THE ECONOMIC IMPACT OF MIGRATION: A SURVEY

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Abstract

This survey reviews both theoretical and empirical papers that examine the economic effects of labour mobility. We address three broad sets of issues: firstly, the effect that immigration has on the host country's labour market. Although the possible adverse effects that immigration can have on the wage and employment levels of natives are typically examined, immigration may also have a role to play in raising skill levels. This leads to the second broad issue: the effect of migration of a particular skill composition on the long-term (endogenous) growth of the host country. Finally, immigration can have a major economic impact on the source country. These effects can either be positive or negative depending on the interplay between the effects of growth, remittances and the brain drain.

INTRODUCTION

Immigration is one of the most important issues in the contemporary global economy.[1] It is estimated by the United Nations that over 175 million people now reside outside the country of their birth. This clearly has major economic and political implications for both the sending and receiving countries. Coppel *et al.*

(2001) identify four major of international population movements. Firstly, there is the effect that immigration has on the host country's labour market. Although the possible adverse effects that immigration can have on the wage and employment levels of natives are typically examined, immigration may also have a role to play in reducing skill shortages in certain key sectors of the economy. Secondly, immigration is likely to influence the budgetary position of the receiving country because the amount recent arrivals receive through health, education and welfare systems is unlikely to exactly balance the increased tax revenues from new workers. Thirdly, it is argued that immigration may be a solution to the ageing population problem that faces many OECD countries. Finally, immigration can have a major economic impact on the source country. These effects can either be negative, in terms of a brain drain (though a brain drain can be beneficial if it creates incentives for human capital investment in the source country), or positive since migrants' remittances are thought to be an important economic development tool for many labour exporting countries. The overall balance of these effects is therefore likely to have a major influence on the immigration policies that are implemented, both in the source and host countries.

In this survey we review the theoretical and empirical literature on the economic effects of international migration, focusing in particular on the influence that immigration can have on growth rates in the host and source countries. Without some restriction, this is a vast literature so some constraints must be placed on the scope of our survey. First, we exclude any consideration of papers that study the *determinants* of migration in an attempt to understand the pressures for migration or migration equilibria.[2] The level of migration (controlled or otherwise) is a given throughout this survey. Second, where possible our empirical evidence relates to the European migration experience.[3]

We structure the rest of the survey around four sections. Section 2 examines *level effects* based on the strictly static framework adopted by Borjas (1995) and reviews papers where migration affects transitional but not long-term growth. Section 3 then looks at a much smaller literature on the effects of migration on long-term growth. The section concludes with results from a current project involving the authors. Section 4 discusses the policy implications that emerge from the papers that have been surveyed and Section 5 concludes.

MIGRATION WITH EXOGENOUS OR ZERO GROWTH

The Immigration Surplus

The *immigration surplus* is the term coined by Borjas (1995) to refer to 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 blocs, East and West, and assume that wages are perfectly flexible and labour markets clear in both blocs. Further assume that the regions produce the same composite output and the labour force is equal. Capital of both the physical and human variety are given and higher in the West. Both average and marginal output per worker are therefore higher in the West.

Figure 1.

The Immigration Surplus: Flexible Wages and One Type of Labour

Figure 1 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 labour (MPL) curves give total output and the MPL(West) is higher than its Eastern counterpart - MPL(East) - because physical and human capital are higher in the West. Ignoring human capital differences for the moment, then 1 unit of Eastern labour is equivalent to 1 unit of Western labour. Output then rises by an amount *KDBA* in the West and falls by an amount *FJAH(=ECBA)* in the East. The increase in output is therefore given by the area

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 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 an amount *KDE* - the immigration surplus. This constitutes a total gain of $w_W KDw$ for Western capitalists and a loss of $w_W KEw$ for Western workers. Similarly the non-migrants in the East lose by an amount *FGJ(=EJC)*; $wFGw_E$ is a gain for Eastern workers and $wFJw_E$ 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.

Borjas (1995) provides rough estimates of the immigration surplus for the US, but in fact it could be any OECD country. Assume first that all workers, East and West, are perfect substitutes. Suppose a host workforce N expands to *L=N+M,* where *M* is the number of immigrants. Then the immigration surplus is given by

$$S = \frac{\Delta w . M}{2Y} = \left(\frac{L \Delta w}{w \Delta L} \right) \cdot \left(\frac{w}{L} \right) \cdot \left(\frac{\Delta L . M}{2Y} \right)$$

$$= -\frac{1}{2} e \left(\frac{wL}{Y} \right) \left(\frac{M}{L} \right)^2 = -\frac{1}{2} esm^2$$

where we have put $\Delta L = M$ (since all migrants find employment), s is labour's share of national income, e is the elasticity of the wage rate with respect to the labour force and $m = M/L$ is the proportion of migrants in the workforce ($AB/0B$ in Figure 1).

Given that labour income accounts for around 70% of GDP for most OECD countries, and just under 10% of the US (or German) workforce are immigrants and the elasticity of the factor price of labour (capital fixed) is thought to be around 0.3 (Hamermesh, 1993), Borjas puts $s=0.7$ and $e=-0.3$ to arrive at the pessimistic conclusion that a 10% increase in the workforce through immigration increases US (or German) GDP by only 0.105%. This net gain is accompanied by a 3% fall in the wage rate and hence a not-insignificant redistribution from labour to capital.

Now consider immigration with wage rigidity. The general case of some wage flexibility, which encompasses the case of full flexibility above, is illustrated in Figure 2 - taken from Levine (1999). The labour supply curves (which, following Layard *et al.* (1992), we refer to as the 'bargained real wage' or BRW curves) and the labour demand (MPL) curves are shown for the two blocs. Upward-sloping BRW curves are consistent with a number of theories of wage determination including the monopoly union model, bargaining and efficiency wage theories. As a result of migration from East to West, with some real wage flexibility, the BRW (W) shifts to the right and employment rises by *WW'*. Similarly the BRW (E) shifts to the left and employment falls by *EE'*.

Figure 2.

The Immigration Surplus: Inflexible Wages and One Type of Labour
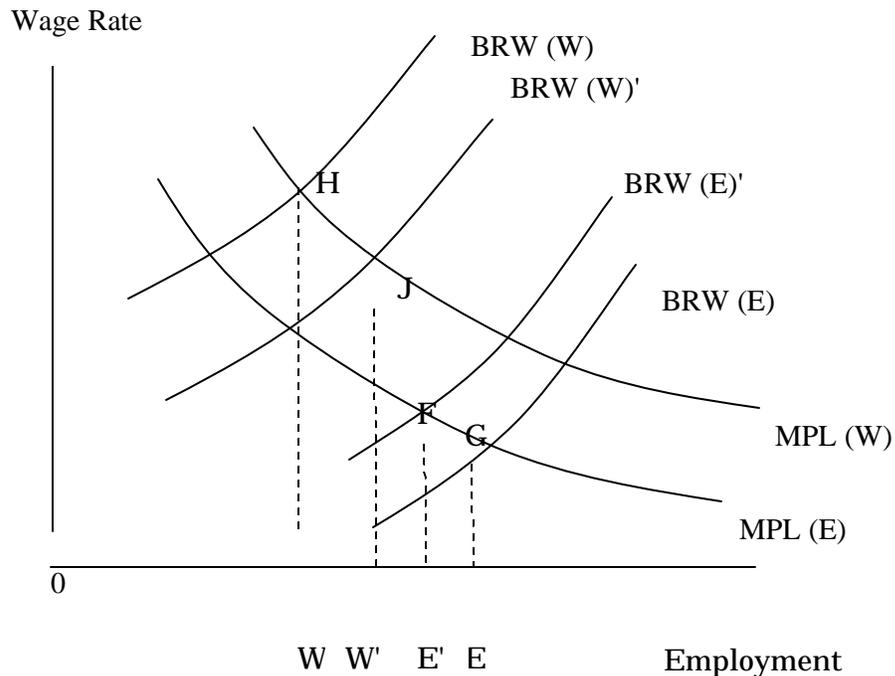
The welfare implications of East-West migration - which we analyse in more detail in the next section - can be assessed by comparing the increase in Western output (*HJWW'*) with the decrease in the East (*FGEE'*). We have illustrated the case where *WW'*, *EE'* and the real wage flexibility in the two regions are about equal. Then the net output gains are positive; in general, however, the output effects are crucially dependent on the degree of real wage flexibility in the

two labour markets. To work out the immigration surplus, we put $\Delta L = \boldsymbol{h}M$ where $\boldsymbol{h}_i \in [0,1]$ - encompassing the cases of complete wage flexibility $\boldsymbol{h} = 1$ and complete inflexibility $\boldsymbol{h} = 0$. The immigration surplus now becomes

$$S = -\frac{1}{2}esm^2\boldsymbol{h}^2 \tag{1}$$

which provides an even more pessimistic outlook for the economic benefits of migration for host residents.

The analysis up to now has assumed only one type of labour. Suppose now the workforce in both blocs consists of skilled and unskilled labour and output $Y=f(K, L, H)$ in the host country, where L and H denote skilled and unskilled labour respectively. Let elasticities of factor prices w_L and w_H be denoted by $e_{LL} = \partial \log w_L / \partial \log L$, $e_{HH} = \partial \log w_H / \partial \log H$ and $e_{LH} = \partial \log w_L / \partial \log H$. Let the migration rate be $m = M/(L+H)$ and the post-migration proportion of skilled labour be $h = H/(L+H)$. Let $\boldsymbol{b}$ denote the fraction of skilled workers among immigrants and the changes in the skilled and unskilled workforces following migration be $\Delta L = \boldsymbol{h}_L (1 - \boldsymbol{b})M$ and $?H = ?_H \beta M$ where $\boldsymbol{h}_i \in [0,1]$ are measures of labour market flexibility for the two types of labour. Finally let $s_L = w_L L/Y$ and $s_H = w_H H/Y$ be factor shares. Then following Borjas (1995), the immigration surplus generalizes to

$$S = -\frac{s_H e_{HH} \boldsymbol{b}^2 m^2 \boldsymbol{h}_H^2}{2h^2} - \frac{s_L e_{LL}(1-\boldsymbol{b})^2 m^2 \boldsymbol{h}_L^2}{2(1-h)^2} - \frac{s_H e_{HL}\boldsymbol{b}(1-\boldsymbol{b})m^2 \boldsymbol{h}_L \boldsymbol{h}_H}{h(1-h)} \tag{2}$$

From the assumed concavity of the production function the immigration surplus can be shown to be positive. Equation (2) can be used to assess immigration policy that favours immigrants with or without skill. Borjas (1995) quotes Hamermesh (1993) whose survey suggests that the factor elasticity is greater for skilled than unskilled workers. Then as this elasticity rises if immigration consists solely of skilled workers, the immigration surplus can rise substantially depending on original mix of skilled and unskilled workers in the population. Thus Borjas' analysis provides a foundation for a positive theory of immigration policy and points to a strong economic case for an immigration policy that favours skilled immigrants.

Borjas (2001) analyses the immigration surplus in an economy with regional differences in marginal product. Compared to the situation with a 1-region aggregate labour market, where the gains arise because immigrants and natives complement each other, Borjas (2001) argues that immigration improves economic

efficiency by speeding up the process of wage convergence. The idea underlying the paper is simple - immigration injects into the economy a group of highly mobile self-selected individuals who are ready to move to exploit economic opportunities in different areas. The underlying assumption is that native workers respond slowly to wage differentials and their marginal product is not maximized. By moving to the high wage region, immigrants generate two kinds of benefits for natives. First, they increase national GDP through the standard immigration surplus and second, they maximize the income that accrues to natives net of migration costs. The author presents both descriptive statistics and econometric evidence in support of these hypotheses. Data refer to the US economy, where new immigrants show a high propensity to cluster in high wage areas. In the European context, there is clear evidence that the costs of internal migration play an important role in slowing down the convergence process and therefore new immigrants may improve labour market efficiency.

Bauer and Zimmermann (1999) use the Borjas (1995) framework to provide simulations for immigration's effect on the EU economy (as well as separately for the German and UK economies). They also extend Borjas' analysis by introducing the possibility of unemployment for unskilled labour. They estimate that if there is an immigration inflow equal to 1% of EU employment and this consists solely of manual (unskilled) workers then natives gain by only 0.01% of EU GDP in the full employment scenario. If non-manual (skilled) workers migrate then the gain to natives increases to 0.03% of EU GDP. They also estimate the distributional effects of immigration, finding that largest gains accrue to capital, with a 1% immigration of skilled workers producing gains of 0.22% of EU GDP. Non-manual natives will gain if less than 40% of immigrants are manual and manual natives will gain if less than 70% of immigrants are non-manual. In the unemployment scenario, natives can lose as a result of the immigration of manual workers, because their jobs may be displaced. However, potential gains from the immigration of non-manual workers in this scenario may be much larger; they estimate that native workers may gain by up to 6.9% of EU GDP if there is zero native unemployment. Calculated gains are likely to be under-estimates because they ignore the tax and social security contributions of immigrants as well as the increase in labour demand that could result from higher consumption levels.

Brain Drain or Gain?

The question of how migration of the highly skilled affects human capital formation and the average level of human capital in the source and destination countries is of major importance. Miyagiwa (1991) analyzes the brain drain phenomenon, introducing increasing returns to scale in the education sector in a model with heterogeneous workers. The key elements of the model are that information is not a public good and that geographical distances matter. This implies

that the greater the number of educated workers in the economy, the greater the income of each educated worker. To illustrate this, suppose there are two countries of different size - in particular, country A (e.g. the US) is bigger than country B (e.g. Taiwan). The author shows that in the bigger country not only is there a larger number of workers, but also a higher percentage of the population acquire education. The increasing returns effect results in higher wages for skilled workers in country A and therefore skilled workers from country B have an incentive to migrate to country A. The author considers two cases. In case 1, all skilled workers migrate with direct and indirect positive effects for the host country. In case 2, only a proportion of the skilled migrate and the effects of the brain drain for the source country are ambiguous. There is the possibility of a positive brain drain (i.e. the income of the migrants increases, while the income of the low skilled non-migrants is kept constant), but it is also possible that only the most gifted gain from opening up the economy. In fact, given externalities in education, migration of the most gifted negatively depresses incomes of the 'intermediate' individuals forcing them to migrate.

Mountford (1997) suggests an alternative scenario. The amount of human capital in any period depends on the decision of households to acquire education. The prospect of higher wages through emigration stimulates acquisition of human capital and therefore enhances growth. This effect can be stronger than the direct effect of emigration. A brain drain may therefore actually enhance growth in the source economy. Stark *et al.* (1997, 1998) reach similar conclusions, as do Beine *et al.* (2001) in an overlapping generations framework.

Becker *et al.* (1990) take a different perspective on human capital formation and the brain drain phenomenon. They model economic growth assuming endogenous fertility, but depart from both the Malthusian and neoclassical approaches by placing investments in human capital at the centre of the analysis. We assume that rate of return to human capital is higher in economies with a higher stock of knowledge. As a result, economies with a low initial stock of human capital choose large families and invest a small amount in each child, while countries with a high stock of human capital do the opposite. This paper contributes to the brain drain literature because it gives an explanation for why the brain drain occurs from poor to rich countries. Moreover, if returns to education are increasing in the stock of knowledge, this advantage will not disappear.

MIGRANTS' SAVING, REMITTANCES AND DURATION OF MIGRATION

In exogenous growth models with exogenous savings the effect of an increase in the savings rate is to increase the level of the *per capita* capital stock

and therefore *per capita* output.[4] Therefore, in order to analyse the effect of immigration on transitional growth, it is necessary to examine whether immigrants, particularly those who only stay for short periods, have positive saving rates and if so, how these savings rates compare with those of natives.

Galor and Stark (1990) use an overlapping generations framework to show that migrants have a higher savings ratio than natives if they face a positive probability of return migration. This is consistent with the life-cycle theory of consumption since migrants may expect their future income to fall, if they have a positive probability of returning to their home country and will save more to smooth their lifetime levels of consumption. Similarly, Djajic (1989) proposes that temporary migrants have a higher savings ratio because of their expectations of future price levels in the host and home countries. Studies also assume that immigrants have a higher marginal utility of consumption in the home country.

Karayalcin (1994) argues that temporary migrants save more than natives because they face a higher rate of interest if there is imperfect capital mobility. A 2-country overlapping generations model is developed to examine the impacts of both temporary and permanent migration. Temporary migration is equivalent to international capital mobility because they produce the same interest rates, output levels and wage (at every point in time). Both temporary and permanent migration cause world income and output levels to rise. This is explained by the Borjas-type argument of labour migrating from the labour abundant low wage country to the host country which has a higher marginal productivity. Dustmann (1997) extends previous studies to incorporate the effects of uncertainty, finding that if the migrants' variance of income is higher than that of natives then they will save more. However, this result depends on whether any of the potential random shocks in different time periods are correlated.

Rather than holding their savings in the receiving country, migrants may opt to transfer money back to friends and family in the source country in the form of international remittances.[5] The amounts sent abroad are substantial, with World Bank estimates of officially recorded remittances amounting to around $75bn in 2000, although this is thought to be a significant underestimate of the true figure. Therefore remittances are a vital development tool and source of foreign exchange for many countries. For example, Coppel *et al.* (2001) report that remittances were 1.5 times the level of exports of goods and services in Albania in 1998 and were equivalent to more than 20% of exports in six other countries. Furthermore, the total amount sent in remittances is thought to far outweigh net level of foreign aid received from OECD countries (Coppel *et al.*, 2001).

However, there is a debate over the extent to which remittances boost the economy of the source country since income is used for consumption and not investment (Glytsos, 1993). Macmillen (1982) outlines some of the negative consequences if remittances are used in this way: an increase in price level and imports, an overvalued exchange rate and a dependence on remittances which may delay long term economic policies, especially if the level of remittances cannot be guaranteed due to economic fluctuations. Policies to divert remittances to more productive sources may be neccesary. However, Adams (1998) finds that external remittances do have an important statistical effect on the accumulation of rural assets in Pakistan.

Empirical evidence on the savings of migrants is provided by Merkle and Zimmermann (1992), who investigate savings behaviour of guestworkers living in Germany. Nearly all guestworkers had positive savings, either a savings account in the host country or through remittances (which they argue are a special form of savings if the migrant intends to return to their home country). They find a negative relationship between planned duration of residence in Germany and remittances, but this was not statistically significant. However, guest-workers who return home early may well hold savings in their home country. Unfortunately, they do not compare migrants' savings rates directly with those of natives.

Evidence suggests that local savings rates (earnings invested into savings in the host country) are higher for immigrants in Britain and France. Immigrants living in Birmingham and Manchester had a savings rate around 2% above the British average in 1965 (Jones and Smith, 1970) and Granier and Marciano (1975) report that French immigrants had a saving rate that was 50% higher than a native with a similar income level. Paine (1974) reports that Turkish migrants had a local savings rate of 36%, which was well above the national rate for developed economies. It is also worth reporting the effect that these savings have on the probability of entrepreneurship. McCormick and Wahba (2001), analyse use of savings by return migrants to Egypt, find that 29% of their sample were entrepreneurs after returning, compared to 18% before migrating. Savings accrued by the migrant while overseas, they argue, account for much of this increase because potential entrepreneurs are often liquidity constrained and savings can provide capital to start a business (Evans and Jovanovic, 1989). The acquisition of overseas work experience increases the probability that literate migrants become entrepreneurs, which may reflect skill acquisition while abroad.

Mankiw *et al.* (1992) provide supporting evidence to the Solow (1956) view that richer countries have higher savings rates, whereas poorer countries tend to be those with high rates of population growth. This suggests that those countries that experience large immigration flows have lower growth rates. However, these

variables are not significant in the regression for a sample of OECD countries. Mankiw *et al.* (1992) also emphasise that account be taken of human capital differences in the empirical specification. The results of their augmented Solow model indicate that human capital is important in explaining wealth differences, even within OECD countries. There may be a link between savings and human capital in that a higher saving rate produces higher income in the steady state, which causes human capital levels to increase even if the rate of human capital accumulation remains the same. Higher savings are associated with higher levels of total factor productivity.

THE WELFARE STATE AND DEMOGRAPHIC CONSIDERATIONS

It is important to determine whether immigrants are more or less likely to be recipients of welfare payments than natives, particularly if low skilled immigrants are attracted by the relatively generous social welfare payments that are offered in some countries. Immigrants are less likely to be social welfare recipients, and when they do receive assistance, these are typically lower than those received by natives with similar characteristics (OECD, 1997). However, Gustman and Steinmeier (2000) find that the probability that an immigrant to the US receives state benefits has risen since the 1970s. This can be explained by the lower levels of human capital and poorer English language skills of more recent immigrant cohorts. Borjas and Hilton (1996) also report that immigrant households are more likely to be benefit recipients than native households, but find that immigrants' welfare recipient rates fall the longer they stay in the host country.

However, in order to examine the fiscal impact of immigration more fully, the amount received in immigrant tax receipts should be compared with social welfare payments to immigrants. Lalonde and Topel (1997) survey US evidence and report that immigrants are net contributors, although most of this evidence relates to the 1970s, since when average immigrant skills have decreased and hence a larger proportion are below the poverty line. Net benefits associated with recent immigration may be smaller than for previous cohorts. Gott and Johnston (2002) suggest that immigrants make a positive net contribution to the UK economy. They estimate that in 1999/2000, immigrants to the UK contributed £31.2bn in taxes and received £28.8bn in benefits and services. Furthermore, intergenerational considerations should be taken into account, and if this is done immigrant contributions may be an underestimate since second generation immigrants are also likely to be net tax payers.

Canova and Ravn (2000) examine macroeconomic consequences for West Germany of German unification using a dynamic general equilibrium model. They argue that this event is similar to a mass migration of low-skilled workers holding no

capital into a foreign country. In the absence of a welfare state, West to East transfers raise distortionary tax rates and result in an investment boom and depressed output. Winners are Western owners of capital, highly skilled workers and migrants. With the welfare state, the investment boom disappears and recession is prolonged. Winners are now confined to migrants and unskilled workers in the former East Germany.

Sinn (2002) focuses on the potential adverse fiscal consequences of migration that may result from EU enlargement. He expects there to be significant East-West migration, induced by large wage differentials that exist and this could produce some of the positive aspects of migration that we have discussed previously. However, if migration occurs as a result of the welfare programmes offered by Western countries, then this could create competition between these countries to deter Eastern migrants from entering. The overall outcome of this process could therefore be the erosion of the welfare state. To prevent this, Sinn (2002) recommends the harmonisation of welfare systems (which may be too expensive), selective migration policies or limiting, the access of migrants to the welfare system.

Many OECD countries face the problem of an ageing population. In the 2001 UK Census, it was reported that for the first time, the population aged over 60 was greater than the population aged under 16. In addition to lower fertility and mortality rates, there has been a trend towards early retirement, especially among skilled workers, leading to a pensions crisis. Immigration could help to alleviate this 'demographic time-bomb' since immigrants are typically younger and have higher fertility rates. Furthermore, Zimmermann (1995) reports that there is strong migration potential from developing and Eastern European countries because many of these countries have growing populations. However, the current level of immigration will be unable to sustain the level of the working age population because has been estimated that a net migration of around 1.5 million individuals *per annum* is required to keep the EU's working population constant until 2050 (United Nations, 2000).

MIGRATION AND ENDOGENOUS GROWTH

A vast theoretical and empirical literature pioneered by Romer (1986, 1990),has emerged since the 1980s which has transformed the way economists think about growth. New growth theory contrasts with the earlier neoclassical or old growth theory of Solow (1956), which invoked *exogenous* technical change to explain sustained long-term growth. By contrast, focus of the new *endogenous* growth (EG) theory is on how the consumption and savings decisions of households, investment decisions of firms, and public policy in various forms, determine long-

term growth. Whilst the neoclassical model could be described as a model *with* long-run growth, new literature offers a number of possible models *of* long-run growth.

The EG literature can be divided into three broad strands: the first builds on Romer (1986), is closest to the classical tradition and emphasises capital accumulation as the engine of growth, with capital broadly defined to include human and physical components. The second sees EG driven by the accumulation of human capital (Lucas, 1988). In the third broad strand of the literature, following Romer (1990) and Grossman and Helpman (1991), the discovery of new goods and of new processes provides the engine of growth. Research and Development (R&D) activity provides blueprints for these innovations and a feature of this literature is the attempt to understand the economic forces that drive R&D. This section first reviews papers that draw upon this literature to assess migration impacts on long-run EG.

Growth Driven by Capital Stock

Reichlin and Rustichini (1993) study the impact of migration in a 2-period overlapping generations model of consumers with free trade and perfect capital mobility. Following Romer (1986), the authors assume that level of technology is an increasing function of the aggregate stock of capital (i.e. knowledge is a public good) through a learning-by-doing mechanism. Due to externalities, equilibrium is characterized by a continuous flow of migration from low wage to high wage countries. Flow of migrants from the poor to the rich country does not stop since the assumption of perfect capital mobility implies the high wage country has a higher capital-labour ratio and this advantage increases over time in the presence of positive externalities. The existence of a scale effect of the labour force is the key, even if controversial, element of the model. The two countries are assumed identical in terms of technology, but they differ in terms of initial stocks of factors of production.

In the first part of the paper, they show configurations of the migration patterns in a homogeneous labour framework. They then discuss the case of heterogeneous labour where the scale effect (the crucial one in the homogenous labour case) may be partially or totally offset by a 'composition effect' - a change in the ratio of skilled to unskilled in the two countries. In the latter case, a flow reversal in migration patterns takes place. The size effect is captured by a technology which is positively affected by the aggregate stock of capital, as in Romer (1986). Young individuals are endowed with different predispositions towards emigration so that a given proportion of workers will move. In the model with unskilled and skilled workers, this proportion is assumed equal to the fraction

of agents who are willing to qualify as skilled workers. The composition effect influences the relative position of a country and gives a possible explanation of why a country which, at some point in time, is a sending country, may become a receiving country in the future, even if there are large positive externalities. The main condition of the reversal, which is also a condition for convergence in the growth rates, is a balanced composition of skilled and unskilled workers.

To sum up, the authors show that the positive effects of migration are determined by pure size effects. On the other hand, with high and low skill workers, the continuous flow of migrants affects the ratio of skilled and unskilled and if the flow is proportionately larger in the unskilled labour sector then migration, through the composition effect, may penalize the receiving country.

Growth Driven by Human Capital

Walz (1995) uses a 2-bloc EG model to address the effects of migration on both host and source countries. He provides conditions under which a brain drain is beneficial for the source economy, avoiding the use of pure size effects. He offers an explanation of skill formation and migration decision in an EG model with individuals living a finite period of time. In particular, individuals choose whether they will invest in education or work in the unskilled sector. A key assumption of the model is given by the presence of two types of agents with different advantages in the education process. Clearly, agents with an advantage in the human capital formation process have a higher incentive to invest in education and migration acts as a screening device. Since the costs of migration are the same for both categories, the expected benefits to migration are higher for workers with a greater ability in the education process. Two cases may arise. In case 1, the expected zero benefit condition is satisfied before all individuals with an advantage in the education process (i.e. a type 1 agent) have chosen to become skilled. In case 2, all type 1 and some type 2 individuals invest in education. In contrast with Beine *et al.* (2001), the author explicitly considers two countries, developing the analysis of the dynamic effects of migration in the source (low wage) as well as in the host (high wage) economy.

The central idea is that migration affects the growth rate of the economies by altering the composition of the labour force in each country. Each country specializes in the production of a consumption good. In each country, besides the consumption sectors, an education sector exists. The evolution of knowledge depends positively on the average human capital, the result of migration decisions. The author highlights the positive effects of opening up the economies for individuals in both countries via a decreasing price level and a rising real income. If the growth in the source country does not decrease, migration can make everybody

better off. Moreover, if migration increases the overall growth rate, the positive dynamic effects offset any negative static effects.

The role of history and initial conditions is highlighted in Premer and Walz (1994). The authors explain divergence between regions or countries through an EG model in which regional growth occurs due to learning by doing and where the allocation of skilled workers is endogenously determined.

Haque and Kim (1994) concentrate on the effects of migration of the highly skilled on the source economy. In a 2-country EG model with heterogeneous agents, the authors show that the migration of skilled labour may have negative effects on income and growth in the sending economy.[6] The heterogeneous individuals live two periods. In the first period they may decide to invest in education while in period 2 they can choose their location. The two countries differ in terms of government policies and possibly technology. These differences explain migration flows, which will result in a truncation of the distribution of ability in the source country. As in Walz (1995), there is a tendency for individuals with higher ability to migrate. This generates a permanent decrease of the growth rate in the home country, which is proportional to the fraction of the population that has migrated. Whereas the effects on the host country depend on the evolution of the ratio of the average human capital of the two countries. Given this theoretical framework, the authors derive implications for policies to affect the level of human capital, distinguishing the case of a closed economy from one which is open.

Growth Driven by R&D

Lundborg and Segerstrom (2000, 2002) examine a quality-ladders model of economic growth based on a North-South model in Grossman and Helpman (1991, chapter 12). In such a model, growth is driven by improvements in product quality. In each period, firms engage in a R&D race to become the quality leader by hiring R&D workers. A firm that wins the race becomes the only producer in that period. All firms stay in the R&D race and every leading firm will be replaced by another. Any firm's probability of becoming the leader depends positively on its own R&D effort and negatively on the aggregate effort made by all firms. Since all firms are identical, they all make the same R&D investments and face the same probability of becoming the product leader.

The world is made up of two regions called North and South. The high-quality products of the North are called 'high-tech', only Northern firms can produce them. The products of the South are called 'low-tech'. The Northern firms could produce them but they will not do so because production of high-tech products is more profitable. Consumers spend a fixed part of their expenditure on

commodities of each region. They benefit from the innovation in both regions through falling commodity prices, therefore the rate of growth of *real* expenditure is identical in both regions. Southern welfare levels are a constant fraction of northern welfare levels. There is a constant incentive to migrate.

Consider first what happens when some Southern consumers/workers die. To start with this means a reduction of consumer expenditure in the South.[7] Therefore, demand and production of Northern commodities falls and the relative wage of Northern consumers falls, leading to a fall in Northern expenditure. The fall of expenditures leads to a fall in the growth rate because there are reduced incentives to invest in R&D. All these circumstances reduce Northern welfare. Southern welfare is affected negatively by the fall in growth rate, but it is affected positively through the increase in the relative wage. As far as workers - who receive labour income - in the South are concerned the latter effect dominates the former in simulation evidence presented by the authors. As far as capitalists - who own the stock value of firms - in the South are concerned, the growth effect dominates.

Now consider the effect of migration from the South to the North. An R&D worker is assumed to be more productive in the North than in the South, therefore the growth potential in the world economy increases when labour moves to the North. We also have the effect of a population decrease in the South as discussed in the previous paragraph. In addition we have the impact of the labour supply increase in the North, that puts further pressure on the wages in the North. Firms in the North and South increase R&D expenditure. But in simulations the resulting increase in growth is not sufficient to make migration beneficial to Northern consumers. Northern workers are affected more than Northern capitalists. Southern workers benefit from migration; the incentives to migrate are reduced. Thus welfare effects of migration can be divided into static effects from changes in wages and the terms of trade, and dynamic effects from higher growth. Static distributional effects are as the previous section - Northern workers (excluding new immigrants) and Southern capitalists lose and Northern capitalists, Southern workers and migrants gain. Workers in the North and South gain from increased growth, but Northern capitalists can lose because more R&D activity intensifies competition and squeezes profits. Table 1 summarizes these results on winners and losers. The net effect of migration is naturally sensitive to parameter values and to the specification of the model.

Table 1.

**Winners and Losers under skilled Migration: Static and
Dynamic Aspects**

Groups	Static Analysis	Dynamic Analysis
Northern Capitalists	Winners	Winners or Losers
Northern Workers	Losers	Winners
Southern Capitalists	Losers	Winners
Southern Workers	Winners	Winners
Migrants	Winners	Winners

In a 2-country, 3-sector model, Bretschger (2001) challenges a main result of the existing literature on the impact of migration on growth, namely the positive effects of unskilled migration given an elasticity of substitution between skilled/unskilled greater than 1 (Grossman and Helpman, 1991). Moreover, the author shows the role of countries' shares in world goods markets, a role neglected by previous studies.[8] Using an expansion in varieties framework, the author analyzes the impact of the supply of skilled and unskilled workers on the growth rate in open economies. In the medium term, the three sectors (traditional, high tech and R&D sectors), are spread in the two economies, but given increasing returns in the R&D sectors, the final outcome will be one of full specialization.

After presenting empirical evidence supporting his model, the author considers two versions. In a first version, he shows the effects of migration in expanding varieties in consumption, as in Grossman and Helpman (1991). An increase in skilled migration has unambiguously positive effects on growth, while the effects of unskilled migration depends on the elasticity of substitution of skilled and unskilled in both the high tech and the traditional sector. In particular, the smaller the country, the higher the possibility of negative effects on growth of unskilled migration. In a second version of the model, Bretschger (2001) considers the case of an expanding varieties in inputs into production, highlighting the role of the reward for the inventions of new designs (R&D sector). In this version he assumes varieties to serve as intermediate goods for a capital input and he shows how a migration of unskilled labour has unambiguously negative effects on the growth rate. At the same time, the growth effects of an equi-proportionate immigration of unskilled and skilled depends again on the elasticity of substitution and the countries' size.

To summarise, the main findings of Bretschger (2001) are: migration of skilled labour has a positive effect on the host country but migration of unskilled labour has a negative impact of on growth. A corollary of these results is that migration of the highly skilled negatively affects growth in the source economy, which is in accordance with the mainstream literature on the brain drain. The example of Switzerland with its policy that discriminates foreign skilled labour is introduced to support the author's arguments.

The importance of the skill composition of migrants is also emphasised by Levine *et al.* (2002). They revisit the work of Borjas (1995) and extend his analysis in a number of directions. First, they study the immigration surplus in the context of a general equilibrium model in which capital is endogenous and the welfare of the indigenous population is set out explicitly. Second, they introduce several sectors into the model so that changing the skill composition leads to changes in sector shares. Third and related to the second development, they introduce dynamics and develop a model with long-term EG driven by R&D. The result is that growth effects on the immigration surplus come to dominate the purely static effects in the original analysis of Borjas, but they are not sufficient to eliminate the emergence of losers among the section of natives competing with immigrants in the labour market.

Migration and Growth: Empirical Evidence

Despite the positive effect that immigration can have on growth, immigration is typically not included as an explanatory variable in the avalanche of (cross section) growth regressions that have emerged following Barro (1991). Even those studies that attempt to control for virtually every conceivable covariate e.g. Levine and Renalt (1992) and Hoover and Perez (2001) do not explicitly control for immigration. Rather, they include the population growth rate of which net migration is just one component, although this variable is not very significant in their regressions. On the other hand, Sachs and Warner (1997) include the growth of the economically active population minus the population growth rate, which they find to be positive and almost significant at the 5% level. Therefore we must look to other evidence to demonstrate the importance of immigration *per se* on growth.

A possible reason for the relative absence of immigration as an economic explanation for growth was suggested by Neal and Uselding (1972) who believed that economists take the growth rate of the labour force as a fixed parameter, even in periods when the amount of immigration varies. However, there is considerable evidence from the economic history literature as to the importance of immigration, and of factor movements in general, on growth and convergence.

Kindleberger (1967) was one of the main advocates of the view that immigration was the main factor behind the remarkable rates of economic growth witnessed in the post-war period in Europe. Taylor (1999) suggests that his empirical model for the period 1870-1914 "...certainly indicates the importance of the three classical factors, and the indisputably mobile labour and capital, as the basis of economic growth" (p. 1642). Focusing solely on Argentina over this period, Taylor (1997) finds that immigration drove down real wages in the country by

around 25% and caused a 19% increase in GDP. Given the huge inflow of people over this period, Taylor (1997) describes Argentina as an ideal test case for analysing the economic impact of immigration. Neal and Uselding (1972) estimate that the 1912 US physical capital stock would have been between 13% and 42% lower had it not been for immigration into the US economy and that its proportionate effect on human capital would have been at least as great.

Other attempts to quantify the magnitude of the effect of immigration have used fairly crude techniques. For example, Askari (1974) simply multiplied the annual contribution of labour to growth by the percentage of foreign workers in the labour force. He found that the impact of immigrants on growth rates in the EEC was fairly small. The largest effects were found in Luxembourg, where immigrants were estimated to have increased annual growth rates by an average of around 7% (0.2 percentage points per year) between 1960 and 1970. Impact of immigrants on the annual growth rates of Belgium, France, Germany and the Netherlands was much smaller since immigrants typically contributed less than 0.05 percentage points. Other studies include that of Gallais-Hamonno (1977) who estimated that immigrants contributed around 5% to France's GNP.

Blattner and Sheldon (1989) take a different approach in that they specify a production function for Switzerland that distinguishes between domestic and foreign labour. They apply a growth accounting framework to isolate the contribution of immigrants to output growth rates, productivity and *per capita* GDP. They estimate that foreign labour accounted for around 0.3 percentage points of the 2.7% average growth rates that Switzerland experienced between 1961 and 1982. The other contributions to output growth were domestic employment (0.1 percentage points), hours of work (-0.2 percentage points), capital (0.8 percentage points) and technical change (1.7 percentage points). However, they find that foreign employment had a negative effect on both productivity growth and *per capita* growth over this period, which they explain by the lower output elasticity of foreign workers, possibly as a result of the jobs in which immigrants are typically found.

POLICY IMPLICATIONS

Policy debates typically focus on the role of institutions and governments as mechanisms, which can first regulate migration flows and their composition and second mitigate the potential negative impact of immigration on the host country. On the one hand, studies in favour of migration emphasize its role in partially offsetting slower growing or declining populations as well as easing the skilled labour shortages in specific sectors. On the other hand, opponents point to the adverse impact on native unemployment and wages, although most empirical

studies find that the effect of immigrants on the host country labour market is small.[9] Here we attempt to synthesize the policy implications of papers surveyed on three themes: i) What are the static and dynamic consequences of an increase in immigration? ii) What is the relationship between skilled/unskilled migration and economic development in the source and host countries? (iii) What role can governments play?

Previous surveys by Borjas (1994, 1995, 1999, 2001) focus on the static effects of migration. Borjas (1994, 1995) produces clear policy recommendations. In a heterogeneous labour market framework, he looks at the original mix of skilled and unskilled workers in order to measure the immigration surplus and analyse the role of possible complementarities between migrants and native factors. However, he estimates that immigration has only a small impact on US GDP and causes a not-insignificant redistribution from labour to capital. For these reasons, Borjas' earlier work suggests a pessimistic outcome from active recruitment policies. However, the 'greasing the wheels' argument in Borjas (2001) is more optimistic. Whether the resulting immigration surplus is significant or not, winners and losers remain and this suggests that compensating redistributive policies among immigrants, domestic workers and domestic capital owners may be necessary. A similar policy is suggested by Steineck (1996), who concludes in favour of potential positive effects of migration, which are unequally distributed amongst the native population.

Turning to the dynamic aspects of immigration (growth and economic development), the debate focuses on the skill content of migrants and concerns of a possible brain drain from LDCs. Growth may be driven by pure size effects, human capital and R&D and the policy prescriptions are strongly related to the mechanism generating growth. In a model where growth is driven by pure size effects, Reichlin and Rustichini (1993) suggest an active migration policy, whilst in a world with different skills they also look at the composition of migration and recommend policies which guarantee a proportional flow of skilled and unskilled migrants.

Lundborg and Segerstrom (2000, 2002) in a two-country EG model with a homogeneous labour force, show that the representative agent loses from large immigration quotas, despite a positive growth effect, whilst the population of the sending country gains. Given this negative result for natives in the host country, the authors consider different policy recommendations. A migration tax lowers the incentive to migrate but native workers would have been better off in a no migration equilibrium. Migration incentives can be affected by other policies. In the Lundborg and Segerstrom framework, even if a R&D subsidy in the host country enhances growth, a R&D subsidy in the sending country has the positive effect of

reducing migration incentives by lowering the international utility differences among workers.

Policies that favour immigration of more skilled individuals are advocated by Bretschger (2001), since it is argued that migration of the highly skilled raises human capital levels in the host country and therefore has a positive effect on its growth rate. Referring to the experience of other countries (e.g. Canada), the quality of migrants can be influenced by adopting a points system to meet the labour market needs of the EU. However, the quality of migrants with regards to the transferability of their human capital depends on the type of skills they possess and the characteristics of the host and sending countries (e.g. language, institutions etc). This implies that selection mechanisms based on the country of origin may also be considered by labour importing countries.

The positive effects of skilled migration are also stressed by Levine *et al.* (2002). They revisit and extend the standard Borjas analysis (Borjas, 1995). Focusing on the dynamic aspects, the authors show that in an EG framework, the positive effects of skilled migration are magnified. At the same time, however, the distributional effects still dominate.

Issues surrounding the skill composition of migrants are also important in the context of the brain drain for LDCs. Therefore policies designed to promote growth in these countries should take the human capital flight into account. To the extent that human capital is an important determinant of growth, Haque and Kim (1994) suggest that in an open economy, subsidies to education can have a negative impact on the growth rate of the source country. On the other hand, some of the papers surveyed above suggest that the possibility of migration can have positive effects for the home country by encouraging individuals to enhance their human capital stocks. Another important benefit of international migration LDCs are remittances, although there is some debate over the extent to which these payments are used for productive purposes. Therefore policies that encourage remittances to be invested should be recommended.

CONCLUSIONS

This survey has reviewed a large number of theoretical models that consider various aspects of the immigration process, focusing in particular on the effect that immigration can have on growth rates. In general, these models indicate that immigration should increase growth, both in terms of endogenous and short-run growth. This is particularly the case if the inflow of workers consists mainly of the highly skilled. However, the outflow of skilled workers from sending countries might have a detrimental effect on those countries i.e. the brain drain, but some

authors argue that the migration of the highly skilled can actually bring about positive effects in that it is likely to encourage human capital formation in the source country.

There are relatively few reliable econometric estimates of the contribution that migration makes to raising growth rates, but no shortage of empirical evidence on its importance in various time periods for different countries. The survey also contains a discussion of the policy options available for both sending and receiving countries, in the light of the empirical evidence and theoretical findings. With reference to the forthcoming enlargement of the EU, given that migration from Eastern to Western Europe may well produce positive growth effects, especially if migrants are highly skilled, an overly restrictive migration policy may constrain the overall growth of the region.

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NOTES

1. See Zimmermann (1995) for a summary of the migration experiences of European countries in the post-war period.

2. Bauer and Zimmermann (1999) provide a recent review of the determinants of international migration and the characteristics of immigrants.

3. There have been a number of recent surveys of the migration literature. Friedberg and Hunt (1995) mainly review empirical studies of the impact of migration, Ghatak, Levine and Wheatley-Price (1996) focus mainly on the migration decision, and Schiff (1996) explores whether trade liberalization and free migration policies are substitutes. Borjas (1999) - building on Borjas (1994, 1995) - focuses on two main aspects of the economic analysis of immigration, namely the determinants of the immigration decision and the impact of immigrants on the host country. Commander *et al.* (2002) set out a number of ways in which models address the brain drain phenomena. The closest to our survey in terms of scope is provided by Steineck (1996). Our survey builds on this paper, drawing on the substantial literature in more recent years, particularly regarding endogenous growth.

4. The effect on *per capita* consumption is more subtle depending on whether the savings rate is above or below the 'golden rule' that maximizes *per capita* steady-state consumption. For further details, see Barro and Sala-i-Martin (1995).

5. Lucas and Stark (1985) discuss the motives for sending such payments.

6. The positive growth in this model is achieved through a positive intergenerational externality.

7. It is not clear what happens to the wealth of the dead consumers.

8. The interdependence between immigration and country size works in the following way: small economies can sell additional goods without affecting world prices very much. In particular, if we assume an increase in the supply of unskilled workers, this will determine an expansion in the unskilled sector first, which is usually grows more slowly. In this case, the negative effects of growth determined by low skilled migration is stronger for small economies.

9. Even those studies which make use of quasi-experimental evidence, such as Card (1990) for the Mariel boatlift of Cubans to Miami and Hunt (1992) for the repatriation of Algerians to France, find that the inflow of immigrants had only a minimal effect on the wage and employment levels of native workers.

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