

# Migration, Skill Composition and Growth \*

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## Abstract

The UK, with its relatively liberal immigration policies following recent enlargements, has been one of the main recipients of migrants from new EU member states. This paper poses the questions: what is the effect of immigration on a receiving economy such as the UK? Is the effect beneficial or adverse for growth? How differently would skilled (or unskilled) migration affect both receiving and sending economies? What factors would contribute to immigration/emigration benefits/costs and economic growth driven by migration? Who are the winners and losers in both the sending and host regions? We utilize an endogenous growth two-bloc model with labour mobility of different skill compositions to address these questions. We show that migration, in general, is beneficial to the receiving country and increases the world growth rate. With remittances, the sending country in aggregate can also benefit. The only exception is in the case of unskilled migration, which can actually have a detrimental impact on the world growth rate. Winners are migrants, and the skill group in the region that sees its relative size decrease.

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**Keywords:** Migration, Labour mobility, Skill composition, Economic growth

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# 1 Introduction

Labour mobility is one of the most important and controversial issues in contemporary economic and political debates. In the lead-up to the recent general election in the UK, it appears that migration has been perceived as a burden for the indigenous population, resulting in less liberal migration policies proposed by all the major political parties. It is clear that the post-enlargement migration in the European Union, as well as migration from outside the EU15, has raised the UK population since the beginning of the 1990s. Since the onset of the economic crises, immigration has declined, but still over 14% of the working age in the UK were born abroad.<sup>1</sup> The UK economy, with its relatively liberal immigration policies following the two most recent enlargements, has been one of the main recipients from the new EU countries. Does this make the UK economy stronger or weaker? What are the economic benefits/costs associated with migration? The answers to these questions clearly have major implications not only for the UK, but also for the migrants' countries of origin. The overall balance is likely to have an impact first on the natives' attitude towards migration, and second on future immigration policies at home and in the sending economies.

In general, it is argued that inflows of migrants can have an impact on the host country's labour market as well as on the welfare and pension systems, effects that can be either beneficial or negative. However, the fiscal burden of migration, the impact on unemployment and arguments related to migrants' labour mobility, whilst important, are not covered here. Our focus in this paper is on the dynamic *long-run growth* implications of migration for both the UK and the EU. We examine migration of different compositions and identify both aggregate effects and the beneficiaries and losers.<sup>2</sup>

We then must start with the following question: who is the typical immigrant to the UK and the EU from within and from countries outside the EU? Immigrants' skill composition plays a fundamental role in our analysis and for this reason migration trends by skill group are examined in some detail in section 2. The rest of the paper is then organized as follows. Section 3 presents our theoretical framework in which we describe

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<sup>1</sup>See Wadsworth (2010).

<sup>2</sup>See Barrell *et al.* (2007) for an earlier analysis of the impact of EU enlargement on various macroeconomic variables in, both, sending and receiving countries

an endogenous growth two-bloc model with labour mobility of different skill compositions. Section 4 then reports simulation results based on this model. Section 5 reviews related empirical evidence of the economic impact of migration and its skill composition. Finally we conclude and discuss some policy implications in section 6.

## 2 Migration Trends

The purpose of this section is to assess both the aggregate flows and the skill composition of migration into the UK and the EU from the early 1990's.

### 2.1 Total and Net Migration for the UK

Our figures are obtained from the Office for National Statistics for all International Migration estimates, which are mainly based on the International Passenger Survey. Although these are the official estimates for the UK, it only considers long-term migration (these intending to stay/leave for more than one year on arrival departure) so will miss many A8 migrants.<sup>3</sup>

The number of immigrants in the UK has doubled up between 1992 and 2009. Figure 1 shows that over 500,000 migrants are estimated to have arrived each year since 2004. This compares with a figure of less than 300,000 in 1992, gradually increasing for a decade since then. The figure jumped up to 586,000 in 2004, (the year of major EU enlargement) and reached the highest figure on record, 596,000 in 2006, followed by the second highest figure, 590,000 in 2008, of which 86% were non-British citizens.

The estimated number of people leaving the UK was just less than 300,000 in the early 1990s, similar to the number of immigrants. This trend was maintained until 1997 and since then, the number of emigrants has increased by over 100,000 to 400,000 in 2006 and to 427,000, the highest figure on record, in 2008. This is compared with 340,000 in 2007. The rise in 2008, the year the UK was hit by the worldwide financial crisis, was a result of a large (about 50%) increase in emigration of non-British citizens, especially returning A8 migrants.

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<sup>3</sup>See Drinkwater and Clark (2008) for more details and issues arising from the inadequacy of migration data.

Net migration, measured by the difference between these inflows and outflows, was around 50,000 until 1997 and increased to 244,000, the record highest in 2004 and slightly decreased in 2005 and 2006, picking up again to 237,000 in 2007. The figure then decreased to 163,000 in 2008. Despite this increase in net immigration it should be pointed out that the share of immigration stock in total population (10.7% in 2007) is lower in the UK than other OECD countries such as Canada (20.1%), Sweden (13.4%), and Germany (13%).<sup>4</sup>

## 2.2 Skill Composition of All Immigrants in the UK

Immigrants in the UK have, on average, longer educational attainment than UK-born workers and more recent immigrants appear to be more educated than existing immigrants.<sup>5</sup> Figure 2 shows that as total immigrants rise, the number of immigrants with every usual occupation *prior to migration* has increased since 1991. From this figure, the biggest occupational category of immigrants to the UK have been the professional and managerial group. By contrast, the absolute number of immigrants with “other adults”, consisting of adult dependents and adults with no job prior to migration, has been fairly steady.

Turning to occupational shares in Figure 3, the proportion of other adults to total migration inflow has gradually decreased over time from over 20% in 1992 to below 10% in 2004. The share of immigrants with professional and managerial occupation has been around or over 30% of total immigrants for all years since 1991. The share of immigrants with manual and clerical occupation has gradually increased from under 20% in 1991 to above 25% in 2005 with the help of a speedy increase in its absolute number since year 1997, 50,000 in 1997 to 150,000 in 2005. This flow recently started decreasing to 126,000 in 2008. Similar to manual occupations but more dramatically, the number and the share of immigrants, who were students prior to immigrating to the UK (and would possibly become students again, employed or unemployed), both have increased from 50,000 (17%) in 1992 to 175,000 (30%) in 2006. Such a trend of skill biased immigrants to the UK is comparable with that of unskilled biased migrants to the US.<sup>6</sup>

However, looking at the *post-migration* occupational distribution of immigrants com-

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<sup>4</sup>See OECD (2009).

<sup>5</sup>See Wadsworth (2010)

<sup>6</sup>See Dustmann *et al.* (2005)

pared to UK-born labour force, one can find a pattern which is somewhat different from their occupational distribution prior to migration.<sup>7</sup> As discussed in Wadsworth (2010), despite the high qualification of immigrants respect to average UK-born workers, they mainly tend to work in less skilled jobs than might be expected given their previous job experiences and qualifications. The important implication of this observation is that only looking at immigrants' post-migration occupations may well be underestimating their skill composition. This is particularly the case of A8 migrants.

In fact, from table 3 in Wadsworth (2010) that looks at the *post-migration* occupational distribution of immigrants compared to UK-born labour force, one can find a pattern which is somewhat different from their occupational distribution prior to migration. It appears that the largest proportion of immigrants were working in professional occupations (16.5% of all immigrants). This is greater than the share of UK-born workers in the same occupational group (13.1%) and marginally greater than a share of UK natives in managerial occupations (16.4%). At the same time, almost 16% of all immigrants worked in elementary occupations in 2009, which has sharply increased for new immigrants (28.4%) and was much higher than the share of UK-born labour force serving in this occupational group (about 10%). This indicates that there seems to be *co-existence* of both skilled and unskilled bias of immigrants to the UK. It is in some sense not surprising to see that *post-migration* occupational distribution of immigrants has changed following the enlargements. Skill composition before was strongly affected by the point system so it is not surprising to have a high proportion of high skilled immigrants before enlargements and from countries outside the European Union.

### 2.3 Total and Net Migration in the EU

Figure 4 presents long-term trends of net migration of old EU15 members and new EU12 members. There was no significant change in net migration for both old and new EU member countries until mid 1980s. Since then, the size of net migration for western EU15 countries has dramatically gone up from virtually zero in 1980-1984 to 2 million people in 2003, followed by a fall to about 1.6 million in 2005. In contrast, there was no noticeable change in the figure for new EU members.

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<sup>7</sup>Figures 2 and 3 use pre-migration occupations.

Looking at the share of foreign citizens in total population for individual EU15 countries in Figure 5, every old member country with an exception, Sweden, (from 5.5% to 5.3%) has experienced a rise in international migration stock in recent years 2000-2006. Most dramatic increases are observed from Spain, Ireland, Italy, Luxembourg, and the UK. Zaičeva and Zimmermann (2008) show that most people who “intend to move abroad” in old EU15 countries were more likely to have relatively non-professional occupations. However, the share of potential emigrants with these occupations have clearly declined since 2002, and people with other professional, self-employed, general management occupations have become more willing to move abroad.

## 2.4 Summary and Issues

The main trend observed here is that both immigration and net migration to the UK has risen since 1993 and the net migration recently started to fall from 2007. Immigrants to the UK are, on average, more educated than UK-born workers.<sup>8</sup> Immigrants to the UK with professional and managerial occupations prior to migration tend to take the largest share of total immigrants. At the same time, the share of immigrants with manual and clerical occupations has gradually increased, at least partly due to an increasing inflow of migrants employed in non-professional jobs from the new EU accession countries. This means that the high proportion of skilled immigrants has been maintained by high inflows of relatively more professional workers from elsewhere such as other old EU members and non-EU overseas countries. Like the UK, most of old EU member countries have experienced a rise in international migration stock in recent years. People who intend to move abroad from both the old EU15 and new EU10 countries were more likely to have relatively non-professional but nevertheless skilled occupations.

Finally the post-migration distribution of immigrants’ occupations is less skilled than for pre-migration occupations with which overall there does not appear to be an unskill bias for migration into the UK or the old EU15. This suggests that migrants tend to take less skilled occupations than expected given their pre-migration occupations and qualification and that looking at the post-migration occupation may give a misleading estimate for skill composition.

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<sup>8</sup>See Wadsworth (2010)

### 3 Empirical Evidence

A vast number of studies have investigated the economic impacts of international migration and a large proportion of this literature has focused on the effects of migration on economic growth. The literature has extensively been reviewed in Borjas (1999), Card (2005), Drinkwater *et al.* (2003) and Hanson (2008). Among these studies, Barro and Sala-i-Martin (1992) and Barro and Sala-i-Martin (1995) investigate the effect of migration on economic growth and income convergence based on neo-classical models in which net-migration would foster economic growth through faster convergence to a steady state level of income per capita. They find that regional net-migration has positive effects on growth in OLS regressions for the US and Japan (no statistically significant growth effect is found for European countries) and the inclusion of the migration variable slightly increases the estimate of beta-convergence. More relevant empirical studies have used the similar convergence regression model but found no consensus on the effect of migration on growth and convergence.<sup>9</sup>

Turning to the empirical evidence of the relationship between migration, skill composition of migrants, and economic growth, Winters (2001) suggests that if workers migrating from a developing country to a developed country face a quarter of the wage gap between the two economies, the liberalisation of the immigration quotas with a 5% increase in populations of developed countries would bring about a global welfare gain of about \$300bn at 1997 prices. Similarly, Walmsley and Winters (2005) argue that developed countries' lifting of immigration restrictions to both unskilled and skilled workers from developing countries by 3% of the developed countries' labour force would yield a global welfare gain of \$150bn at 1997 prices. A much higher (more than four times greater) welfare gain from the same liberalisation is estimated by World Bank (2006) using various estimated models, concurring with our results below.

Rodrick (2004) estimates a positive gain of emigration for sending countries, among various estimation results, such that liberalised labour mobility with a 3% increase in developed countries labour forces which are supplied by temporary immigrants from developing countries for 3 to 5 years would stimulate the latter's annual welfare by \$200bn.

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<sup>9</sup>See Perssons (1997), Toya *et al.* (2004), Maza (2006), Kyrdar and Saracoulu (2008) and Buch and Toubal (2009).

World Bank (2006) reports that a lifting of immigration quotas by 3% of labour force in developed countries would deliver welfare gains to natives in both developing and developed countries and new migrants in the latter, but this change would cause welfare loss for old migrants in the latter. Walmsley *et al.* (2009), using a model of bilateral migration flows, find that liberalisation of quotas on both unskilled and skilled workers from developing economies by 3% of labour force in high-income countries would yield increases in the real GDP of the developed economies which use the increased labour supply in production, while in the spirit of our exercise in the previous section, gains of the developing countries seem to depend on the magnitudes of remittances sent home and thus differ across the labour exporting developing economies.

Walmsley *et al.* (2009) also suggest that although the labour importing developed countries would experience gains per migrant from both unskilled and skilled migration, the gains from skilled migration is greater than that from unskilled migration. Again this concurs with our results (see sections 4.2 and 4.3). Such increases in labour supply induced by the lifting of the immigration quotas are found to reduce the wages of both unskilled and skilled workers in the labour-importing developed economies by approximately 1.5%. However, there is little econometric evidence that immigration to the UK has reduced wages and employment for UK born workers in the UK (see Manacorda *et al.* (2007)). All natives in both country groups would experience gains in terms of real GDP because the increased migration brings about increased returns to capital and increased tax revenues to the labour importing developed countries, while it raises wages and remittances from abroad in the labour-exporting developing countries.

In the recent literature, it is found that since higher returns to education are expected from skilled workers than unskilled workers, an increase in the skilled migration prospects would foster human capital formation even from the sending countries' perspective. In Beine *et al.* (2001) and Beine *et al.* (2008), for instance, it is found that when an economy is open to migration, such increased migration opportunities particularly in economies with low skilled emigration rates stimulate investment in education due to higher expected returns to education and thus increase human capital stock. They also find that this beneficial brain effect of migration dominates the drain effect owing to the emigration of some workers. In contrast, Marchiori *et al.* (2009) show that for countries with high

skilled emigration rates, the brain drain effect dominates the brain gain effect as reduced skilled workers would hamper innovation activities or technology adaptation in the sending country on top of the reduced capacity in domestic production.

## 4 A Theory of Growth, Migration and Skills

We firstly need to model the process by which innovation and other economic processes affect longer term rates of growth. This has been the subject of a burgeoning theoretical and empirical literature in recent years. In contrast with the earlier neoclassical theory as developed by Solow, which invoked exogenous technical change to explain sustained growth, the focus of this new *endogenous* growth theory is on how the consumption and savings decisions of households, the investment decisions of firms and public policy determine growth. Positive externalities from R&D expenditure and investment in physical or human capital figure prominently in this theory and indeed can provide the engine for sustained growth, providing a potential role for government to raise growth by providing subsidies to private investment, R&D, training and education.

The endogenous growth literature can usefully be divided into two broad strands. The first is closest to the Solow tradition and emphasizes capital accumulation as the engine of growth, with capital broadly defined to include human and physical components. In the Solow model growth cannot be sustained in the long-run without the presence of exogenous technical change because capital accumulation is accompanied by a fall in the marginal product of capital. Income from investment and therefore savings also fall to a point where the latter only replaces worn-out equipment and plant. The economy then only grows in the long run if there is labour or capital augmenting technical change.

Various mechanisms have been suggested by which the tendency of the marginal product to fall can be offset, allowing investment to generate sustained growth. The introduction of human capital accumulation or capital externalities can in principle prevent the marginal product of physical capital diminishing as the latter accumulates and long-run growth emerges driven ultimately by the determinants of investment. The complete story is not as straightforward as all this sounds: the contribution of the human and physical capital externality must be sufficient to prevent growth petering out, but at the same time these effects must not be excessive otherwise a balanced growth path is not achieved.

Rather restrictive theoretical conditions are needed to ensure that this is so, which may not hold true in the real world.

The model to be developed here draws upon a second broad strand of the literature in which the discovery of new goods and processes provides the engine of growth. R&D activity provides blueprints for these innovations and in turn require as inputs what Grossman and Helpman (1991) refer to as knowledge capital, by which they mean a body of scientific knowledge and techniques not specific to any one production process. Knowledge capital has two important characteristics that drive growth. First, it is a public good: it is non-rival (ie one firms consumption of knowledge does not reduce the amount available to others) and it is non-excludable. Second, corresponding to the idea of learning by doing in Arrow (1962), knowledge capital increases with the cumulative R&D experience and therefore with the total stock of new goods in the economy. These two assumptions regarding knowledge capital can be used to explain the idea of a capital externality in the previous strand of growth theories. For the R&D strand of growth theory one question remains: what drives R&D investment? Schumpeter (1942) argued that it is driven by the expected profitability of the new product reflecting conditions in the relevant factor and product markets that determines the amount invested in R&D and with it the pace and direction of industrial innovation. Monopoly profits from the sale of new goods play a central role, another Schumpeterian idea, and this departure from perfect competition is a further feature that distinguishes the R&D led view of economic growth. Translated into formal theory an investment in a new blueprint will be undertaken if the expected net present value from the future stream of monopoly profits (taking into account the possibility of losing the monopoly position through an erosion of patent rights) equals the initial outlay on R&D. The resulting growth of the aggregate economy will depend on the interaction between firms producing distinctive goods and earning monopoly profits, the same or different firms engaging in R&D activity to invent new blueprints and consumers making savings and consumption decisions and supplying labour.

Globalisation of economies adds a further dimension to the theory of growth. Trade, borrowing and lending in world financial markets and the international mobility of factors of production can all contribute to growth on a world scale. Knowledge capital now becomes a public good on an international scale. Every country can benefit from the

emergence of new scientific knowledge and techniques in any single country. Countries that are best equipped to both absorb these spillovers as well as generate new ideas themselves will outperform others.

It is necessary at this stage to distinguish between two products of R&D. The first we have discussed and is described as knowledge capital. To recap, this is not specific to any particular new product but is a public good consisting of a stock of general scientific and technical ideas which will prove useful to the next generation of innovators. The second product is a private good protected, albeit imperfectly, by patent laws and consists of a blueprint for a new good or industrial process. Firms will undertake R&D if the expected value of future monopoly profits exceeds the initial fixed costs.

By introducing migration into the picture, *asymmetries* between sending and host regions now become a central feature. Following Parente and Prescott (2000) we assume that both East and West have access to the same common technologies, but the ability of firms to avail themselves of the best technology differ in the two blocs, leading to different total factor productivities (TFPs). Estimates from Hall and Jones (1999) suggest that TFP levels are far lower in the new EU10 than the old EU15. Since our focus is on *long-run* growth, the question arises as to whether large TFP differences will persist for long in the transitional economies. Estimates of TFP growth and labour productivity for Eastern and Western Germany in the 1990s from Burda and Hunt (2001) show that in the first half of the decade convergence was rapid, but in the second half it slowed down considerably leaving Eastern labour productivity almost frozen at around two-thirds of that in the West. This suggests that in the transitional economies we may expect some rapid convergence at first, but that some significant East-West TFP productivity difference will persist for some considerable time. This is what we assume in the model we set out below. The remaining differences between East and West are the factor endowments of skilled and unskilled labour and initial capital which are both higher in the West.

The questions that remain are: given that there may well be a skill-bias if anything, what is the effect of immigration on receiving economies in the West such as the UK? Is the effect beneficial or adverse for growth? Does emigration have brain drain effects on sending economies? How differently would skilled (or unskilled) migration affect both receiving and sending economies? What factors would contribute to immigration/emigration

benefits/costs and economic growth driven by migration? Who are the winners and losers in both the sending and host regions?

#### 4.1 The Model

To answer these questions, we use a formal endogenous growth two-bloc model, based on the work of Currie *et al.* (1999), Chui *et al.* (2001) and Levine *et al.* (2010) which in turn builds on the work of Grossman and Helpman (1991). The model has two blocs, “East” and “West” with the following features in each bloc:

- There are three factors of production: skilled labour, unskilled labour and physical capital.
- In the absence of specialization there are four sectors: a high-technology manufacturing sector producing an expanding variety of differentiated goods; a traditional traded sector producing a single traded homogeneous good (e.g., food, steel); a traditional non-traded sector produces another homogeneous good (e.g., construction, services) and an R&D innovative sector producing blueprints for new manufactured goods.
- As well as producing blueprints for new goods, R&D generates knowledge capital which is a public good within and between the two regions.
- The ranking of unskilled-skilled labour intensiveness is: traditional non-traded, traditional traded, manufacturing and R&D.
- The assumed market structures for outputs are competitive for the traditional and R&D sectors and monopolistic for manufacturing.
- Labour markets are assumed to clear and there are no free public services.
- In the basic model there is no labour mobility between East and West and this is subsequently compared with the case where migration between these blocs occurs.
- Migration of skilled workers from East to West reduces the size of the R&D and high tech sectors in the East and increases it in the West. This is the *sectoral reallocation effect* of migration. Potentially with a sufficient exodus of this category of workers the East can be left with an economy specializing in low-tech activity.

- Since TFP is higher in the West there is an *efficiency effect* of East-West migration from workers with any skill level and capital being more effectively employed.

A solution to the model constitutes a general equilibrium involving the interaction of financial, product and labour markets. Using formal mathematical models such as this has a number of advantages over simple descriptive analysis. Often mathematical modelling confirms the initial intuition of more descriptive models and therefore provide an invaluable check on the coherence of the argument. Sometimes formal models provides surprises and further insights which either explain stylized facts or provide the basis for empirical investigation.

## 4.2 The Immigration and Emigration Surpluses

The ‘*immigration surplus*’ according to Borjas (1995) is the increase in income of the indigenous population of the host country following immigration. The simplest model to assess the magnitude of the immigration surplus is as follows. Consider two economies, ‘East’ and ‘West’ where wages are perfectly flexible. Capital of both the physical and human variety are fixed and higher in the West. Both average and marginal output per worker is therefore higher in the West. In addition, following the recent literature on income differences between countries<sup>10</sup> we assume that total factor productivity is higher in the West, which creates a further outward shift in the Western marginal product of labor curve relative to the East.

Figure 6 shows what happens when migration from East to West occurs. The Eastern workforce (fully employed by assumption) falls from OA by an amount HA increasing the Western workforce by the same amount AB=HA. The area under the marginal product of labor (MPL) curves give total output and the MPL(West) is higher than its Eastern counterpart MPL(East) because physical and human capital is higher in the West. Ignore for the moment human capital differences; then 1 unit of Eastern labor is equivalent to 1 unit of Western labor. Output then rises by an amount KDBA in the West and falls by an amount FJAH=ECBA in the East. The *net* increase in world output is therefore given by the region KDCE. The real wage falls in the West and rises in the East. If there are costs associated with migration and migrants maximize income net of costs, migration

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<sup>10</sup>See, for example, Parente and Prescott (2000).

will cease before wages are equalized. Figure 1 shows the case of *factor price equalization* where migration costs are zero and migration leads to equal wage rates. Migrants gain by an amount EDCJ; non-migrants in the East see total output fall by an amount FJG. The original Western population gains by the shaded amount KDE – the immigration surplus. This constitutes a total gain of  $w_W K D w$  for Western capital and a loss of  $w_W K E w$  for Western workers. Similarly the non-migrants in the East lose by an amount  $FGJ = EJC$ ;  $w F G w_E$  is a gain for Eastern workers and  $w F J w_E$  is a loss for Eastern capitalists. Thus the losers are the original Western workers and Eastern capitalists; the winners are the migrants and Western capitalists.

This simple analysis does not differentiate between different types of labour but Borjas (1995) does go onto discuss the importance of the skill composition of immigrants. This is because the skill level of immigrants will determine the degree to which immigrants will be competing with natives for jobs and hence what impact they will have on their wages as well establishing the relationship between these different skill groups and capital. Borjas (1995) suggests that as the complementarity of skilled labor and capital rises Hamermesh (1993), the immigration surplus can increase substantially if immigration consists mainly of skilled workers, although this will depend on the original mix of unskilled and skilled workers in the population. Therefore, the key issue to establish is whether immigrants and natives are substitutes or complements in the production process and as a result, a relatively large literature has emerged on estimating the extent of the substitutability/complementarity between native and immigrant workers.<sup>11</sup>

The welfare gain (or loss) in the East, the *Emigration Surplus* and the *World Surplus* are assessed in a similar fashion. In the numerical results that both are measured in utility terms as the percentage *equivalent permanent consumption change* relative to the balanced-growth steady state.

## 5 Simulation Results

The properties of the general equilibrium solution obtained numerically and the calibration used are set out in detail in Levine *et al.* (2010). Here we provide a summary of the main findings.

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<sup>11</sup>See Borjas (1999) for a summary of early studies.

The impact of migration in the host and in the receiving country is a result of counteracting forces. Some authors focus on the impact on wages and on labour market conditions in general as in Borjas (1995). Others, such as Lundborg and Segerstrom (2002) and Lundborg and Segerstrom (2000) look at the negative impact on the asset value of equity issued to finance R&D. In our general equilibrium framework the factors that contribute to the immigration/emigration surplus/deficit are: technological complementarities, terms of trade, change in asset prices, efficiency and sectoral reallocation effects. The static and dynamic effects often have a counteracting impact on economic welfare at home and abroad.

We consider the case where the East is relatively less endowed with skilled labour and total factor productivity (TFP) is lower in the East. With this particular pattern of skill-labour endowments and TFP in the two regions, we examine the effect of East-West migration with different skill compositions. Though all the effects are present in our simulations, by concentrating on migration with and without skill bias keeping the other parameters fixed, we focus our analysis on the *efficiency* and the *sectoral reallocation* effects of international migration highlighted above.

### 5.1 Migration with no Skill Bias

Figure 7 shows the effect of a 10% increase in the Western population from immigration with no skill bias in its composition. An increase in growth now occurs of 0.25% which is almost entirely the result of a movement of workers from a country with a low TFP to one with a high TFP (*the efficiency effect*). All sectors in the West grow as they absorb the immigrant workers. The transfer of workers from a less to a more efficient R&D sector sees the Western share of new products rise and world growth rises. The consequent increase in demand for high skill labour causes the relative skill-unskilled wage in both blocs to rise. There is a small rise in the Western R&D share and a small decrease in the corresponding share in the East.

The effect of these changes on welfare is summarised in panels (b) to (e) of figure 7. Figure 7(e) shows the world surplus worked out as the equivalent percentage permanent change in consumption for a representative household consisting of skilled and unskilled workers, in the East and in the West, weighted according to post-migration proportions.

The maximum world surplus is around 9% when migration reaches 10% of the Western workforce. This breaks down into 1% for Western skilled workers, about 0.5% for native unskilled workers, giving an *immigration surplus* of around 0.85% for the representative Western native household (figure 7b). For those remaining in the East skilled workers gain by over 0.75%, unskilled workers lose by -1.35% giving an *emigration deficit* for the representative Eastern non-migrant of about -1.2% (figure 7c). Finally figure 7(d) shows that the representative migrant gains by a substantial 200%. In summary, with our parameter values, the positive *efficiency effect* comes to dominate the potential static negative effects highlighted in the literature. Winners in order of the size of gain are migrants, overwhelmingly, followed by skilled workers in the West, unskilled workers in the West and skilled workers in the East. The only losers are unskilled workers in the East.

## 5.2 Migration with Skill Bias

We now show the impact in our model of a 10% in the Western population from immigration with skill bias. A change in the composition of labour will have an impact on the way resources are allocated between the different sectors (*sectoral reallocation effect*) with a positive or negative impact on growth depending on the type of migration we are considering. In this framework with biased migration, the manufacturing and R&D sectors play an important role. Our next set of simulations in figure 8 looks at the effect of a 10% increase in the Western population consisting of skilled workers. Now there are substantial reallocation effects in both blocs, towards high-tech activity in the West and the opposite in the East, arising from the changes in the proportions of skilled to unskilled workers. Indeed skilled migration of over 5% of the West workforce sees the R&D and high-tech sectors disappear altogether in the East.

Taken together with the efficiency effect of a movement from a less to a more efficient economy, growth now rises by over 0.5% (figure 8a). The world surplus now rises to 11% (figure 8e). The immigration surplus is almost 12% for unskilled natives, -2.5% for skilled natives averaging at almost 6 % (figure 8b). The emigration surplus is 17% for skilled, -50% for unskilled averaging at -10% (figure 8c), but both skilled and unskilled migrants gain substantially again (figure 8d). Winners, again in order of gain, are migrants, unskilled

workers in the West and skilled workers in the East. The losers are skilled workers in the West and unskilled workers in the East. So the distributional effect of skilled migration is to reduce inequality in the West, but do the opposite in the East.

### 5.3 Unskilled Migration

We now look at the impact of a 10% increase in the Western population consisting of unskilled migration. This seems to be the least relevant case according to our assessment of migration trends in section 2. Unskilled migration now has a *negative* impact on the world growth rate.<sup>12</sup> From Figure 9, in comparison with skilled migration, now we have a opposite symmetrical sectoral reallocation effect owing to a change in the opposite direction of the proportion of skilled and unskilled workers in the West, but there is still a positive *efficiency effect* due to a movement of workers from a country with a low TFP to one with a high TFP. The world surplus is now a modest 0.4%. The emigration surplus is 13% for unskilled and -12% for skilled while the immigration surplus is 5% for skilled natives and -16% for unskilled natives. Winners, once again in order of gain, are migrants, unskilled workers in the East and skilled workers in the West. The losers are unskilled workers in the West and skilled workers in the East. So now the distributional effect of unskilled migration is to increase inequality in the West, but do the opposite in the East.

### 5.4 Summary

The main result that emerges is that while unskilled migration decreases growth, migration of no-skill bias and skilled migration from a low to a high TFP region of the world increases growth, but in the absence of some distribution mechanism there are winners and losers, with remaining non-migrants in the latter category. The reason is that the East sees a reduction in its share of high tech goods which involve a price mark-up over marginal cost, and the relative wage of the unskilled workers fall. Distributional effects are summarized in Table 1.

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<sup>12</sup>In Drinkwater *et al.* (2007) we also investigate the impact of migration on the immigration surplus for different degree of complementarities and we show that when skilled labour and capital are complements changes in asset prices can have a significant effect and that the complementarity worsens the impact of unskilled migration.

Migration Group	No Bias	Skilled Bias	Unskilled Bias
Migrant	Winners	Winners	Winners
Western Skilled	Winners	Losers	Winners
Western Unskilled	Winners	Winners	Losers
Eastern Skilled	Winners	Winners	Losers
Eastern Unskilled	Losers	Losers	Winners

**Table 1. Winners and Losers from Migration.**

One possible distribution mechanism is through remittances from migrants to their families remaining in the East. In Levine *et al.* (2010) we examine the effects of skilled migrants remitting a given percentage of their income ranging between 0% and 50%. Assuming that families are either entirely skilled or unskilled, these remittances will end up in the pocket of skilled households in the East. This group were winners in the absence of remittances so remittances in themselves do not mitigate the distributional effects of migration. However if we assume that intra-country distributional mechanisms exist, or that households are of a mixed skilled type, then we can focus on the representative household in both blocs. Then we can show that at any remittance rate above around 35%, migrants remain substantial winners, and the Eastern representative household begins to emerge as a winner. These welfare effects with remittances are summarized in Table 2.

Type of Migration	Growth Effect (%)	IS (%)	ES (%)
Unbiased	0.3	0.85	-1.2
Skilled	0.5	5.5	-8.0
Skilled with 50% remittances	0.5	5.5	7
Unskilled	-0.35	-0.05	-6

**Table 2. Growth, Immigration Surplus (IS), Emigration Surplus (ES) of Representative Households.**

## 6 Conclusions and Policy Implications

In this section we summarize our results and attempt to formulate their policy implications. The East-West European migration that followed the 2004 and 2007 enlargements has created one of the most interesting migration-policy ‘laboratories’ in the world. In light of the main results that emerge in section 5 it is useful to summarize the nature of European migration flows since World War II. Periods of labour shortages such as in the 1960’s induced active recruitment policies in some European countries. This openness was followed by a period of restrained migration. Since the fall of the Berlin wall, all CEECs now grant their citizens the right to migrate and from that time East-West migration started to gain particular attention. However some EU countries still maintained barriers to immigration. Following recent enlargements, much East to West migration was anticipated. The UK did not initially impose any transitional restrictions on labour mobility and has clearly experienced an increase in the number of immigrants, particularly from the East. A well-known result of the migration literature, namely the prediction that benefits and losses from integration will be distributed unevenly among the individual factors of production, deserves special attention.

In a static economic analysis of labour markets, migration could decrease wages or the probability to be employed of workers who directly compete with immigrants. In our general equilibrium framework we look at the overall picture and we focus on the dynamic long-run aspect of migration. Section 5 shows that migration, in general, is beneficial to the receiving country and increases the world growth rate. The only exception is in the case of unskilled migration which can actually have a detrimental impact on the world growth rate. This possibility however seems to be unlikely from our examination of migration trends in section 2 which suggests that if anything, the skill composition of immigrants is biased towards skilled workers.<sup>13</sup>

The debate which has focused on the role of institutions and governments as mechanisms that can regulate migration and its composition as well as mitigate the potential negative impact of immigration on the receiving countries, poses many controversial questions. Here we focus on an aspect that can capture them all: what are the dynamic consequences of migration in the host and in the sending economy? To summarize the

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<sup>13</sup>This is supported by the analysis in Wadsworth (2010).

main result of our theoretical framework, the dynamic aspect magnifies the role of high skilled migration. Depending on the skill group, some workers in the East and West lose even if overall the receiving and the sending economies gain.

How does this translate in terms of policy recommendations? First of all, given the potential benefits of migration for the long-term growth rate, especially if migrants are high skilled, an overly restrictive migration policy may constrain the overall growth in both regions. However our analysis gives strong support to policies supported by all mainstream parties in the UK to restrict immigration from non-EU countries to skilled workers. Second, whether the resulting immigration and emigration surpluses are significant or not, winners and losers remain and this suggests that compensating redistributive policies can mitigate the distributional effect of migration. We have examined one such mechanism - remittances - but clearly there is a role for policy that as well as encouraging these flows, needs to ensure that overall economic gains are more equally distributed through measures using the tax system, welfare-to-work and the provision of public services. Finally, our analysis points out to a greater need to integrate immigrants in order to reduce the gap between post-migration and pre-migration distribution of immigrants' occupations. While part of this gap can be explained in terms of the temporary nature of migration, particularly for A8 migrants, we believe there is a scope to improve migrants integration (i.e language effective training, advice from employment services etc). We think that migrants' skill depreciation due to limited integration can pose a severe limit to their economic contribution and requires special attention.

Clearly, our investigation of the macroeconomic impact of migration is not exhaustive. For example, we do not look at the impact of migration on unemployment. While short-run effects on unemployment in the host country are not excluded, Ortega (2000) offers a theoretical explanation of why immigration can be beneficial to the native worker, while Borjas (2001) "greasing the wheels" argument <sup>14</sup> provides another optimistic view of the labour market impact of migration in the host economy. The impact of migration can also be analyzed from a different perspective. For example, an important question concerns the role that migrants can have in mitigating the fiscal burden associated with the phenomenon of an aging population. A strand of research, using a general equilibrium overlapping

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<sup>14</sup>Immigration injects in the economy a group of highly mobile self-selected individuals, ready to move to exploit economic opportunities in different areas.

generations framework, looks at the net fiscal impact of migration. The answer to this is in part related to the skill composition of the migrant (Ortega (2005), Cohen and Razin (2009) and Cohen *et al.* (2009)).

Concerns over skilled migration have been raised by the literature on the “brain drain” in the source economies. We have seen from a theoretical perspective that as high skilled migrants that move to the country with a higher TFP, world growth increases, but results in a decrease in the size of the “modern” manufacturing and R&D sectors in the sending economy. Although not formalized in our framework, migration can increase the overall level of human capital in the source economy by increasing investment in human capital (Beine *et al.* (2008)). Remittances, which in our model have only the function of a redistributive device, can provide important benefits by increasing human and physical capital investment. Clearly, different policy recommendations in the sending economy are dependant on whether it perceives either a brain drain or brain gain.

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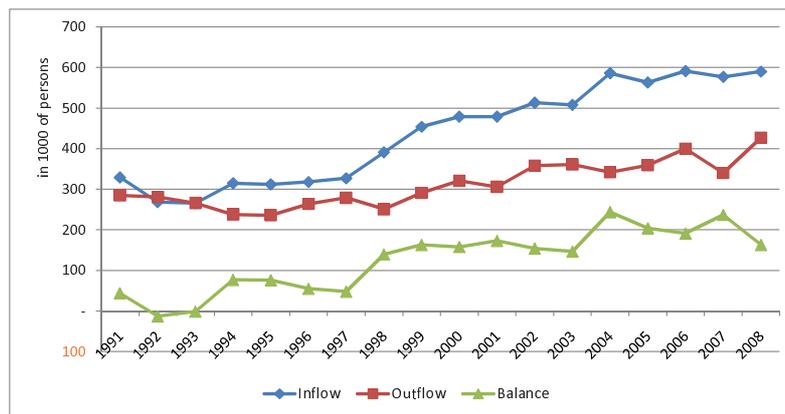


Figure 1: **Total Long-Term International Migration, UK**

**Source:** Long-Term International Migration (LTIM) and International Passenger Survey (IPS) from UKNS. **Notes:** Data rounded to thousands. The IPS is the main component of these LTIM estimates. IPS estimates allow a more detailed analysis of the characteristics of international migrants.

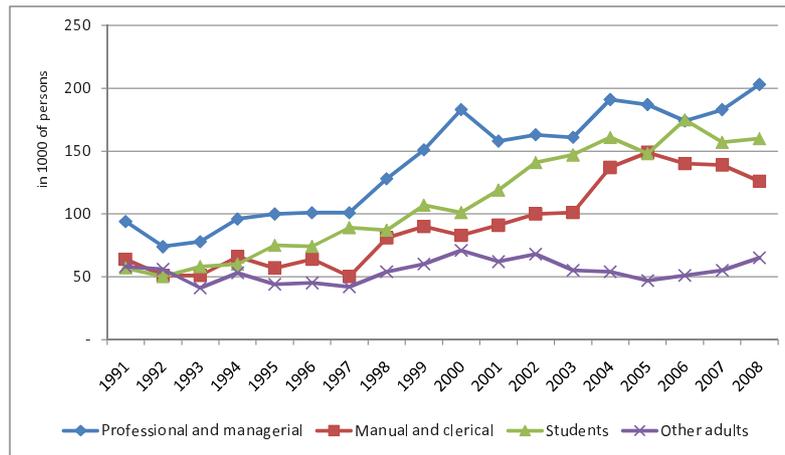


Figure 2: Migration Inflows by Occupation, UK (in 1,000)

**Source:** Long-Term International Migration (LTIM), International Passenger Survey (IPS) from UKNS. **Notes:** Usual occupation prior to migration. Data rounded to thousands.

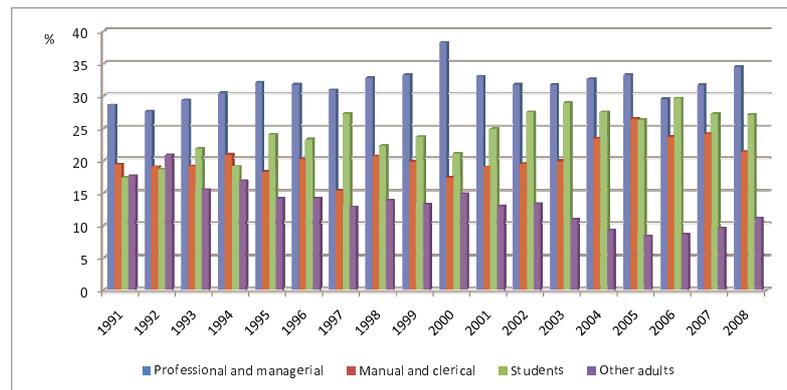


Figure 3: Migration Inflows by Occupation, UK (in %)

**Source:** Long-Term International Migration (LTIM), International Passenger Survey (IPS) from UKNS. **Notes:** The figure is measured by immigrants with that particular occupation (usual occupation prior to migration) divided by total number of immigrants that also include children as well.

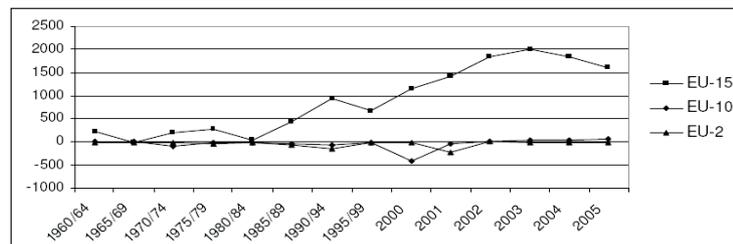


Figure 4: Net Migration in EU15, EU10 and EU2 (in 1,000)

**Source:** Figure 1 of Kahanec and Zimmermann (2008). Data are from Eurostat Population Statistics (2006), Table F-1 p. 95 (till 2000), and Eurostat Yearbook (2008), Table SP.22, p. 67 (from 2000 onwards). **Notes:** In 1,000 of persons. Net migration is estimated as the difference between total population growth and natural increase. Annual averages for the periods 1960-64 to 1995-99 are reported. For Cyprus starting from 1975 government controlled area only. 2000-2001: corrections due to census.

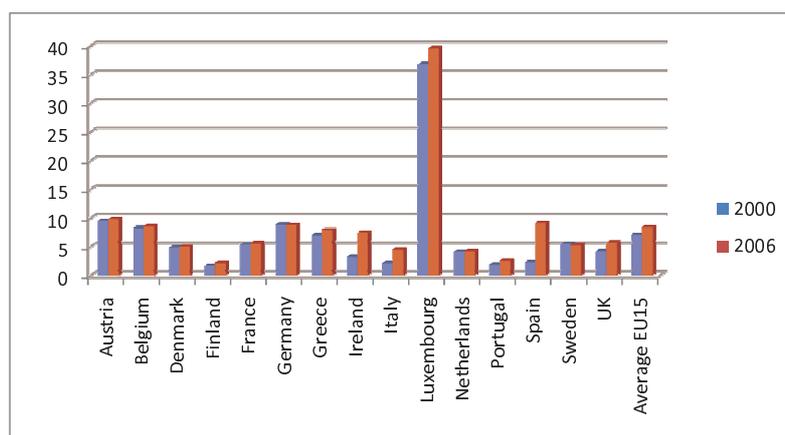


Figure 5: **International Migration Stock, Old EU15 (Foreign citizens in % of total population)**

**Source:** Zaiceva and Zimmermann (2008) originally based on Eurostat.

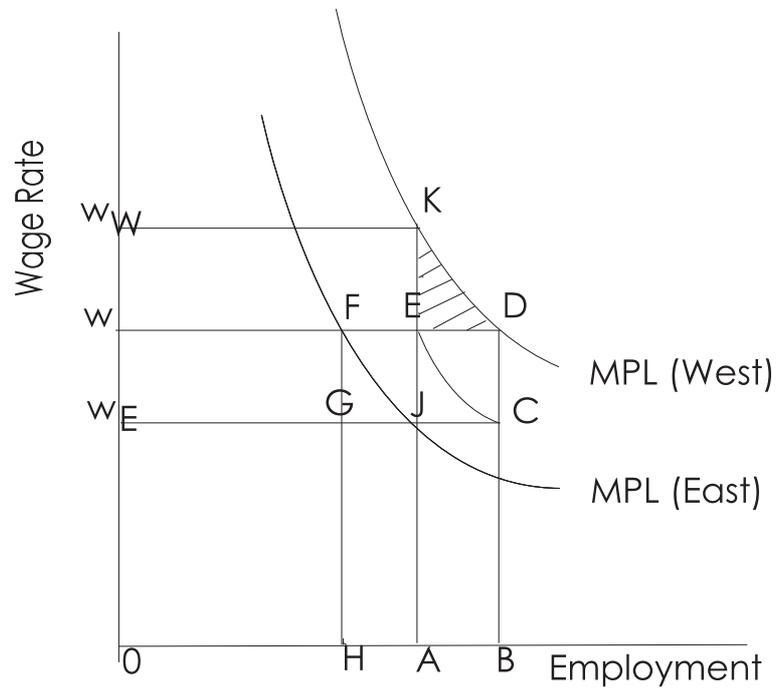
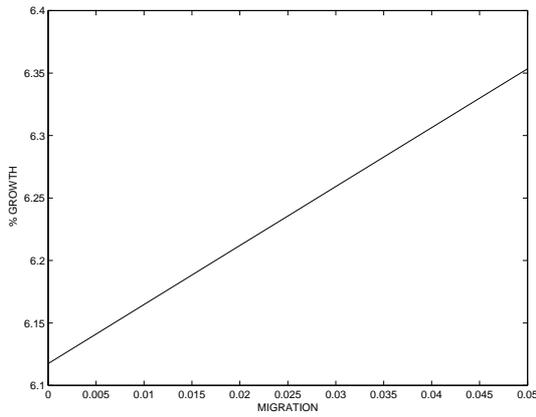
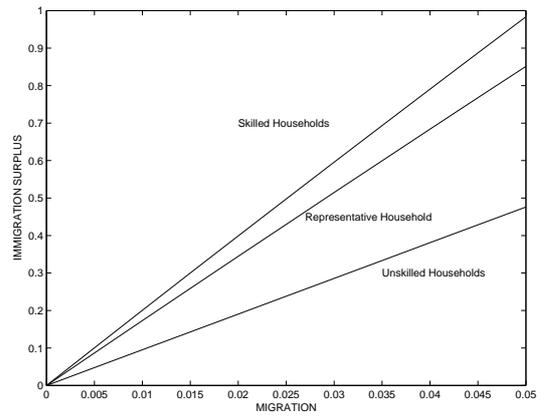


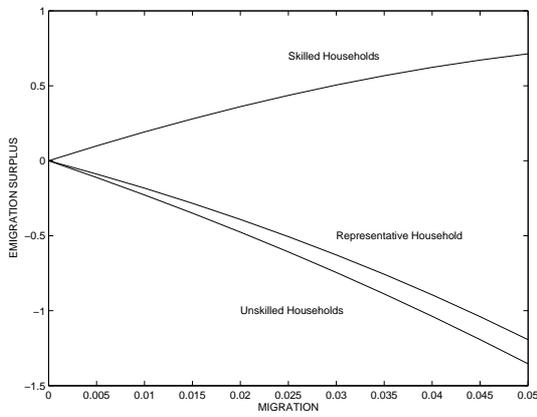
Figure 6: **The Immigration Surplus with Homogeneous Labour**



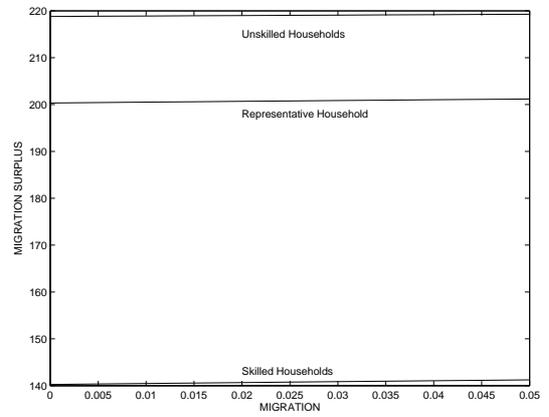
(a) WORLD GROWTH



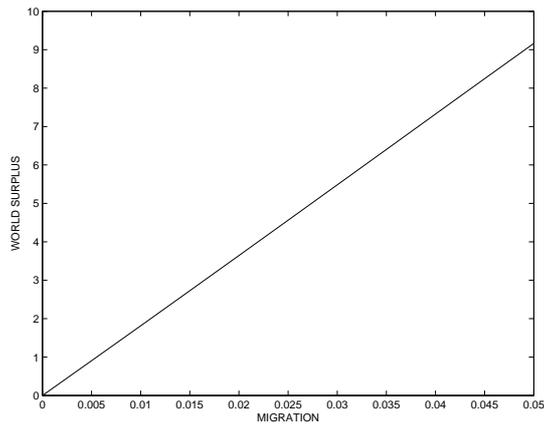
(b) IMMIGRATION SURPLUS



(c) EMIGRATION SURPLUS

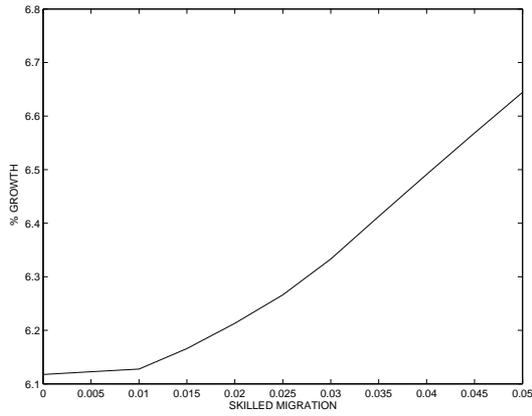


(d) MIGRATION SURPLUS

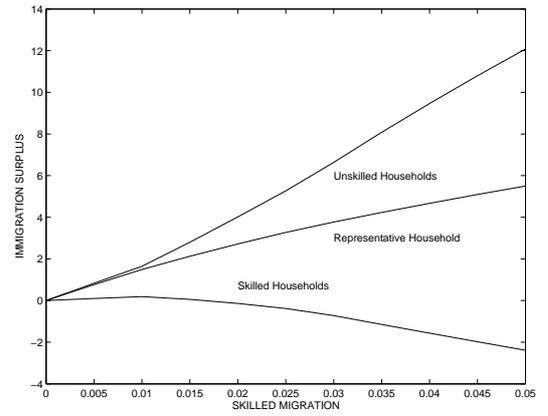


(e) WORLD SURPLUS

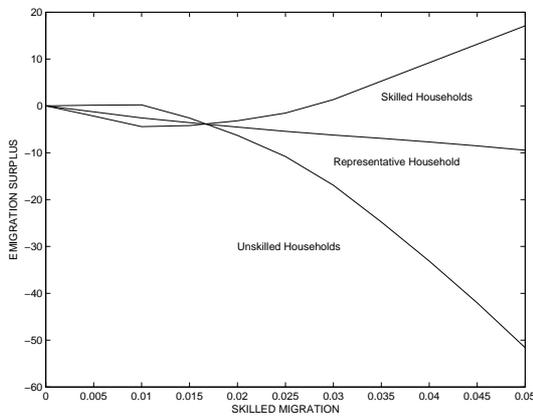
Figure 7: No-Skill bias migration with Pre-Migration Labour



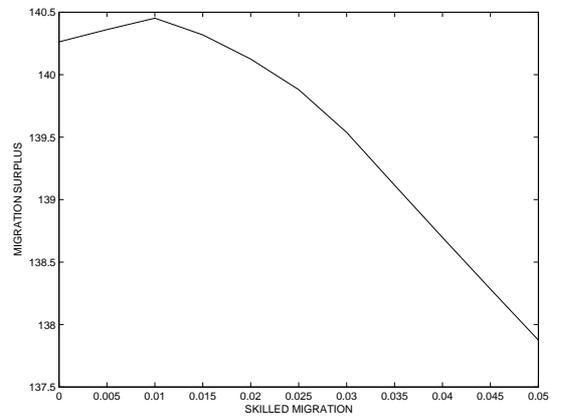
(a) WORLD GROWTH



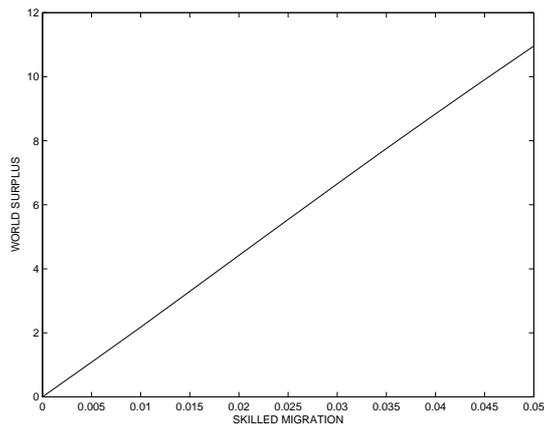
(b) IMMIGRATION SURPLUS



(c) EMIGRATION SURPLUS

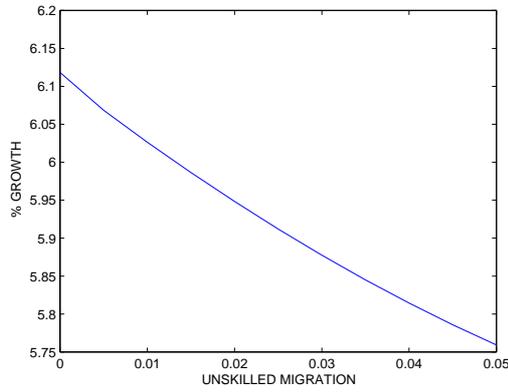


(d) MIGRATION SURPLUS

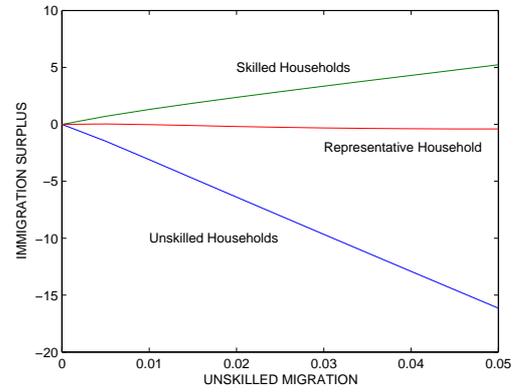


(e) WORLD SURPLUS

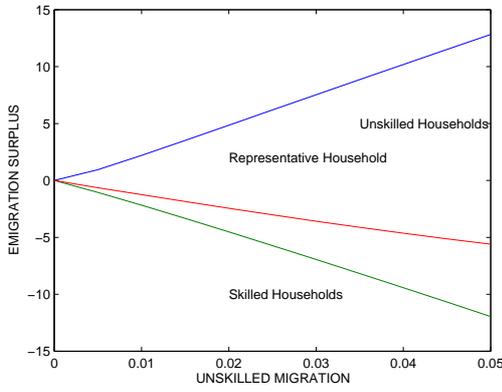
Figure 8: High Skilled Migration with Pre-Migration Labour



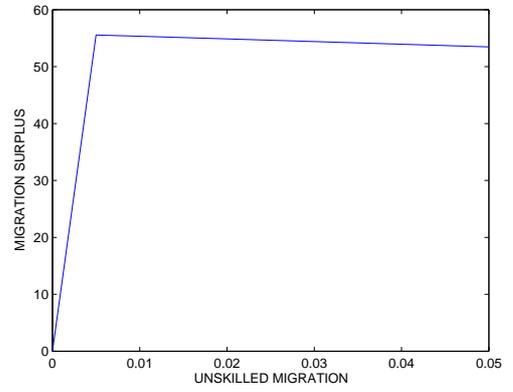
(a) WORLD GROWTH



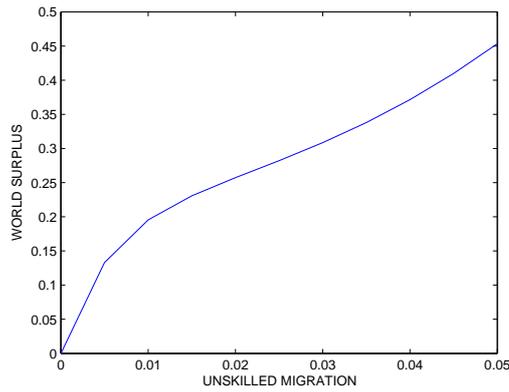
(b) IMMIGRATION SURPLUS



(c) EMIGRATION SURPLUS



(d) MIGRATION SURPLUS



(e) WORLD SURPLUS

Figure 9: Low Skilled Migration with Pre-Migration Labour