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FLOWENLA Discussion Paper

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ABSTRACT

This survey reviews both theoretical and empirical papers that examine the economic effects of labour mobility with a particular reference to intra-European migration. 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.

Keywords: migration, factor mobility, economic growth, immigration surplus

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1 Introduction

Immigration is one of the most important issues in the contemporary global economy.¹ It is estimated that over 110 million people now reside outside the country of their birth (United Nations, 2002). This clearly has major economic and political implications for both the sending and receiving countries. Coppel et al. (2001) identify four major consequences 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 since 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 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. Also, in an integrated world economy an increase in the growth driven by innovation benefits everyone. 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

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

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

possible our empirical evidence relates to the European migration experience.

We structure the rest of the survey around five sections: Section 2 reviews previous surveys in this area. Section 3 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 4 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 5 discusses the policy implications that flow from the papers surveyed and Section 6 concludes with some suggestions for future research.

2 Previous Surveys

This section reviews six previous surveys by Friedberg and Hunt (1995), Ghatak, Levine and Wheatley-Price (1996), Schiff (1996), Steineck (1996), Borjas (1999) and Commander et al. (2002) concerned with the economic effects of migration.

Friedberg and Hunt (1995) is mainly a survey of the empirical literature that examines the positive benefits of immigration for the host country by looking at possible complementarities between migrants and native factors, and by investigating the effects of immigration on growth. The paper also discusses theoretical considerations on the issue.

In the theoretical part, they separate analysis of the the closed economy from that of the open economy analysis. In the closed economy case, the usual substitution and complementarity effects take place. In a Heckscher-Ohlin framework (trade with migration), the authors concentrate on the case in which countries have very different endowments of factors and factor price equalization does not occur. An increase in unemployment is not excluded, especially in the European setting. Nevertheless, the empirical evidence for both the US and Germany finds no significant detrimental effects of immigrants on employment and wages. In a cross-section analysis, the authors highlight the need to use instrumental variables to remove the bias due to immigrant choice of location based on labor market conditions.

Finally, the authors discuss the effects of migration on the growth rate of the host economy. They use a modified Solow growth model for the theoretical framework (i.e., the human capital-augmented Solow-Swan model). The key question here is whether immigrants bring enough human capital to offset their dilution of physical capital in the

receiving economy. The main limitations of this theoretical framework are: a closed economy is assumed and the absence of congestion effects. From the theoretical point of view, migrants move to countries with higher wages, but the authors point to possible problems once there is simultaneity between migration and growth. These problems are studied and reported in Barro and Sala-i-Martin (1992) which conclude there are insignificant effects of migration on growth. Again, the survey emphasis is placed on the role of human capital of migrants in determining the growth rate of the host economy.

Ghatak, Levine and Wheatley-Price (1996) present a critical survey of theories of migration, their welfare and policy implications and their empirical relevance. The Harris-Todaro model is extended to examine risk averse behaviour within families where the migration of members of families serves to diversify risk. The welfare implications of the individual migration decision and government intervention in the form of employment subsidies is also examined.

In the survey of Schiff (1996) the focus is on the issue of whether trade liberalisation is a substitute, or not, for migration. Drawing on a paper which subsequently was published as Lopez and Schiff (1998), he concludes that migration costs and financing constraints on unskilled workers lead to complementarities between trade liberalisation and migration. Complementarity occurs because there are economies of scale and sector specific technological differences. A lowering of tariffs increases the wage in the host country and eases the financial constraints for unskilled workers. This leads to more migration of this group of workers. He concludes that to counteract this, foreign investment or aid is desirable.

Steineck (1996) covers the economic impact of migration looking at the influence of the migration phenomenon on welfare (i.e., the aggregated effects and their distribution among natives). The author presents a survey of the comparative-static factor market analysis, namely changes in relative factor prices under the assumption that immigrants are remunerated at their marginal contribution and of the effects due to market distortions, increasing returns etc (i.e., the divergence between remuneration and marginal contribution). Moreover, he provides a more complete picture by including a dynamic analysis. The author starts the survey by introducing a basic model with homogeneous labour (Berry and Soligo, 1969) in which he concludes in favour of the positive effects of migration that are unequally distributed between native capital owners and workers.

Then some variations of the basic framework are introduced to see how they affect the qualitative results. These extensions are divided in two groups: the ones that do not contradict its conclusions, as in Rivera-Batiz (1983) and Bohning (1984) (i.e. demand contribution by immigrants, two or more goods, international capital mobility) and some, supported by empirical work, that affect the general results (i.e. heterogeneous labour market, short term rigidities in the labour market, increasing returns to scale etc). The connections between theory and empirical evidence have concentrated on these issues. In particular, in order to arrive at definitive conclusions regarding the heterogeneous labour market model, empirical evidence on the degree of substitutability between the different groups is required. Looking at the most relevant studies, the author concludes that they show a negligible effects of migration on domestic workers (i.e. the degree of substitutability between domestic workers and immigrants is low). The author also distinguishes short run from long run effects and claims in favour of a possible increase in unemployment in the short run, determined by the migration flow.

Empirical estimates of scale economies in the production sector leads the author to conclude that they are not relevant in the debate. At the same time, he presents empirical studies on the effect of immigration on the public redistributive system which arrives at different conclusions. Basically he concludes that final answers are not possible and a lower level of aggregation is required.

In the second part of the work, Steineck reports theoretical results and supportive empirical evidence on the dynamic effects of the migration phenomenon. The conclusions depend very much on how technological progress is modelled. Three cases are distinguished:

1. A neo-classical growth model with exogenous technological progress;
2. A neo-classical model in which technological progress is driven by capital intensity in an ad hoc fashion;
3. An endogenous growth model in which technological progress is driven by both physical and human capital intensities.

In the first case, the Steineck concludes in favour of allocative effects of migration, given the assumption that immigrants do not bring any capital along (i.e. a decrease

in the aggregate capital intensity). In particular, migration shifts the economy to more labour intensive production which is not negative in its economic impact per se –the shift depends on the saving rates of immigrants since the returns to capital have risen and there is space for positive effects on the rate of accumulation. On the other hand, in case two, he shows the presence of clear negative effects of migration for the welfare of the domestic population. Under the assumption that immigrants on average own less capital per capita than natives, immigration slows down technological progress as well as the rate of growth of the economy. In the final case, based on Bretschger (1993), technological progress depends on individuals' incentive to invest in the R&D sector and to the extent that migration changes the relative factor prices, it affects the rate of progress.³ In this third case, Steineck concludes by saying that migration has a positive effect on growth through technological progress if it increases the return on R&D investments. This will occur if migration consists of of skilled workers, thus increasing the skill composition of the domestic labour force.

The survey by Borjas (1999), 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. The first part investigates the effects of migration on the host country's labour market which are a synthetic presentation of a family of models already introduced in one of the author's previous works. As in the original work, the theoretical framework is used to describe the effects of migration firstly by assuming a homogeneous labor market and secondly by including an heterogeneous labor market analysis. Then, this set of models are used to simulate the impact of immigration on the US labour market. As in Borjas (1995), the author concludes in favour of a small impact of migration on US labour market. Section 3.1 below describes these results in detail. In the second part of the work, Borjas focuses on the empirical research of skill distribution of immigrants and natives since these are the main determinants of the impact of migration on the host country. He examines the factors that motivate only some individuals to migrate in a particular country, a theme that lies outside the scope of this survey.

Borjas concludes the analysis by surveying the attempts to measure the impact of

³A similar model is found in Bretschger (2001), surveyed in section 4.3 below.

migration on the wage structure in the host country. Most studies have found that immigrants have only a small negative impact on the wages and employment of natives. For example, DeNew and Zimmermann (1994) estimate that a 1 per cent increase in the share of foreign labour caused a 4.1 per cent fall in the average hourly wage of all German workers. This overall effect appears to be slightly larger than the estimates produced for the US (Zimmermann, 1995). 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 small effect on the wage and employment levels of native workers. Possible explanations for these findings are that immigrants are sometimes complements to natives in the production process, thereby increasing the productivity of natives, immigration creates extra demand for goods and services and that immigrants may help to erode institutional constraints such as trade unions (Zimmermann, 1995).

However the main point made by Borjas concerns the necessity to include estimates of native responses to immigration in the so called “spatial correlations” estimates, namely correlations between economic outcomes in an area and migration to that area. Two problems arise from this: immigrants may not be randomly distributed across labor markets (a positive correlation would simply mean that migrants tend to concentrate in better performing geographical areas as showed in Friedberg and Hunt, 1995) and natives may respond to migration by relocating. Given the failure of spatial correlations estimates to reveal the impact of migration on wages in the host country, the author suggests and reviews the so-called factor proportions literature. This literature relies on a theoretical framework and for this reason it has been criticized by some researchers. Nevertheless, this approach can still say something on the economic impact of migration if we recognize that it is based on a very specific story. As noted by the author, “*the factor proportions approach does not estimate the impact of immigration on the wage structure; rather , it simulates the impact*”. Borjas (2002) applies a different econometric methodology by analysing the effect that immigrants have on the wages of natives by using occupational rather than geographical clustering. In particular, he finds that by using this approach, immigrants have a much larger effect on wages, an immigrant inflow that increases the supply of workers with particular skills by 10 per cent reduces the wages of natives in that

group by 2-3 per cent and lowers weeks worked by 2 per cent.

The recent survey by Commander et al.(2002) sets out a number of models to address the brain drain phenomena. In the final part of the survey, the authors focus on an adapted ‘new’ economic geography framework. Looking at the brain drain from that perspective, the phenomenon appears temporary, but with negative welfare effects in the periphery country during the transitional phase.

3 Migration with Exogenous or Zero Growth

3.1 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 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 $MPL(\text{West})$ is higher than its Eastern counterpart $MPL(\text{East})$ because physical and human capital is higher in the West. Ignore for the moment human capital differences; 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 *net* increase in output is therefore given by the shaded 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 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 $w_W KDEw$ for Western capital 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 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

$$\begin{aligned} S &= \frac{\Delta w \cdot M}{2Y} = \left(\frac{L \Delta w}{w \Delta L} \right) \cdot \left(\frac{w}{L} \right) \cdot \left(\frac{\Delta L \cdot M}{2Y} \right) \\ &= -\frac{1}{2} e \left(\frac{wL}{Y} \right) \left(\frac{M}{L} \right)^2 = -\frac{1}{2} e s m^2 \end{aligned}$$

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 $m = \frac{M}{L}$ is the proportion of migrants in the workforce ($\frac{AB}{OB}$ in figure 1).

Given that labour income accounts for around 70 per cent of GDP for most OECD countries, and just under 10 per cent of the US (or German) workforce are immigrants and the elasticity of the factor price of labour (capital fixed) thought to be around 0.3 (Hamermesh, 1993 see Appendix), Borjas puts $s = 0.7$ and $e = -0.3$ to arrive at the pessimistic conclusion that a 10% increase in the workforce through migration 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 migration 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 curves (the marginal product of labour, MPL) 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. OA is the total labour force in East and West prior to migration (assumed to be equal). As a result of migration equal to $HA=AB$,

with some real wage flexibility, the BRW (West) shifts to the right and employment rises by WW. Similarly the BRW (East) shifts to the left and employment falls by EE. The welfare implications of East-West migration – which we analyze 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 $\Delta L = \eta M$ where $\eta \in [0, 1]$ encompassing the cases of wage flexibility $\eta = 1$ to complete inflexibility $\eta = 0$. The immigration surplus now becomes

$$S = -\frac{1}{2}esm^2\eta^2 \quad (1)$$

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 work-force in both blocs consists of skilled and unskilled labour and output $Y = f(K, L, H)$ in the host country where L and H denotes skilled and unskilled labour respectively. Let elasticities of factor prices w_L and w_H be denoted by $e_{LL} = \frac{\partial \log w_L}{\partial \log L}$, $e_{HH} = \frac{\partial \log w_H}{\partial \log H}$ and $e_{LH} = \frac{\partial \log w_L}{\partial \log H}$. Let the migration rate be $m = \frac{M}{L+H}$ and the post-migration proportion of skilled labour be $h = \frac{H}{L+H}$. Let β denote the fraction of skilled workers among immigrants and the changes in the skilled and unskilled work-forces following migration be $\Delta L = \eta_L(1 - \beta)M$ and $\Delta H = \eta_H\beta M$ where $\eta_i \in [0, 1]$ are measures of labour market flexibility for the two types of labour. Finally let $s_L = \frac{w_LL}{Y}$ and $s_H = \frac{w_HH}{Y}$ be factor shares. Then following Borjas (1995), the immigration surplus generalizes to

$$S = -\frac{s_H e_{HH} \beta^2 m^2 \eta_H^2}{2h^2} - \frac{s_L e_{LL} (1 - \beta)^2 m^2 \eta_L^2}{2(1 - h)^2} - \frac{s_H e_{HL} \beta (1 - \beta) m^2 \eta_L \eta_H}{h(1 - h)} \quad (2)$$

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

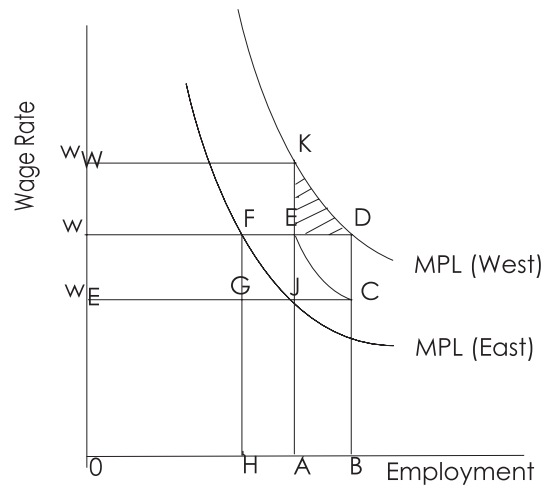


Figure 1: **The Immigration Surplus: flexible wages and one type of labour**

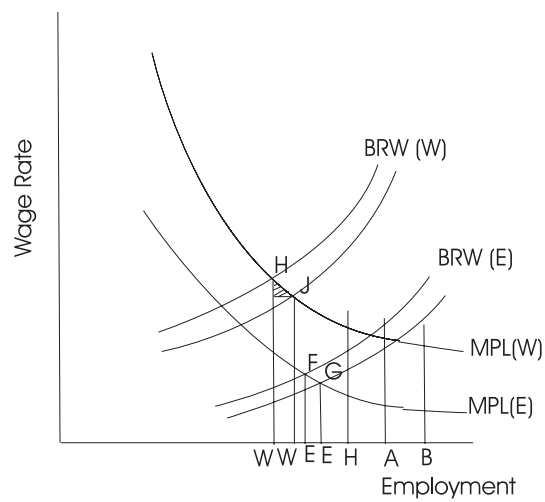


Figure 2: **The Immigration Surplus: inflexible wages and one type of labour**

can rise substantially depending on original mix of skilled and unskilled workers in the population.

We can use (2) to assess immigration policy that favours immigrants with or without skill. Assume Cobb-Douglas production technology (the Appendix shows that this assumption is consistent with the empirical evidence, at least for aggregated labour). Then it is easy to show that $e_{LL} = -(1 - s_L)$, $e_{HH} = -(1 - s_H)$, $e_{HL} = s_L$ and $e_{LH} = s_H$. Assume total labour's share is as before so that $s_L + s_H = s = 0.7$ and that the skilled wage rate is twice that of the unskilled rate. Further assume that before immigration $H = L$, so that $h = \frac{1}{2}$ in (2). Figure 2 shows calculations of the immigration surplus as the proportion of immigrants who are skilled varies between $\beta = 0$ and $\beta = 1$. When $\beta = h = \frac{1}{2}$ we have the same estimate as for the homogeneous case with an immigration surplus just above 0.1%. As β increases to 1 the immigration surplus rises to 0.5%. Equally as β falls to zero the immigration surplus rises, but this time by less to 0.36%. Immigration by workers whose skill composition differs from natives raises the immigration surplus, but by less if the immigrants are less skilled than the average native. The reason for this is that given fixed capital a 1% increase in unskilled labour raises output by s_L which is less than the corresponding increase of s_H when immigrants are skilled. For comparison figure 2 also shows the case where there is no capital so that labour shares add to unity ($s_L + s_H = 1$). Then the immigration surplus is zero at $\beta = h = \frac{1}{2}$ and changing the composition of the workforce to be more or less skilled is symmetrical in its effect on the immigration surplus.⁴

In the final part of Borjas (1995) he uses Hamermesh (1993) whose survey suggests that the factor elasticity elasticity may be greater for skilled than unskilled workers. This suggests that skilled labour and capital are complements rather than substitutes and that Cobb-Douglas technology may not be an appropriate when labour is disaggregated. Then as this complementarity rises, if immigration consists solely of skilled workers, the immigration surplus can rise substantially depending on the original mix of skilled and unskilled workers in the population. Thus the analysis of Borjas 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.

⁴This is a standard result in which no benefit is derived by natives and migrants trading in factor inputs.

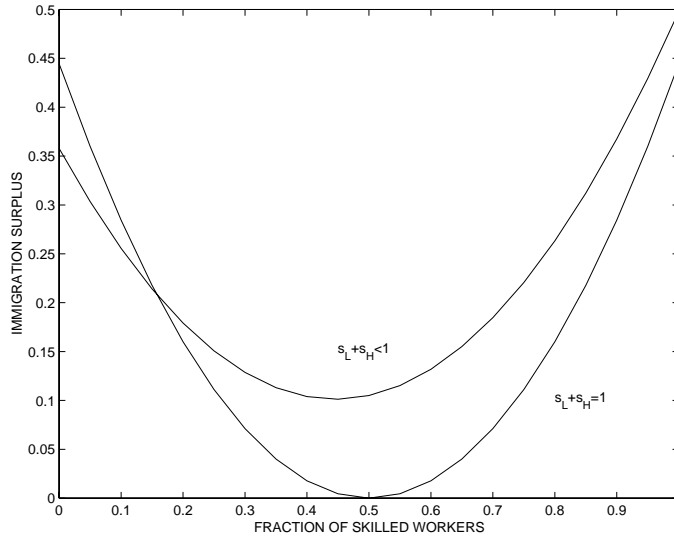


Figure 3: **Immigrant Skills and the Immigration Surplus**

Borjas (2001) analyses the immigration surplus in an economy with regional differences in marginal product. Compared to the context of a one-region aggregate labour market where the gains arise because immigrants and natives complement each other, the author argues that migration improves economic efficiency by speeding 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, namely people ready to move to exploit economic opportunities in different areas. The assumption underlying the idea 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; second, they maximize the income that accrues to natives net of migration costs. The author presents both descriptive analysis and empirical findings in support of his intuition. The data refers to US economy, where new immigrants show a high propensity to cluster in high wage areas. Comparing the case of Europe, there is clear evidence that migration costs play an important role in slowing down the convergence process and new immigrants may improve labour market efficiency.

Bauer and Zimmermann (1999) use the Borjas (1995) analysis to provide simulations for the effect of immigration on the EU economy (as well as for the German and UK

economies). However, they extend Borjas' analysis introducing the possibility of unemployment for unskilled labour. They estimate that if 1 per cent of EU employment in 1993 immigrates and this consists solely of manual (unskilled) workers then natives gain by only 0.01 per cent of EU GDP in the full employment scenario. If non-manual (skilled) workers migrate then the gain to natives increases to 0.03 per cent of EU GDP. They also estimate that distributional effects of immigration and find that the largest gains accrue to capital, with a 1 per cent immigration of skilled workers produces gains of 0.22 per cent of EU GDP. They suggest that non-manual natives will gain if less than 40 per cent of immigrants are manual and manual natives will gain if less than 70 per cent of immigrants are non-manual. In the unemployment scenario, natives can lose as a result of the immigration of manual workers, if their jobs are displaced. However, the 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 per cent of EU GDP if there is zero native unemployment. The authors note that the calculated gains are likely to be underestimates 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.

3.2 Migration and Trade

Is the position of a number of policymakers which at the same time advocates free trade, but restrictions on immigration policy, inconsistent? On the one hand, it is widely recognized that in the standard Heckscher-Ohlin-Samuelson (H.O.S.) model, trade and migration are perfect substitutes (i.e. if free trade takes place, it will nullify any incentive to migrate and *vice versa*). Under these circumstances, the question of the effects of migration on natives and on the whole economy becomes redundant. Trade liberalization will decrease and then nullify migratory pressures, both in sending and host countries. On the other hand, we know this is not the end of the story. Once we move from the perfect competitive framework and/or we introduce some kind of distortions in our economy and/or allow for different technologies in the host and source countries, the analysis gains new insights and the links between migration and trade are not trivial.

Some authors claim that the free movements of people differs from the movement of commodities for different reasons. Wellisch and Walz (1997) show why some rich countries

are reluctant to open their borders to migration after creating a free trade area. They introduce government activities, namely redistribution programs, in a two-country (H.O.S.) model with unskilled and skilled workers. Following the same lines, Schiff (1998) explains why free trade might be preferred to free migration by using the concept of social capital.⁵ People share norms, language and culture, and migration flows affects this social capital in both the sending and the receiving countries.⁶ The author concludes that the South (or East) always gains by freeing trade and the North (or West) by controlling immigration. The superiority of free trade compared to free migration is also claimed by Davis and Weinstein (2002) in a Ricardian model where one country (i.e. is technologically superior in all sectors. With free trade, the country has a monopoly power over its own technology and migration represents an erosion of this monopoly power. The authors show that world income rises while natives of the host country unambiguously lose out.

As clearly argued by Venables (1999) , the H-O-S model does not separate out specific factors for agriculture and industry. Once we introduce this assumption, an increase in an economy's endowment of one factor might reduce the return to the other. By allowing the richness of analysis of the specific factors model, Venables shows that the links between trade and factor mobility are ambiguous. Similarly, Razin and Sadka (2000) and Schiff (1996), by relaxing some of the H-O-S assumptions, show that free trade might not be a substitute for migration. Ambiguous effects derive from the relaxation of the constant returns to scale and the identical technologies assumptions. Economies of scale external and internal⁷ to firms can generate complementarities between movements of commodities and movements of people. Similarly, if we assume that technologies are not identical, factor mobility and commodity trade might complement each other. As pointed out by Razin and Sadka (2000), the productivity advantage could simply reflect superiority in terms of general infrastructure which is certainly the case in the East-West context. Finally, as mentioned before, complementarity between migration and trade results from a H-O-S model with migration costs and financing constraint. In this framework, complementarities

⁵The set of social norms, culture, values that affect the interactions among people and enter the utility and production functions.

⁶The author identifies four kind of externalities.

⁷The results driven by the assumption of increasing returns at the level of the firm will be developed in the next section.

are more likely the lower the skills and income of potential migrants.

By departing from the standard trade approach Gatsios et al. (1999) analyse the effect of trade liberalization on labour flow through the effects on the provision of some public good. They show that under quite reasonable conditions, trade liberalization determines a decrease in the provision of public good and an increase in emigration.

The assumption of increasing returns at the level of the firm⁸ and transportation cost are at the basis of the so called ‘New Economic Geography’ models. The complementarities between trade and migration follows from the presence of positive externalities, namely agglomeration economies, between individuals’ (consumers/workers) and firms’ location decisions. The extension of the Dixit-Stiglitz model into the Economic Geography took off with Krugman in the early 90’s. In particular, Krugman (1991) shows that the interactions of labour migration and the assumptions of increasing returns and trade costs, create a tendency for firms and workers to cluster together as areas integrate. Agglomeration into the ‘large’ region is driven by scale economies, namely plant fixed costs of production and scale economies through the scale benefits of a larger market⁹ (i.e., by pecuniary externalities). At the same time, the fixed agricultural population in the periphery is a centrifugal force working against complete agglomeration in the core. The complementarity between trade and migration follows from the process of cumulative causation. In particular, the increase in the number of firms in one region determined by a decrease in trade costs, makes that region more appealing for individuals (i.e., higher wages and increase in the number of local varieties) and it generates the above mentioned process of cumulative causation. Thus by adding imperfect competition, trade liberalization affects the location choices of individual and firms and a core-periphery structure may emerge. This strong result can be mitigated in different ways. Ludema and Wooton (1999) mitigate it by introducing some kind of imperfect mobility (i.e., individuals have preferences for living in a particular country) or, as suggested by Sapir (1999), by considering a world where international factor migration depends not only on wage differentials but also on the income level in the sending country. In these cases the Krugman-Venables framework is still theoretically valid, but more empirical work is required.

⁸The increasing returns are in the form of monopolistic competition model of Dixit and Stiglitz (1977).

⁹The manufacturing sectors provide their own internal force for local agglomeration by consumers demand).

Empirical evidence on the relationship between immigration and trade is limited , according to Girma and Yu (2002), this is limited. However, the evidence that does exist almost exclusively points to a positive impact of immigration on trade between the immigrants' host and home countries. Two explanations are usually given for this result. Firstly, immigrants have a preference for products that originate in their home country and secondly, immigration between two countries reduces the transaction costs of bilateral trade. The first of these explanations should only result in an increase in the host country's imports, whereas both imports and exports would be expected to increase as a result of the second explanation. Transaction costs could be reduced through a number of channels. Firstly, trade can be enhanced through the diminution of communication barriers resulting from immigrants being able to converse with co-linguals in their home country. Immigrants can also bring with them information about home country products if these are differentiated from those of the host country and hence the cost of obtaining this information will be reduced. The development of trust through immigrant contacts can also reduce the costs of negotiating and enforcing trade contracts.

Empirical studies typically use a gravity equation of trade augmented by immigration data to measure the size and direction of the trade-immigration relationship. Gould (1994) analyses the impact of immigration on trade between the US and 47 trading partners between 1970 and 1986. He suggests that the immigrant information effects appear to be stronger for imports and exports of consumer manufactures than for producer goods and that exports are influenced by immigrant links to a greater extent than imports. Head and Ries (1998) employ a similar methodology to investigate the effect that immigration has on Canadian trade patterns and also find a significant relationship between trade and migration flows. Furthermore, Wagner et al. (2002) estimate that the average new immigrant for Canada increases exports to their own country by \$312 and increase imports by \$944. Helliwell (1997) reports that migration produces international trade effects but does not have an impact on inter-provincial trade. This may occur because inter-provincial migrants may not add greatly to the knowledge base that already exists about institutions and markets in other provinces.

Both Helliwell (1997) and Gould (1994) suggest that there may be decreasing returns to migration. Girma and Yu (2002) report different results depending on whether immigrants

originate from Commonwealth or non-Commonwealth countries. They find that a 10 per cent increase in the immigrants from non-Commonwealth countries increases bilateral UK exports by 1.6 per cent and imports by 1 per cent in their static models.¹⁰ However, they do not find any significant relationship between immigration and trade for Commonwealth countries. They interpret these findings as supporting the view that immigration reduces the transaction costs of bilateral trade as a result of the immigrant specific knowledge of foreign markets and social institutions rather than through the personal or business contacts that immigrants may retain with their home countries. Dunlevy and Hutchison (1999) also provide historical evidence in favour of the positive impact that immigration had on imports into the US around the turn of the twentieth century.

3.3 Brain Drain or Gain?

The question of how migration of high skilled affects human capital formation and the average level of human capital in the source and in the destination countries, has come to command first order importance in the discussion of both the static and dynamic consequences of immigration. Miyagiwa (1991) analyzes the brain drain phenomenon introducing increasing returns to scale in the education sector in a model with heterogeneous workers. The key point of the model is that information is not a public good and that geographical distances matter. This implies that, the greater the number of educated in the economy, the greater the income of each educated (i.e. high skill) worker. In the one country case, the marginal ability is lower than the one chosen by the social planner (i.e., there exists a positive externality and too few skilled). In the second part, the author considers two countries with the structure described above, but of different size. In particular, country A (e.g., US) is bigger than country B (e.g., Taiwan). The author shows that in the bigger country not only are there a higher 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 in 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

¹⁰The estimated coefficients in the dynamic models are lower than those in the static models because it is argued that trade volume is strongly autoregressive.

only a proportion of the skilled migrate. Then the effects of the brain drain for the source country are ambiguous. It seems that there is the possibility of a positive brain drain (i.e., the income of the migrants increase while the ones of the low skilled non-migrant is kept constant), but it is also possible that only the most gifted gain from opening up the economy. In fact, given the presence of externalities in education, the migration of the most gifted negatively depresses the incomes of the ‘intermediate’ individuals forcing them to migrate. Miyagiwa points to an unequal distribution effects of migration on the smaller size country.

A traditional argument is that migration lowers growth in the source economy when the highly skilled workers emigrate. Mountford (1997) addresses this question using a model where human capital is crucial to transitional growth. 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 the 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.

The positive effects in terms of human capital formation is also taken up by Stark Helmenstein and Prskawetz (1997, 1998) in which conditions for a brain gain are developed, and by Beine Docquier and Rapoport (2001) in an overlapping generations model of two period-lived individuals. The former are similar papers that examine the notion that the gains from prospective migration may increase the human capital levels in the source country. They show how a positive employment probability in the host country provides an incentive to increase human capital formation because of higher returns to human capital overseas (Stark et al., 1998). Migration can therefore contribute to economic development in the home country, even without the need to assume that migrants return with skills they have acquired overseas. Stark et al. (1997) conclude that policymakers should consider not implementing measures that hinder emigration.

In Beine et al (2001), agents with a different level of abilities choose their level of education in the first period and supply a fixed quantity of labour in the second period. The productivity of workers depends on the level of the education acquired in the first period and on human capital heritage which is assumed equal for all individuals. The only sector of the economy produces a composite good in a perfectly competitive market

(constant returns to scale). Basically, the authors assume uncertainty in the probability of receiving a visa which is equal for individuals with the same level of education. The education choice for agents is governed by an indifference condition between foreign and domestic returns to capital. One crucial point is that the reservation ability (i.e., the ability of the marginal agent) is a decreasing function of the probability of migrating. In other words, if this probability is high more people invest in education with a prospective to migrate. The so-called *ex ante* brain effect has a positive effect in the growth rate of the economy as a whole and of the source economy as well. On the other hand, the growth rate of the source economy is negatively affected by the proportion of high skilled workers that migrate -brain drain effect. Obviously, the case for negative effects of migration in the source economy arises when the brain drain effect dominates while the case for a beneficial brain drain exists if some conditions are satisfied. Basically, a brain drain can be beneficial also for the source country if the probability to migrate is high enough to induce a significant ‘brain gain’ effect, but low enough to avoid a strong drain effect.

Becker et al (1990) look at the human capital formation and at the brain drain phenomenon from a different perspective. Basically, 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. In their economy, saving across generations takes place through either a high demand for children and lower investment for each, or fewer children and higher investment in human capital, and through investment in physical capital. The basic assumption is that the rate of return in human capital is high in economies with a higher stock of knowledge. As a result, economies with a low initial stock of human capital choose large families investing a limited amount for each child, while countries with a high stock of human capital do the opposite. This paper contributes to the brain drain literature since it gives an explanation of why brain drain is from poor to rich countries, namely the ones with higher returns in education. Moreover, if returns to education are increasing in the stock of knowledge, this advantage will not disappear.

3.4 Migration and Inequality between Regions

Faini (1996) is more concerned with the convergence and whether migration increases or decreases inequality between regions. He develops a two-region model of migration. The population in each region is modelled through a two-period overlapping generations model. Consumers are endowed with a unit of labour in youth only. In each period of her life, a consumer i derives utility from a consumable good that is inter-regionally traded. Consumption is multiplied by a parameter $\theta^i \geq 1$ which depends on the location of the consumer. If she migrates, θ^i falls to one. This introduces a cost of migration. θ is allocated between individuals according to a Pareto distribution. The fraction of the young that will decide *not* to migrate can then be written as a function of the ratio of wages in the two regions only, with the added convenience of a constant elasticity ϵ .

There are two sectors of production. Production in the non-traded intermediate commodity depends on the capital stock in that sector only with a constant elasticity ϕ . Returns to scale are increasing if $\phi > 1$. Firms take the cost of capital as given, but compete in the output market in a Cournot fashion. Production in the traded sector depends on labour, capital and the non-traded intermediary. Since the latter is produced at increasing returns to scale, endogenous growth is possible, but Faini confines the analysis to parameter values for which there is only transitional growth. The capital stock is composed of the traded commodity but adjustment costs prevent perfect capital mobility between regions. The interest rate is exogenous and coincides with the discount rate of consumers. Capital depreciation is complete.

Assume initially that the labour force is identical, but that the initial capital stock is not the same. First consider the case without migration. In each region the rental rate is a negative function of the installed capital stock. Therefore the relative rental rate declines when the relative capital stock increases in the North, leading to an inflow of capital to the South. The model is stable and regional convergence occurs. Now assume that there is labour mobility. The relative rental differential depends negatively on the relative capital stock as before, but it also depends positively on $(1 - \phi)\epsilon$. Therefore if the degree of labour mobility is sufficiently high and the returns to scale in the intermediate sector are sufficiently strong, then the model diverges.

3.5 Migrants' Saving, Remittances and the 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 per capita capital stock and therefore per capita output. (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 – see Barro and Sala-i-Martin, 1995). 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 generation 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. These two 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 two-country overlapping generations model is developed to examine the impacts of both temporary and permanent migration. It is shown that 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 essentially 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 the previous studies to incorporate the effects of uncertainty. His analysis suggests that if the migrant's variance of income is higher than natives of the host country then they will save more. However this result depends on whether any 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. Lucas and Stark (1985) discuss the motives for sending such payments. The amounts sent abroad are substantial, with World Bank estimates of officially recorded remittances of around \$75 billion in 2000 although this is thought to be a significant underestimate of the true figure. Therefore it is argued that 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 they were equivalent to more 20% of exports in six other countries. Furthermore, the total amount sent in remittances is thought to far outweigh the net level of foreign aid that is received from OECD countries (Coppel et al., 2001).

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

Empirical evidence on the savings of migrants is provided by Merkle and Zimmermann (1992) who investigate the savings behaviour of guestworkers, most of whom are Southern European, living in Germany. They found that nearly all guestworkers had positive savings, either a savings account in the home country or through remittances (which they argue are a special form of savings if the migrant intends to return to their home country). They found a negative relationship between the planned duration of residence in Germany and remittances but this was not significant at the 5 per cent level. However, but they note that guest-workers who return home early may well hold savings in their home country. The conclude that their evidence supports Galor and Stark's hypothesis. However they do not compare migrants' savings rates directly with those of natives.

There is also some evidence to suggest 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 per cent 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 per cent higher than a native with a similar income level. Paine (1974) reported that Turkish migrants had a local savings rate of 36 per cent, which was well above the national rate for developed economies. Although our focus is on Europe, it is worth reporting McCormick and Wahba (2001) who analyse the savings of return migrants to Egypt and the effect that these savings have on the probability of entrepreneurship. They report that 29 per cent of their sample were entrepreneurs after returning compared to 18 per cent before migrating. They argue that savings accrued by the migrant while overseas 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). They also find that the acquisition of overseas work experience increases the probability that literate migrants become entrepreneurs, which may reflect skill acquisition while abroad.

Mankiw, Romer and Weil (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 may however suggest that those countries that experience large immigration flows may 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 this augmented Solow model indicate that human capital is important in explaining wealth differences, even within OECD countries. They also suggest that 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. They further note that higher savings are associated with higher levels of total factor productivity.

3.6 Migration, Unemployment and Asymmetric Information

The role of history and initial conditions is highlighted in Bencivenga and Smith (1997) in an exogenous growth model with a given proportion of high and low skilled workers. They show how in a two-period overlapping generations model, migration from rural area to the city determines unemployment. In contrast to Harris-Todaro (1970), unemployment arises as a self-selection mechanism (only high skilled migrate and the skills are private information). The authors show the possibilities of multiple steady states through a non-monotonic relationship between current and future capital-labour ratios, and that if too many migrate, adverse selection and unemployment can cause the saving rate to decrease.

Ortega (2000) offers a view of unemployment and immigration in a dynamic two-country labour matching economy. Unemployment does not arise from the assumption of wage rigidity in the developed area. In particular, the work offers a theoretical explanation of why immigration might have positive effects on natives. The outcome is not predetermined, given the existence of multiple equilibria ('no-migration', 'partial' and 'total migration' equilibria) and equilibria are Pareto-ranked. In particular, the migration equilibrium Pareto dominates the no-migration ones. Individuals in the disadvantaged country¹¹ are better off since their decision to migrate positively affects their probability to find a job. At the same time natives are better off because migration positively affects labour demand. Compared to some literature that concentrates on the competition between natives and migrants in economies with rigid wages, fixed capital and therefore a fixed number of job, Ortega shows how the arrival of immigrants influences positively the job creation in the host country.

The inclusion of trade allows an explicit analysis of migration forces and unemployment rates. Epifani and Gancia (2001) in a new economic geography framework model the links between trade costs, migration and unemployment rates and show that the 'core' region gains from migration flows. The benefits are not only in terms of higher real wages, but also in terms of lower unemployment rate¹². As is typical in the Krugman framework, the effects on unemployment rates through labour mobility are temporary. In fact, as trade costs decrease, return migration speeds up the process of convergence.

¹¹Their country has worse structural characteristics which determine more frictions.

¹²The decrease (increase) of the unemployment rate in the core (periphery) region is determined by a decrease (increase) in the cost of intermediates (i.e. higher search costs for firms).

Katz and Stark (1987) discuss the situation where asymmetric information regarding migrants' skills on the part of foreign employers may reduce the skill level of migrants entering the receiving country. Katz and Stark (1989) extend this analysis and find that the effect of asymmetric information on migration depends on the type of skill level that is desired. For example if migration is desired at the lowest skill level then asymmetric information could reduce both the quality and quantity of migrants or have no effect at all. They also suggest that as employers discover the true productivity of migrant workers over time, the quality and quantity of migrants might actually increase since this lessens the impact that group averaging has on deterring the migration of the highly skilled. Beine et al (2001) discuss the issue of screening further.

3.7 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. Evidence suggests that 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. They therefore conclude that the net benefits associated with recent immigration may be smaller than for previous cohorts. Gott and Johnston (2002) also 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 state services. Furthermore, intergenerational considerations should be taken into account, and if this is done the contribution made by immigrants may be an underestimate since second generation immigrants are also likely to be net tax payers.

Canova and Ravn (2000) examine the 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 and high-skilled workers and migrants. With the welfare state the investment boom disappears and the recession is prolonged. Winners are now confined to migrants and unskilled workers in the former GDR.

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 mostly induced by the relatively large wage differentials that currently 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 from occurring, 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. For example, in the recently published 2001 United Kingdom 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. This means that several countries, especially those where pensioners are reliant on state pensions, are now confronted with a pensions crisis. It has therefore been suggested that 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 since it has been estimated that a net migration of around 1.5 million individuals per annum is required in order to keep the working population in the EU constant until 2050 (United Nations, 2000).

4 Migration and Endogenous Growth

A vast theoretical and empirical literature has emerged since the 1980s which has transformed the way economists think about growth. The pioneer of this research was Paul Romer (1986, 1990). 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 the focus of the new *endogenous* growth (EG) theory is on how the consumption and savings decisions of households, the 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, the new literature offers a number of possible models *of* long-run growth.

The EG literature can be usefully 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 endogenous growth 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. 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 in order to assess the impact of migration on long-run endogenous growth.

4.1 Growth Driven by Capital Stock

Reichlin and Rustichini (1993) study the impact of migration in a two-period overlapping generations model of consumers with free trade, perfect capital mobility. Following Romer

(1986), the authors assume that the 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 the presence of externalities, the equilibrium is characterized by a continuous flow of migration from low wage to high wage countries. The flow of migrants from the poor to the rich country does not stop since the assumption of perfect capital mobility (i.e. interest rate equalization) makes the high wage country the one with a higher capital labor 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 the configurations of the migration patterns in a homogeneous labor 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 off-set 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 predisposition to emigrate 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 main points of this work, the authors show the positive effects of migration 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.

4.2 Growth Driven by Human Capital

Walz (1995) uses a 2-bloc endogenous growth 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 provides an explanation of skill formation and migration decision in an endogenous growth 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 higher incentives to invest in education and migration acts as a screening device. Since the cost to migrate are the same for both categories, the expected benefits to migrate 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. 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 in the paper 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 which is 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 of the source country does not decrease, migration can make everybody better off. Moreover, if migration increases the overall growth rate, the positive dynamic positive effects may offset the negative static effects for the host country.

The role of history and initial conditions is also highlighted in Premer and Walz (1994). In this paper the authors explain regions/countries divergence through an endogenous growth 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 high skilled migration in the source economy. In a two-country endogenous growth model with heterogeneous agents¹³, the authors show that the migration of skilled labour may have negative effects on income and growth in the sending economy. The heterogeneous individuals live two periods. In the first period they may decide to invest in education while in period two 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 of 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 population that has migrated, while the effects in the host country depend on the evolution of the ratio of average human capital of the two countries. Given the theoretical framework just described, the authors derive implications for policies to affect the level of human capital distinguishing the case of a closed from the one of an open economy.

4.3 Growth Driven by R&D

Lundborg and Segerstrom (1999, 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 an 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

¹³The positive growth in this model is achieved through a positive intergenerational externality.

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.¹⁴ Therefore demand and production of Northern commodities falls and the relative wage of Northern consumers falls. This leads 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 worse affected than Northern capitalists. Southern workers benefit from migration; the incentives to migrate are reduced. Thus the 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 North and South gain from increased growth, but Northern capitalists can lose because more R&D activity intensifies competition and squeezes profits.

¹⁴It is not clear in the paper what happens to the wealth of the dead consumers.

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

Table 1: Winners and Losers under skilled Migration: Static and Dynamic Aspects

Table 1 summarises these results on winners and losers. The net effect of migration is naturally sensitive to parameter values and to the specification of the model.

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 works¹⁵. 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 an 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

¹⁵The interdependence between immigration and country size works in the following way: small economies can sell additional goods without affecting world prices too 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 the slow growing one. In this case, the negative effects of growth determined by low skilled migration is stronger for small size economies.

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 migration of unskilled 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 sum up, the main findings of Bretschger (2001) are: positive effects in the host country of high skill migration and negative impact of unskilled labour on growth. A corollary of these results is that migration of the high skilled negatively affects growth in the source economy, perfectly in line with the main-stream literature on brain drain. The case of Switzerland with its policy that discriminate foreign skilled labour is introduced to support the author's thesis.

The importance of the skill composition of migrants is also stressed 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 endogenous growth 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.

4.4 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 the effect of 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 per cent 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 varied. 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 labor 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 per cent and caused a 19 per cent 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 per cent and 42 per cent 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 these effects 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 per cent (0.2 percentage points per year) between 1960 and 1970. The 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 per cent 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 per cent 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.

5 Policy Implications

The East-West European migration that will follow the pending enlargement of the European Union creates one of the most interesting migration-policy 'laboratories' in the world. In a continent, like Europe, where popular concern about social cohesion used to be particularly strong, labour-migration channels were virtually closed. Today, the transition toward a fully integrated area and the rising demand for foreign labour are changing the terms of the debate. The work presented in this survey suggests some guidelines for the removal of the restrictions to labour mobility. 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 and across generations, deserves special attention.

In order to focus on the policy implications of the papers surveyed in this work, we need to summarize the experience gathered in previous accession rounds and from the European migration flows since World War II. As described in the literature, periods of labour shortages such as in the 1960's induced active recruitment policies in some European countries. This openness had been followed by a period of restrained migration. Since the fall of the Berlin wall, all CEECs now grant their citizens the right to move in and out,

and from that time East-West migration started to gain particular attention. However EU countries still maintained barriers to immigration, e.g. some have migration quotas.

Different empirical studies , show that low immigration figures which can be traced back to restrictive immigration policies in member states. The gap in terms of per capita incomes, factor endowments and the state of technology that is expected to last for a long period of time suggest an increase in the flow of migrants once a full integration into the EU is complete. Despite no clear implications of a removal of the restrictions to labor mobility, concerns are often expressed that immigration will interest mainly low skilled migrants given the distinct gap in higher education enrolment rates. Moreover, the difficulties in transferring human capital acquired in the East to EU labour market is also under analysis. Other empirical studies end up with different conclusions and show that high ability workers are the more likely to migrate.

The debate has focused 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 in the host countries of immigrants. On the one hand, studies in favour of migration stress its role in partially offsetting the slower growing or declining population as well as easing the skilled labour shortages in specific sectors. On the other hand, opponents point to the impact on native unemployment and wages. Here we attempt to synthesize the policy implications of the papers included in the survey with respect to three themes: i) What are the static and dynamic consequences of an increase in the foreign labour supply? ii) What is the relation between skilled/unskilled migration and economic development in the source and host countries? (iii) What role can governments play?

We summarize the main findings in terms of possible gains of migration for the host countries and the distribution of these benefits and policies to stimulate growth and welfare in both the source and the host country¹⁶.

- Previous surveys on this theme and Borjas (1994, 1995, 1999 and 2001), focus on the static effects of migration. Borjas (1994 and 1995) ends up with clear policy recommendations. In an heterogeneous labour market framework, he looks at the

¹⁶Different models have been proposed and the choice among the different policy designs for labour migration depends, strongly, on the economic model we believe is appropriate for the EU economies.

original mix of skilled and unskilled workers in order to measure the so-called immigration surplus and analyse the role of possible complementarities between migrants and native factors. However, Borjas found a small impact of migration on US GDP and a not-insignificant redistribution from labour to capital labour market. For these reasons his earlier work suggests a pessimistic outcome from active recruitment policies. However his "greasing the wheels" argument in Borjas (2001) that immigration injects into the economy a group of highly mobile self-selected individuals, ready to move to exploit economic opportunities in different areas, 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), which concludes in favour of potential positive effects of migration, unequally distributed between native population. Again the need for compensation mechanism between winners and losers are raised.
- As far as unemployment is concerned, the literature reviewed shows only the possibility of short run effects of migration on the unemployment rate. The work of Ortega (2000) offers a theoretical explanation of why immigration might have positive effects on natives in terms of a lower unemployment rate, but overall the literature does not consider unemployment as a major issue in designing immigration policies.
- Looking at the dynamic aspects of the EU enlargement, (growth and economic development), the debate focuses on the role of migration of high skilled and concerns of a possible 'brain drain' in less developed countries. 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.
- If we decide to take into account the possible effects of immigration on innovation and technological change, we obtain the following results. Lundborg and Segerstrom (1999, 2002) in a two-country endogenous growth model with an 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 dif-

ferent 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 an R&D subsidy in the host enhances overall growth, an R&D subsidy in the sending country has the added positive effect of reducing migration incentives by lowering the international utility differences among workers.

- Moving to a world with different skills, one of the most relevant findings is that migration of high skilled positively affects the level of human capital in the host country and, following predictions from economic theory, the migration of high skilled has unambiguous positive effects on the growth rate in the host country.
- In a model where growth is driven by pure size effect, 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 they recommend policies which guarantee a proportional flow of skilled and unskilled migrants.
- Policies that favour immigration of more skilled individuals are advised by Bretschger (2001). Looking at other countries experience (e.g., Canada), the quality of migrants can be influenced by adopting a points system to meet EU labour market needs. At the same time, differences in the quality of immigrants can also be explained in terms of differences in the national-origin mix of migrants and selection mechanisms based on the country of origin can be considered as well. In fact the quality of migrants also with regard to human capital transferability, depends on the type of skill and the characteristics of the host and sending countries (e.g., language, institutions, etc).¹⁷
- The positive effects of high skilled migration is also stressed by Levine et al. (2002). They revisit the standard Borjas analysis (Borjas, 1995) extending it in different directions. Looking at the dynamic aspects, the authors show that in an endogenous growth framework, the positive effects of high skilled migration are magnified. At the same time, distributional effects still dominate. In the simulations, the highly skilled loose even if overall population gain from migration.

¹⁷See Bauer and Zimmermann (2000).

- Concerns over skilled migration has been raised by the literature on ‘brain drain’ in the source countries. Governments of the sending countries in favour of growth promoting policy, should take the ‘human capital flight’ into account. To the extent that ability is an important determinant of growth, Haque and Kim (1994) suggest that subsidies on education in an open economy can have negative impact on the growth rate of the source country. On the other hand, some of the papers surveyed above on the brain drain/gain literature stress the positive effects of opening up the economies for individuals in both countries. Another important benefit of international migration for the source country are remittances, although there is some doubt regarding the extent to which these payments are used for productive purposes. Clearly, different policy recommendation follow if we believe either in a brain drain or in a brain gain effect.

6 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 migration 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 without 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 upcoming enlargement of the EU, it is suggested that given that migration from Eastern to Western Europe may well have positive growth effects, especially if migrants are high-skilled, an overly restrictive migration policy may constrain the overall growth of the region.

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A Elasticities from Hammermesh

Using usual notation, consider a CES production function

$$Y = [\gamma L^\rho + (1 - \gamma)K^\rho]^{\frac{1}{\rho}} \quad (\text{A.1})$$

with minimum cost function

$$C = Y \left[\gamma^{\frac{1}{1-\rho}} w^{\frac{-\rho}{1-\rho}} + (1 - \gamma)^{\frac{1}{1-\rho}} r^{\frac{-\rho}{1-\rho}} \right]^{\frac{-(1-\rho)}{\rho}} \quad (\text{A.2})$$

Then using Shepherd’s Lemma the conditional demand for labour $L(Y, w, r)$ can be obtained. Then η_{LL} in Hammermesh is the elasticity of labour demand with respect to the wage rate keeping output and r fixed. It can be shown that

$$\eta_{LL} = -\frac{w\partial L}{L\partial w} = -\frac{rK}{Y}\sigma \quad (\text{A.3})$$

where $\sigma = \frac{1}{1-\rho}$ is the elasticity of substitution along a CES isoquant (i.e., $\sigma = \frac{d \ln \frac{K}{L}}{d \ln \frac{w}{r}}$) Hammermesh arrives at the conclusion that the empirical evidence suggests $-\eta_{LL} \in [0.15, 0.75]$

with a best guess at $-\eta_{LL} = 0.3$. From (A.3) with capital's share at 0.3, this suggests $\sigma = 1$, i.e. Cobb-Douglas technology!

In the analysis of Borjas $e = \frac{\partial \ln w}{\partial \ln L}$ keeping capital fixed. With C-D technology this means $e = (1 - \gamma) = 0.3$.