The Economic Costs to International Labor Restrictions: Revisiting the Empirical Discussion

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Summary. — In a 1984 article, Hamilton and Whalley calculated the annual efficiency gains from free international migration. We update that study to compare developments over time, with the aim of producing more reasonable and politically-relevant scenarios. Our results suggest that the estimated gains from the liberalization of global immigration controls have increased substantially. Indeed, we find that even a small liberalization of international migration restrictions can still yield substantial gains. In particular, we estimate that a 10% increase in international migration corresponds to an efficiency gain of about US$774 billion (1998) dollars.
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If we consider both the sending and the receiving countries as part of the same world, then—and on this every economist agrees—the overall effect of the migration on the average standard of living of the world's people is positive. The reason for this is that the migrant goes from a place where he or she is less productive to a place where he or she is more productive. This increased production benefits the standard of living of the community as a whole, as well as that of the migrating individual. (Simon, 1999, p. 299)

1. INTRODUCTION

While borders dissolve for goods, services and finance (not to mention disease, justice and culture), people remain landlocked. The pace and scope of globalization in recent decades has exceeded the expectations of all but the most enthusiastic supporters. Under the twin banners of freedom and efficiency, consumers and firms have broken out of their parochial, national, contexts to mingle in increasingly global markets. This nexus has brought both opportunity and hardship—unequally distributed across the globe.

Of course, the opportunities offered by globalization are not spread equally across markets.

In contrast to earlier periods of globalization (e.g., late 19th century)—and the openness of other factors, goods and services markets—labor markets remain remarkably protected. Whereas governments claim impotence in the face of other globalizing forces, they remain remarkably potent in shielding domestic economies from international labor flows.

With this article we examine the global costs of this potency. In particular, we ask: What might be the expected economic gains from liberalizing national labor market regulations? In light of contemporary attitudes toward

international immigration, it may be more reasonable to ask: What costs are associated with a complete closure of national labor markets?

Answering these sorts of questions is not common fare in contemporary development studies. There have been remarkably few economic studies of the *international* effects of migration. Indeed, for much of international economics, labor mobility is seen as an integral part of international trade theory. Standard trade models, resting on the work of Hecksher, Ohlin and Samuelson, begin by assuming that labor is immobile across countries, and hold that labor-abundant countries will export those goods that are relatively intensive in the production of labor. In a sense, these countries are seen to export labor: the trading of goods substitutes for the trading of people.

A notable and early exception to this lack of interest in the systemic effects of free labor mobility is Hamilton and Whalley's (H&W's) remarkable study from 1984, using 1977 data. Since that time, however, surprisingly little has been written on the subject. [1] For this reason, we start where H&W left off and construct an applied equilibrium model to generate a number of estimates (contingent on varying parameters) of the potential gains from liberalizing international labor markets.

Our research suggests that the estimated efficiency gains from liberalizing immigration controls have only increased over time. While these gains were substantial in 1977, they have—in most cases—only grown over the subsequent two decades. Using 1998 data, we find that the estimated gains from free migration may be as high as US$55.04 trillion—exceeding the world's GDP in that year. Even when several adjustments are made to make the analysis more realistic, the potential gains remain enormous. Indeed, our smallest estimate yielded a gain of 1.97 trillion dollars a year (or 5.6% of the world's GDP in 1998). More significantly, a substantial proportion of these gains can be reaped without allowing for full migration. Even small initial changes in international migration controls could produce significant economic gains, and these gains dwarf those generated by traditional development policies.

Like Hamilton and Whalley, we do not intend to minimize the potential obstacles to globalizing labor markets: they are enormous, and probably insurmountable. Nor do we wish to exaggerate the reliability of our empirical claims. Given the simplicity of the model, and the paucity of the data, we hasten to emphasize that the results, like the questions that motivate them, are highly speculative. Rather, our intent is modest: to provide an explicit and straightforward estimate of the costs of continued immigration controls. Only when these costs are known and made explicit can the global community make informed decisions about the utility (both economic and otherwise) of maintaining stringent migration controls.

Our argument is presented in three parts. The first part provides our motivation for the study. Given the very speculative nature of the project itself, we think it is useful to begin by emphasizing its political and economic relevance. The second part of the article provides the main thrust of our argument. This part is divided into three subsections, providing: (a) our replication of the original model; (b) an update of the analysis using 1998 data and a comparison over time; and (c) an examination of the effects from a partial liberalization of migration flows. The article concludes by noting the limitations of this approach and by sketching out some paths for future research.

2. BACKGROUND

We are motivated by the fact that there are remarkably few analyses, conducted at the global level, which examine the potential gains from freer migration. While there is an extensive literature examining the potential costs and benefits of migration into the developed world, and fewer studies on the effects of migration to and from the developing world, the issue of international gains from free labor mobility has not received much attention by political economists.

This lacuna is all the more curious when we realize that international migration—though relatively small compared to the transnational flow of other factors, goods and services—is growing rapidly, if unequally, across different legal and skills' categories. The UN estimates that on average, over the last decade, over 2.3 million people a year immigrated from less developed to more developed regions of the globe (UN Population Division, 2001, p. 139). Indeed, in the year 2000, about 175 million people—roughly 3% of the world's population—resided in a country other than where they were born (UN Population Division, 2002). While these numbers remain low compared to earlier

periods of globalization, they are not insignificant. [2]

The number of migrants will only rise, along with our awareness of the inability of rich states to restrict a rising flood of unwanted (illegal) immigrants. For example, a large, crossnational study of immigration controls found:

> Despite significant increases in immigration control efforts... and the tightening of entry restrictions and monitoring of unauthorized foreign workers already working in other countries... [there is] less confidence today among officials that they could effectively regulate immigration flows and employment to unauthorized foreign workers than there was fifteen years ago. (Cornelius, Martin, & Hollifield, 1994, p. 4)

For this reason, there has been an impressive growth of national studies on the effects of immigration in developed countries. [3] As might be expected, estimations of potential cost/gains vary widely according to initial assumptions about the nature and character of the immigrant labor force. But most economists tend to recognize (if often implicitly) that the gains of increased immigration are potentially substantial. Even scholars who are leery of liberalizing the developed world's immigration controls, recognize the potential economic gains that can be generated internationally:

> [t]he principles of free trade first enunciated by David Ricardo almost two centuries ago suggest that the world would be much richer if there were no national borders to interfere with free movement of goods and people. By prohibiting the immigration of many persons, the United States inevitably shrinks the size of the world economic pie, reducing the economic opportunities that could be available to many persons in the source countries. (Borjas, 1999, p. 181)

As the world shrinks and inequalities grow it will become increasingly difficult for wealthy states to continue pursuing their current immigration policies. This growing divide between rich and poor states may pose the greatest threat to our common future. Under these conditions, it is doubtful that the developed world will be able to cordon itself off indefinitely: as distance in the world recedes with technological, social, demographic and political advances, the demand for international migration will undoubtedly grow.

Concomitantly, demographic pressures within the developed world will make it difficult (at least costly) to not consider a more liberal approach to immigration. The overall economic impact of declining (and aging) populations can be serious. The OECD estimates that the cumulative effects by mid-century could reduce the US living standards by 10%, the EU's by 18%, and Japan's by 23% (measured by GNP/capita adjusted for terms of trade effects). [4] If accurate, these figures represent formidable political and economic challenges to the developed world. The most obvious solution to these changing demographic patterns is to complement the West's declining and aging populations with younger immigrants. It is little wonder, then, that the World Trade Organization has introduced temporary migration to the international trade agenda (so-called Mode 4 trade).

Finally, recent work by economic historians has documented the important role played by international migration during the late 19th century in shrinking real wage differences across the Atlantic economy (see, e.g., Hatton & Williamson, 1994, 1998; O'Rourke & Williamson, 1999). International migration, combined with the relatively free flow of capital and goods, allowed some of Europe's peripheral states to experience a phenomenal economic "catch-up." In short, it would appear that emigration played an important role in explaining the economic development of several European countries prior to World War I. For all these reasons, we believe that it makes sense to engage a discussion of the international effects of increased labor migration.

3. THE ANALYSIS

This section is divided into three parts. The first part introduces the original model and our attempt to replicate it, and its findings. The second part applies this new model to newer data in order that we can compare developments over time (between 1977 and 1998). The third part then examines the effects of partial liberalization of migration flows.

(a) Replicating the model

In 1984, Hamilton and Whalley calculated the annual efficiency gains from lifting global immigration restrictions. Given the implicit parameters of their approach, it is not surprising that they found freer mobility to generate world efficiency gains, as well as some improvement in the distribution of world incomes among nation-states. What is surprising,

however, is the expected size of the gains generated by their model. In particular, they found that annual gains from free labor mobility might significantly exceed the (then) worldwide GNP. After running a number of potential scenarios, they produce some "unadjusted" estimates of gains that ranged from $4.7 trillion to $16 trillion (at the time, *worldwide* GNP in 1977 was US$7.82 trillion)!

Although there are several limitations to this approach—many of them recognized by the original authors, others will be referenced below—it remains a useful starting point for any attempt to estimate the potential gains from free labor mobility. This section introduces the original H&W model, and some of its inherent shortcomings. In the following section we will employ a similar model with newer data, in order to provide an estimate of how these gains have changed over time.

Conceptually, H&W's argument can be divided into three parts. First, they assume there is a fixed supply of (worldwide) labor and full employment throughout the world. This labor supply, fully employed, produces a single output that is homogeneous across regions. Second, they use (regional) Constant Elasticity of Substitution (CES) production functions to estimate differences in the marginal productivity of labor (MPL) across regions. [5] These differences are assumed to be the result of barriers to mobility. Finally, they estimate

how labor would reallocate in the absence of these barriers and measure the associated efficiency gains. In short, H&W assume that wage rate equalization is achieved through unimpeded international labor flows (not via the traditional factor price equalization theorem). An outline of their method is provided in Table 1.

In particular, H&W generated marginal revenue product schedules directly from aggregate production functions for seven world regions. For each region they constructed a CES production function where they specified the substitution parameter, ρ_i. This implies a value for the elasticity of factor substitution in production for each region. To estimate the weighting parameters, δ_i, they determined the first-order conditions for cost minimization, used observations on factor use and factor returns in each region, and assumed that factors were paid their marginal products before the immigration controls were removed. The scale parameter, γ_i, was then determined in the production function for each region. These estimated production function parameters were then used to calculate the change in labor allocation across regions after the removal of immigration controls. In the removal case, an equalized marginal revenue product of labor across regions was found, consistent with full employment of the fixed worldwide labor supply.

Table 1. *Method for calculating global efficiency effects of modifying immigration controls*

—For each region, an aggregate CES function is used:

$$Y_i = \gamma_i[\delta_i K_i^{-\rho_i} + (1 - \delta_i)L_i^{-\rho_i}]^{1/-\rho_i},$$

where γ_i is a constant (defining units of measurement), δ_i is a weighting parameter, $\sigma_i = 1/(1 + \rho_i)$ is the elasticity of substitution between factor inputs, K_i and L_i are capital and labor service inputs, and Y_i is value added in region i.

—The elasticity of substitution, $\sigma = 1/(1 + \rho)$, is assumed to range from 0.5 to 1.5 (where ρ is the substitution parameter). As $\sigma \to 1$, the CES tends to the Cobb Douglas function; and as $\sigma \to 0$ it tends toward the Leontief (fixed coefficient function). Obviously, where $\sigma = 1$ or $\sigma = 0$, the functions are undefined.

—From the assumption that factors receive their marginal product in each region in the presence of existing controls, values of δ_i are determined from the ratio of first-order conditions:

$$\delta_i = \left(\frac{K_i^{1/\sigma_i}}{L_i^{1/\sigma_i}}\right) \Big/ 1 + \left(\frac{K_i^{1/\sigma_i}}{L_i^{1/\sigma_i}}\right).$$

—Units are assumed for the output produced in each region such that one unit sells for $1. The GDP value for the region, K_i, L_i, ρ_i, and δ_i are used to solve for γ_i.

—An iterative procedure is then used to calculate the change in labor allocation after a modification of immigration controls consistent with: (a) equalized MPL in all regions; and (b) full employment of the fixed labor supply.

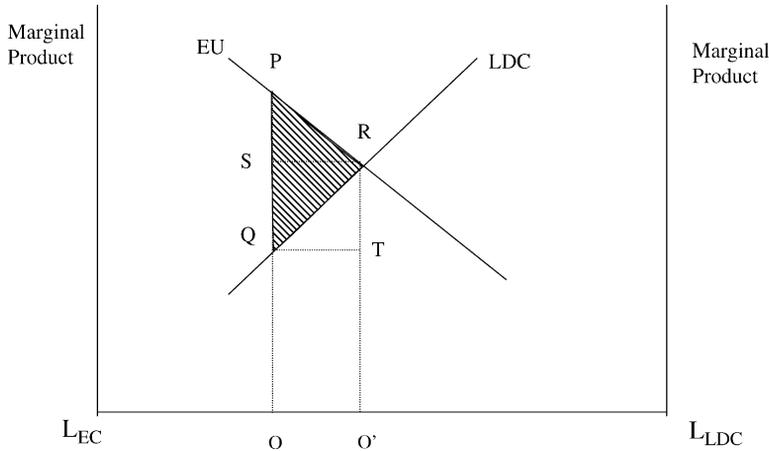Derived from Hamilton and Whalley (1984, p. 66).

Figure 1. *Conceptualizing the gains from free labor mobility.*

Following Bhagwati (1984), we might think of the immigration effects in H&W's model in terms of a world consisting of two regions: one rich (the EU), the other poor less-developed countries (LDCs). [6] The EU and LDC schedules in Figure 1 are the marginal-product schedules of the countries that will import (EU) and export (LDC) labor respectively, in the absence of immigration restrictions. Thus, $L_{EU}O$ is the EU's and $L_{LDC}O$ is the LDC's labor supply. With restrictions on migration in place, the wage is OP in the EU and OQ in the LDC. With restrictions removed, a uniform wage is reached at O'R and O'O labor migrates from the LDC to the EU.

Consequently, the total impact on output and the impacts on different groups can be found in the following:

   —PQR = total world gain,
   —PSR = gain by the original nationals and residents of the EU,
   —SQTR = gain by migrants,
   —SQR = gain of the LDC if the loss of those left behind is combined with migrant's gain. [7]

These calculations allow H&W to generate straightforward (albeit simple) estimates of the potential gains from free international migration. To do so, they relied on data from the World Bank Atlas (for the GNP per capita in US dollars and population figures), and labor share values derived from the UN. All of these data were aggregated into seven regions: the EEC, US, Japan, Other Developed Countries, OPEC, NICs, and LDCs. After calculating the efficiency gains from their unadjusted samples, H&W made three types of adjustments to their data-related assumptions: (i) they compensated for the fact that the national workforce is smaller than the population figure; (ii) they recognized that the differential efficiencies of labor vary across regions; and (iii) they replaced nominal exchange rate values with PPP rates.

In order to ensure that we have a firm basis for comparison, our first objective was to replicate H&W's original findings. Unfortunately, the authors' original discussions with respect to both data and method were rather vague and incomplete. Nevertheless, by using the same data and methods, when they were explicit, we managed—after several attempts at duplication—to replicate the original findings, with a margin of difference that ranged between 15% and 20 %. [8] An explicit comparison can be found in Appendix A. [9]

(b) *Update and diachronic comparisons*

Once we were confident that we could consistently replicate H&W's original approach, we moved to develop a database that would allow us to compare developments over time. We also aimed to build on subsequent research and conceptual development. While our methodological approach largely parallels H&W's

Table 2. *Summary features of regions*

	Low human development	Medium human development	High human development	Total
1977				
Number of countries	30	52	38	120
GDP PPP in trillion US$	0.23	2.24	5.29	7.76
Population in billions	0.43	2.38	0.80	3.60
GDP/Capita PPP in US$	536	943	6652	2158
1998				
Number of countries	30	52	38	120
GDP PPP in trillion US$	0.94	12.92	21.45	35.31
Population in billions	0.74	3.44	0.93	5.11
GDP/Capita PPP in US$	1,272	3,752	23,044	6,905

original study, we have made the following changes:

—We have used the Penn World Tables as our source for the population and GDP/capita indicators. Data are based on 120 countries in both 1977 and 1998 (there were 179 countries in the original study). For this reason, our (M&L) unadjusted calculations in the analysis below are the equivalent of H&W's PPP (exchange rate) adjustments (with the exception that their PPP adjustments are based on correction factors rather than true PPP figures).

—We have substituted H&W's idiosyncratic seven-region aggregation with the more common three-region classification used by the UNDP. Thus, the data are aggregated into countries that have High, Medium and Low levels of Human Development. [10] By using a higher level of aggregation we will generate lower estimates of efficiency gains. The summary features of these regions are provided in Table 2.

—We have updated the workforce adjustments to 0.45 (high), 0.34 (medium) and 0.34 (low) for 1977 and 0.48, 0.41, and 0.41 for 1998. These adjustments are based on figures from the ILO. [11] By contrast, H&W used a more crude adjustment, where the workforce was assumed to be 60% of the developed world's population, but just 40% in the rest of the world (H&W, 1984, p. 70).

—Recent work by Acemoglu & Zilibotti (2001) suggest that H&W's original efficiency adjustments (1:2 and 1:3) were too small. Based on this new research, we assume that efficiency differences between the most and least developed regions are about 1:5 (i.e., that labor in the least devel-

oped regions of the world is about 20% as efficient as labor in the developed regions). We then run a series of scenarios, allowing efficiency adjustments to vary across regions (i.e., 1:3 for the Medium Human Development region and 1:5 for the Low Human Development region: see Appendix C for further description). [12]

—Following Gollin (2002), we assume that the labor shares are constant across regions and time, and are set equal to the global mean income share for the entire sample, using Gollin's first and second adjustment methods. The first adjustment treats all the operating surplus of private unincorporated enterprises (OSPUE) as labor income—a method that obviously overstates the labor share of income. Specifically, the labor share is "(employee compensation + OSPUE)/(GDP − indirect taxes)," and the resulting global mean income share is 0.762 (based on UN *National Accounts Statistics* (1986, 1997 & 2000) data from 1977, 1992, and 1998). Gollin's second adjustment method yields more conservative efficiency gains than his first adjustment (15–30% lower). In particular, this method computes the labor share thus: "employee compensation/(GDP − indirect taxes − OSPUE)." Using this, second, adjustment approach we generate the global mean income share to be 0.687 (based on UN *National Accounts Statistics* (1986, 1997 & 2000) data from 1977, 1992, and 1998). Our analysis below relies on the second, more conservative, adjustment method.

—Rather than focusing on the largest potential gains, we narrow our discussion to the most reasonable parameters, as justified by

recent research. As the parameters of CES production functions are highly sensitive to very slight changes in the data, variable measurements, estimation methods, etc., we aim to be explicit about our parametric choices, and support them when necessary. We also aim to narrow the discussion to the most reasonable policy scenarios.

Table 3 provides an overview of the estimated global efficiency gains for the new calculations. Our general methodological procedure is the same as H&W's, as outlined in Table 1. Thus, Table 3 is the equivalent of Table 6 in H&W and it includes both unadjusted and adjusted estimates. [13] Like H&W, we hasten to note the sensitivity to the values of substitution elasticities in the table. Therefore, following Nadiri (1997, pp. 109–110), we will focus the discussion on findings that assume elasticities of substitution equal to 1.0 in all regions.

Generally, the efficiency gains are significantly smaller than they were in the H&W (seven-region) study. Nevertheless, the gains remain very substantial: in the unadjusted case, using elasticities of substitution of 1.0, the estimated efficiency gains are on the order of US$7.19 trillion (1977), or just less than the world's total GDP for that year! [14] Indeed, when we run the analysis with the full (i.e., disaggregated) dataset, the corresponding figure exceeds the 1977 world GDP, or US$8.73 trillion.

In the adjusted estimates, we find that the expected efficiency gains drop rather substantially, and that the adjustment factors compound one another in reducing global efficiency gains. Thus, the smallest estimate of global efficiency gains is one that compensates for population workforce and labor efficiency adjustments. Still, even here, at the smallest

elasticities of substitution, the model suggests that world efficiency gains could approach US$0.34 trillion in 1977. This remains almost 10 times more than Cline's (1979) "optimistic" account of the annual gains LDCs could expect ($40 billion/year) if the world adopted a series of generous policy changes (e.g., commodity price stabilization, cancellation or rescheduling of LDC debt, relaxation of trade protection in the North on LDC exports and increased aid flows). Though our three-region aggregation provides smaller gains than the original H&W analysis, the magnitude of these gains are still substantially more than can be produced by any reasonable policy alternative (or combination thereof).

Thus, the new data and aggregations produce lower estimates than the original H&W piece, but the overall trend remains the same and the magnitude of the estimated gains in 1977 were phenomenal. Our driving question, however, remains: have these gains changed significantly over the subsequent two decades?

Table 4 provides the first steps toward answering this question. This table is equivalent to Table 3, using 1998 data. Here, in the most reasonable (adjusted) scenario, the expected gains are almost US$3.4 trillion. (In the *unadjusted* scenario, with elasticities of 1.0, we find that the world can expect an efficiency gain from the removal of immigration controls at the order of US$34.08 trillion—a phenomenally large figure. [15]) To provide some context, the world's official funding for development totaled only US$65.5 *billion* in the year 2000 (OECD, 2001). The potential impact from the private sector is also miniscule in comparison, as total Foreign Direct Investment to the developing world in the year 2000 was only US$1.9 trillion! [16] When these figures were adjusted to

Table 3. *Estimates of annual worldwide efficiency gains from global removal of immigration controls (US$ trillion 1977)*

		Elasticities of substitution in production in all regions				
		1.5	1.25	1.0	0.75	0.5
No adjustments	All countries	11.27	10.16	8.73	6.90	4.58
	3 Regions	8.50	7.97	7.19	5.93	3.69
Adjustments	3 Regions					
PW		6.07	5.64	5.12	4.37	3.72
EU3 & EU5		1.51	1.40	1.25	1.04	0.75
PW + EU3 & EU5		0.73	0.66	0.58	0.47	0.34

Notations for adjustments: PW—population workforce adjustment; EU3 & EU5—labor efficiency units correction using factors of 1:3 and 1:5 for the medium and low human development regions respectively.

Table 4. *Estimates of annual worldwide efficiency gains from global removal of immigration controls (US$ trillion 1998)*

		Elasticities of substitution in production in all regions				
		1.5	1.25	1.0	0.75	0.5
No adjustments	All countries	55.04	48.72	40.63	30.09	17.36
	3 Regions	41.70	38.63	34.08	26.71	15.38
Adjustments	3 Regions					
PW		34.49	32.00	28.37	22.54	13.53
EU3 & EU5		6.58	5.99	5.24	4.25	3.01
PW + EU3 & EU5		4.33	3.91	3.39	2.75	1.97

Notations for adjustments: PW—population workforce adjustment; EU3 & EU5—labor efficiency units correction using factors of 1:3 and 1:5 for the medium and low human development regions respectively.

compensate for workforce and efficiency differences, the estimated gains remain substantial—the lowest estimate being US$1.97 trillion.

As world GDP in 1998 was substantially larger than in 1977, our diachronic comparison can be facilitated by a comparison of relative figures. Table 5 compares the unadjusted and adjusted results in terms of relative GDP. Here we see a substantial increase over time, especially in the adjusted cases. Indeed, in our middle scenario—where elasticities of substitution are set to one in all regions—we find that the relative gains increased from 7.5% to 9.6% of world GDP over the intervening 21 years.

(c) *Partial liberalization*

In this final section of the analytical discussion we examine the effects of a more reasonable scenario, where international labor markets are only partially liberalized. In particular, we examine the efficiency gains at different levels of migration; we consider the distributional consequences of these; and we provide some estimate of the number of migrants being generated by the various scenarios.

One of the most interesting results from the original H&W analysis was how the gains from free migration could be reaped with only small levels of immigration. Table 6 provides an overview of the results that might be expected from allowing for the partial removal of immigration controls in the adjusted three-region calculations, under the new efficiency scenarios. [17] Like H&W's original piece, we find that the gains are largest in the initial phases of migration. In particular, we find that with elasticities equal to 1.0 in each region, 10% elimination of

Table 5. *Comparison of annual worldwide efficiency gains from global removal of immigration controls—unadjusted and adjusted three-region calculations (US$ trillion 1977–98)*

	Elasticities of substitution in production in all regions				
	1.5	1.25	1.0	0.75	0.5
No adjustments					
1977	8.50	7.97	7.19	5.93	3.69
1998	41.70	38.63	34.08	26.71	15.38
% Gains relative to total real GDP					
1977	109.5	102.7	92.7	76.4	47.6
1998	118.1	109.4	96.5	75.6	43.6
Adjustments					
PW + EU3 & EU5					
1977	0.73	0.66	0.58	0.47	0.34
1998	4.33	3.91	3.39	2.75	1.97
% Gains relative to total real GDP					
1977	9.4	8.5	7.5	6.1	4.4
1998	12.3	11.1	9.6	7.8	5.6

Notations for adjustments: PW—population workforce adjustment; EU3 & EU5—labor efficiency units correction using factors of 1:3 and 1:5 for the medium and low human development regions respectively.

Table 6. *Estimates of annual worldwide efficiency gains from partial liberalization of migration restrictions—adjusted three-region calculations (US$ billion 1977)*

% Reduction in difference between region and global wage rates	Elasticities of substitution in production in all regions				
	1.5	1.25	1.0	0.75	0.5
1	20	17	14	10	7
2	40	34	27	20	14
4	79	66	53	40	27
6	118	98	79	59	39
8	155	130	104	78	52
10	192	160	128	96	64
	(26%)	(24%)	(22%)	(20%)	(19%)
20	356	299	242	182	121
40	577	501	415	319	216
60	683	609	519	410	283
80	723	653	567	458	322
100	732	663	579	471	335

Population workforce adjustment and labor efficiency units correction using factors of 1:3 and 1:5.

the wage differentials produces about 22% of the total potential gain. More significantly, even small increases in migration reap significant benefits: just a 1% increase in migration levels yields 2.4% of the total potential gain.

Table 7 reports the distributional impacts of liberalized migration, using the 10% scenario described above. In Panel A, not surprisingly, we see that the rich region gains workers, while workers flee from the medium and low human development regions. In the middle scenario, where the elasticities of substitution are set to one in all regions, workers in the poorest regions can expect an increase in wages (4.1%)—and yet the corresponding decline to wages in the richest regions is relatively small (−2.5%). Similarly, in Panel B, we find that capital owners in the High Human Development region are made better off, whereas capi-

tal owners in the poor regions can expect rather substantial declines in their return.

It should not be surprising to find that the new distributional gains, as depicted in Table 8, mirror those from the 1977 data—only they are larger. Both the wage gains (and drops) and the capital gains (and losses) have increased in both High and Low Human Development regions. In the scenario where the elasticities of substitution are assumed to be equal to one across all regions, those workers who remain in the poorest regions (after a 10% liberalization of migration restrictions) can expect their wages to increase by 11.4%. Capital owners in these regions, by contrast, have much to lose.

As was the case in the earlier analysis, the gains are reaped unevenly across migration levels. Table 9 presents the 1998 equivalent of

Table 7. *Distributional impacts of 10% removal of immigration controls—three-region adjusted case with population workforce adjustment and labor efficiency units correction using factors of 1:3 and 1:5 (percentage change 1977)*

	Elasticities of substitution in production in all regions				
	1.5	1.25	1.0	0.75	0.5
(A) % change in wage rates to non-migrating labor					
High human development	−2.4	−2.5	−2.5	−2.5	−2.6
Medium human development	3.5	3.4	3.3	3.2	3.2
Low human development	4.2	4.1	4.1	4.0	3.9
(B) % change in return to capital by region					
High human development	8.6	7.1	5.7	4.3	2.9
Medium human development	−10.4	−8.7	−6.9	−5.2	−3.5
Low human development	−12.3	−10.5	−8.3	−6.1	−4.4

Table 8. *Distributional impacts of 10% removal of migration restrictions—three-region adjusted case with population workforce adjustment and labor efficiency units correction using factors of 1:3 and 1:5 (percentage change 1998)*

	Elasticities of substitution in production in all regions				
	1.5	1.25	1.0	0.75	0.5
(A) % change in wage rates to non-migrating labor					
High human development	−3.0	−3.0	−3.1	−3.2	−3.2
Medium human development	2.3	2.2	2.1	2.0	1.9
Low human development	11.7	11.5	11.4	11.2	11.0
(B) % change in return to capital by region					
High human development	10.8	9.0	7.2	5.4	3.6
Medium human development	−7.0	−5.6	−4.4	−3.2	−2.0
Low human development	−28.5	−25.0	−21.0	−16.6	−11.7

Table 9. *Estimates of annual worldwide efficiency gains from partial liberalization of migration restrictions—adjusted three-region calculations (US$ billion 1998)*

% Reduction in difference between region and global wage rates	Elasticities of substitution in production in all regions				
	1.5	1.25	1.0	0.75	0.5
1	125	104	84	63	42
2	246	205	165	124	83
4	482	403	324	243	163
6	711	594	479	360	241
8	930	780	629	473	318
10	1143	958	774	584	393
	(26%)	(25%)	(23%)	(21%)	(20%)
20	2,083	1,761	1,430	1,090	739
40	3,385	2,927	2,423	1,877	1,299
60	4,030	3,571	3,025	2,392	1,692
80	4,277	3,845	3,314	2,667	1,924
100	4,331	3,909	3,391	2,748	1,996

Population workforce adjustment and labor efficiency units correction using factors of 1:3 and 1:5.

Table 6. As with the 1977 analysis, we find that the marginal efficiency gains are larger for initial units of migrating labor, since the marginal product differences are largest in the initial stages of development. In other words, a substantial proportion of the total gains can be generated by a relatively light relaxation of international migration controls.

This discussion raises important questions about the number of migrants that are associated with each scenario. In a related piece (Moses & Letnes, 2004), we develop and expand this model to estimate the actual number of migrants being generated in each scenario and contrast them with actual migration flows (in order to analyze their economic impact). The results of these comparisons suggest that our model tends to generate very large flows of migrants across international borders. Even

in the most reasonable (1%) scenario, the model generates 44 million migrants (or about 5% of the native population in the developed world).

In today's political context, it may be more appropriate to consider a counterfactual scenario that examines the costs of closing off international migration all together. After all, chances are that migration controls will be strengthened, rather than lifted, in the aftermath of September 11, 2001. To estimate these costs, we used data from the UN's Population Division to estimate the flow of migration that occurs between the regions in our model. [18] With these figures, we can estimate the gains associated with current levels of international migration. When the model is adjusted for population workforce and efficiency (1:3/1:5) concerns, we estimate that the annual world gain from existing levels of migration is about

US\$32 billion. This corresponds to the gain that would be accrued if migration controls were liberalized by less than 1% (cf. Table 9). Thus, restricting world immigration would incur an annual efficiency loss of about US\$32 billion. When using the UN's projections of future migration trends we estimate that the future cost of closed borders can be slightly less: about US\$25 billion annually over the next decade (2000–10).

Because of the model's sensitivity to wage differences, it is clear that this increase in efficiency gains is derived from the increased income (and hence wage) inequalities over the past 20 years. Although there are some important dissenters [19] a number of recent empirical studies have mapped an inverse relationship between globalization and global income inequalities over recent decades. [20] In this context, it is not surprising to find that as global income inequalities rise, so too do the potential efficiency gains from increased international migration. To the extent that the increased globalization of finance and goods/services trade has not managed to decrease income inequality across the globe, increased labor mobility may be the most effective means of shrinking this dangerous gap.

4. CONCLUSION

Since its 1984 publication, the questions raised by Hamilton and Whalley's article have become only more pertinent. One by one, governments have jettisoned international restrictions on goods and capital mobility in order to reap the anticipated efficiency gains. A sprawling literature has documented the economic impact of increased globalization of goods and other factors. Yet there has been remarkably little work done on estimating the efficiency gains from liberalizing the last refuge of domestic market regulation. While it is unlikely that states will be willing to completely liberalize their domestic labor markets, it is still important to understand the costs associated with closed border policies.

Our intent with this paper has been relatively simple: to update the Hamilton and Whalley analysis. Our motivations for doing so are two-fold. First, the world has changed significantly since 1977, and we are interested in finding out if these changes have affected the efficiency gains associated with free labor mobility. It appears that they have, and that this is an artifact of the growing global inequal-

ity that is often associated with globalization. Second, the policy relevance of this piece has become more important in a world characterized by increased globalization on other fronts. By revisiting this important issue in the context of a larger globalization debate, we hope to provide a measure of gain that can be compared to the efficiency gains generated by international mobility on other fronts (e.g., capital market liberalization).

As we expect our findings to provoke discussion, we wish to conclude with a number of caveats. This study is the first step in a longer journey where we hope to provide more dependable indicators of the sort of gains that the world economy can expect to reap by relaxing immigration controls. We are fully aware of the shortcomings of our current approach, but we believe that it is important to begin where the existing literature left off. In the future, we hope to develop a more realistic applied general equilibrium model, and to buttress the counterfactual analysis with statistical studies of efficiency gains associated with existing migration flows.

As a first step down this path, we have largely replicated Hamilton and Whalley's original approach. This analysis was littered with empirical, conceptual and methodological shortcomings, most of which the authors themselves were fully aware. To our mind, future analyses need to consider revisions of some of the more problematic components (some of which are noted by the authors themselves), including:

—*Full employment.* The assumption of full employment is necessary in order to assume that wage rates are determined by the marginal productivities of labor. But in less developed countries there is generally large, open and disguised unemployment. A perfectly elastic (Malthusian) labor supply function for the LDCs may be more realistic. Under these conditions, however, the loosening of developed country immigration restrictions would lower wage rates in all countries, as the worldwide labor supply would expand!

—*Constant wage/rental ratio within and across regions.* Because of a lack of data for the return on capital (presumably), H&W assume that the ratio of wages to profits (w/r) is equal to unity in both rich and poor states before free migration. This implies that a high real wage rate is associated with a high profit rate, and vice versa.

But the CES production function employed implies an inverse relationship: (i.e., a relatively high real wage rate in the developed world should be associated with a relatively lower profit rate). In the future we hope to allow for different ratios across regions.

—It is highly unrealistic to assume that capital will be fixed by region when labor restrictions have been abolished. Future models need to *incorporate both capital and labor mobility*. The work by Hatton & Williamson (1998), on 19th century cross-Atlantic labor flows, confirms this.

—It may be that a larger portion of the difference in wages across regions reflects *productivity differences*. If so, removing immigration controls in developed countries would have no impact on labor mobility. As H&W note, however, this too is an extreme position (H&W, 1984, p. 63). Some common ground must be found between these extremes.

—To the extent that the model *abstracts from commodity trade and capital flows*, the efficiency gains that it produces may be exaggerated.

—The *model should be expanded* to consider the effects of migration by legal status (illegal/legal) and skill level; to consider intertemporal tradeoffs; etc.

Even though we recognize the inherent (and contentious) limits to the approach, we are moved by the magnitude of the annual efficiency gains estimated by it. Even the smallest (most cautious) estimations exceed the combined current levels of development assistance and foreign direct investment to the developing world. The unadjusted estimates even approach the worldwide GDP figures. Notwithstanding concerns for the brain drain, these speculative findings suggest that the developing world needs to consider more carefully the potential economic gains that might be harvested from advocating free migration as an important means to economic development.

Of course, all of these gains do not accrue to the poorest countries; but the very size of the gains suggests that international migration may be one of the most effective means of shrinking the income gap that separates rich and poor countries. For this reason alone, more research needs to be done on examining the potential gains from freer migration—even in the current political context, where the tendency is rather to increase barriers to international migration. If our rough analysis is to be trusted, this tendency could significantly worsen the income divide between rich and poor worlds.

NOTES

1. We are aware of only three other recent attempts to measure the potential gains from free international migration. Lundborg & Segerstrom (2002) offer a radically different approach to the problem by analyzing the effects of immigration quotas on growth and welfare in a North–South version of the quality ladders growth model. They find that higher immigration quotas lower the discounted welfare of Northern worker and capital owners. This contradicts our findings (below) and those of another recent study by Ana María Iregui. Iregui (2002) produces aggregate estimates that are remarkably similar to our own, but her model introduces a segmented labor market (skilled/unskilled) to show that worldwide efficiency gains are smaller when only skilled labor migrates. The third attempt was presented to a joint WTO-World Bank symposium on Model 4 trade: Winters (2002) shows how a very small increase in the developed world's immigration of both skilled and unskilled workers (equivalent to 3% of their workforces) could generate an increase in world welfare of over US$150 billion per annum.

2. For more historical accounts of migration, see McNeill & Adams (1978), Potts (1990), Castles & Miller (1993), Weiner (1995), and Stalker (2000).

3. Some of the most prominent examples include Simon (1989/1999), Borjas (1999), US Department of Labor (1989), and Böhning (1984).

4. Turner, Giorno, de Serres, Vourc'h, & Richardson (1998). For the UN's perspective, see UN Population Division (2000).

5. It is not necessary to use the CES production function. Indeed, it may be theoretically preferable to use Cobb-Douglass or Leontief production functions. But we have kept the CES production to facilitate comparisons with H&W (who employed it originally), and because it includes the other two functions as special cases.

6. This is somewhat problematic, as the diagram assumes linear marginal product schedules, whereas the method used generates schedules directly from an aggregate production function in each region. Still, the diagram has some illustrative value.

7. H&W assume that this (SQR) is the correct measure of the change in income for a region where labor emigrates. Bhagwati (1984, pp. 692–693) questions this, suggesting that it is problematic to think of migrants in a free world context in terms of contributing to the social welfare in the country of emigration.

8. We believe that there are three potential sources for the difference: labor share data, calculations for generating K, and the issue of which variables should be controlled for under different stages of the iteration procedure. We have not received a response from the original authors that could help us clarify the nature of these differences. Nevertheless, the differences are stable across models, and we are confident that our procedure is fairly similar to that used by H&W in the original piece.

9. We might also note that our findings were largely confirmed by an independent attempt at duplication conducted by Geoffrey Reed at the University of Nottingham.

10. For practical reasons, we have imposed the 2000 categories (High, Medium, Low), backward in time onto both the 1998 and 1977 data. A list of countries and their HD characterization is provided in Appendix B.

11. Regional population-weighted averages have been calculated based on 1977 and 1998 figures on "Economically Active Population" from ILO's *Yearbook of Labour Statistics* (1979 and 1998). The Medium and Low Human Development regions were treated as one due to the scarcity of country statistics in the latter group.

12. As pointed out by an anonymous reviewer, this is a less-than-optimal means for taking into account varying productivity levels. While it may take five workers in the developing world to produce as much as one worker in the developed world, this does not mean that the immigrant worker will be five times less efficient. Our approach, following H&W, takes a shortcut by simply reducing the population of the Medium Human Development and Low Human Development regions by a ratio (0.333 and 0.2, respectively). This has the effect of reducing the number of people who will migrate and the resulting efficiency gains.

13. H&W (1984, p. 72). Appendix C provides a brief overview of the approach to generating these figures.

14. In the new dataset, the total real GDP figure in 1977 was US$7.76 trillion.

15. When the analysis is run with all countries (rather than with a three-region aggregation), the corresponding gain climbs to US$40.63 trillion.

16. Letnes (2002, p. 47). The FDI figure of US$1.9 trillion is equivalent to about 30% liberalization of migration restrictions (with elasticity of substitution equal to 1 in each region, adjusted for population workforce and an efficiency correction of 1:3 and 1:5 for the Medium and Low Human Development regions respectively).

17. Appendix C provides a brief overview of the approach to generating these figures.

18. UN Population Division (2001, p. 139). Three caveats are in order. First, the UN's aggregation is slightly different than our own. Second, our dataset contain only 120 countries, while the UN includes all countries of the world. On both counts, the differences are not large and should not affect the outcome of our estimations. Finally, these figures are somewhat misleading in that they include large flows among countries within each group. A more detailed description of this, or any other, aspect of the analysis can be obtained by contacting the authors.

19. E.g., Sala-i-Martin (2002) and Melchior, Telle, & Wiig (2000).

20. E.g., UNDP (1999), UNCTAD (1997), Korzeniewicz & Moran (1997), and Radetzki & Jonsson (2000).

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APPENDIX A. MODEL COMPARISONS[a]

Comparative estimates ot annual worldwide efficiency gains from global removal of immigration controls ($ billion 1977). Percent differences in parentheses

	Elasticities of substitution in production in all regions				
	1.5	1.25	1.0	0.75	0.5
No adjustments (H&W)	15,410	13,820	11,520	8,580	5,520
No adjustments (M&L)	17,922	16,405	14,001	10,375	6,473
	(16)	(19)	(22)	(21)	(17)
PW adjustment (H&W)	11,040	9,930	8,360	6,360	4,300
PW adjustment (M&L)	12,868	11,813	10,158	7,689	5,020
	(17)	(19)	(22)	(21)	(17)
XR adjustment (H&W)	12,110	11,080	9,800	8,090	5,460
XR adjustment (M&L)	14,005	12,896	11,434	9,469	6,516
	(16)	(16)	(17)	(17)	(19)
EU3 adjustment (H&W)	5,090	4,560	3,820	2,930	2,040
EU3 adjustment (M&L)	6,031	5,503	4,735	3,639	2,449
	(18)	(21)	(24)	(24)	(20)
EU2 adjustment (H&W)	8,830	7,940	6,700	5,140	3,559
EU2 adjustment (M&L)	10325	9456	8165	6229	4,148
	(17)	(19)	(22)	(21)	(17)

Notations: PW: Population Workforce adjustments, XR: Exchange Rate adjustments (PPP), EU3: Labor efficiency units correction using factors of 1:3, EU2: Labor efficiency units correction using factors of 1:2.
Source: H&W (1984, p. 72: Table 6) and authors' calculations.
[a]1977 model comparisons with seven-region calculations. M&L estimates were generated using a world population set at 4.15 billion.

APPENDIX B. CLASSIFICATION OF COUNTRIES INTO REGIONS ACCORDING TO UNDP CATEGORIES

Region 1: High human development	Antigua and Baruda Argentina Australia Austria Barbados Belgium Canada Chile Costa Rica Cyprus Denmark Finland France	Greece Honk Kong Hungary Iceland Ireland Israel Italy Japan Korea, Rep. of Luxemburg Netherlands New Zealand Norway	Poland Portugal Seychelles Singapore Spain St. Kitts and Nevis Sweden Switzerland Trinidad and Tobago United Kingdom United States Uruguay
Region 2: Medium human development	Algeria Bolivia Botswana Brazil Cameroon Cape Verde China Colombia Comoros Congo Dominica Dominican Republic Ecuador Egypt El Salvador Equatorial Guinea Fiji Gabon	Ghana Grenada Guatemala Guyana Honduras India Indonesia Iran Jamaica Jordan Kenya Lesotho Malaysia Mauritius Mexico Morocco Namibia	Nicaragua Panama Papua New Guinea Paraguay Peru Philippines Romania Sao Tome and Principe South Africa Sri Lanka St. Vincent and Grenadines Syrian Arab Rep. Thailand Tunisia Turkey Venezuela Zimbabwe
Region 3: Low human development	Angola Bangladesh Benin Burkina Faso Burundi Central African Rep. Chad Congo, De. Rep. Of Ethiopia Gambia	Guinea Guinea-Bissau Haiti Ivory Coast Madagascar Malawi Mali Mauritania Mozambique Nepal	Niger Nigeria Pakistan Rwanda Senegal Sierra Leone Tanzania Togo Uganda Zambia

Source: UNDP's (2002) which is based on 1999–2000 data.

Tables 3 and 6:
Unadjusted
Calculations

From Table 1 we have a CES function where $Y_i = \gamma_i[\delta_i K_i^{-\rho_i} + (1-\delta_i)L_i^{-\rho_i}]^{1/-\rho_i}$, and where:

- L is the Labor Input, which in the unadjusted scenario is equal to the population;
- K is the Capital Input (which is constant). Given the assumption that the wage rate, w, is equal to the capital rental, r, $K \equiv ((1 - \text{Labor Share}) * Y)/w$. The latter is derived from $Y = wL + rK \Rightarrow 1 = wL/Y + rK/Y = \text{Labor Share} + \text{Capital Share}$. The wage rate, $w = (\text{Labor Share} * Y)/L$;
- ρ, is dependent upon the elasticity of substitution, which is assumed to range from 0.5 to 1.5 (the elasticity of substitution, $\sigma = 1/(1 + \rho)$); and

- $\delta_i = \left(\dfrac{K_i^{1/\sigma_i}}{L_i^{1/\sigma_i}}\right) \bigg/ 1 + \left(\dfrac{K_i^{1/\sigma_i}}{L_i^{1/\sigma_i}}\right) = (K/L)^{1+\rho}/(1 + (K/L)^{1+\rho})$.

The GDP value for the region, K_i, L_i, ρ_i, and δ_i are then used to solve for γ_i based on the CES function given above. An iterative procedure is then used to calculate the change in labor allocation after a modification of immigration controls consistent with: (a) equalized MPL in all regions; and (b) full employment of the fixed labor supply. In practice this gives the following set of equations (see Table 1 for assumptions made):

- $\text{MPL}_1 = (1-\delta_1)\gamma_1^{-\rho}Y^{1+\rho}L_1^{-\rho-1}$

- $\text{MPL}_2 = (1-\delta_2)\gamma_2^{-\rho}Y^{1+\rho}L_2^{-\rho-1} = \text{MPL}_1$

- $\text{MPL}_3 = (1-\delta_3)\gamma_3^{-\rho}Y^{1+\rho}L_3^{-\rho-3} = \text{MPL}_1$

- $L = L_1 + L_2 + L_3$

Here, ρ_i, δ_i, and γ_i are held constant, while L and Y is allowed to change. The latter two variables are given by the following expressions:

- $Y_i = \gamma_i[\delta_i K_i^{-\rho_i} + (1-\delta_i)L_i^{-\rho_i}]^{1/-\rho_i}$; and

- $L_i = (\text{MPL}_i/((1-\delta_i)\gamma_i^{-\rho}Y_i^{1+\rho))1/(-\rho-1)}$.

By substituting the expression for Y into the MPL and L equations (and by equalizing the MPL across regions) we have now reduced the number of unknowns to MPL, L_1, L_2, and L_3. Using an iterative procedure, we can now guess a value for the equalized MPL: one that gives us the regional Labor Inputs, L_1, L_2, and L_3. This procedure is repeated until the total labor input (which in the unadjusted calculations means the total population), $L = L_1 + L_2 + L_3$.

APPENDIX C—*continued*

Tables 3 and 6: Adjusted Calculations	We aimed to make the unadjusted calculations (described above) more realistic by making a number of adjustments:

- A population workforce adjustment, PW, is obtained by substituting population as a proxy for Labor Input with data on Economically Active Population from ILO's *Yearbook of Labour Statistics*. I.e., the population data are multiplied by a ratio.
- Two separate efficiency adjustments, EU3 and EU5, are obtained (to allow for differential efficiencies of labor across regions) by dividing the original Labor Input (the population) with a factor of 3 and 5, respectively. As described in the text, these adjustments are derived from Acemoglu and Zilibotti (2001). This adjustment is done only for the Medium and Low Human Development regions; as a consequence it will increase the regional wage rate/MPL for these two regions. Lower world efficiency gains will follow as regional wage differences are reduced (with a factor of 3 and 5 respectively).

Note that the ''All Countries'' scenario only implies that the calculations have been performed for all the individual countries and not the regional aggregates.

Tables 4 and 7: Partial removal of controls	To generate the estimated effects of a partial removal of immigration controls, we allow only a part of the difference between each region's wage rate and a global mean wage rate to be eliminated. That is, all the regions have the same percentage difference between their own wage rate and the global mean removed, and a new labor allocation is sought, consistent with both the specified partial liberalization and full employment of the fixed labor supply. In the iteration procedure, therefore, the global mean MPL is guessed, while the regional MPLs are given by the following expression:

$$MPL_i = MPL_{OLD} - (MPL_{OLD} - MPL_{GLOBAL\ MEAN}) * \text{Ratio of Liberalization}.$$

The rest of the iterative procedure follows the procedure outlined under the unadjusted calculations above.

Source: Population and PPP data are from *Penn World Tables* version 6.0, while data on workforce is from ILO's *Yearbook of Labour Statistics* (various issues).