International Migration, Purchasing Power Parity (PPP) and the Money Metric of Welfare Gains

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May 1, 2006

Paper prepared for the 9th Annual Conference on Global Economic Analysis
Hosted by the United Nations Economic Commission for Africa (UNECA)
Addis Ababa, June 15-17, 2001

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Abstract: This paper argues that the rise in real global income as a result of migration from low-income countries to high-income countries overestimates the money metric of global welfare gains by at least a factor of two. This is contrary to the analysis of trade policies where the rise in real income, calculated according to national accounting convention, does provide an accurate estimate of the money metric of welfare gains. The complication in migration scenarios arises because the price changes that a migrant experiences, as prices of non-tradable goods differ significantly between the host and home countries, are not represented in the deflators of the host country, but should be taken into account in the money metric of the welfare change of the migrant. Adjustment of real income of migrants using purchasing-power-parity (PPP) adjustment factors provides a good approximation of the money metric of welfare gains.

The correct application of the money metric of welfare produces in the case of migration a counterintuitive example of money transfers that increase the money metric of global welfare. Remittances by migrants back to their home country should not be PPP-adjusted, as those who remain in the host country, do not experience a significant change in prices. Because income of new migrants that is not remitted home should be PPP-adjusted, remittances by new migrants increase global welfare.

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Table of Contents

1. Introduction

Policies that reduce obstacles to migration will change global welfare. Many people will enjoy gains in welfare, while some will suffer losses; in the same way the elimination of trade barriers generates winners and losers. While economic models provide insight in gains or losses for a typical consumer or worker, aggregation of the welfare gains and losses is not straightforward, because welfare is fundamentally incomparable across persons. How can we determine if the gain for one person can more than compensate the loss for another person?

Standard practice in applied general equilibrium modeling is to represent a change in welfare by a change in income. For each decision making unit an equivalent variation (EV) in income is computed that would have generated at the original prices the same increase in welfare as the actual increase in welfare in a simulation. So, all the changes in income and prices in the simulation are summarized in one money metric. These EVs are then aggregated over persons to calculate the change in global welfare. The logic behind this global aggregate is that the changes in welfare observed in a simulation could have been achieved at constant prices if the global increase in income would have increased by the amount of the aggregate EVs, accompanied by the appropriate income redistribution. So, if global welfare increases in terms of EVs, it does not mean that the welfare gains of the winners are considered more important than the welfare losses of the losers, but that the shock is similar to a situation in which global income would have increased and redistribution of income would have taken place.

A good approximation of the EVs is the increase in real income. The approximation is so good that often only real income is calculated in modeling exercises to calculate global welfare gains. However, the real income gains as calculated in National Accounts, which basically apply to countries and not to individuals, are no longer relevant once persons move from one country to another. Therefore, we have to rethink the measurement of EV for migrants. The main purpose of this paper is to describe a new way of calculating the equivalent variation of income for migrants.

2. Money metric and equivalent or compensating variation

Policies that reduce obstacles to migration will change global welfare. Many people will enjoy gains in welfare, while some will suffer losses; in the same way the elimination of trade barriers generates winners and losers. While economic models provide insight in gains or losses for a typical consumer or worker, aggregation of the welfare gains and losses is not straightforward, because welfare is fundamentally

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Before we introduce this new calculation of EV for migrants, we first define the concepts in a more formal way and we introduce a very simple two-country model. The purpose of the model is not to be comprehensive or realistic, but to clarify some basic concepts. After the new way to calculate EV for migrants is introduced in this small model, the second part of the paper will apply the new concept to the World Bank's global LINKAGE model, which provides a more comprehensive and more realistic illustration of the consequence of the new approach.

Assume two countries, a high-income country *H* and a low-income country *L*. In each country consumers can purchase two goods, a non-tradable good *N* and a tradable good *T*. They make their consumption decisions on the basis of a Cobb-Douglas utility function. For simplicity we assume that all people have the same utility function, irrespective of whether they live in country *H* or country *L*.

$$U_c = \theta_c C_{Nc}^{\alpha_N} C_{Tc}^{\alpha_T} \qquad c = H, L$$

Where U_c = Utility of representative consumer in country *c*.
C_{sc} = amount consumed per person of product *s* in country *c*

All income is consumed and demand for the two products is thus

$$C_{Nc} = \alpha_N \frac{Y_c}{P_{nc}}$$

$$C_{Tc} = (1-\alpha_N) \frac{Y_c}{P_t}$$

$$with\ \alpha_N + \alpha_T = 1$$

Where Y_c is per capita income in country *c*.

Substitution of these demand equations in the utility function gives the indirect utility function

$$U_c = Y_c / P_c$$

$$with \quad P_c = \frac{1}{\theta_c}\left(\frac{P_{nc}}{\alpha_N}\right)^{\alpha_N}\left(\frac{P_T}{1-\alpha_N}\right)^{1-\alpha_N}$$

The money metric *M* of utility level U_c at prices P_{Nc} and P_T is

$$M_c(U_c, P_{Nc}, P_T) = P_c U_c$$

If a shock in a simulation has generated a new welfare level, the equivalent variation in income can be calculated as

$$EV = M_c(U_c^{NEW}, P_{Nc}^{OLD}, P_T^{OLD}) - M_c(U_c^{OLD}, P_{Nc}^{OLD}, P_T^{OLD}) =$$
$$= \left[\frac{P_c^{Old}}{P_c^{New}}\frac{Y_c^{New}}{Y_c^{Old}} - 1\right] M_c(U_c^{OLD}, P_{Nc}^{OLD}, P_T^{OLD})$$

If we choose units of measurement such that in the initial situation both prices are equal to 1 and if income is 1, then the level of indirect utility is $U_c^{Old} = 1$. Assume the price of non-tradable goods jumps in a simulation to 10, but income does not change. Indirect utility is then reduced to $U_c^{new} = 10^{-\alpha_N}$. The

money metric of that new utility level at old prices is $M_c^{new} = 10^{-\alpha_N}$. And the equivalent variation (EV) in income of the price increase is

$$EV = M^{new} - M^{old} = 10^{-\alpha_N} - 1$$

This equivalent variation is exactly the increase in real income if we use as deflator

$$P_c = \frac{1}{\theta_c} P_{Nc}^{\alpha_N} \; P_T^{1-\alpha_N}$$

To further illustrate the use of equivalent variation, we add production to the model and look at the impact of aid flows. Each country produces both goods with only labor as input. Labor productivity in the non-tradable sector does not differ between the two countries, but the labor in country *H* is ten times as productive as labor in country *L* in the production of tradable goods.

$$A_{Nc} = Q_{Nc} \quad c = H, L$$
$$A_{TH} = 0.1\, Q_{TH}$$
$$A_{TL} = Q_{TL}$$
$$A_{Nc} + A_{Tc} = A_c \quad c = H, L$$

Where A_{sc} = labor used in sector *s* and in country *c*
A_c = total labor force in country *c*.
Q_{sc} = amount produced of product *s* in country *c*

In the initial situation without aid or other transfers there is no trade between the two countries. Each country consumes the amount of tradable and non-tradable goods it produces and for simplicity we assume that the whole population works. The inclusion of dependant children or elderly would not change the basic analysis.

$$C_{sc} = Q_{sc} \; / \; A_c$$

If we take the tradable goods as numéraire, prices are

$$P_T = 1$$
$$P_{NH} = 10$$
$$P_{NL} = 1$$

Where P_T = price of tradable goods
P_{Nc} = price of non-tradable goods in country *c*.

Under these assumptions labor will be allocated similarly in the two countries over the two sectors:

$$A_{Nc} = \alpha_N \; A_c$$
$$A_{Tc} = (1-\alpha_N)\; A_c$$

Per person, both countries will produce and consume the same amount of non-tradable goods.

$$C_{Nc} = \alpha_N$$

However, country *H* will produce and consume per capita 10 times as many tradable goods.

$$C_{TL} = (1-\alpha_N)$$
$$C_{TH} = 10(1-\alpha_N) = P_{NH}\,(1-\alpha_N)$$

Although only productivity in the tradable goods sector is larger in country *H*, wages and per capita income in country *H* are 10 times wages and per capita income in country *L*.

$$Y_H = (Q_{NH}\; P_{NH} + Q_{TH}\; P_T)\,/\,A_H = PN_{NH}$$
$$Y_L = (Q_{NL}\; P_{NL} + Q_{TL}\; P_T)\,/\,A_L = 1$$

What is the impact of aid provided by country *H* to country *L*? Let's assume people in country *H* give a share γ of their income to people in country *L*.

The demand equations become now

$$C_{NH}^{NEW} = \alpha_N (1-\gamma) Y_H \,/\, P_{NH}$$
$$C_{TH}^{NEW} = (1-\alpha_N)(1-\gamma) Y_H \,/\, P_T$$

As technology is fixed, prices will not change, but people in country *H* will consume now less of both goods. They will produce less of the non-tradable good, but they will produce more of the tradable good in order to export tradable goods to country *L*.

$$Q_{NH}^{NEW} = \alpha_N\; (1-\gamma)\; A_H$$
$$Q_{TH}^{NEW} = P_{NH}\; (1-\alpha_N + \alpha_N \gamma)\; A_H = 10\,(1-\alpha_N + \alpha_N \gamma)\; A_H$$

Where the following represents the amount of traded goods exported:

$$E_T = \gamma P_{NH} A_H = 10\;\gamma\; A_H$$

The money metric of the welfare loss of a person in country *H* is

$$EV_H^{IND} = -10\ \gamma$$

Total welfare loss in country *H* according to this measure is

$$EV_H = -\gamma\ P_{NH} A_H = -10\ \gamma\ A_H$$

And once again this is exactly the decline in real income in country H. In country L, consumption of both goods will increase

$$C_{NL}^{NEW} = \alpha_N \left(1+ \gamma \frac{P_{NH} A_H}{P_{NL} A_L}\right) = \alpha_N \left(1+10\ \gamma \frac{A_H}{A_L}\right)$$
$$C_{TL}^{NEW} = \frac{(1-\alpha_N)}{P_T}\left(\frac{P_{NL} A_L + \gamma\ P_{NH} A_H}{A_L}\right) = (1-\alpha_N)\left(1+10\ \gamma \frac{A_H}{A_L}\right)$$

If country *L* continues to produce both goods (see below for the opposite case), then also there prices will not change, but resources will be shifted away from the production of tradable goods towards the production of non-tradable goods.

$$Q_{NL}^{NEW} = \alpha_N\ (A_L + 10\ \gamma\ A_H) = \alpha_N\ (A_L + P_{NH}\ \gamma\ A_H)$$
$$Q_{TL}^{NEW} = A_L - Q_{NL}^{NEW} = (1-\alpha_N)\ A_L - P_{NH}\ \alpha_N \gamma\ A_H = (1-\alpha_N)\ A_L - 10\ \alpha_N \gamma\ A_H$$

The equivalent variation describing the welfare gains is equal to the increase in real income for country *L*.

$$EV_L = 10\ \gamma\ A_H$$

In this example aid does not change global income, or the money metric of global welfare.

If aid is large enough to push country *L* completely out of the production of tradable goods, then prices are no longer fixed. Increased demand for non-tradable goods will push prices of those goods up. Additional aid beyond that point only has a limited impact on welfare and real income in the receiving country. The EV-gain in the receiving country of an additional aid dollar is less than the EV-loss in the donor country and will thus reduce global real income. In formulas:

It must be that Q_{TL} is zero, which implies that:

$$\alpha_N P_{NH} \gamma A_H \geq (1-\alpha_N) A_L \Leftrightarrow \gamma \geq \frac{(1-\alpha_N)}{\alpha_N P_{NH}} \frac{A_L}{A_H} = \frac{(1-\alpha_N)}{\alpha_N 10} \frac{A_L}{A_H}$$

It is also the case that export of tradables equals aggregate consumption, therefore the following must hold:

$$E_T = \gamma P_{NH} A_H = A_L C_{TL} = A_L \frac{a_T}{P_T}\left[P_{NL} + \frac{\gamma P_{NH} A_H}{A_L} \right]$$

with per capita income in the region *L* is equal to the wage plus the value of aid per capita. From this identity we can deduce the following:

$$\alpha_T P_{NL} A_L = \alpha_N \gamma P_{NH} A_H$$

This identity can then be used to deduce the following:

$$C_{NL}^{NEW} = 1$$
$$C_T^{NEW} = 10\ \gamma\ A_H / A_L$$
$$Q_{NL}^{NEW} = A_L$$
$$Q_{TL}^{NEW} = 0$$
$$EV_L = \theta_L \left(\gamma P_{NH} \frac{A_H}{A_L} \right)^{(1-\alpha_N)} A_L - A_L = \theta_L \left(\gamma 10 \frac{A_H}{A_L} \right)^{(1-\alpha_N)} A_L - A_L$$

Finally, we can show that the derivative with respect to gamma of the equivalent variation formula is less than the derivative of the equivalent variation for the high-income region:

$$\begin{aligned} \frac{\partial EV_L}{\partial \gamma} &= \theta_L \left(\frac{\gamma P_{NH} A_H}{A_L} \right)^{(1-\alpha_N)} A_L \frac{(1-\alpha_N)}{\gamma} \\ &\leq P_{NH} A_H \end{aligned}$$

Re-grouping and replacing θ_L with its value, the inequality is equivalent to the following:

$$(\alpha_T)^{-\alpha_T} (\alpha_N)^{-\alpha_N} A_L^{\alpha_N} \alpha_T \leq (\gamma P_{NH} A_H)^{\alpha_N} \Leftrightarrow (1-\alpha_N) A_L \leq \alpha_N \gamma P_{NH} A_H$$

which is exactly the inequality we started with.

In the examples till now there was a close link between the equivalent variation of welfare gains or losses and changes in real income in both countries. In case of migration that link is not straightforward. Changes in real income are no longer a good approximation of welfare gains. To illustrate this, assume migration from country *L* to country *H* increases the labor force in *H* by μ percent, and new migrants

obtain the level of productivity in the host country. As in the initial situation there is no trade and per capita production and consumption of natives in both countries remain the same. However, total production and consumption in the countries do change:

$$Q_{NH}^{NEW} = \alpha_N (1+\mu) A_H$$
$$Q_{TH}^{NEW} = P_{NH} (1-\alpha_N)(1+\mu) A_H = 10 (1-\alpha_N)(1+\mu) A_H$$
$$Q_{NL}^{NEW} = \alpha_N (A_L - \mu A_H)$$
$$Q_{TL}^{NEW} = (1-\alpha_N) (A_L - \mu A_H)$$
$$C_{sH}^{NEW} = Q_{sH}^{NEW} / (A_H + \mu A_H)$$
$$C_{sL}^{NEW} = Q_{sL}^{NEW} / (A_L - \mu A_H)$$

As in both countries prices do not change, real income in country *H* has increased by $10\,\mu A_H$ and in country *L* has declined by μA_H. This suggests a global income gain of $9\,\mu A_H$. However, this increase overstates the global welfare gains and it is not a good approximation of EV. The problem is that according to the real income definition on a country basis, prices have not changed. And that is no longer an appropriate description of prices relevant for individuals. It is still true for those who stay in the same country, but it is not true for new migrants. This is important because all the welfare gains accrue to new migrants in this example.

For the migrants, income has increased tenfold after migration, but prices have increased too. Costs of living in the host country are significantly higher than in the country of origin as prices of non-tradable goods and services are ten times as high.

For the migrant utility before and after migration is

$$U_M^{OLD} = Y_L / P_L = Y_L$$
$$U_M^{NEW} = Y_H / P_L(P_H) = Y_H / P_{NH}^{\alpha_N} = P_{NH}^{-\alpha_N} (P_{NH} Y_L)$$

The money metric *M* of utility level U_M at prices original (P_{NL} and P_T) is

$$M_M (U_M, P_{NL}, P_T) = \theta^{-1}\, P_{NL}^{\partial}\, P_T^{1-\alpha}\, U_M^{1/(\alpha_N+\alpha_T)} = U_M P_L = U_M$$

And the EV-measure of welfare increase for all migrants together is:

$$EV = \left[M_c (U_c^{NEW}, P_{Nc}^{OLD}, P_T^{OLD}) - M_c (U_c^{OLD}, P_{Nc}^{OLD}, P_T^{OLD})\right] \mu A_H =$$
$$= P_L [U_M^{New} - U_M^{Old}]\, \mu A_H = [P_{NH}^{-\alpha_N} P_{NH} Y_L - Y_L] \mu A_H = \mu A_H [P_{NH}^{1-\alpha_N} - 1]$$

This is also the global welfare gain, which is clearly different from the gain in global real income calculated in the standard way, i.e. the following condition holds:

$$P_{NH}^{1-\alpha_N} \leq P_{NH}$$

A problem in the application of the formula above in applied general equilibrium (AGE) models is that those models normally do not contain information of price levels, nor about relative prices of non-tradable goods across countries. These models initialize all prices at 1 by implicit choice of the unit of measurement. This problem can be solved by deflating the new income of migrants by a PPP correction factor, which compares price levels across countries.

$$PPP = \frac{P_{NH}^{\alpha} \; P_T^{1-\alpha}}{P_{NL}^{\alpha} \; P_T^{1-\alpha}} = \left(\frac{P_{NH}}{P_{NL}} \right)^{\alpha} = 10^{\alpha}$$

The deflated new income ($10^{1-\alpha}$) can then be compared with the old income (1) as both incomes are expressed in the same (base) prices. The increase in real income after this correction is again a good approximation of the EV of welfare gains by migrants and thus of the global welfare gains.

Interestingly, income sent back home by migrants in the form of new remittances should not be adjusted. Those who remain at home do not experience a change in price. The implication is that global welfare increases if migrants from low-income countries send money back to their country of origin. This seems counterintuitive, because aid flows or other transfers from rich countries to poor countries do not change global welfare. The reason is not that we consider remittances different from aid flows or other transfers. The reason is that we have to treat migrants' consumption in host countries differently.

Before we apply the PPP correction in an empirical model, it has to be emphasized that the aggregation of welfare gains and losses is not done on the basis of PPP prices. Aggregation is done on the basis of market prices (the base prices before the shock). We only use a PPP correction function to transform current prices that migrants face back into original market prices they were accustomed to in their home country.

If welfare aggregation were to be done in PPP prices, the whole analysis would be different. In that case for example aid flow would increase global welfare. By shifting resources in donor countries towards tradable goods and shifting resources in the other direction in the aid-receiving countries, production of non-tradable goods can increase without a decline in the production of tradable goods.

$$Q_{NL} + Q_{NH} = \alpha\,(A_L + A_H + 9\gamma A_H)$$
$$Q_{TL} + Q_{TH} = (1-\alpha)\,(A_L + 10A_H)$$

In PPP analysis that would show up as an increase in global real income. In our analysis, real income does not change globally. But even in that case spending by new migrants in host countries have to be corrected for international price differences.

3. Application using the World Bank's LINKAGE Model

Changes in nominal income

The model described above has many simplifying assumptions compared to a standard GE model. Among other things, it excludes capital income, it assumes same consumption patterns, no change in prices, and assumes goods are either perfectly homogeneous or perfectly non-traded. At the same time, as mentioned above, most GE models are calibrated to unitary prices in some base year—across all regions—and therefore it is typically not possible to do the standard EV calculation, i.e. the relative value of achieving the new utility level at the new (host) prices compared to the old (home) prices. Instead, we use a shortcut. We adjust the real consumption of the new migrant in the host country by the relative PPP exchange rate between the host and home countries. Table 1 describes the procedure.

The first panel of Table 1 shows the change in nominal after-tax income for four groups of households—natives in high-income countries (including migrants from other high-income countries), 'existing' migrants in high-income countries, all 'remaining' residents in developing countries, and 'new' migrants. Income by source is broken into three components—capital and labor (after-tax) income and net remittances. For natives in rich countries, nominal capital income increases by $319 billion, offset by a decline in wage income of $162 billion for a net income gain of $158 billion.[1] For existing migrants, income decreases by $100 billion—composed of a decline in wage income of $125 billion, but offset by a decline in outward remittances of $26 billion. For developing country residents, labor income increases by $170 billion, offset by a decline of $16 billion in capital income and augmented by a net increase in remittances of $99 billion. Total nominal income gain is $253 billion.

For new migrants—assuming they had no capital income in their home country—nominal income increases by $549 billion, of which $126 billion is remitted back for a total net income gain of

[1] There is a minor change in remittances for migrants from other high-income countries.

$423 billion. The average per-worker after tax wage increases from $4,900 to $43,000 (in 2025).[2] The average after-tax wage in high-income countries for natives is $63,000. [The averages include both skilled and unskilled workers.]

Globally, this leaves an increase in nominal after-tax household income of $735 billion. This amount is spent on the private consumption of goods and services and savings.

Government expenditures are linked to GDP. As GDP rises in these simulations, government expenditures also rise. The nominal increase in high-income countries is $88 billion, and $58 billion in developing countries. Assuming government expenditures are allocated on a per capita basis, nominal expenditure on natives in high-income countries declines by $60 billion and by $4 billion for existing migrants. On the other hand, expenditure for new migrants increases by $152 billion—and unlike the expenditures for natives, it exactly matches their tax payments, i.e. the shock is revenue neutral vis-à-vis the new migrants.

The per capita numbers may be of interest. In the baseline, residents in high-income countries receive an average of $10,480 in government goods and services (excluding transfer payments). In developing countries, the average per capita expenditure is $413, though $626 for the new migrants on average.

Adding the change in personal consumption expenditure and public expenditure leads to a global nominal gain of $882 billion. The net nominal gain of $158 billion for rich country residents is offset by a transfer in public expenditure of $60 billion to the new migrants for a total net gain of $98 billion. In developing countries, the gain of $253 billion is augmented by an increase in government expenditure of $58 billion, for a total of $312, of which nearly $100 billion comes from an increase in net remittances. The new migrants get the bulk of the nominal gains. To their $423 billion nominal income gain (after remittances) is added the $152 billion increase in their consumption of public goods and services.

Changes in real income

The second panel of table 1 shows the gains adjusted by changes in prices. For residents in high-income countries, this reflects the nominal gains adjusted by the change in the consumer price index (CPI) for private expenditures and by the government price deflator (GPI) for public expenditures. The CPI barely changes. Though the price of non-tradables declines, this is offset by higher prices for manufacturing and capital-intensive goods and for imports. The GPI on the other hand declines by 0.6 percent because

[2] The average wage of the new migrant is relatively high (compared to the developing country average) because of the composition of the new migrants that reflects a relatively high proportion from middle-income countries.

government expenditures on goods and services are concentrated in non-tradables. Similar adjustments are made for residents in developing countries. In developing countries the CPI increases by 0.7 percent and the GPI by 1.7 percent. The relatively high-loss of high-skilled workers is reflected in a higher cost of providing public goods and services. For the new migrants, their original basket of goods and services is adjusted for the CPI in the home country. The new basket is adjusted for the CPI in the host country. Remittances, on the other hand, are adjusted by the CPI in the home country, since this is where they will be spent.

In aggregate, the price adjustment lowers the nominal gain in private expenditure from $735 billion to $554 billion. The largest adjustment (in percentage terms) occurs in the developing countries due to the CPI adjustment. The adjustments in government expenditures are even more important. These adjustments reverse the decline in rich countries—to near zero compared to a loss of $64 billion in nominal terms. On the other hand, the rise in the cost in developing countries lowers the nominal increase from $58 billion to only $12 billion. In aggregate, the global gains amount to $674 billion in real terms, of which $481 billion accrues to the new migrants—$372 billion in the form of higher wage income after remittances and $109 billion in the form of increased expenditure on public goods and services.[3]

PPP adjustments

The final adjustment is made to the purchasing power of the rise in real income for new migrants for both private and public expenditure on goods and services. This is shown in the third panel of table 1. Only two numbers are different. The utility value of private expenditure of new migrants is adjusted for the relative purchasing power of the higher labor income, i.e. the adjustment concerns the relative change in the cost of living in the new host country relative to the home country. Thus the real gain of $372 billion, drops to $126 billion. Similarly, public services are adjusted from a gain of $109 billion to $36 billion. The total net gain for new migrants then becomes only $162 billion and the net global gain is $356 billion. The implied PPP exchange rate is 2.3 that is somewhat lower than the developing country average (3.2 on a GDP-weighted basis). The main reason is that migrants on average are coming from the higher-income developing countries where the PPP exchange rates are typically closer to the market exchange rates.

[3] Though the GPI declines in high-income countries—this is only true for existing residents. For new migrants, there is also an adjustment for the differences in the GPI between the home and host countries. The GPI grows relatively more rapidly in rich countries in the baseline than in developing countries.

Table 1: Source of gains in standard simulation—$billion in 2025

	Capital	Labor	Remit-tances	Sub-total	Govt.	Total
			Nominal gains			
High-income						
Natives	319	-162	1	158	-60	98
LMY migrants	0	-125	26	-100	-4	-104
Total	319	-287	26	58	-64	-6
Developing	-16	170	99	253	58	312
New migrants	0	549	-126	423	152	576
Global	303	431	0	735	147	882
			Real gains			
High-income						
Natives	282	-143	1	139	-1	139
LMY migrants	0	-114	26	-88	0	-88
Total	282	-257	26	52	-1	51
Developing	-53	96	87	131	12	143
New migrants	0	485	-114	372	109	481
Global	229	325	0	554	120	674
			Real gains—PPP adjusted			
High-income						
Natives	282	-143	1	139	-1	139
LMY migrants	0	-114	26	-88	0	-88
Total	282	-257	26	52	-1	51
Developing	-53	96	87	131	12	143
New migrants	0	239	-114	126	36	162
Global	229	79	0	308	48	356

4. Conclusions

In this paper we discussed two sets of issues that arise when one calculates global gains from migration. Some aspects of the discussion are specific to migration, other parts of the argument are also relevant for the analysis of other policy shocks. The first set of issues is related to how the gains of specific groups

should be evaluated. The second set of issues is related to how the gains should be aggregated over groups and countries.

Evaluation of the welfare gains of individual groups. In standard applications of general equilibrium (GE) models, the welfare impacts of specific groups are evaluated using a concept from welfare theory called equivalent variation (EV). The concept is relatively straightforward. Welfare changes as a result of changes in nominal income and changes in prices. EV calculations summarize this welfare change in terms of an equivalent change in income alone, showing by how much income at original prices would have to change to achieve the same change in welfare as observed in a simulation.[4]

For most households, the standard notion of the change in real income, that is, the difference in nominal income adjusted by the change in the CPI, is a good approximation of EV.[5] This is not the case for new migrants, however. There is no standard price index that can be used as a deflator for the change in the nominal gains for the new migrants, since the prices they face in their new host country have no linkages to the prices they paid in their home countries. GE and macro models typically calibrate base-year prices in each region to one (or unit value) by choosing corresponding volume units.[6] This approach does not allow one to take into account the price increases that new migrants face as a result of their migration. In the migration simulations described above, the macro PPP exchange rate (as an approximation of the rise in prices faced by migrants from developing to industrial countries) has been used to adjust the gains to the migrants—although this is just an approximation of the true welfare gains. Because of the cost-of-living adjustment to the welfare gain of new migrants, the real gain reported is no longer equal to real income gains of countries—and real output gains—measured using national accounting standards. However, the standard real income measure is still a good approximation of the welfare gains for the other households in the model.

To the extent that new migrants remit part of their income to their country of origin and that income is spent in that country of origin, the increase in the cost of living that new migrants face is not relevant. Therefore, the EV measure of remittances is larger than the same nominal income spent by the new

[4] One of the advantages of the EV measure is that it transforms the ordinal concept of welfare into a cardinal concept of income. While it is impossible to measure how much one welfare level differs from another (one can only conclude that one level is preferred to another), the corresponding increase in income can be measured, and the size of the increase has a clear meaning.

[5] For example, in trade-reform scenarios, the change in the price index is a relatively good approximation of the welfare impact, since the new price is approximately the old price less the tariff.

[6] There are exceptions. For example, in the case of climate-change models, it is necessary to know the relative prices of the different fuels to accurately determine the carbon tax.

migrant in the host country. This difference illustrates the incentive for new migrants to remit income home.

Aggregation of gains. The second issue relates to the interpretation of the "global" gains. Typically, to derive aggregate or global gains, EV (expressed in a common currency, typically the U.S. dollar) is summed across all households. For individual persons or homogeneous groups this EV aggregation, expressed as a percentage of original income, is a good approximation of the change in welfare (or more precisely, it is a good indication of the change in welfare).[7] However, no clear link exists between global welfare and the aggregation of EV across heterogeneous groups, because we do not know how to weigh individual welfare across heterogeneous groups (a particularly difficult issue in aggregating across countries at very different stages of development, as is done here). For example, while most groups gain from migration in the scenario discussed in the text, some lose. The fact that the change in global welfare (expressed as the aggregation of EV across groups) is positive does not mean that the welfare gains of the winners are considered more important than the welfare losses of the losers. Thus, global gains as expressed in aggregate EV should not be interpreted as a value judgment on how to weigh individual or local welfare gains.

The aggregation of EV across groups does, however, have a useful interpretation, which is linked to the notion of compensation and Pareto optimality. As long as the global gains are positive—using the standard practice of adding up EVs across households—then it is possible through redistribution to compensate households that lose so that no one is worse off relative to the baseline scenario, while some are better off. In that sense *the global gain can be compared with an equal rise in global output plus redistribution.*

An alternative approach to calculating global gains would be to add up changes in income measured in PPP terms. The rationale for that alternative is that because prices of non-traded goods are lower in developing countries, the addition of a dollar to a developing country would enable the purchase of a larger amount of goods and services than in an industrial country. In that case, both base income and gains for new migrants and for those who remain in developing countries would be roughly three times as large as reported here. This is true for all gains, whether they come from migration itself, from remittances, or from changes in wages and prices in developing countries. As a result, the share of those who (originally) live in developing countries in global aggregates would increase in the measurement of both global income levels and global welfare gains. However, the percentage increase in income for developing countries would not be affected.

[7] The size of the change in individual welfare is undetermined, since welfare is an ordinal concept.

Obviously, global income and global gains would also be larger if expressed in PPP terms. As the percentage increase in welfare for people (originally) living in developing countries is larger than the percentage increase for those living in high-income countries, a switch to PPP measures would also increase the global gains as a percentage of global income. If in the migration scenario presented here the gains are PPP-adjusted, the global gains would amount to 0.9 percent of global income in the baseline, instead of 0.6 percent using the EV aggregation. This illustrates that people (originally) living in developing countries are the biggest gainers of migration in percentage terms.