

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

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Abstract

The economics literature increasingly recognizes the importance of migration. In this paper a bilateral global migration model is developed and used to investigate the impact of lifting restrictions on the movement of labor. Quotas on skilled and unskilled labor in the developed economies are increased by 3% of their labor forces, with the additional labor supplied by the developing economies. The results confirm that these restrictions impose significant costs on nearly all countries. All of the developed (labor importing) economies gain in terms of real incomes. While results differ across the developing (labor exporting) economies, most gain as a result of the higher remittances sent home.

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1. Introduction

The Uruguay round heralded a new wave of optimism for developing country members as the first international discussions on the ‘*temporary mobility of natural persons* (Mode 4)’ took place and the the General Agreement on Trade in Services (GATS) was created as a permanent forum for managing services trade liberalization. Developing countries hoped at last to capitalise on their abundant labor. But despite a backdrop of many years of capital and goods market liberalization, policy makers on both sides of the GATS Mode 4 negotiations remained cautious and defensive, resulting in little progress being made (Winters, 2005a). This contrasts strongly with the evidence that the welfare benefits from liberalizing the movement of labor across boundaries would be huge.

First, Winters (2001) argued that if individuals moving from a developing to a developed country made up just a quarter of the wage gap between the two nations, mobility equivalent to a 5% increase in industrialised countries populations would yield a global welfare gain of approximately \$300bn at 1997 prices. A similar back-of-the-envelope calculation estimated that liberalization equivalent to a 3% rise in ‘rich’ countries’ labor 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 corroborated these computations.

Walmsley and Winters (2005) estimated that liberalization of the quotas on the flows of both skilled and unskilled labor from developing to developed nations equivalent to 3% of the latter’s labor 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) suggested that a similar lifting of quotas would produce approximately double these gains (World Bank, 2006). World Bank (2006) used the GMig2 Database with a modified version of the World Bank’s LINKAGE recursive-dynamic general equilibrium model. The paper found a global welfare gain of US\$674

billion from a 3% increase in the labor force of high-income countries, with the developing world supplying the additional workers. World Bank (2006) also found that natives and new migrants in high-income countries, and the natives of the developing countries, all experienced welfare gains; while the old migrants in the developed countries experienced welfare losses. This can be partially explained by a key assumption from that model – native workers and migrant workers do not compete directly with each other, they are related instead by an elasticity of substitution. It should be noted that the results of these various models may not be directly comparable due to differences in the underlying base year or time periods examined; World Bank (2006) for instance uses a dynamic model to investigate the impact of migration.

Although all of these estimations should be viewed with a large 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 or the estimated gains to goods trade liberalization. Moreover, these benefits represent only static gains. They fail to account for any dynamic effects, such as those associated with simulated investment, technology transfer or ‘brain circulation’, whereby service providers return home with greater levels of experience and ‘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 also implies challenges – of integration, of family separation and of labor market shocks in host countries – which policy analysis must take into account.

In this paper we develop a bilateral global migration model, based on the GTAP model (Hertel, 1997) and similar to the model developed by Walmsley and Winters (2005), which takes into account bilateral labor flows rather than the latter’s global migrant pool. It is a companion paper to Parson et al. (2007) in which the new bilateral data that make the approach possible are described and summarized. The new model and data are used to repeat Walmsley and Winters (2005) exercise on the impact of liberalizing the temporary movement of natural persons: Quotas on both skilled and unskilled temporary labor in the developed economies are increased by 3% of their labor forces, with the

additional labor being supplied by the developing economies in proportion to their shares of the stocks of migrants in about 2000. Section 2 of the paper outlines the model and data, while section 3 discusses the experiments undertaken. Section 4 presents some results and conclusions are drawn in section 5. The exposition focuses on changes from our previous work, in order that readers can judge the extent to which having bilateral data changes our perceptions. The new data also allow us to answer some new questions – e.g. on the effects of regional labor agreements – but these are left to another occasion.

2. The GMig2 Model and Data Base

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

We use a standard global applied general equilibrium model (GTAP, Hertel, 1997) which has been adjusted to take into account bilateral labor 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 labor to intermediate the flow of labor 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 (2007), 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.

2.1. The GMig2 Data Base

The data base used with the Bilateral Labor Migration Model (GMig2) is based on the GTAP 6 Data Base (Dimaranan and McDougall, 2005)³ and is augmented with the bilateral migration data base developed by Parsons et al (2007) and remittance data from the World Bank (Ratha, 2003). Like the GTAP Data Base, the GMig2 Data Base also covers 87 regions and 57 sectors and can be extended as the number of regions in the GTAP data base increases⁴. The GMig2 data base construction process is documented

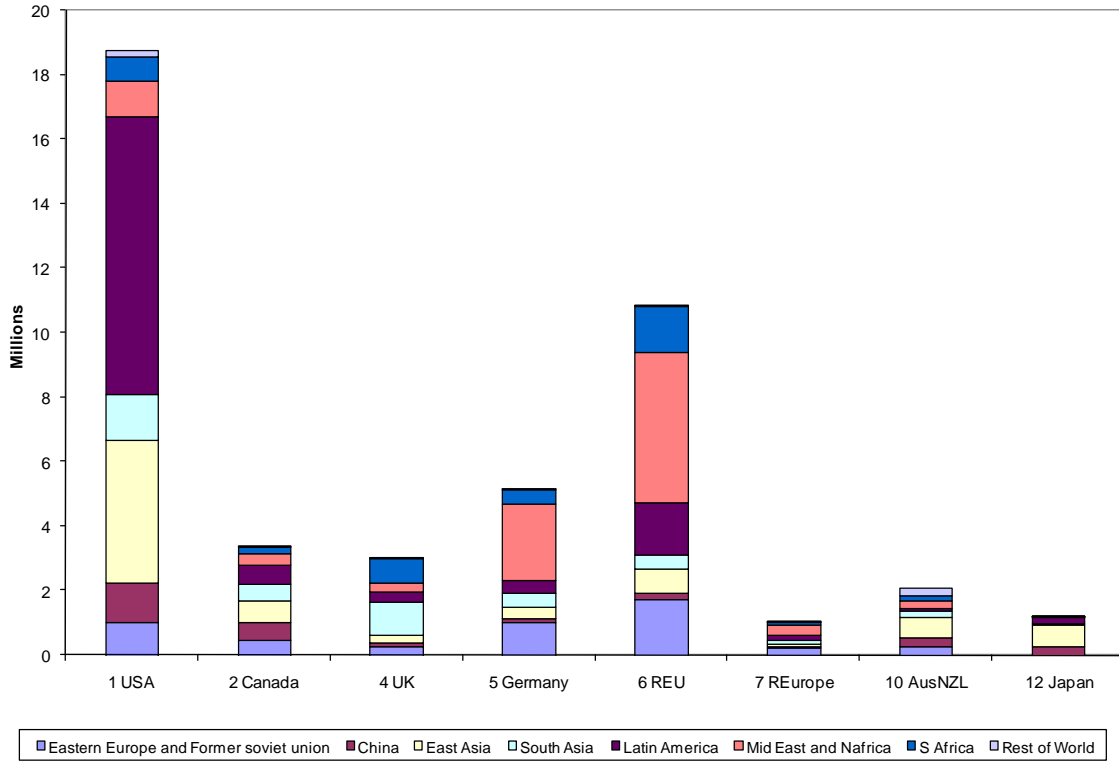
³ Note that the Walmsley and Winters (2005) paper is based on version 5 data with reference year 1997. The version 6 data base is based on 2001.

⁴ The new headers in the GMig2 data base and sets files are listed in Appendix 1, available at: https://www.gtap.agecon.purdue.edu/resources/tech_papers.asp, GTAP technical paper 28.

Walmsley, Ahmed and Parsons (2005); and readers interested in learning more about the underlying data are referred to this document.

The GMig2 Data base is then aggregated into 21 regions and 22 commodities for the purpose of this paper. The resulting aggregated data are depicted below: bilateral labor (Figure 1), remittances (Figure 2) and wages (Figures 3)⁵.

Figure 1: Number of Foreigners by Host Region (for selected home regions)



Source: Parsons, Skeldon, Walmsley and Winters (2007).

Figure 1 show the current (approximately 2000-2002) stocks of foreign population by slected home regions in the eight host countries investigated in this paper. The USA has by far the highest number of foreigners, 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

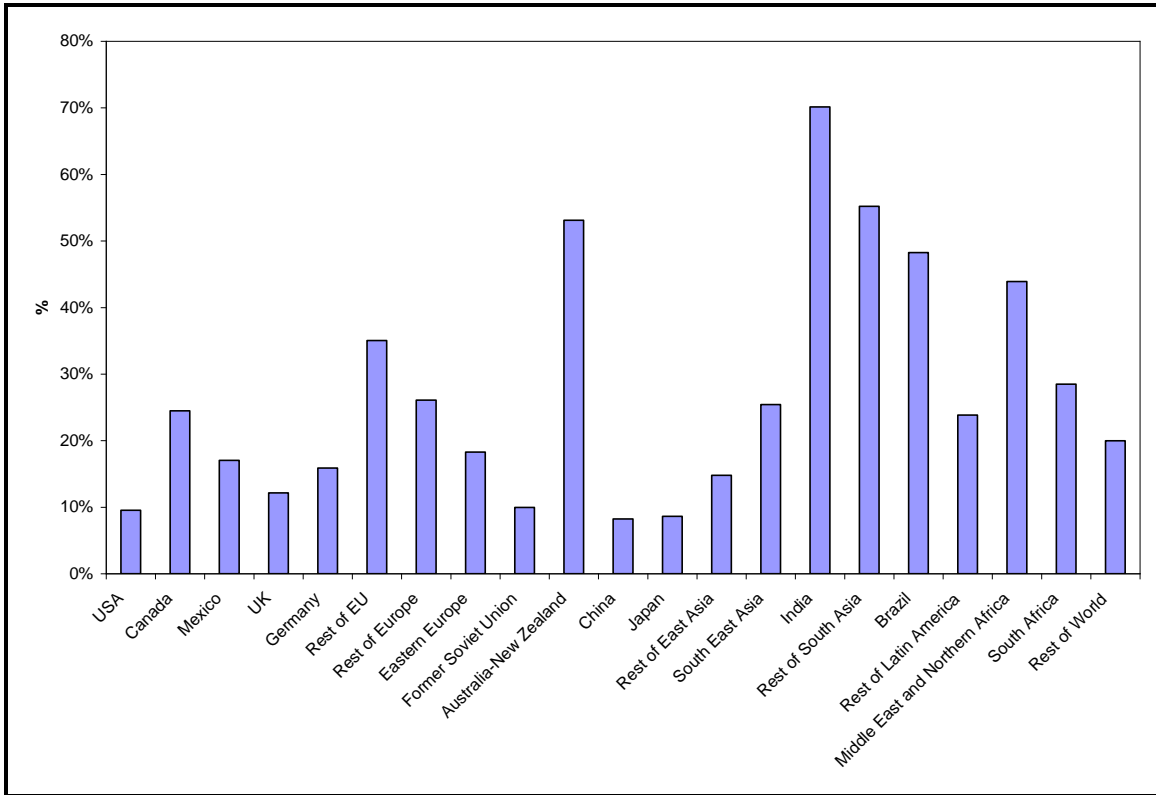
⁵ Note that the wages data are based on GTAP data and estiates of labour force participation, and skill splits. In some cases estimates may not result in accurate estimates of wages.

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. In the GMig2 data base, South Asians have particularly high remittance rates⁶ as a share of income and if this behaviour extends to new migrants, permanent residents in South Asia are likely to gain remittances considerably as a result of allowing more migration. Chinese migrants on the other hand send only a small share of their income home. The difference between India and China is surprising given that both export substantial numbers of skilled workers to developed economies, such as the USA. Kapur and McHale (2005) suggest that it is primarily due to differences in incentives, and in particular tax incentives. They argue that Chinese migrant labor tend to send money home in the form of foreign direct investment, and in particular for the purchase of real estate, rather than as remittances.

⁶ This is the result of high remittances in obtained from Ratha (2003) relative the the low estimated wages of migrant workers (as estimated in Walmsley, Ahmed and Parsons (2005)).

Figure 2: Ratio of Remittances (to Labor Income) sent home by Migrants from each Region in the initial Data Base (%)⁷

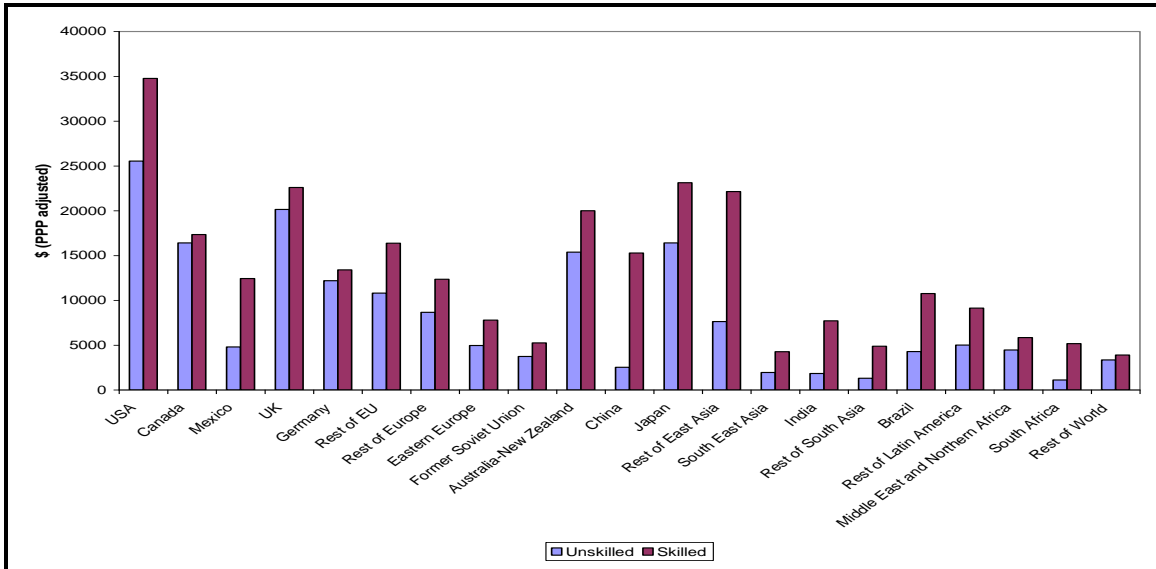


Source: GMig2 Data Base: Walmsley, Ahmed and Parsons (2005)

Figure 3 depicts the average 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 indexes 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.

⁷ This is the sum of remittances from all host regions flowing into the home region, divided by the total income of those migrants earned in their host regions.

Figure 3: Average Real (PPP) Wages of Permanent Residents by Region in the base data



Source: GMig2 Data Base: Walmsley, Ahmed and Parsons (2005)

A number of assumptions were made in creating the GMig2 Data Base which are important to note before discussing the details of the model. These assumptions are outlined in Box 1.

Box1: Assumptions made in the construction of the GMig2 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.

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

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. Nominal 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 ($W_{i,r,r}$):

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

where: BETA is the proportion of the difference obtained by a person of labor type i migrating from region r to region c. BETA is equal to 0.75 where wages rise between the home and the host, and 0.3 where wages fall.

Note that the nominal wages of migrants and permanent residents are solved simultaneously while ensuring that total wage payments within the 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, as in the GTAP Model (Hertel, 1997), but are included only 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.

2.2. The GMig2 Model

As in the GMig2 Data Base, the model tracks both the “home” and “host” region of each person and worker. The *home* region is defined as the permanent residence of the

person/worker; in the data base this is their place of birth. The *host* region is the region in which the person resides/works. This section is divided up into a number of sub-sections to explain the model: labor and population flows; wages; income and remittances; sector specific migration; and return migrants.

2.2.1. Labor and Population flows

The labor force of skill i , located in region r ($LF_{i,r}$), and available to firms for production, is therefore the sum across *home* regions (c) of all workers located in the *host* region r (equation (1)); similarly for population, Equation (2).

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

$$POP_r = \sum_c POP_{c,r} \quad (2)$$

An increase in the number of migrant workers from region c to region r would reduce the number of workers in the developing labor supplying regions ($LF_{i,c,c}$ would fall) and increases the labor force of the developed labor importing region ($LF_{i,c,r}$ would rise). The populations would change in similar ways. While in the underlying GMig2 Data Base it was assumed that migrant workers moved with their families, in the model the user can specify through a change in parameters whether or not the migrant's families migrate⁸.

Changes in the number of migrants occur through exogenous shocks to the labor supply. Shocks can be made to: a) the number of migrants from region c who move to region r directly ($LF_{i,c,r}$) to simulate a bilateral movement of labor⁹; b) the total labor supply in the host region ($LF_{i,r}$) to simulate an increase in the quotas of the host region¹⁰; or c) the total supply of labor in the home region to simulate an exodus of migrants or the return of migrants¹¹. In the second case the change in quota is assumed to be filled by migrants from countries in the same proportions as the current stock of migrants in the current data base; similarly migrant workers are assumed to move to host regions in the same shares

⁸ TEMP in the basedata = 1 if families do not migrate; and 0 if families do.

⁹ See Appendix 2, Standard Closure, available at:

https://www.gtap.agecon.purdue.edu/resources/tech_papers.asp, GTAP technical paper 28.

¹⁰ See Appendix 2, Increase in quotas of Labor Importing Region, available at:

https://www.gtap.agecon.purdue.edu/resources/tech_papers.asp, GTAP technical paper 28.

¹¹ See Appendix 2, Increase in exodus from Labor Exporting Region available at:

https://www.gtap.agecon.purdue.edu/resources/tech_papers.asp, GTAP technical paper 28.

as the current migrants. It is assumed that there is excess demand for quotas and hence quotas are completely filled.

2.2.2. *Wages*

In the GMig2 Data Base, 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, reflecting the fact that their productivities have also changed¹². This data provides the *initial* wages of the migrant workers.

$$W_{i,r,c} = W_{i,r,r} + \text{BETA} \times (W_{i,c,c} - W_{i,r,r}) \quad (3)$$

Any changes in the labor force are allocated across sectors so as to equalize the percentage change in the wage earned by all workers (domestic and foreign). Foreign and domestic labor are assumed to be perfect substitutes (although their wages and marginal products are not equal)¹³.

The model is consistent with standard trade theory – countries benefiting from inward migration experience a decline in the marginal product/wage of labor as they move down their marginal product curves, and production increases as firms gain greater access to cheaper labor. Returns to capital increase as capital becomes scarce relative to labor. The reverse is true for those countries experiencing outward migration.

2.2.3. *Income and Remittances*

Given the emphasis of the model on migration and the impact on migrants of various trade and migration-related policies, it is important to show the changes in the incomes of the various agents in the model: permanent residents, existing migrants, new migrants and return migrants.

¹² There are a number of alternative ways of determining wages. All migrants could receive a proportion of the host country wage (perhaps depending on the development of their home country). This method allows us to take into account both the home and host country wages in determining the migrants' wages. It could also be argued that BETA should depend on the home and host region. For instance, migrants from developed countries who are expatriated to developing economies might get further benefits which increase their nominal wage above the nominal wage they would have received at home. Since data on the value of BETA is scarce and we concentrate on migration from the south to the north we have chosen not to take this possibility into account.

¹³ Note that it is also possible to alter (via a shock) the relative productivities of workers.

Permanent Residents

$$\Delta Y_{r,r} = \sum_{f \in NLAB} \Delta FY_{f,r,r} + \sum_{l \in LAB} \Delta FY_{l,r,r} - \Delta D_r + \Delta T_r + \sum_{c \in REG} \Delta RM_{r,c} \quad (4)$$

The income of permanent residents (equation (4)) depends on the change in income from non-labor and labor endowments (FY), plus remittances (RM) received from migrant workers abroad. Since permanent residents receive all the income on capital, depreciation (D) is also taken out and permanent residents are assumed to receive the tax revenue (T). To obtain the change in real income the change in income is then reduced by the effect of any changes in prices. This method determines the real change in income at market exchange rates and is comparable to real income as calculated in the standard GTAP model or in Timmer and van der Mensbrugge (2006)¹⁴.

Existing Migrants

$$\Delta Y^E_{r,c} = \sum_{l \in LAB} \Delta FY^E_{l,r,c} - \Delta RM_{r,c} \quad (5)$$

The income of existing migrants (equation (5)) depends on the income from their endowment of labor (FY^E_l), less remittances (RM^E) sent home. To obtain real income the change in income is then adjusted for changes in prices to obtain the change in real income at market exchange rate.

New Migrants

$$\Delta RY^N_{r,c} = \frac{PPP(c)}{PPP(r)} \times \left[\sum_{l \in LAB} FY^N_{l,r,c} - RM^N_{r,c} \right] - \left[\sum_{l \in LAB} IFY^N_{l,r,r} \right] \quad (6)$$

The change in real income of new migrants (equation (6)) equals the final income obtained in their new country of residence from their endowment of labor (FY^N_l) (less remittances (RM^N) sent home), less the labor income they received before they migrated (IFY^N , where I in IFY stands for initial)¹⁵. Following Timmer and van der Mensbrugge (2006) the final income is discounted by PPP in their new residence relative to the PPP

¹⁴ In Appendix 3 a second method is outlined which determines the real change in income at PPP and compares the market exchange rate (MER) and purchasing power parity (PPP) methods. Appendix 3 is available at: https://www.gtap.agecon.purdue.edu/resources/tech_papers.asp, GTAP technical paper 28.

¹⁵ Note that we do not consider changes in income from other endowments – it is assumed that any gains or losses on other endowments affect the incomes of permanent residents only.

in their home country so that the final income is converted back to equivalent income in the home country and hence the change in real income at the home¹⁶ country's market exchange rate is obtained. The reason for this adjustment is that prices faced by the new migrants change as a result of moving between countries which have different underlying price levels.

Return Migrants

$$\Delta RY_{r,c}^R = \left[\sum_{l \in LAB} FY_{l,r,r}^R \right] - \frac{PPP(c)}{PPP(r)} \times \left[\sum_{l \in LAB} IFY_{l,r,c}^R - IRM_{r,c}^R \right] \quad (7)$$

The change in real income of return migrants (equation (7)) equals the final income obtained in their home country from their endowment of labor (FY_l^R), less the initial labor income they received from their host country, prior to returning home (IFY^R) less remittances (IRM^R , again I in IRM stands for initial). In this case the initial income is discounted by PPP in their host country and any change in prices in the home country are applied to obtain the change in real income at the home¹⁷ country's market exchange rate.

In the GMig2 Data Base and in the GMig2 model, remittances flowing out of the host country back to the home country are assumed to be a constant proportion of income. Hence as the number of new migrants or their wages increase, remittances increase. Remittances then flow back to the permanent residents of the home country of the migrant. Remittances therefore reduce the income of the migrants and increase the incomes of permanent residents back home. For the purposes of determining income spent in the host economy this is ideal¹⁸; however, as a measure of the gain made by the new migrants there are a few deficiencies: a) new migrants may have supported the same family members before moving as they are sending remittances to after migrating; b) although they do not spend the money, new migrants gain utility from sending money

¹⁶ Alternatively initial income could be converted to the host country, however we choose not to do this so that the change in real income of new migrants can be compared to those permanent residents they left behind. This is not an issue when discounting by PPP.

¹⁷ Alternatively initial income could be converted to the host country, however we choose not to do this so that the change in real income of new migrants can be compared to those permanent residents they left behind. This is not an issue when discounting by PPP.

¹⁸ In each country, incomes earned by both domestic and foreign-born residents are collected by the regional household and allocated across consumption, government and saving in the host region; that is, migrants adopt their host countries' consumption patterns.

home; and c) remittances sent home may be invested on the new migrants behalf. For these reasons we also calculate gross income of new migrants in which remittances are not taken out.

Remittance flows also affect a county's balance of payments. In GTAP (8) and GMig2 (9) respectively:

$$Y = C + I + G + X - M = C + S + G \quad (8)$$

$$Y = C + I + G + X - M + NREM = C + S + G \quad (9)$$

The current account balance in GMig2 is therefore given by:

$$CAB = X - M + NREM \quad (10)$$

2.2.4. Sector Specific Migration

In the standard GTAP model, labor moves across sectors to equalise the percentage change in the wage; thus labor moves to the sectors with the highest demand for labor. This is also the standard closure for GMig2. 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 the labor movement is restricted to specific sectors.

This is achieved in the model by dividing the sectors into two groups¹⁹: one group of sectors which does not employ the migrant workers (A); and a second group of sectors which does (B). The supply of labor to each group must equal its demand, and labor can flow freely within each group but not between them. All migrant workers are supplied to the group of sectors which accept temporary labor (B), while the supply of labor to the other group (A) is held fixed. This approach also has implications for permanent labor, since the inflow of migrant workers is assumed not to be off-set by outflow of permanent labor. 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 labor force unchanged, so this assumption of the opposite for TMNP should be considered rather carefully.

¹⁹ This is done via the header PRDG and PMAP in the sets file, see Appendix 1, available at: https://www.gtap.agecon.purdue.edu/resources/tech_papers.asp, GTAP technical paper 28.

3. Experiments

In this paper changes in migration are modelled by ‘shocking’ the allocation of workers across countries in the model. 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%.

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 focuses 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, the size of the shock and sensitivity analysis on the parameters are examined.

Quotas on the temporary movement of natural persons are assumed to increase in a number of traditionally developed labor-importing regions, and to be filled by labor from a number of traditionally developing labor-exporting countries according to the current shares of migrants in the host countries labor force²⁰. The regions used in this analysis into developed labor-importing²¹ and developing labor-exporting regions²².

It is assumed that the host regions increase their labor 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 America²³. The

²⁰ 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 labor forces emigration stocks. Thus lots of Mexicans went to Europe and Moroccans to the USA.

²¹ USA, Canada, UK, Germany, Rest of EU, Rest of Europe, Australia-New Zealand and Japan.

²² Mexico, Eastern Europe, Former Soviet Union, China, Rest of East Asia, South East Asia, India, Rest of South Asia, Brazil, Rest of Latin America, Middle East and Northern Africa, Southern Africa, and Rest of World.

²³ 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 countries 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. The skill splits in the underlying data were obtained from Docquier and Markouk (2005).

increase in the labor force of the developed labor importing region by 3% is the same as the shock applied in Walmsley and Winters (2005) except that the underlying data has improved significantly. These improvements in the underlying data base have led to the following improvements in the shocks themselves:

- a) Improved estimates of skill shares have resulted in less skilled migrants overall (4.3m as opposed to 8m).
- b) Improved estimates of bilateral relations – e.g., more workers flow from Mexico and Latin America to the USA and from Eastern Europe to Europe.
- c) Improved estimates of skill shares for migrants – e.g., Mexico supplies mostly unskilled workers, while East Asia supplies more skilled.

4. The Results

The increase in the quotas of the developed labor-importing economies, equivalent to 3% of their labor 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 labor on real GDP, the terms of trade, imports, exports, factor returns etc by region is investigated. Next the sectoral implications of the movement of labor in both the labor-importing and labor-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. Finally, we undertake some sensitivity analysis with respect to our choice of beta and the size of the shock, amongst others.

4.1. Macroeconomic Effects

Table 1 depicts some of the macro results from the increased quotas, separated into the impact of raising quotas on unskilled and skilled migrant labor respectively. The labor-importing developed economies experience increases in real GDP as a result of the increased supply of labor which can be used in production. Given the fact that the number of new unskilled migrants is more than double that of new skilled migrants while their wage is more than half, it is not surprising that the Real GDP of the labor importing economies increases more as a result of unskilled labor migration. The gains from

unskilled migration, however, are not double those of skilled, suggesting that, per migrant worker, skilled migration is more beneficial to the developed labor importing economies.

As expected the wages of unskilled and skilled workers fall with the increase in supply due to the raising of quotas. When the quotas on skilled and unskilled are considered separately, a rise in unskilled migration lowers the return to unskilled workers and raises the return to skilled workers; likewise a rise in skilled migration lowers the return to skilled workers and raises the return to unskilled workers. In some cases the wages of skilled and unskilled move in the same direction from the skilled/unskilled migration, this is due to the impact of remittances and changes in the terms of trade. The addition of these effects gives the change in wages when both skilled and unskilled migration takes place; as expected the wages of skilled and unskilled both fall by approximately 1.5%.

The increased supply of labor also causes an increase in output and results in losses in the terms of trade and real exchange rate²⁴. With the exception of Japan, this depreciation in the real exchange rate causes exports to increase. In the case of Japan the increase in supply of labor is minimal and hence the deterioration in the terms of trade is minimal, when compared to its trading partners; exports fall. Imports also rise in the developed labor importing countries due to the increase in income and numbers of consumers.

The trade balance of the labor-importing developed economies tends to rise as the decrease in prices and the 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 labor supply and demand for goods increase the demand for capital. The increased return to capital causes investment to increase, and in the long-term this would result in even higher capital stocks and production (not modelled here).

In the labor-exporting developing economies the reverse is true. As the supply of labor falls, real wages rise and real GDP falls. Again, even though the losses are greatest from the loss of unskilled workers, when we consider the fact that more unskilled workers

²⁴ 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.

migrate than skilled, it is the loss of skilled workers which has the greatest impact per migrant. This can be seen in the figures for Real GDP and in the changes in real wages of skilled and unskilled; the real wages of skilled rise significantly more than those of unskilled workers, despite the fact that more unskilled workers migrate under this scenario. The rise in real wages also results in an increase in the real exchange rate and a fall in the trade balance. This is offset by the remittances which cause the current account balance to rise.

Table 1: Macroeconomic Results (Difference from base) due to the unskilled and skilled movement of labor

	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 ²⁵ (%)		Real wages of skilled (%)		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	0.85	0.61	-0.28	-0.24	7090	7238	-4167	-2556	1.43	1.18	0.23	0.08	0.54	0.30	-1.30	0.40	0.52	-1.48	0.66	0.48
Canada	0.94	0.49	0.02	0.05	256	364	-604	-42	1.13	0.58	1.16	0.55	1.11	0.32	-1.24	0.27	0.60	-1.71	0.72	0.32
Mexico	-0.76	-0.28	0.49	0.16	-1467	95	2552	861	-1.81	-0.19	-0.51	-0.10	-1.88	-0.67	2.35	-0.16	0.03	2.29	-0.47	-0.19
UK	0.86	0.62	-0.12	-0.11	1452	839	-1226	-868	1.36	0.85	0.72	0.43	0.68	0.45	-1.17	0.38	0.56	-1.49	0.63	0.43
Germany	0.80	0.52	-0.07	-0.07	-953	292	-2191	-786	0.79	0.57	0.95	0.51	1.06	0.45	-1.34	0.31	0.49	-1.54	0.59	0.32
Rest of EU	0.72	0.50	-0.08	-0.05	3464	2639	-684	-28	1.04	0.62	0.75	0.41	0.41	0.18	-1.34	0.28	0.42	-1.58	0.48	0.31
Rest of Europe	1.10	0.62	0.03	0.01	-349	-165	-995	-532	0.82	0.47	1.19	0.65	1.83	0.99	-1.61	0.34	0.64	-1.47	0.82	0.44
E. Europe	-0.61	-0.51	0.19	0.15	118	-109	1619	920	-0.67	-0.53	-0.48	-0.30	-1.57	-0.88	0.99	-0.27	-0.26	2.87	-0.36	-0.27
F Soviet Union	-0.09	-0.11	0.08	0.08	904	299	1216	697	0.33	0.06	-0.20	-0.06	-1.30	-0.68	-0.06	-0.14	-0.18	0.69	-0.19	-0.10
Australia-New Zealand	0.81	0.59	0.02	0.01	228	214	-259	-154	0.92	0.60	0.72	0.40	0.73	0.40	-1.36	0.31	0.43	-1.72	0.61	0.42
China	-0.04	-0.14	-0.01	0.02	1705	790	2593	1465	0.27	-0.01	-0.10	-0.18	-0.53	-0.37	0.00	-0.09	-0.08	0.84	-0.09	-0.11
Japan	0.89	0.55	-0.05	-0.03	-5341	-4343	-10012	-7232	-0.14	-0.29	1.08	0.69	1.38	0.98	-1.21	0.28	0.46	-1.41	0.65	0.39
Rest of East Asia	-0.64	-1.08	0.07	0.12	564	378	2043	1675	-0.45	-0.74	-0.63	-0.85	-1.54	-1.55	1.00	-0.64	-0.33	4.14	-0.45	-0.84
S. East Asia	-0.09	-0.14	0.12	0.11	-643	-1350	1867	1514	-0.44	-0.63	-0.21	-0.25	-0.75	-0.44	0.19	-0.07	0.04	1.16	-0.08	-0.10
India	-0.02	-0.06	0.21	0.50	-746	-1820	1142	1066	-1.15	-2.72	0.24	0.64	-0.61	-0.29	-0.03	-0.02	0.05	0.75	-0.13	-0.11
Rest of South Asia	-0.02	-0.11	0.72	0.52	-1306	-895	525	336	-3.98	-2.82	1.03	0.64	-0.43	-0.26	0.16	-0.02	0.38	1.24	-0.05	-0.09
Brazil	-0.13	-0.17	0.25	0.24	-568	-571	1348	806	-0.95	-0.86	0.10	0.18	-1.08	-0.62	0.31	-0.01	0.17	0.86	-0.21	-0.18
Rest of Latin America	-0.48	-0.45	0.50	0.34	-2402	-1508	2188	1289	-1.78	-1.13	0.03	0.03	-1.15	-0.66	0.98	-0.21	-0.02	2.75	-0.35	-0.30
Middle East and N. Africa	-0.39	-0.17	0.39	0.24	-1182	-1348	2395	1107	-0.80	-0.52	-0.05	0.13	-0.96	-0.31	0.82	-0.05	-0.09	1.16	-0.25	-0.06
Southern Africa	-0.06	-0.24	0.31	0.28	-658	-931	680	494	-0.67	-0.91	0.24	0.22	-0.81	-0.55	0.16	-0.06	0.14	1.74	-0.07	-0.13
Rest of World	-0.46	-0.18	0.84	0.48	-166	-108	-31	-30	-2.94	-1.60	0.43	0.42	0.07	0.27	1.68	0.15	0.47	1.68	0.17	0.17

²⁵ Non-Migrants include permanent residents of the region and exiting migrants who have not moved countries as a result of the simulation.

When compared to the result in Walmsley and Winters (2005) the gains in real GDP are larger for the developed labor importing economies due to the fact that the data is more recent (2001 as opposed to 1997) and the productivities of the new migrants are higher. The real wages of skilled workers tend to fall less given the fact that overall there is less skilled migration, while the wages of unskilled workers fall further. The differences between the results for the labor exporting economies are more mixed, reflecting several differences between the data and the two models:

- A more recent base year tends to cause larger reductions in the Real GDP and real wages of the developing labor exporting countries;
- higher remittances (Ratha, 2003) tend to raise real GDP and real wages;
- and improved bilateral relations can increase or decrease the changes in real GDP and real wages depending on the direction of the change. For instance more migrants are supplied by Mexico, Latin America and Eastern Europe and hence real GDP and real wages are more adversely affected.

4.2. Sectoral Effects

Table 2 shows the output gains, per new immigrant, to the labor importing economies across all sectors from the new unskilled and skilled migrants. The gains in output are greatest to the manufacturing and services sectors. The relative size of the sectoral output gains from increased unskilled and skilled workers depends on the relative use of skilled and unskilled labor by the sector. Hence there is a tendency for agricultural and light manufacturing sectors to gain more from unskilled migrants than skilled and for services and other manufacturing to gain more from skilled labor per new migrant worker in the labor-importing developed economies.

Table 2: Sectoral Results of Developed Labor-Importers: Changes in output²⁶ as a result of increase in unskilled and skilled quotas respectively (divided by total new skilled/unskilled immigrants respectively) (\$US millions)

	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	351	281	412	423	261	190	369	271	776	640	190	111	809	601	515	429
Livestock	145	134	127	95	92	70	44	36	110	105	48	44	429	345	32	34
Meat	857	797	555	434	800	731	515	478	811	829	479	463	815	759	235	259
Dairy	433	448	397	369	541	490	446	378	553	573	401	367	794	656	226	250
Food	2098	2215	1290	1180	2066	1911	1492	1513	1536	1709	1178	1189	1326	1386	2507	2816
Other Primary	272	291	615	744	92	95	84	64	149	144	159	170	509	525	169	163
Wood and paper	2098	2460	2167	1779	1656	1680	1315	1296	1228	1571	1163	1530	1007	1270	1246	1822
Textiles and wearing apparel	1885	1567	1237	874	1362	979	1154	1061	1602	1675	565	446	645	728	992	833
Chemicals and Minerals	3498	4291	1814	1765	3249	3060	3406	4044	2837	3651	1642	1951	1349	1694	2543	3326
Metals	2421	2780	1738	1286	2191	1864	2185	2231	1608	1912	1710	1887	970	1305	1664	2480
Autos	1693	1842	2179	2295	1019	836	2062	2025	1031	1191	813	895	432	475	1180	1863
Electronics	1758	3139	1106	1577	1282	1342	1933	2421	858	1243	514	642	220	306	1782	1897
Other manufactures	4291	6570	2643	2929	4519	3822	4084	4732	2024	2369	2350	2962	1143	1277	1417	1413
Household Utilities	1746	2155	1303	1422	1147	1384	666	819	846	1308	1933	1873	1111	1413	1934	3050
Construction	2954	3254	2807	1936	2630	2697	2765	2167	1245	1450	3120	3341	1459	1561	5861	9563
Trade	7729	7776	3387	3061	5856	5192	3609	3371	2654	3357	3757	4320	4094	4730	6328	9431
Transport	2502	2581	3405	3060	2696	2571	1473	1499	1561	2013	1713	2280	1896	2317	2662	3818
Communications	987	1529	697	860	856	1061	504	614	450	771	637	630	690	947	746	1064
Financial Services	2511	4490	675	719	1927	2275	271	444	975	1584	1347	1157	696	1013	1217	1727
Insurance	1051	2210	426	556	962	1252	425	545	252	468	530	499	453	677	487	726
Business services	4999	7616	2486	2788	5199	6570	754	833	2132	3715	2224	2135	3018	4176	4032	5857
Other service	8504	14916	3878	8421	4104	7862	9433	12425	4316	10020	5981	7173	3303	8134	7739	11192

²⁶ 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 3: Sectoral Results of Developing Labor-Exporters: Changes in output²⁷ as a result of increase in unskilled and skilled quotas respectively (divided by total new skilled/unskilled immigrants respectively) (\$US millions)

	Mexico		Eastern Europe		China		Rest of East Asia		India		Rest of South Asia		Rest of Latin America		Southern Africa	
	Unskill	Skill	Unskill	Skill	Unskill	Skill	Unskill	Skill	Unskill	Skill	Unskill	Skill	Unskill	Skill	Unskill	Skill
Crops	-145	204	-231	-81	283	280	-130	-43	292	33	-91	-88	-173	5	91	108
Livestock	-14	13	-24	-7	28	47	-26	-35	26	22	43	46	-59	-55	84	84
Meat	-267	-318	-250	-155	-3	-64	-227	-335	95	118	123	156	-153	-130	59	59
Dairy	-60	-62	-136	-103	1	4	-63	-97	556	843	189	229	-85	-75	-15	-24
Food	-418	-522	-484	-455	96	-94	-470	-795	304	214	300	351	-347	-380	178	124
Other Primary	-6	255	-38	-10	265	84	-16	-7	66	-181	92	68	-65	-83	146	-18
Wood and paper	-341	-590	-547	-555	-79	-367	-381	-897	-142	-200	-71	-112	-361	-456	-163	-271
Textiles and wearing apparel	-547	82	-574	-148	1,418	2,072	-560	-148	-858	-2,120	-3,388	-4,376	-647	-616	-114	-200
Chemicals and Minerals	-718	-1,349	-1,084	-1,399	-367	-1,735	-1,411	-3,107	-866	-1,580	-397	-602	-955	-1,296	-287	-519
Metals	-836	-1,251	-1,162	-1,102	-951	-1,643	-1,413	-2,212	-1,800	-2,407	-406	-545	-989	-1,024	-755	-984
Autos	-597	-1,011	-370	-440	-210	-382	-734	-1,341	-281	-237	-51	-70	-215	-271	-132	-200
Electronics	-759	-898	-417	-770	-29	-1,342	-910	-3,497	-300	-406	-63	-95	-193	-284	-74	-122
Other manufactures	-1,351	-2,832	-1,700	-2,263	-1,904	-4,381	-2,530	-5,179	-2,558	-3,518	-662	-939	-855	-1,118	-811	-1,218
Household Utilities	-48	-112	-243	-395	-18	-298	-456	-1,740	422	568	439	475	-147	-203	-33	-175
Construction	-860	-2,121	-1,081	-1,242	-2,256	-2,782	-1,624	-2,927	-1,313	-529	-212	-268	-660	-769	-310	-330
Trade	-434	-1,510	-467	-583	-29	-873	-1,148	-3,233	79	147	111	-8	-272	-454	37	-124
Transport	-349	-786	-465	-495	87	-431	-402	-968	6	-24	252	166	-504	-651	-71	-220
Communications	-32	-229	-94	-234	-32	-182	-224	-746	2	0	-8	-47	-62	-202	11	-42
Financial Services	-31	-270	-108	-232	-3	-264	-408	-1,450	-39	-87	-6	-45	-102	-260	26	-84
Insurance	-65	-417	-46	-100	5	-68	-138	-496	-62	-112	-46	-99	-46	-159	-9	-80
Business services	-93	-471	-348	-984	182	-286	-667	-2,348	-1	-559	-3	-86	-230	-539	-53	-297
Other service	167	-2,857	-315	-2,161	90	-1,382	-1,163	-7,522	1,106	1,047	756	482	21	-2,146	425	-272

²⁷ 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).

The sectoral results for the developing labor-exporting economies are depicted in Table 3. Again the losses are greatest in the manufacturing and services sectors, and the loss of unskilled labor has a greater impact on those sectors which use unskilled labor most intensively and likewise for skilled. While output does decline in most sectors, China and India in particular experience some considerable gains across all sectoral output. While it may seem counter intuitive that loss of labor 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.

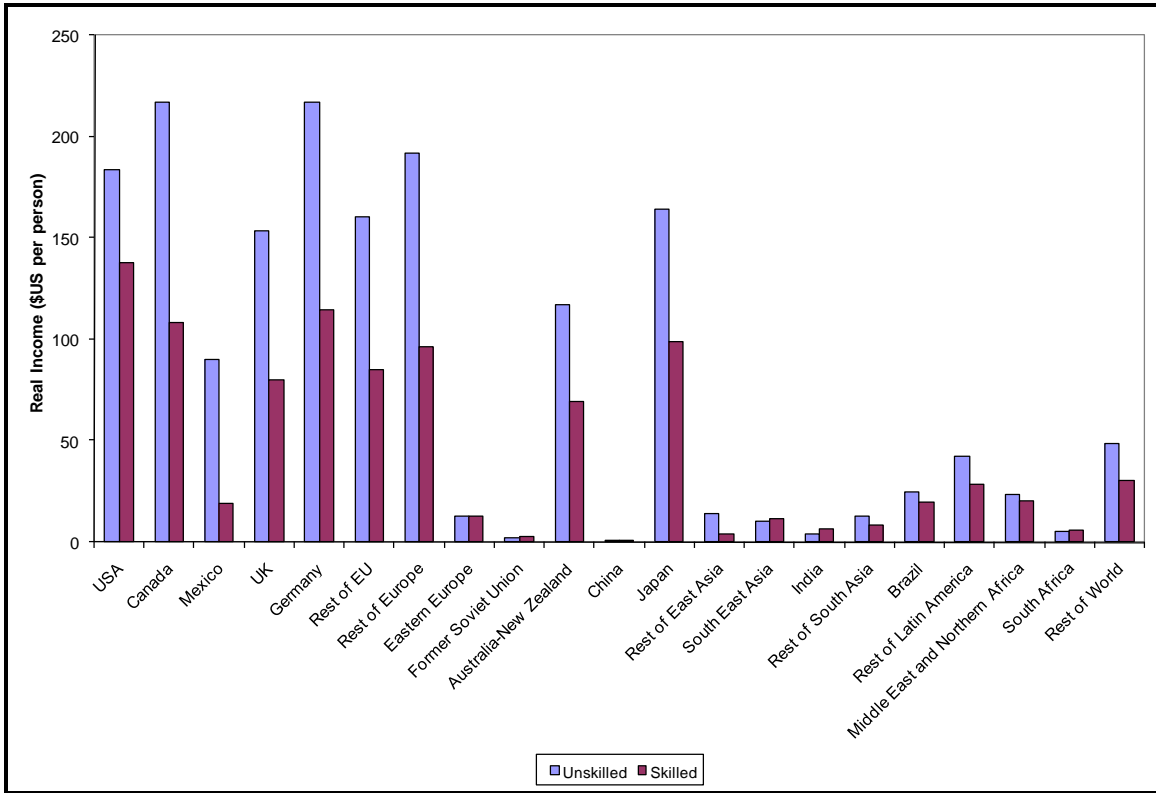
The results also show that an increase of 3% of the labor force, which is equivalent to a rise of 27% in the number of migrants in the USA, raises exports by 4.03% and imports by only 0.55%. These estimates are likely to underestimate the impact of the movement of people on trade for two reasons: a) 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 impact of the movement of labor under Mode 4 on exports and imports. They estimated 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%; this change in imports is far higher than the estimates presented here.

4.3. *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.

All permanent residents of the labor-importing developed and labor-exporting developing countries (or country groups) gain in terms of real incomes as a result of the increased migration (Figure 4). The labor exporting economies gain from increased remittances and wages, while the labor importing economies gain from increased returns to capital and increased tax incomes. Hence we find no brain drain effects; this is also due to the fact that we do not include many of the externalities discussed in the literature. The labor importing developed economies gain the most (per permanent resident) in terms of real income from unskilled migration. The main reason for this is that more unskilled workers migrate. If we take into account the fact that more unskilled workers are imported the results are mixed with some countries (UK, Germany and Rest of Europe) gaining more from unskilled workers than from skilled workers. The results for the developing labor exporting economies, however, are mixed. Many of the large developing labor exporting economies (South East Asia, India, and the Former Soviet Union) gain more from the migration of skilled labor than from unskilled migration. This is due to the fact that they already supply a large number of skilled workers and will continue to do so as a result of the liberalisation; while Latin America and Africa gain more from the increase in unskilled migration (Figure 4). When the number of skilled and unskilled imported and exported are taken into account the gains are largest from skilled workers.

Figure 4: Changes in Real Income of Permanent Residents due to unskilled and skilled migration respectively per permanent resident



With the assumption of substitutability between foreign and domestic workers, 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. As a result the per capita real income of the average existing migrants in the developed labor-importing economies declines. The average existing migrants in the developing economies gain as the supply of labor falls and wages rise. Some of these increases in wages are significant (e.g. Mexico and Rest of East Asia) where the loss of labor is greatest.

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 (6)) after remittances are removed. In Tables 4A and 4B the change in

real new migrant income/wage (per new migrant) is shown. The following equation is included to assist our understanding of the results for the change in real new migrant income/wage (per new migrant) ($\Delta w_{r,s}$):

$$\Delta w_{r,s} = (1 - r_r)w_{r,s} - w_{r,r} \quad (13)$$

Where: $w_{r,s}$ is the final real wage of migrants from region r, earned in region s (note that these wages initially depend on both the home and host country via equation (B2));

$w_{r,r}$ is the initial real wage earned at home; and

r_r is the remittance rate for people from region r.

Almost all of the new unskilled and skilled 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 Japan and then the other economies (Table 4A and 4B). This is due to the fact that real wages are highest in the USA, followed by these other economies (Figure 3). The declines in real incomes are due to a combination of factors:

- a) Real wage differentials between the home and host regions for skilled workers are generally smaller than for unskilled workers, and in some cases the real wages may even be lower at home than they are abroad (e.g., The Rest of East Asia).
- b) Remittances are now sent back home. This lowers the real income of the migrants even further and in some cases real incomes fall (Figure 2). It is possible that the removal of remittances might cause real income to fall, where large portions of income are sent back home as remittances²⁸.

²⁸ 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.

Table 4A: Percent Change in Real Income (net of remittances) of new migrants by Home and Host Regions relative to their real home income (prior to migration) 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	237	122	170	64	44	55	106	119
Eastern Europe	220	107	172	46	37	13	119	122
Former Soviet Union	362	204	268	118	115	79	198	200
China	599	389	551	249	187	284	348	337
Rest of East Asia	123	52	83	12	30	57	25	50
South East Asia	684	405	516	267	250	370	401	336
India	214	100	145	48	35	48	82	100
Rest of South Asia	559	352	414	221	222	319	334	208
Brazil	134	53	86	13	-9	55	45	51
Rest of Latin America	193	121	171	53	36	58	132	98
Middle East and Northern Africa	155	55	128	77	19	45	20	122
Southern Africa	1,116	746	890	511	438	549	687	679
Rest of World	364	257	294	113	0	246	148	216

Table 4B: Percent Change in Real Income (net of remittances) of new migrants by Home and Host Regions relative to their real home income (prior to migration) as a result of the movement of skilled workers (%)

Home Region	Host Region							
	USA	Canada	UK	Germany	Rest of EU	Rest of Europe	Australia-New Zealand	Japan
Mexico	83	-5	22	-26	-14	6	12	22
Eastern Europe	180	43	95	9	43	12	76	99
Former Soviet Union	346	127	194	70	132	56	165	200
China	65	14	40	-31	-11	-26	22	4
Rest of East Asia	14	-17	-13	-47	-41	-36	-5	-26
South East Asia	336	115	213	84	129	70	188	179
India	1	-50	-34	-61	-47	-69	-41	-33
Rest of South Asia	138	27	55	-5	43	-21	53	17
Brazil	29	-33	-14	-48	-31	-36	-20	-13
Rest of Latin America	125	31	69	-7	21	-9	64	53
Middle East and Northern Africa	149	14	92	24	17	19	3	137
Southern Africa	262	93	144	46	102	28	128	137
Rest of World	439	221	271	100	88	205	187	281

The bilateral data, which in principle allow us to estimate the change for every home-host country pair, make this table far richer than we would contemplate in the original work, Walmsley and Winters (2005). This is not, however, because the difference in wages between r and s is conceptually different from previously (i.e. $\Delta w_{r,s} = w_r - w_s$, in obvious notation), but because we have a better handle on the numbers flowing from s to r .

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 (2003) which are substantially higher than those used in the previous study - which were obtained from IMF data.

4.4. Sensitivity Analysis

In this final section we undertake some basic systematic sensitivity analysis to examine how sensitive the results are to changes in the size of 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 of the implications on real income of the permanent residents. Overall the results of the sensitivity analysis concur with those found in Walmsley and Winters (2005).

The results show that the gains to permanent residents 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 initial BETA (equation B2 in Box 1), and re-calibrate the initial data, we find that the real income of the migrants in the labor-importing countries changes²⁹. If BETA is raised the productivities (wages) of the migrants is higher and the developed economies gain more. The impact on the labor-exporting economies from changes in the BETA is minimal and the direction of the impact is mixed. Changes in BETA do not

²⁹ Changing the BETA as part of the simulation provides different results, see Ojeda, McCleery, De Paolis and Walmsley (2007).

alter the remittances sent home. This is because as BETA is raised remittances as a share of income falls. Therefore with a higher BETA (and higher income) the new migrants just send home a lower share of their income.

Finally, we examine the impact of restricting the movement of workers across sectors, i.e. the new migrant workers are given jobs in the services sectors³⁰ and permanent resident labor is assumed not to move out of these sectors. In the standard GMig2 model and closure the new migrants increase the total supply of labor and this additional labor 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) we also consider the case where labor is restricted to specific sectors using the method described in section 2.2.4. Overall we find that the gains are much lower in the labor importing economies, than in the case where labor movement across sectors is not restricted. This is not surprising since allowing labor 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 real incomes of the labor importing countries with sector restriction is not as high in the unrestricted base case, the developing country labor exporters gain considerably more in terms of real income. This is due to the fact that the labor exporting economies will be able to gain from the production and export of goods produced by the non-services sectors and the considerable improvement in their terms of trade. The permanent resident of the USA, on the other hand experience gains as a result of the sectoral restrictions, this is due to the gains resulting from the very large decline in prices.

There are a number of other assumptions that are critical to apportioning the gains of migration across permanent residents, and new and existing migrants. Many of these assumptions were considered by van der Mensbrugge in the World Bank (2006) report on international migration and remittances, including the role of perfect substitutability,

³⁰ Transport, Communications, Financial services, Insurance and Business Services.

the implications of the fiscal assumptions and the role of substitutability between capital, skilled labor and unskilled labor.

World Bank (2006) assume that domestic and foreign migrant workers are not perfect substitutes and therefore find that native workers could be (partially) isolated from a wage decline thereby raising their welfare (relative to the perfect substitution assumption made in this model). Existing migrants, on the other hand, are more negatively impacted since the supply shock becomes relatively larger. In its report on international migration and remittances the World Bank (2006)¹ did not come to a conclusion on the degree of substitution as the literature on this is not conclusive, but sensitivity analysis indicates its importance.

Secondly, in this paper we assume that new migrant pay taxes, but do not obtain any of the benefits accruing from those taxes. In the World Bank (2006) report sensitivity analysis was undertaken to show how their welfare results differed under different assumptions:

- 1) Fiscal neutrality (new migrants received the same value of benefits as their taxes);
- 2) No public benefits accrue to new migrants but they pay taxes; and
- 3) New migrants receive the same per capita public benefits as native workers.

They found that the move from (1) to (2) nearly doubled the welfare gains for native workers and raised the global gains (because public benefits accruing to new migrants are adjusted by a cost-of-living factor that reduces the value of those benefits to the new migrants). Under assumption (3) we might expect that the welfare gains of the permanent residents would be even lower, as migrants receive benefits greater than the value of their taxes. Walmsley and Winters (2005) found a similar result when they incorporated taxes into the GTAP 5 data base; the USA IO table used in the GTAP 5 Data Base did not include income taxes. In this paper, the GTAP 6 Data Base is used and taxes are collected from migrants.

Finally, in the standard GTAP model substitution occurs across natural resources, land, capital, and skilled and unskilled labor. There is an emerging view that unskilled labor is a substitute for a skilled-capital composite factor and that skilled labor is a near complement with capital. Under this latter assumption, it may be the case that returns to capital increase even more relative to the default assumption as the relative scarcity of capital increases with the rise in skilled labor—again changing the distribution of the welfare gains.

5. Conclusion

It is increasingly recognised that the removal of restrictions on the movement of labor across country borders could contribute significantly to the real incomes 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 labor 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 labor migration model (GMig2) has allowed for improved analysis of the movement of labor 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 labor 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' labor forces. The real income of permanent residents in the developed economies increases significantly; with most of those gains arising from the lifting of quotas on unskilled labor. The

permanent residents of developing countries also gain in terms of real incomes from sending unskilled labor and skill labor, although the gains from skilled are lower. 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 liberalization of the movement of labor 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 liberalization. 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 liberalization accrue to the labor 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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