	9,030	9,294
Eastern Europe	12,825	6,923	9,365	3,739	2,581	179	8,265	8,287
Former Soviet Union	15,759	9,703	11,487	6,250	5,501	2,527	10,664	10,003
China	17,820	11,904	14,573	8,339	6,039	7,233	11,675	11,548
Rest of East Asia	9,739	3,842	5,713	1,009	2,254	2,536	2,504	4,644
South East Asia	14,877	9,308	11,157	7,124	6,126	7,666	10,533	9,025
India	6,154	3,594	4,358	2,366	1,719	1,191	3,636	3,802
Rest of South Asia	9,028	6,348	6,739	4,194	3,872	4,836	6,700	3,532
Brazil	7,613	3,733	4,895	1,843	173	2,736	4,036	4,019
Rest of Latin America	11,966	8,006	9,838	4,245	2,847	2,719	9,462	7,333
Middle East and Northern Africa	8,504	3,860	7,093	5,272	2,068	2,102	2,815	8,056
South Africa	14,870	10,332	11,544	7,444	5,948	6,373	10,776	9,987
Rest of World	13,661	10,185	10,304	4,817	-2,804	7,807	7,297	9,364

Table 7B: Change in Real Income of new migrants by Home and Host Regions as a result of the movement of skilled workers

Home Region	Host Region							Japan
	USA	Canada	UK	Germany	Rest of EU	Rest of Europe	Australia-New Zealand	
Mexico	15,039	3,287	5,778	216	1,151	-339	6,655	8,091
Eastern Europe	16,363	4,742	8,073	1,574	4,251	373	9,036	10,756
Former Soviet Union	20,731	8,538	11,148	5,104	8,089	3,666	12,132	13,478
China	11,873	285	3,717	-4,023	-658	-6,017	3,823	3,788
Rest of East Asia	-679	-12,040	-9,778	-15,525	-13,911	-14,264	-8,274	-7,730
South East Asia	18,085	7,303	9,795	5,143	6,844	3,477	11,545	10,657
India	2,886	-2,127	-1,027	-3,361	-2,179	-4,368	-741	-43
Rest of South Asia	7,537	1,608	2,451	-584	1,757	-1,684	3,750	238
Brazil	4,968	-2,696	-1,030	-4,613	-2,737	-4,037	-149	463
Rest of Latin America	13,603	4,542	7,190	598	2,690	-1,069	9,269	7,819
Middle East and Northern Africa	11,496	2,799	6,843	4,745	2,950	2,850	3,221	11,470
South Africa	15,207	5,694	7,587	2,832	5,461	637	8,605	9,072
Rest of World	18,428	9,641	10,122	4,077	-3,697	6,314	9,255	13,175

6.4. Welfare and Welfare Decomposition of Permanent Residents and Existing Migrants

The overall change in the welfare of the permanent residents and existing migrants²⁰ by host region are shown in column VIII of Table 4. The overall gains or losses are driven primarily by the welfare changes experienced by the permanent residents since these are the largest group in the host region. The welfare effects are decomposed in Table 4 according to the 9 categories outlined in Box 2 above.

In the labour-importing developed economies welfare gains accrue from positive contributions from the allocative efficiency and endowment effects which are partially offset by negative terms of trade and remittances (the outflow of remittances) effects. The endowment effect in the welfare decomposition includes the contributions of the new migrants (i.e. their labour). This contribution of the new migrants must be paid for and hence in column VII of Table 4 the income paid to new migrants is subtracted from the decomposition to obtain the welfare gains of the permanent residents and existing migrants. Allocative efficiency improvements result from increases in production or use of taxed items or alternatively the decrease in production/use of a subsidized item. The positive allocative efficiency effects here are due primarily to the increase in supply of factors, which are taxed in the underlying data base, and the increase in production, which are also taxed. The endowment effects are also positive for the developed labour importing economies due to the increased supply of labour endowments.

The decomposition of welfare for the labour-exporting developing economies shows that losses in welfare result from the endowment and population effects resulting from the loss of skilled and unskilled labour. These negative effects are offset by gains in terms of trade and remittances. The allocative efficiency effects are mixed, in some developing economies efficiency gains are made from increased imports.

²⁰ Note this does not include the welfare of the new migrants.

Table 4: Decomposition of the change in Welfare of permanent residents and existing migrants by Region (\$US Millions)

	I	II	III	IV	V	VI	VII	VIII
	Allocative Efficiency	Endowment	Population	Terms of Trade	Price of capital goods	Remittances	New Migrants	Total
USA	57,876.31	113,393.88	0.00	-5,358.70	-1,930.54	-21,270.03	-90,170.45	52,540.47
Canada	5,274.85	6,276.88	0.00	138.81	181.93	-1,342.16	-4,852.32	5,677.98
Mexico	121.08	-1,344.39	-7,601.44	984.52	-74.52	4,465.94	0.00	-3,448.81
UK	9,166.60	15,391.90	0.00	-730.23	-89.53	-4,695.29	-10,540.01	8,503.44
Germany	15,775.08	12,479.36	0.00	-844.83	262.12	-2,413.59	-9,946.06	15,312.09
Rest of EU	36,595.62	28,972.41	0.00	-2,402.61	528.70	-7,217.55	-22,358.95	34,117.61
Rest of Europe	4,215.06	4,464.28	0.00	77.90	133.09	-1,040.95	-3,386.01	4,463.37
Eastern Europe	-763.18	-77.92	-4,201.32	694.16	55.90	2,711.79	0.00	-1,580.58
Former Soviet Union	-89.11	-108.92	-681.05	282.90	78.24	801.27	0.00	283.34
Australia-New Zealand	2,152.94	4,339.48	0.00	-3.27	44.42	-918.13	-3,328.74	2,286.70
China	-224.64	-992.03	-1,006.90	34.85	338.95	1,636.69	0.00	-213.08
Japan	24,958.72	44,846.65	0.00	-71.12	510.61	-8,175.01	-36,451.99	25,617.85
Rest of East Asia	-988.57	-2,797.95	-8,341.43	586.17	8.71	3,040.72	0.00	-8,492.35
South East Asia	8.37	-60.28	-1,424.53	1,118.10	-28.59	5,647.48	0.00	5,260.55
India	56.18	-165.64	-203.48	433.12	-62.42	4,996.97	0.00	5,054.74
Rest of South Asia	97.01	-134.26	-184.05	354.21	-61.19	3,345.18	0.00	3,416.88
Brazil	-57.50	-407.62	-1,040.16	310.36	43.77	3,495.71	0.00	2,344.57
Rest of Latin America	90.72	-1,917.62	-6,611.92	1,467.48	4.75	7,915.88	0.00	949.29
Middle East and Northern Africa	-231.06	-600.53	-5,113.55	2,136.02	36.00	6,259.48	0.00	2,486.36
South Africa	-64.48	-503.11	-430.62	663.30	-5.76	2,980.80	0.00	2,640.14
Rest of World	50.08	-4.18	-178.00	79.88	21.69	239.04	0.00	208.50
Total	154,020.07	221,050.38	-37,018.44	-48.98	-3.68	464.24	-181,034.53	157,429.06

6.5. *Sensitivity Analysis*

In this final section we undertake some basic systematic sensitivity analysis to examine how sensitive the results are to changes in the shocks, the proportion of wages assumed to be gained by the new migrants and the impact of allocating these new migrants directly into the services sectors. Rather than include all the results here we concentrate on a comparison on the welfare implications for the permanent residents and existing migrants (Table 8).

The results show that the gains to permanent residents and existing migrants roughly double as the size of the shock increases from 3% to 6%. This assumes that there is still sufficient demand for the quota places.

When we alter the beta (equation B3 in Box 1) we find that the welfare of the residents of the labour-importing developed countries changes. If beta is reduced then the productivities/wages of the migrants is lower and the developed economies gain less. The reverse is true if the beta is raised. The impact on the labour-exporting economies from changes in the beta is minimal and the direction of the impact on welfare is mixed. Changes in beta do not alter the remittances sent home. This is because beta is reduced as the remittances as a share of income rises. The opposite occurs as beta rises. Therefore with a lower beta the new migrants just send home a higher share of their income.

In the standard simulation all developed economies increased their labour forces by 3%. In the current temporaries simulation we assumed that those economies which already imported a great deal of migrant labour (e.g. USA) were more likely to increase their quotas than those which had never opened their borders to migrant labour (e.g. Japan). The experiment was set up in such a way that the total increase in new migrants was the same as in the original simulation (i.e. 3% of the developed economies labour force). However, the distribution was not proportional to their populations but rather to the current temporaries. As expected the gains accrued mostly to those with the largest increases in new migrants entering their economies. Hence the USA and other traditional labour importing regions, such as Australia and Canada, gained more than in the original experiment while Japan gained substantially less. As in the original experiment this

labour was supplied by those labour-exporting developing economies who already supplied most of the migrant labour (e.g. Mexico and South America for the USA) so more Mexicans and South Americans moved to the United States. Hence the gains or losses of the residents back in the home increased.

Last, we examine the impact of restricting the movement of workers across sectors, i.e. the new migrant workers are given jobs in the services sectors and permanent resident labour is assumed not to move out of these sectors. In the standard GMig2 model and closure the new migrants increase the total supply of labour. This additional labour is then allocated across sectors so that the percentage change in the wage is equal across sectors. The reason for this closure is that even if migrants are not permitted to work in all sectors of the economy, permanent residents are permitted and are likely to move to other sectors in response to more migrant workers entering a sector. As in Walmsley and Winters (2005) however we also consider the case where 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; the supply is fixed exogenously for each group and labour can flow freely within each group but not between them. All temporary labour flows are added to the supply for the group of sectors which accept temporary labour (A), while the supply of labour to the other group (B) is held at its original level. 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 where there have been influxes of foreign workers, leaving the total labour force unchanged. So, our assumption of the opposite for TMNP should be considered rather carefully.

We then find that the gains are marginally lower than in the case where labour movement across sectors is not restricted. This is not surprising since allowing labour to allocate itself across sectors leads to a more efficient allocation of resources and would lower prices across all commodities, rather than just services. It should be noted that while overall welfare in the simulation with sector restriction is not as high in the unrestricted base case, the developing country labour exporters appear to be gaining more in welfare for the most part. On the other hand, the labour importing developed countries appear to experience lower welfare gains as a result of restricting labour mobility across sectors.

Overall the results of the sensitivity analysis concur with those found in Walmsley and Winters (2005).

Table 8: Comparison of Change in Welfare of Permanent Residents and Existing Migrants by Host Region under alternative assumptions

	3% shock	6% shock	Services Sectors
USA	52,540.47	105,759.67	47,595.91
Canada	5,677.98	11,366.26	5,046.95
Mexico	-3,448.81	-7,561.26	-3,465.02
UK	8,503.44	17,086.65	6,769.16
Germany	15,312.09	30,563.66	13,088.02
Rest of EU	34,117.61	68,280.25	30,192.60
Rest of Europe	4,463.37	8,922.22	3,373.61
Eastern Europe	-1,580.58	-3,321.03	-1,397.69
Former Soviet Union	283.34	568.72	710.62
Australia-New Zealand	2,286.70	4,610.70	2,030.61
China	-213.08	-444.79	512.15
Japan	25,617.85	51,304.38	20,366.14
Rest of East Asia	-8,492.35	-17,307.29	-8,307.86
South East Asia	5,260.55	10,354.29	5,444.54
India	5,054.74	9,911.96	5,083.99
Rest of South Asia	3,416.88	6,664.59	3,379.91
Brazil	2,344.57	4,592.37	3,110.56
Rest of Latin America	949.29	1,387.21	1,025.86
Middle East and Northern Africa	2,486.36	4,705.11	2,660.47
South Africa	2,640.14	5,166.06	2,773.66
Rest of World	208.50	400.71	186.12

Total	157,429.06	313,010.42	140,180.30
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7. Conclusion

It is increasingly recognised that the removal of restrictions on the movement of labour across country borders could contribute significantly to the welfare and development of developing economies. This paper contributes further to the current literature by extending the global applied general equilibrium model (GMig), developed by Walmsley and Winters (2005), to include bilateral labour flows and hence provide further evidence of the potential gains from the relaxation of these restrictions to the world as a whole.

The development of a bilateral labour migration model (GMig2) has allowed for improved analysis of the movement of labour in a number of important ways. In Walmsley and Winters (2005) all migrants were assumed to have the same characteristics. With bilateral data however we can distinguish between the migrant workers by both their host and home countries. Hence a migrant worker in the USA will differ from a migrant worker in Europe due to the fact that their home country is likely to differ. These differences in their home country will be reflected in their productivities, wages, skill levels, and remittance rates which in turn will affect how the movement of labour across international borders will impact the host and home economies. Moreover we can distinguish between permanent residents; and new and existing migrant workers and hence examine the impact of policies on each of these types of workers.

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 resulting increase in welfare of permanent residents in the developed economies is \$US382 per person. Most of those gains (\$US227 per person) arise from the lifting of quotas on unskilled labour. On average the permanent residents of developing countries also gain, \$US4.60 per person, in terms of welfare from sending unskilled labour, but lose \$US1.35 per person from sending skilled workers. While results differ across developing economies, most gain as a result of the higher remittances sent home.

In general the results found here are consistent with those obtained by Walmsley and Winters (2005), there are significant gains to be made from the liberalisation of the movement of labour and most of these gains accrue from the movement of unskilled workers. The improved data and modelling of bilateral flows however has led to a significant increase in the gains expected from liberalisation. This is due to the fact that we assume that migrants obtain a larger proportion of the differences in wages and hence productivities between the home and host region and that we are using the GTAP 6 Data Base, based on a reference year of 2001. Moreover more of the gains from liberalisation accrue to the labour exporting developing economies in this paper due to the fact that remittances are higher in the underlying data base (Ratha, 2003).

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