NÚMERO 8/Abril'97/PREÇO 1 500$00/ISSN 0872-4733

NOTAS ECONÓMICAS 8

REVISTA DA FACULDADE DE ECONOMIA DA UNIVERSIDADE DE COIMBRA

The Endogeneity of Labour Supply through Migration. Evidence from the OECD Countries

Elias Soukiazis Faculdade de Economia da Universidade de Coimbra

resumo

Neste artigo, analisam-se as determinantes das migrações em vários países industrializados. Afirma-se que a oferta de mão-de-obra é endógena do crescimento e que a imigração é uma importante fonte de oferta de mão-de-obra. A análise concentra-se mais nas determinantes económicas do que nos factores sociais explicativos dos movimentos migratórios. Analisa-se essencialmente a resposta da migração às alterações das oportunidades económicas (factores da procura), por exemplo, às diferenças de rendimento, de salários e desemprego. O estudo cobre os principais países da OCDE que utilizando um modelo alternativo de análise das migrações que considera a imigração e a emigração, respectivamente, importação e exportação de mão-de-obra.

résumé / abstract

Dans cet article, on analyse les déterminants des migrations dans différents pays industrialisés. On affirme que l'offre de main d'œuvre est endogène de la croissance et que l'immigration est une source importante d'offre de main d'œuvre. L'analyse se concentre sur les déterminants économiques plutôt que sur les facteurs sociaux qui expliquent les mouvements migratoires. On analyse essentiellement la réponse des migrations aux dégradations des opportunités économiques (facteurs de la demande), par exemple, les différences de revenu, de salaires et de chômage. L'étude couvre les principaux pays de l'OCDE utilisant un modèle alternatif d'analyse des migrations qui considère immigration et émigration respectivement comme importation et exportation de main d'œuvre.

In this article the determinants of net migration are analysed across several advanced countries. It is argued that labour supply is endogenous to the growth process and that migration is a significant source of labour supply. The analysis concentrates on the economic determinants, rather than on the social factors which may explain migration movements. In particular, the responsiveness of migration to changes in economic opportunities (factors of demand), such as income, wage and unemployment differentials will be tested. The empirical framework covers the main OECD countries employing an alternative approach of modelling the migration process treating immigration and emigration as import and export of labour, respectively.

1. Introduction

In this study, it is argued that the growth of labour should be considered as an endogenous variable and that labour supply should not be considered as a limiting factor in the growth process. If the internal labour supply sources (natural increase of the labour force, increased female participation, disguised unemployment or underemployment, increases in hours worked) are not enough to fulfil the requirements of the excess demand, then international labour movements in the form of immigration might contribute to the relaxation of any constraint on growth due to indigenous labour supply shortage. In contrast to neoclassical theory (that labour is exogenous to the growth process), it seems more reasonable, at least for short run analysis, to think of labour as endogenous and mobile, and migration (internal or external) as a considerable source of labour supply. Labour moves from region to region, or country to country, responding positively to economic opportunities.

2. Modelling the migration process

The conventional "macro" approach to modelling the migration process is to specify net migration as a function of wage differentials or wage ratios and the difference in unemployment rates or unemployment ratios[1]. *Net migration* for the receiving country is defined as the difference between a region's immigration and emigration expressed as a proportion of its population (or its total labour force), and it is assumed to be an increasing function of the wage differentials and a decreasing function of unemployment differentials. The simple specification can be presented as:

$$(NM)_t=a_0+a_1(Wh/Wa)_t+a_2(Uh/Ua)_t \qquad (2.1)$$

or $$(NM)_t=a_0+a_1(Wh-Wa)_t+a_2(Uh-Ua)_t \qquad (2.2)$$

or $$(NM)_t=b_0+b_1(Wh)_t+b_2(Wa)_t+b_3(Uh)_t+b_4(Ua)_t \qquad (2.3)$$

where $(NM)_t$ is net migration for the receiving country at time t (as a percentage of its population or its total labour force), $(Wa)_t$ and $(Wh)_t$ refer, respectively, to the wage rate in region a (abroad) and h (home) in period t, and $(Ua)_t$ and $(Uh)_t$ refer, respectively, to the actual unemployment rate abroad and home in period t. It is expected that a_1 is positive and a_2 is negative in equations (2.1) and (2.2), and b_1, b_4 positive and b_2, b_3 negative in equation (2.3). The static specifications (2.1) and (2.2) rely on the assumption that the coefficient of the wage rates abroad and home are of the same absolute magnitude, or $b_1=-b_2$ in equation (2.3). The same restriction is imposed for the coefficient of the unemployment rates, which implies that the impact of the unemployment rate abroad and home on net migration is the same (in absolute terms), or $b_4=-b_3$ in equation (2.3). The above restrictions have the advantage that it is less likely to find multicollinearity between the explanatory variables, especially between Wh and Wa, (as is the case in equation 2.3), which can be a serious problem when the equations are estimated using inter-regional data of the same country, where convergence in wage rates and unemployment rates is more likely to exist as a result of a greater mobility of the labour force[2].

The basic models (2.1) and (2.2) have been tested extensively, with some minor modifications concerning the lag structure of the variables, and some different proxies used for the wage and unemployment differentials. Lianos (1972) used a partial adjustment mechanism, testing Greek migration to West Germany, Australia, Canada and the United States from 1959 to 1966 as a function of wage rate differentials. He found a positive and statistically significant response of potential migration to wage differentials and that it takes 26 months for a given stock of migrants created by wage differentials to be depleted. Salvatore (1977) employed a model using regional data for the Italian economy, over the period 1958-1974. He estimated models similar to

1 For more details of the determinants of international (or inter-regional) migration, see Soukiazis Elias (1995), Chapter 3.

2 For this argument see in Salvatore (1977)

equations (2.1) and (2.2) in a static and dynamic form (with lagged-dependent variable) and found that the equation specified in the form of wage rate and unemployment rate differences performed better than in the form of ratios. He also found that employment opportunity is a more important determinant than earnings (measured by average wages or income per employed worker).

Katseli and Glytsos (1989) estimated a similar function to equation (2.3) (with lagged dependent variable) to explain migration from Greece to West Germany during the period 1961-1983. Migration is defined as the ratio of total emigration, or the ratio of working emigrants to West Germany, to the Greek population and labour force, respectively. Real income in Germany and Greece is used as a proxy to account for the present value of expected returns (in log form), and employment (in Greece and Germany) as a fraction of the labour force as a proxy for the probability of finding a job. The novelty of the estimated equation is to include emigrant remittances[3] per migrant population to express the idea that one of the principal aims of the emigrant to work abroad is to accumulate extra savings. The estimated results suggest that the most important determinants of the migration rate are current employment opportunities in both the countries of origin and of destination. The lagged dependent variable and actual remittances per migrant appeared to be not significant as proxies for the expected additional savings. Their empirical findings support the hypothesis that emigration and repatriation can be explained by an intertemporal process of exchange of a relatively abundant factor, namely unskilled labour, for a relatively scarce factor, namely capital, which initially takes the form of emigrant remittances and then, at the time of repatriation, takes the form of human capital. Pissarides and McMaster (1990) tested a similar model to (2.1) based on a "general to specific" search in order to find the appropriate dynamic structure of the model. They used nine regional data sets in Great Britain and the analysis covers the period 1961-1982. The pooled regressions of all regions, and the dynamic structure of the model, gave strong statistical evidence that differences in regional wage growth (expressed by the first difference of the log of the ratio of relative wages), rather than the level of relative wages, are important determinants of net inter-regional migration rates. Differences in employment opportunities, measured by regional unemployment ratios, are also important in the movement of the inter-regional labour supply. They also found evidence that relative wages respond to unemployment differentials, but the adjustment process is very long (it takes twenty years to eliminate a disequilibrium unemployment differential in a depressed region) and they suggest that regional policy based on the relocation of jobs from one area to another might not be effective at times of high unemployment. Finally, but not least, Ermisch (1991) provides sufficient evidence from other empirical studies, that unemployment rate differences are a major factor in explaining the mobility of workers between member countries of the EC, and that labour mobility is not likely to be very sensitive to differences between countries in social benefits or after-tax pay.

3. An alternative approach to net migration

The main studies on migration try to explain the international movement of the labour force from the point of view of the individual migrant, analysing and identifying the personal incentives which influence the decision of the migrant to move. However, there is another aspect of the migration movement to which little importance has been given, and which has not been tested empirically. This alternative approach is to identify the causes, and to explain migration, not from the point of view of the individual migrant but from the point of view of the receiving and sending country. More specifically, it is important to explain why a receiving country is willing to accept additional foreign workers participating in its growth process, and why the sending country allows a part of its labour force to migrate abroad. This alternative perspective is illustrated and modelled below.

As we explained in the introduction, migration is considered as a source of labour supply responding mainly to the pressure of demand. Within this context, immigration from the point of

3 The inclusion of remittances is not very accurate since remittances are the result of migration and not the cause.

view of the receiving country can be regarded as an *import function* for labour, and emigration from the point of view of the sending country can be regarded as an *export function* for labour. Then, for each individual country the import of labour (IMM) (immigration) can be assumed to be an increasing function of the real domestic output (Yd) and a decreasing function of the relative price of labour which can be expressed by the ratio of the foreign to the domestic wage rate (Wf/Wd). But there is an important element which is missing from this specification of the immigration function. The decision of a country to import labour depends on whether or not there exists an internal labour surplus. Kaldor's (1957; 1966) view in explaining differences in growth rates was that growth rates in the western countries in the post war period were not constrained by the labour supply (except for the U.K. which suffered from premature maturity) since there was disguised unemployment in the agricultural sector. Cornwall (1977) also argued that countries with small labour participation in the agricultural sector (e.g. Germany) solved the problem of the shortage of labour by importing labour. Godfrey (1983) in a theoretical analysis of an open economy argues that capitalists in economies running into labour shortage could escape its consequences either by employing immigrant labour or by exporting capital to labour-surplus economies.

To incorporate these factors mentioned above we include in the immigration function the share of employment in the agricultural sector (Ah) and the home unemployment rate (Uh), as possible sources of home labour surplus. Accordingly, immigration is assumed to be inversely related to both the share of employment in agriculture and the unemployment rate of the receiving country. The appropriate functional form, and to capture dynamic characteristics, is to specify the immigration equation in an exponential multiplicative form, given by

$$IMM_t = A\,(Yd)_t^{a_1}(Ad)_t^{a_2}(Ud)_t^{a_3}(Wf/Wd)_t^{a_4} \qquad (3.1)$$

where a_1, a_2, a_3, and a_4 are the import elasticities of the demand for labour with respect to domestic income, the employment rate in agriculture, the unemployment rate and relative wages, respectively, and A is a constant. In this specification, a_1 is expected to be positive, and a_2, a_3, and a_4 are all expected to be negative. Equation (3.1) suggests that the import of labour will take place only when the domestic output expands, and provided that there are not enough internal sources of labour to satisfy the demand requirements, or when the skills required can not be found in the domestic market. Additionally, immigration will increase only when the imported labour is cheaper relative to domestic labour.

In the same way, for each individual country the export demand for labour (EM) (emigration) can be assumed as being an increasing function of the real foreign income (Yf) and a decreasing function of the relative price of labour, defined as the ratio of the domestic to foreign wage rate (Wd/Wf). We incorporate also here the idea of the existence of surplus of labour in the destination country (abroad), by using as an additional explanatory variable the total unemployment rate (Uf) abroad, and it is expected that emigration is negatively related to the total rate of unemployment abroad. The relation can be expressed in the following exponential form:

$$EM_t = B\,(Yf)_t^{b_1}(Uf)_t^{b_2}(Wd/Wf)_t^{b_3} \qquad (3.2)$$

where b_1, b_2, and b_3 are the export elasticities of the demand for labour with respect to foreign income, the unemployment rate abroad, and relative wages, while B is a constant. It is expected that b_1 is positive and b_2 and b_3 are both negative. Equation (3.2) from the point of view of the sending country suggests that the foreign demand for its labour increases as a result of the economic recovery in the rest of the world, provided that the labour surplus abroad (measured by the unemployment rate) is not enough to satisfy the excess demand requirements. Additionally, the demand of foreign labour in the destination country increases as a result of a lower wage in the native country relatively to wages abroad.

Equations (3.1) and (3.2) can be combined to define the rate of net migration (NM) as the difference between the immigration (import of labour) and emigration (export of labour) for each

individual country. Before we present the model, it is convenient to make a simple linear transformation of the two original models by taking logarithms of both sides, so that

$$LNM_t=LIMM_t-LEM_t=D+d_1L(Yd)_t+d_2L(Yf)_t+d_3L(Ad)_t$$
$$+d_4L(Ud)_t+d_5L(Uf)_t+d_6L(Wd)_t+d_7L(Wf)_t \qquad (3.3)$$

where $D=LA-LB$, $d_1=a_1$, $d_2=-b_1$, $d_3=a_2$, $d_4=a_3$, $d_5=-b_2$,

$d_6=-(a_4+b_3)$, and $d_7=(a_4+b_3)$, while L represents the natural logarithm

Equation (3.3) is an expression where all forces explaining immigration and emigration, and hence net migration are presented individually. The coefficients (which are the respective elasticities) d_1, d_5 and d_6 are expected to be positive, since, the higher is the increase in domestic income, the unemployment rate abroad and the domestic wage rate, the higher will be the attraction to immigrants. The coefficients d_2, d_4 and d_7 are expected to be negative, since the higher is the increase in income abroad, the domestic unemployment rate and the wage rate abroad, the higher will be the attraction to emigrants. Finally, the coefficient d_3 is also expected to be negative, since the higher the employment participation in agriculture the higher the surplus of labour available to migrate.

An alternative specification of (3.3) is equation (3.4) below where the income, unemployment and wage rate differentials are defined:

$$LNM_t=LIMM_t-LEM_t=C+c_1(LYd-LYf)_t+c_2(LAd)_t+c_3(LUd-LUf)_t$$
$$+c_4(LWd-LWf)_t \qquad (3.4)$$

In order to derive equation (3.4) the following restrictions have been imposed, that $d_2=-d_1$, $d_5=-d_4$, and $d_7=-d_6$. Here, c_1, c_2, c_3, and c_4 are the elasticities of net migration for an individual country with respect to income differentials, the domestic labour participation in agriculture, the unemployment differentials, and wage differentials respectively, while C is a constant. In this specification, c_1 is expected to be positive since the higher the level of domestic income relative to foreign income, the less likely it is that people will emigrate. Additionally, c_2 and c_3 are expected to be negative, because the greater is the availability of surplus labour domestically, the more likely it is for individuals to out-migrate. Finally, c_4 is expected to be positive, since the higher the level of domestic wages relatively to wages abroad, the less the desire to emigrate and the greater the attraction to migrants from abroad.

4. Some historical evidence on net international migration

Before we estimate the net migration equation, it is convenient to present and discuss some historical evidence on net migration for the main OECD countries. In Table 1 we report evidence for the period 1969-1991, distinguishing three groups of countries: the first group covers the countries where net migration is mostly positive (ten countries), the second group covers countries where net migration is mostly negative (four countries), and the third group covers countries where net migration is alternatively positive or negative (five countries). The first column in Table 1 gives net migration (NM) in thousands and the second column gives the ratio of net migration to the total labour force (NM/LF), which also represents the change in total labour force due to net migration. It can be seen from the data, that net migration as a percentage of the total labour force represents a low ratio. However, when migration is related to *other demographic characteristics*, its contribution to the change in the growth of the labour force is shown to be substantial. For some countries, the change in population growth due to migration movements can be compared with the change in population growth due to natural causes (births minus deaths). For instance, in the case of Greece during the years 1969-71 the size of net emigration to West Germany alone approximated the net natural increase in population (Katseli and Glytsos, 1989). It is interesting to examine some absolute figures in order to understand the importance of migration volume in the international labour market. Godfrey (1983) provides such evidence,

showing that the number of people from developing countries working outside their own countries towards the end of the 1970s was around 20 millions. Of these, some 6 millions were in the USA, 5 millions in Western Germany (mainly from Yugoslavia, Greece, Spain, Turkey and Italy), and 3 millions in the Arab region. He characterises this outward labour-supply movement as a "reserve army", borrowing the concept from the Marxian literature, and analyses the costs and benefits of exporting workers in terms of the recorded remittances. He concludes that the strategies of using surplus labour as a source of foreign exchange have to consider factors such as the expected growth of the world economy and international trade in the future decades.

5. The estimation process of net international migration for the main OECD countries

It would be desirable to estimate equation (3.4) as it stands to get the elasticities of net migration with respect to all explanatory variables. However, the fact that net migration (and other variables) can take negative values, does not allow this specification. For this reason, instead of taking logarithms, as a proxy we express the variables in growth rates where it is necessary. The alternative model which is estimated is described below, defining the respective variables and reporting the data sources:

$$(NM/LF)_t=f_0+f_1(yd-yf)_t+f_2(Ud-Uf)_t+f_3(Ad)_t+f_4(wd-wf)_t \quad (5.1)$$

where

NM/LF is net migration from home (origin) to abroad (destination) as a percentage of the total labour force of the home country. This ratio represents also the change in total labour force due to net migration.

Dy=yd-yf is the growth of real income differential, with yd the annual growth of real GDP of the home country, and yf is the average growth rate of real GDP in total OECD countries (destination countries)

DU= Ud-Uf is the unemployment differential defined as the difference of the home unemployment rate (Ud) and the average unemployment rate in total OECD (Uf).

Ad is civilian employment participation in agriculture, hunting, forestry and fishing (in percentage) in the country of origin

Dw=wd-wf is the growth rate of wage differentials in industry, measured as the difference of the growth rates of wages between the home country and the average of the industrial countries in OECD. The growth rates of wages have been calculated from indices (1985=100) on hourly earnings.

Small letters on Y (income) and W (wages) represent growth rates.

Data sources:

Time series data have been taken from:

IMF International Financial Statistics, Yearbook 1993,

OECD National Accounts, Main Aggregates Volume I, 1960-1993,

OECD Labour Force Statistics, various issues, and

OECD Economic Outlook, various issues.

For Portugal, the growth of nominal and real wages in industry have been taken from the National Bank of Portugal, Yearbook, various issues.

In equation (5.1) income and wage differentials are expressed in growth rates, hence the coefficients f_1 and f_4 represent the elasticities of net migration with respect to these variables, and both are expected to be positive. The unemployment differential and the employment participation

in the primary sector are expressed as ratios[4], hence, the coefficients f_2 and f_3 represent the marginal impacts on net migration with respect to these two variables and they are expected to be negative. With this form, equation (5.1) with the main variables expressed in growth rates, is assumed, approximately, to capture the dynamic characteristics of the migration process, as has been emphasised by Todaro and later by others.

As a first attempt, equation (5.1) was estimated individually, using time series data for the main OECD countries over the period 1969-1991, and adopting the "general to specific approach"[5] to capture dynamic characteristics. The estimated results were not encouraging, and the effects of multicollinearity were a serious problem, not allowing any clear conclusion on the individual effects of the explanatory variables and their significance. The limited extent of the time series sets (23 observations) was also a problem not allowing for a clear dynamic specification of the model. For this reason, and mainly in order to avoid small sample problems, *Panel Data* analysis is used, pooling the time series and cross section sets and allowing for different *fixed effects* between countries. With this method, if there are some non-random variables which are omitted from the equations, their effects can be captured in the different intercepts attributed to different countries, using the dummy variable technique. The advantages of Panel Data sets over the conventional cross-sectional or time-series data sets are that they provide a larger number of data points, increasing the degrees of freedom and reducing the risk of collinearity among explanatory variables, hence improving the efficiency of the econometric estimates. The use of Panel Data has been shown to provide more stable estimated parameters, it allows the introduction of dynamic adjustments, and generally it allows us to collect more information (see Hsiao (1986)). Equation (5.1) has been estimated by pooling the data and running a single regression for all 19 countries; for Group I (10 countries) characterised by positive net migration; for Group II (4 countries) characterised by negative net migration, and finally for Group III (5 countries) with negative and positive net migration. In these regressions, each country is given a different intercept to allow for different "fixed effects" on international migration rates. The specification of the equations was selected after a *general to specific* search, with allowance for a variety of lagged effects. The importance of lagged variables can be justified by the existence of market imperfections and other factors which may lead to a delay in the response of potential migrants to economic incentives.

The final pooled equations, estimated by the Least Squares Dummy Variables (LSDV) method over the period 1970- 1991[6], are reported in Table 2, and give interesting results. The coefficient of the growth of income differentials is positive, as expected, and statistically significant in all cases. This is an important result, suggesting that faster growing countries attract migration (with a one year lagged response); hence growth is unlikely to be constrained by labour supply. The coefficient of the unemployment rate differential variable carries the expected negative sign, although, it is not statistically significant in all cases. This suggests, that it is mainly the income growth differential which captures the job opportunity effects, rather than the unemployment rate differentials. An interesting result is that the participation of labour in the primary sector is an important factor in explaining migration flows. The estimated coefficient of this variable has the expected negative sign, and it is statistically significant in the estimation when all countries are considered, and also in the sample of countries of Group I, with positive migration rates. This evidence supports the idea of Kaldor and others, that the primary sector is a source of surplus labour and can contribute substantially to the supply of labour when it is needed. Differences in the growth of money wages also seem to be an important factor in explaining the international migration process[7]. The corresponding coefficient carries the expected positive sign and it is

4 There is no need to express these two variables in growth rates and economically not justifiable.
5 This approach has been suggested by Hendry, and assumes a general specification of the model where all variables enter in the form of levels and their lagged values. The approach will be fully explained later.
6 The first year (1969) of the time series data sets is excluded from each country, since one year lagged variables are used in the estimation.
7 The growth of real wage differentials has also been tested but was found to be not statistically significant.

statistically significant except where the countries of Group III are estimated. An interesting result, is that net migration responds positively to the current and not to the lagged values of wage differentials. Finally, the lagged dependent variable is statistically significant in all cases suggesting that the causes and consequences which influence net migration tend to be self-reinforcing and cumulative.

The statistical diagnostic tests of the model are quite satisfactory. The degree of explanation of the explanatory variables (adjusted R^2) is reasonable, ranging from a low value of 42% to a high value 62%. The F2, F3, and F4 statistics are statistically significant in all cases, suggesting that the slope effects of the explanatory variables are all important in explaining international migration movements. The F1 and F5 statistics indicate in all cases that the hypothesis of no group effects is accepted by the data. Hence countries can be assumed to have the same intercept in the estimation process. This result can also be seen from the fact that the different intercepts attributed to different countries are in most cases not statistically significant. The fact that all intercepts are positive in the estimated equation of group I countries, while all intercepts are negative in the estimated equation of group II countries, confirms that the ranking of countries by positive and negative net migration status is correct. The positive intercept for New Zealand and Finland in the estimation of the equation of Group III countries possibly suggests that these two countries should be included in Group I, and the negative intercept for the U.K., Greece and Italy indicates that these countries might be included in Group II.In general, the estimated equation of Group III is not satisfactory, revealing that the only important explanatory variables are the lagged dependent variable and the lag of income growth differentials. Finally, the estimated autocorrelation coefficient of the residuals (RHO) is zero in all cases, indicating no evidence of serial correlation between the error terms. The fact that Panel Data estimation gives more satisfactory results than individual time series estimation can be taken as an indication that international net migration should be treated at an aggregate level between countries and not in individual terms, since migration movements have mutual and interdependent characteristics.

6. Conclusions

In this study an attempt has been made to show that migration movements within the context of labour supply mobility do respond to economic opportunities, hence the supply of labour in the form of migration should be treated as endogenous in the growth process. This has been shown by trying to explain net migration movements not from the point of view of the individual migrant but from the point of view of the sending and the receiving countries. This idea led us to express immigration as an import function, and emigration as an export function of labour from the point of view of the native country. The model developed for the OECD countries confirmed this thesis reasonably well. Net migration is shown to respond positively to changes in economic conditions, such as the growth of real income and relative wages, and that unemployment in the destination country discourages the outward migration of labour. An important issue which has also been examined is the extent to which the inclusion of the employment participation in the primary sector is important in explaining migration. It has been shown in the case of net migration estimation in the OECD countries, that this variable has significant explanatory power; hence, it should be treated as an additional source of labour supply. Finally, the empirical results suggest that migration should be viewed as an essentially dynamic process involving a lagged response, and that Panel Data analysis is more appropriate in explaining the migration process than time series or cross-section analysis.

References

Cornwall, J. (1977) *Modern Capitalism: Its growth and transformation*, Oxford, Martin Robertson Press.

Creedy, J. (1974) Inter-regional mobility: A cross-section analysis, *Scottish Journal of Political Economy*, Vol. XXI, 1, 41-53.

Drettakis, E.G. (1976) Distributed Lag Models for the Quarterly Migration Flows of West Germany, 1962-72, *Journal of the Royal Statistical Society A*, 139, 365-373.

Ermisch, J. (1991) European integration and external constraints on social policy: is a social charter necessary? *National Institute Economic Review*, 136, May, 93-108.

Greenwood, M.J.(1985) Human Migration: Theory, models, and empirical studies, *Journal of Regional Science*, Vol. 25, 4, 521-544.

Hsiao, C. (1986) *Analysis of Panel Data*, Cambridge, Cambridge University Press.

Kaldor, N. (1957) A model of economic growth, *Economic Journal*, 67, 591-624.

Kaldor, N. (1966) Causes of the slow rate of economic growth of the United Kingdom: An inaugural lecture, *in* Kaldor, N. (1978) *Further Essays on Applied Economics*, London, Duckworth.

Katseli, L.; Glytsos, N. (1989) Theoretical and empirical determinants of international labour mobility: A Greek-German perspective, *in* Gordon, I. and Thirlwall, A., *European factor mobility*, London, Macmillan.

Lee, E.S.(1966) A theory of migration, *Demography*, 1.

Lianos, T.P. (1972) The migration process and time lags, *Journal of Regional Science*, 12, 425-433.

Salvatore, D. (1977) An econometric analysis of internal migration in Italy, Journal of Regional Science, 17, 395-408.

Soukiazis, E. (1995) *The endogeneity of factor inputs and the importance of balance of payments on growth. An empirical study for the OECD countries with special reference to Greece and Portugal*, Ph.D. Dissertation, Keynes College University of Kent at Canterbury, U.K.

Todaro, M.P. (1969) A model of labor migration and urban unemployment in less developed countries, *The American Economic Review*, March, 138-148.

Walsh, B.M. (1974) Expectation, Information, and Human Migration: Specifying an econometric model of Irish migration to Britain, *Journal of Regional Science*, 14, 107-120.

Table 1 — Net migration for selected OECD countries in thousands and as a percentage of total labour force, 1969-1991

GROUP I (positive net migration)

	Canada		USA		Germany		France		Belgium	
	NM	NM/LF	NM	NM/LF	NM	NM/LF	NM	NM/LF	NM	NM/LF
1969	79	0.95	453	0.54	572	2.16	151	0.72	2	0.05
1970	67	0.79	438	0.51	575	2.14	180	0.84	4	0.11
1971	40	0.46	387	0.44	431	1.60	143	0.66	23	0.61
1972	47	0.52	325	0.36	331	1.22	102	0.47	12	0.32
1973	113	1.21	331	0.36	384	1.40	107	0.49	17	0.44
1974	154	1.66	316	0.34	-9	-0.03	31	0.14	23	0.59
1975	122	1.21	449	0.47	-199	-0.73	14	0.06	24	0.61
1976	81	0.79	353	0.36	-72	-0.27	57	0.25	7	0.18
1977	65	0.61	394	0.39	33	0.12	44	0.19	4	0.10
1978	36	0.33	508	0.49	115	0.42	19	0.08	-4	-0.09
1979	69	0.61	540	0.50	246	0.89	35	0.15	1	0.02
1980	109	0.94	845	0.77	312	1.12	44	0.19	-4	-0.09
1981	62	0.52	718	0.65	152	0.54	56	0.24	-7	-0.17
1982	24	0.20	626	0.56	-72	-0.25	61	0.26	-4	-0.09
1983	-10	-0.08	605	0.53	-115	-0.40	56	0.24	-7	-0.17
1984	-7	-0.06	615	0.53	-146	-0.51	45	0.19	-1	-0.02
1985	-17	-0.13	648	0.55	89	0.31	38	0.16	1	0.02
1986	27	0.21	659	0.55	196	0.67	39	0.16	1	0.02
1987	109	0.83	679	0.56	220	0.75	44	0.18	1	0.02
1988	123	0.92	667	0.54	484	1.63	57	0.24	2	0.05
1989	155	1.14	614	0.49	977	3.28	71	0.29	6	0.14
1990	167	1.21	689	0.54	1033	3.40	80	0.33	20	0.48
1991	175	1.26	716	0.56	746	2.43	79	0.32	14	0.33

Table 1 — Net migration for selected OECD countries in thousands and as a percentage of total labour force, 1969-1991

GROUP I (positive net migration)

	Denmark		Australia		Switzerland		Austria		Sweden	
	NM	NM/LF	NM	NM/LF	NM	NM/LF	NM	NM/LF	NM	NM/LF
1969	7	0.30	118	2.21	20	0.65	118	2.21	44	1.14
1970	12	0.50	112	2.02	-6	-0.19	112	2.02	49	1.25
1971	3	0.12	104	1.83	2	0.06	104	1.83	3	0.08
1972	5	0.21	56	0.96	20	0.62	56	0.96	-12	-0.30
1973	12	0.49	67	1.12	8	0.24	67	1.12	-11	-0.28
1974	-7	-0.28	87	1.43	2	0.06	87	1.43	9	0.22
1975	-9	-0.36	14	0.23	-58	-1.85	14	0.23	17	0.41
1976	3	0.12	34	0.54	-54	-1.77	34	0.54	20	0.48
1977	6	0.24	68	1.06	-23	-0.75	68	1.06	23	0.55
1978	5	0.19	47	0.73	-7	-0.23	47	0.73	14	0.33
1979	5	0.19	69	1.06	4	0.13	69	1.06	14	0.33
1980	1	0.04	101	1.49	17	0.54	101	1.49	10	0.23
1981	-2	-0.07	122	1.78	24	0.74	122	1.78	10	0.23
1982	-1	-0.04	103	1.49	21	0.64	103	1.49	-7	-0.16
1983	2	0.07	55	0.79	5	0.15	55	0.79	2	0.05
1984	4	0.15	60	0.84	12	0.36	60	0.84	9	0.20
1985	9	0.33	89	1.22	14	0.41	89	1.22	11	0.25
1986	12	0.43	107	1.41	22	0.64	107	1.41	15	0.34
1987	7	0.25	133	1.71	27	0.78	133	1.72	20	0.45
1988	5	0.17	172	2.16	34	0.97	172	2.16	30	0.67
1989	3	0.10	133	1.61	34	0.96	133	1.61	44	0.97
1990	8	0.27	111	1.31	57	1.59	111	1.31	35	0.76
1991	11	0.38	110	1.29	60	1.67	110	1.29	24	0.53

Table 1 — Net migration for selected OECD countries in thousands and as a percentage of total labour force, 1969-1991 (Continued)

GROUP II (negative net migration)

	Japan		Ireland		Portugal		Spain	
	NM	NM/LF	NM	NM/LF	NM	NM/LF	NM	NM/LF
1969	10	0.02	-7	-0.62	-134	-3.83	-12	-0.09
1970	-6	-0.01	-3	-0.27	-149	-4.13	-21	-0.16
1971	-22	-0.04	6	0.54	-121	-3.37	23	0.17
1972	-21	-0.04	13	1.16	-72	-2.02	-76	-0.57
1973	-22	-0.04	15	1.33	-84	-2.37	-44	-0.32
1974	-20	-0.04	19	1.66	174	4.38	-35	-0.25
1975	2	0.04	17	1.47	347	8.61	24	0.17
1976	-9	-0.02	12	1.03	10	0.24	48	0.36
1977	-13	-0.02	8	0.67	20	0.48	59	0.44
1978	-24	-0.04	15	1.24	30	0.72	29	0.22
1979	-12	-0.02	-1	-0.08	38	0.89	-10	-0.07
1980	0	0.00	-1	-0.08	42	0.96	1	0.01
1981	13	0.02	-2	-0.16	-24	-0.55	89	0.66
1982	9	0.02	-11	-0.85	-33	-0.76	-17	-0.12
1983	-6	-0.01	-11	-0.84	-33	-0.72	20	0.14
1984	-17	-0.03	-18	-1.38	-34	-0.75	-14	-0.10
1985	1	0.00	-26	-1.99	-32	-0.71	15	0.11
1986	-25	-0.04	-25	-1.91	-33	-0.73	-22	-0.16
1987	-28	-0.05	-29	-2.20	-33	-0.72	-43	-0.29
1988	-13	-0.02	-42	-3.21	-33	-0.71	-13	-0.09
1989	-8	-0.01	-36	-2.79	-108	-2.31	-17	-0.11
1990	-76	-0.12	-9	-0.69	-3	-0.06	14	0.09
1991	17	0.03	1	0.07	-1	-0.02	16	0.10

Table 1 — Net migration for selected OECD countries in thousands and as a percentage of total labour force, 1969-1991 (Continued)

GROUP III (positive and negative net migration)

	New Zealand		U.K.		Finland		Greece		Italy	
	NM	NM/LF	NM	NM/LF	NM	NM/LF	NM	NM/LF	NM	NM/LF
1969	-7	-0.66	-52	-0.20	-40	-1.83	-67	-2.16	-73	-0.35
1970	11	1.01	-26	-0.10	-36	-1.64	-39	-1.25	-46	-0.22
1971	9	0.82	-10	-0.04	1	0.05	-22	-1.68	-30	-0.14
1972	24	2.14	-2	-0.01	5	0.23	-30	-0.92	29	0.14
1973	30	2.60	-42	-0.16	6	0.27	-42	-1.28	10	0.05
1974	34	2.82	-83	-0.32	1	0.04	-20	-0.61	-6	-0.03
1975	20	1.63	-40	-0.15	-4	-0.17	59	1.79	-12	-0.06
1976	-12	-0.96	-16	-0.06	-10	-0.42	55	1.66	-5	-0.02
1977	-10	-0.79	-31	-0.12	-11	-0.46	63	1.89	3	0.01
1978	-26	-2.03	8	0.03	-9	-0.37	65	1.95	3	0.01
1979	-26	-2.00	16	0.06	-7	-0.29	43	1.27	4	0.02
1980	-12	-0.92	-51	-0.19	-1	-0.04	48	1.39	5	0.02
1981	-7	-0.53	-16	-0.06	5	0.20	10	0.27	-18	-0.08
1982	11	0.82	-49	-0.18	7	0.28	8	0.22	108	0.47
1983	16	1.18	3	0.01	6	0.23	10	0.26	138	0.60
1984	3	0.22	5	0.02	4	0.16	5	0.13	89	0.38
1985	-14	-1.00	71	0.26	3	0.12	11	0.28	83	0.35
1986	-15	-0.93	62	0.22	2	0.08	7	0.18	72	0.30
1987	-20	-0.23	19	0.07	1	0.04	9	0.23	83	0.35
1988	-28	-1.76	14	0.05	1	0.04	15	0.38	66	0.27
1989	-6	-0.38	53	0.19	6	0.23	29	0.73	42	0.17
1990	7	0.44	50	0.18	9	0.35	168	4.20	145	0.59
1991	7	0.43	49	0.17	-1	-0.04	30	0.73	150	0.61

Note: NM is net migration in thousands and NM/LF is the ratio of net migration to the total labour force (in percentage)
Source: Labour Force Statistics, OECD, various issues.

Table 2 — Estimation of net migration equation, OECD countries, 1969-1991

Panel Data

	All countries	Group I	Group II	Group III
Dy_t	n.s.	0.042 (2.44)	n.s	n.s.
Dy_{t-1}	0.059 (3.76)	n.s.	0.136 (2.68)	0.053 (2.23)
DUt	-0.015 (-1.54)n	n.s.	n.s.	n.s.
DU_{t-1}	n.s.	-0.008 (-0.71)n	-0.016 (-0.63)n	n.s.
AD_{t-1}	-0.013 (-2.62)	-0.023 (-2.20)	-0.014 (-0.73)n	n.s.
Dw_t	0.025 (3.35)	0.026 (3.02)	0.068 (2.95)	n.s
Dw_{t-1}	n.s.	n.s.	n.s.	0.018 (1.74)n
NM/LF_{t-1}	0.635 (17.8)	0.719 (15.8)	0.569 (6.83)	0.616 (9.05)
R^2	0.493	0.621	0.424	0.490
S.E.	0.697	0.407	1.120	0.642
F1 Stat.	1.192	0.525	0.346	0.611
d.f.	(18,398)	(9,209)	(3,83)	(4,104)
F2 Stat.	80.8	69.6	14.2	33.19
d.f.	(5,412)	(5,214)	(5,82)	(3,106)
F3 Stat.	18.6	26.6	8.99	15.95
d.f.	(23,394)	(14,205)	(8,79)	(7,102)
F4 Stat.	77.3	72.0	14.02	35.61
d.f.	(5,394)	(5,205)	(5,79)	(3,102)
F5 Stat.	1.179	1.677	0.636	2.04
d.f.	(18,394)	(9,205)	(3,79)	(4,102)
RHO	0.00	0.00	0.00	0.00
nº of obs.	418	220	88	110

Table 2 — Estimation of net migration equation, OECD countries, 1969-1991 (Continued)

Fixed Effects

	All countries	Group I	Group II	Group III
IRL	-0.087	–	-0.481	–
	(-0.55)		(-1.15)	
SPAIN	0.302	–	-0.299	–
	(1.90)		(-0.71)	
JAPAN	0.286	–	-0.107	–
	(1.82)		(-0.25)	
PORT	0.305	–	-0.063	–
	(1.94)		(-0.15)	
N.ZEANL	0.149	–	–	0.029
	(0.92)			(0.20)
U.K.	0.029	–	–	-0.026
	(0.19)			(-0.17)
FINL	0.125	–	–	0.323
	(0.80)			(2.15)
GREECE	0.289	–	–	-0.131
	(1.84)			(-0.90)
ITALY	0.266	–	–	-0.188
	(1.68)			(-1.27)
CANADA	0.170	0.302	–	–
	(1.08)	(2.72)		
USA	0.187	0.340	–	–
	(1.19)	(3.06)		
GERM	0.261	0.318	–	–
	(1.65)	(2.78)		
FRANCE	0.027	0.558	–	–
	(0.17)	(4.77)		
BELG	-0.145	0.120	–	–
	(-0.92)	(1.01)		
DENM	0.155	0.307	–	–
	(0.98)	(2.67)		
AUSTR	0.295	0.212	–	–
	(1.87)	(1.82)		
SWITZ	0.179	0.301	–	–
	(1.14)	(2.56)		
AUSTRIA	0.426	0.235	–	–
	(2.73)	(2.03)		
SWEDEN	0.505	0.255	–	–
	(3.17)	(2.29)		

Notes: (n) indicates that the coefficient is not statistically significant, but its inclusion improves the estimation results. (n.s.) indicates that the coefficient is not statistically significant and the corresponding variable is excluded from the equation.
The F-Statistics are used for testing the following restrictions: F1 — no group effects on the mean of the dependent variable; F2 — no fit in the regression between the dependent and explanatory variables; F3 — no group effects or fit in regression; F4 — group effects but no fit in regression; F5 — fit in regression but no group effects.
RHO is the estimated autocorrelation of residuals e(i,t).