IMPACT OF DEMOGRAPHIC CHANGE ON INDUSTRY STRUCTURE IN AUSTRALIA

A joint study by the Australian Bureau of Statistics, the Department of Employment and Industrial Relations, the Department of Environment, Housing and Community Development, the Department of Industry and Commerce and the Industries Assistance Commission

DETERMINANTS OF AUSTRALIAN MIGRATION

by

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The views expressed in this paper do not necessarily reflect the opinions of the participating agencies, nor of the Australian government.

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DETERMINANTS OF AUSTRALIAN MIGRATION*

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1. INTRODUCTION

Since the landing of the First Fleet in 1788, the story of Australia's economic development has been the story of its immigrants. Although most Australians are now the second or higher generation to be born in Australia, the massive immigration levels since World War II have ensured a continuing high proportion of immigrants in the population. For example, as at June, 1971, approximately 20 percent of all persons in Australia were born overseas.[1]

Even more important has been the contribution of immigrants to the Australian labour force. Immigrants possessing skills considered to be 'in the national need' have been encouraged to come to Australia. Thus, a higher than average proportion of persons in the skilled trade groups were born and trained overseas (e.g., in 1971 25 percent of the adult population were born overseas, but 33 percent of skilled metal and

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1. Commonwealth Bureau of Census and Statistics (1972).

electrical tradesmen and 39 percent of skilled building tradesmen were born overseas). The role of immigration in providing the labour required to support the post-war expansion of Australian industry should not be under-estimated. Of equal importance was the part played by the migration program in complementing the expansion of the Australian educational system in its efforts to provide professional and skilled workers locally.

The purpose of this paper is to provide an analysis of migration flows as an input to the labour-force and demographic module[1] BACHUROO of IMPACT's medium term model.[2] The following sections of the paper cover successively, a short history of Australian migration, a brief review of some of the more relevant previous work in quantitative modelling of migration, the formulation of a model of international migration for Australia, and a discussion of the results obtained in our attempts to estimate this model.

Production of this paper is topical because of the recent wide interest in migration, generated initially by the First Report of the National Population Inquiry (commonly referred to as the Borrie Report, after its Chairman),[3] and further stimulated by the release of an official Green Paper on Immigration.[4] The Borrie Report indicated to a very wide public audience that current trends in fertility and immigration, which underlie population growth in Australia, were towards lower values than had pertained in the past; and that Australia's future population could therefore be expected to be much lower than was previously

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1. Tulpule, A.H., and McIntosh, M.K. (1976).

2. Powell, A.A. (1977).

3. Australian Government (1975).

4. Australian Population and Immigration Council (1977).

anticipated. The Report went on to identify a number of consequences of the slower growth rate. The fertility projections in the Report were questioned widely and have since been updated by the Australian Bureau of Statistics (ABS) (1976) to include more recent birth statistics. In neither of these studies, however, is migration the primary focus. The intermediate option put forward by Borrie as a basis for projection (and subsequently used by the ABS) is for a net 50,000 immigrants per annum to the year 2001. While this may be a realistic long-term assumption, its constancy is clearly at variance with the present and likely medium term future. Given the needs of IMPACT's medium term model, a model of migration is required which will project the medium-term fluctuations as well as the long-term trend.

In addition to the arguments about size, there have been debates on the role of immigration in easing or exacerbating labour market imbalances. An article by Hughes (1975) has catalogued the arguments, but relatively little statistical analysis has been undertaken. The contribution of the work on migration within the IMPACT project to this debate hopefully will be to estimate the effects of : (i) Australian labour market conditions on the flows of migrants to and from Australia; and (ii) the occupational consequences of these flows. The first, but not the second, of these objectives is within the ambit of the present paper.[1]

2. A SHORT HISTORY OF AUSTRALIAN POSTWAR MIGRATION

The threat of invasion in World War II gave rise to the concept that Australia needed a substantial population increase for both development and defence reasons. Immigrants were needed, not only as a supply of potential

1. Kelley and Schmidt (1978) have somewhat similar objectives, but work at a much more synoptic level of detail.

military personnel, but also for assisting the growth of industry. As a result, Government policy was for more than a decade orientated towards maintaining an annual population growth of two percent : one percent from natural increase, and one percent from net migration.

In the immediate post-war years the displaced persons in Europe presented a "target of opportunity," and from 1949 (the year when post-war transport availability first enabled the implementation of a 'national' immigration programme) to 1952, net migration considerably exceeded the one per cent per annum figure. With the end of the Displaced Persons Scheme, however, net migration dropped to 0.49 per cent in 1953. Having in mind the one per cent target, new sources were "tapped" and positive programming was introduced through agreements with several European countries.

Within the one per cent framework, planning was based on an annual intake of half assisted and half unassisted, half British and half non-British (all of European racial descent, however); and, within the non-British sector, half from the so-called "Northern European" region and half from the "Southern European" region.

Net immigration over 1954/55 and 1955/56 was of the order of one per cent per annum, but when there was a downturn in the Australian economy towards the end of the 1955/56 financial year, it became apparent that adherence to a rigid one per cent target would not be politically acceptable in the light of increasing unemployment. While the composition pattern was retained, the 1956/57 programme figure was reduced from the 1955/56 figure of 125,000 to 115,000.

Economic problems in Australia and considerably reduced emigration pressures in Europe (arising from the success of the Common Market and in particular the increased job opportunities in Western Germany) caused the programme figure to be held to 125,000 over 1960/61, 1961/62 and 1962/63. While in the early part of this period a slack labour market in Australia was the dominating factor, later on the problem was unavailability of migrants from our traditional source countries.

By this time, the annual programmes were determined primarily in the light of the absorptive capacity of the Australian community and the availability of migrants. The Immigration Planning Council, consisting of representatives of employers and trade unions, had been formed to suggest programmes to the Government after consultations with the Department of Labour and the Treasury. The conceptual basis of the programme was essentially that the resident Australian work force still required supplementation by migrant workers from abroad as Australian expansion continued. The need was seen as a long term and continuing one which could be met only by permanent immigration and not by any 'guest worker' arrangement.

With the decline in migrant availability in some of our traditional source countries, and with a continuing demand for migrant labour in Australia, the earlier 'composition' pattern was relaxed, although the British figure, largely through personal nomination by migrants already here, continued to represent a large proportion of the total. New migrant sources began to be developed. During the 1960's, there was also considerable competition from Canada, and to a lesser extent South Africa and New Zealand, for European migrants.

The improving economic situation in Australia and the development of new sources of immigrants allowed the 1963/64 programme intake figure to be increased to 145,000. It stayed around this mark until 1967/68 (142,000 in 1964/65, 145,000 in 1965/66 and 148,000 in both 1966/67 and 1967/68), and increased further to 160,000 in 1968/69 and to 175,000 in 1969/70.

Up to this point, whilst the racially discriminatory nature of Australian immigration activities had been attacked in some quarters,[1] there had been general acceptance of the proclaimed need for continuance of a large-scale immigration programme.

However, strains were developing and at this time some critics began to question the intrinsic value of large-scale immigration in the light of the nation's ability to provide work and services for 170,000 or more settlers each year. Arguments ranged over issues such as pollution, the world population 'explosion,' economic development, quality of life, defence, standards of selection, discrimination on grounds of colour, and the integration of migrants.

This increasing concern was reflected in decisions by the Government of the time. Following the establishment of the Committee on Overseas Professional Qualifications in 1969 and a survey of trade training facilities in migrant source countries, the Government in 1970 announced a $A16 million English language training programme for migrants.

It also announced long-term studies which would assist in shaping future policies. These covered investigations into desirable future population levels for Australia (Professor Borrie, A.N.U.), a cost-benefit analysis

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1. For a more detailed discussion of the 'White Australia Policy' and discrimination refer to Yarwood (1964) and Yarwood (1968).

of immigration (Associate Professor Wilson, Sydney University), and Departmental surveys of migrants during their early years in Australia.

An intake programme of 170,000 was established for 1970/71 and of 140,000 for 1971/72. However, having regard to the then economic conditions in Australia, this latter figure was reduced to 110,000; this was maintained with the change of Government and the same figure was held in 1972/73. The actual numbers of permanent settlers arriving in 1970/71, 1971/72 and 1972/73 were 170,011, 132,719 and 107,401 respectively.

The declared immigration policy of the Labor Government[1] which came to power in December, 1972, represented the first public departure from the 'White Australia' concept, although previous Governments had progressively relaxed the 'colour bar'.

The programme target remained at 110,000 for 1973/74 and 112,712 migrants arrived during that period. With the dramatic increase in unemployment at the end of 1974, the ceiling for the programmed intake for 1974/75 was reduced to 80,000, the lowest figure since 1953/54 (when a target of 90,000 was set). Since commitments had been made to many individual immigrants and contracts let for transport, curtailing the programme halfway through its duration could not be entirely successful, and the actual number of migrants arriving in Australia for the period 1974/75 was 89,147. The measures introduced to constrain the intake during the latter half of the 1974/75 programme were to allow in only refugees, dependent close relations of immigrants in Australia and persons in approved occupational categories.

No formal target was set for 1975/76, but an effective planning figure of 55,000 was used. The severity of the constraints imposed in the latter half of the 1974/75 programme resulted in only 52,748 settlers arriving in the period. The planned intake for 1976/77 involved a further reduction

1. For details of this policy see Australian Department of Labour and and Immigration (1975), pp. 13-15 or Zubrzycki (1974), pp. 181-182.

to 50,000. A change of Government occurred in December, 1975, and this target was increased to 70,000 a few months after the initial announcement. Of the 70,000, 30,000 were to be assisted passages and 40,000 unassisted. In the 1976/77 programme, there was a return to precise planning targets which allowed for 26 per cent of the intake for family reunion, 26 per cent for migrants with acceptable skills, 34 per cent for dependants of the latter category and the remainder for refugees and New Zealanders (the latter may enter under special reciprocal arrangements).[1]

One reason for increasing the target figure was a degree of concern about Australia's fertility level. The Government was reported to have stated its belief that declining fertility levels coupled with lower immigration levels, would lead to a population structure with

> " .... proportionately fewer people in the working age groups supporting proportionately more people in the non-working age groups. Standards of living could also be expected to fall as a result of the change in age distribution of the population."[2]

During the post-war period, Government policy has concentrated on immigration and has placed much less emphasis on emigration, although numbers leaving Australia have increased dramatically, along with short-term movements of both Australians and overseas visitors. (An historical analysis suggesting reductions in transport costs as the reasons for Australia's development pattern is given by Blainey (1974), while James (1977) has recently looked at the current emigration patterns.)

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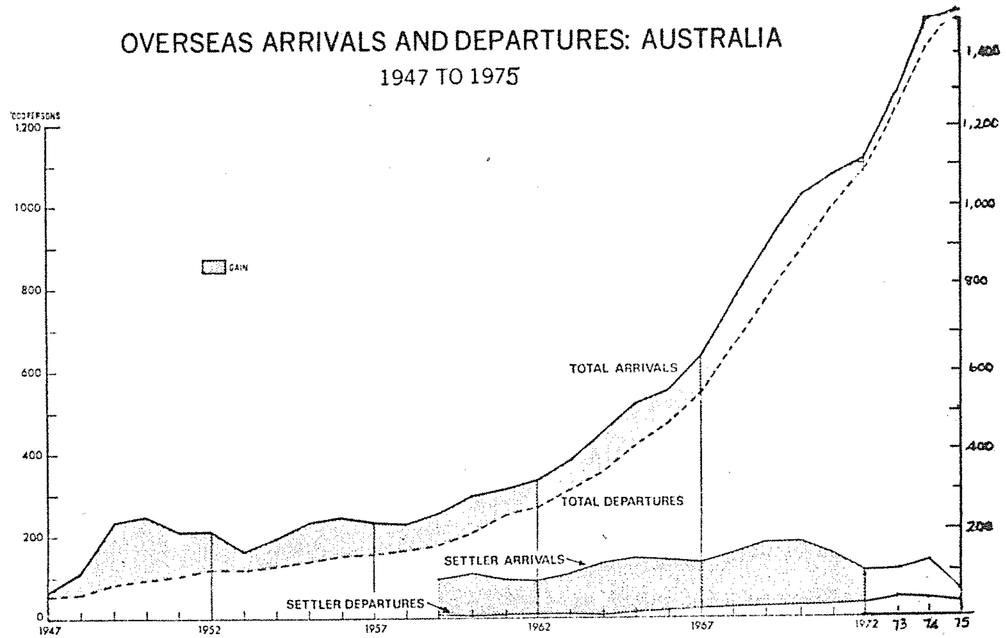
1. MacKellar, M., Financial Review, 6th August, 1976, p.12.
2. Ibid, p.12.

Figure 1 shows overseas arrivals and departures for the period 1947 to 1975, with settler arrivals and departures superimposed on the graph for the period 1959 to 1975 (note that these are calendar years, whereas the previous discussion is in terms of financial years). During most of the period 1947 to 1972, the excess of arrivals over departures was quite marked. Over the period 1972 to 1975, the number of departures rose

FIGURE 1



Source : Immigration Advisory Council, Committee on Social Patterns, Inquiry into Departure of Settlers from Australia, Final Report, 1973, p. 2. (Figures for 1973-75 were obtained from Australian Bureau of Statistics, Overseas Arrivals and Departures, Ref. 4.3, Canberra, various issues.)

more sharply than in previous years, and the overall gain in population through migration declined considerably. The same pattern can be noticed in recent years for settler arrivals and departures. In 1975 the net gain in the settler category was only 25,033 persons compared with 87,573 in the previous year. The recent fall in immigration may be epitomised by the fact that in calendar year 1975, Australia experienced an excess of departures over new arrivals of approximately 8,100 people.[1]

3. QUANTITATIVE STUDIES OF INTERNATIONAL MIGRATION

Migration, and theories of how and why it occurs, is described extensively in the literature. However, there has been very little work in the area of quantitative modelling of international migration flows. This section concentrates on those studies which utilise econometric techniques to model migration, since such a model is required for the BACHUROO framework. Emphasis is placed on studies which involve Australia on the grounds that conditions affecting Australian migration are different from those affecting almost all other countries experiencing large scale migration. The distance from Australia to potential source or destination countries makes the move more costly and more likely to be seen as irreversible.

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1. Australian Bureau of Statistics, (1976), p.21.

Much of the early work was concerned with 'economic hypotheses'[1] incorporating the concept of 'push' and 'pull' effects. In most cases, single equation models were developed using annual or quarterly data and estimated by the method of ordinary least squares.

Authors such as Kelley (1965), Kmenta (1964) and Pope (1968) used unemployment levels in the source and destination countries as measures of the push and pull effects. Kelley also estimated equations using the reciprocal of unemployment in an attempt to capture more accurately the 'tightness' of the labour market, while he and Kmenta both used lag structures to take account of the length of the decision making process.

Variables to account for differences in wages in the source and destination countries were used by Pope (1968), Quigley (1972), Lianos (1972) and Denton and Spencer (1974); while Vanderkamp (1971, 1972) used average incomes in the two regions divided by the distance between them.[2] The last-mentioned author also distinguished, at the theoretical, level, between new, return and 'autonomous' migration flows.[3] Pope also referred to the importance of what he termed *ability* constraints, but these were not explicitly incorporated into his model.

Previous migration has often been said to have an important influence on subsequent flows since, for example, the information flow will be greater and the presence of established fellow countrymen will be an aid to the integration process. 'Information' or 'friends and relatives' variables have been used explicitly in models by a number

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1. These hypotheses are discussed in the qualitative literature by such authors as Jerome (1926), Thomas (1941) and Easterlin (1966), (1968).
2. Vanderkamp's study related to inter-regional migration, hence the inclusion of the distance measure.
3. Autonomous flows include employment transfers within business firms, government agencies and the armed forces, and are therefore not at the individual's discretion.

of authors[1] and have usually given quite significant results. However, in a more recent article, Dunlevy and Gemery (1977) note that the inclusion of a migrant stock variable may represent the influence of friends and relatives or it may capture a partial adjustment mechanism. The authors used estimates of a Koyck distributed lag model of immigration to evaluate the contention that the migrant stock variable is merely a proxy for a lagged adjustment process by comparing them with the estimates obtained in a comparable non-lag model that included a migrant stock variable. On the basis of their results, the authors recommended the inclusion of variables for both migrant stock and lagged migration where possible. However, if only one variable is available, they suggested that migrant stock is an adequate measure of the friends and relatives effect.

Some of the more recent studies[2] have concentrated on the modelling of interstate and international migration in the framework of supply and demand analysis.

Todaro (1969) studied rural-urban migration in less developed countries. In his model the existence of a large pool of unemployed and underemployed workers determines a prospective migrant's 'probability' of finding a job in the urban sector. The probability of successful placement is an important determinant of the migratory flow, and hence of urban labour supply.

Wilkinson (1970) used aggregate labour demand and supply functions derived from neoclassical production and consumer theory to analyse the economic determinants of migration from Europe to the United States

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1. Nelson (1959), Fleisher (1963), Kelley (1965) op. cit., Quigley (1972 op.cit., and Greenwood (1975).

2. See for example Todaro (1969), Wilkinson (1970), Orsagh and Mooney (1970) and Pope (1976).

in the period 1870-1914. The variables driving the immigration flows in his model were national output levels and the differences in real wages between the source country and the United States, as well as a variable representing the ratio of United States immigration to population in the previous year.

More recently, Pope (1976) has used a supply and demand framework to analyse United Kingdom immigration to Australia over the period from Federation to the Great Depression. His supply function included such explanatory variables as the expected real income differential, real transport costs per migrant and expected real search costs; while his demand function included passage subsidies, agricultural output and Australia's defence expenditure. Like Wilkinson, Pope used a variety of estimation procedures.

The model outlined below borrows from the pool of ideas represented by the studies discussed above. We do attempt, however, to put the analysis on a somewhat more systematic basis, by developing a standard paradigm to explain migratory flows. Particular components of net migration are seen as special cases or extensions of this paradigm.

4. A MODEL OF INTERNATIONAL MIGRATION FOR AUSTRALIA 1959-60 TO 1975-76

As noted in the previous section, the single equation approach in the early work of Kelley (1965), Kmenta (1964) and Quigley (1972) does not take account of the interrelationships among the factors that influence the decisions to migrate. In this section we attempt systematically to develop a model of migration which integrates the various aspects of the migration decision and allows the endogenous determination of the migration variables of interest to BACHUROO.

4.1 Components of Australian Migration

The following components of Australia's international migration flows have been chosen for analysis in this paper :

(1) Permanent Arrivals - persons arriving in Australia whose declared intention is to make their migratory move a permanent arrangement. This component includes both assisted and unassisted settlers.

(2) Permanent Departures - persons leaving Australia whose declared intention is to make their move a permanent arrangement. This component includes former settlers (persons who previously entered Australia in the permanent arrivals category) as well as other residents who decide to leave Australia permanently.

(3) Long-Term Arrivals of Overseas Visitors - persons not normally resident in Australia whose declared intended period of stay in Australia exceeds twelve months.

(4) Long-Term Departures of Australian Residents - Australian residents departing whose declared intended period of stay abroad exceeds twelve months.

(5) Long-Term Departures of Overseas Visitors - persons not normally resident in Australia who are departing after a period of stay in Australia of twelve months or more.

(6) Long-Term Arrivals of Australian Residents - Australian residents returning to Australia after an absence of a period exceeding twelve months.

The permanent arrivals and departures categories are of particular interest in this study because of their impact on the structure of the population, and in particular, the labour force. Prior to 1959/60 the Australian Bureau of Statistics did not publish separate data for the permanent movement categories. We decided, therefore, to use only the period 1959/60 to 1975/76 for this study. Since it can be argued that the conditions affecting immigration in the sixties and seventies differed markedly from those in the immediate postwar period, this unavailability of data prior to 1959/60 is not a major problem for the construction of a model with focus on recent Australian experience. Differences emerging in the late fifties included changing source countries of the migrants, concentration on attracting skilled rather than unskilled workers and increases in affluence of the Australian population enabling more persons to travel or work abroad for extended periods.

Within the permanent arrivals category, persons are currently classified into the following groups[1] :

(i) Family Reunion - sponsored spouses, dependent children and parents of Australian residents as well as fiances and fiancees provided that

1. Australian Population and Immigration Council (1977), pp. 30-31 and 39.

evidence of the marriage can be produced within a specified period after arrival. The definition of this group has been broadened and narrowed in previous times as a result of government policy and economic conditions.

(ii) Refugees - displaced and stateless persons, people seeking political asylum, defectors, members of oppressed minorities and victims of natural disasters. This category is determined outside the usual social and labour force considerations, although the number of refugees allowed entry usually impinges on the fulfilment of the rest of the target for permanent settlers.

(iii) Occupational Eligibility - persons in this category are granted visas to settle permanently in Australia on the condition that their occupations are 'in the national need'. The occupations included in this category (which are not published) have varied widely with changing conditions in Australia.

Data relating to migrant flows is collected from cards which are filled out by all persons entering or leaving Australia. In the case of permanent arrivals, more detailed data are available from Immigration Department records. As there is no control or follow-up, the data derived from these cards are therefore subject to all the usual biases with respect to age and occupation that are found in any self-description survey. In particular, these biases probably will be similar to those of the Census of Population and Housing[1]: indeed, it could be argued that the probable presence of these biases ensures that the migrant flows may be compared directly with the Census results, which are usually regarded as the ultimate source for checks on stocks of population and labour force components.

4.2 The Analytical Framework

For the first four component migration flows discussed above - - namely, permanent arrivals, permanent departures, long-term arrivals of overseas visitors and long-term departures of Australian Residents - - a similar modelling technique has been used. For the remaining two categories - - long-term departures of overseas visitors and long-term arrivals of Australian residents - - a simpler auto-regressive approach has been used.

The basic approach for the first four categories involves defining a sub-set of the total population which is considered to be 'at risk' of undertaking the particular type of migration under consideration. This is the population sub-set which could be regarded as contemplating moving and which would, under some conceivable set of economic circumstances, actually move. The complement to this set (and probably the larger portion of the population) are those who would not consider moving - - either through ignorance of the alternative possibilities open to them, or because of the strength of physical,

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1. Commonwealth Bureau of Census and Statistics, (1972).

emotional and social ties to their current country of residence - - regardless of relative economic circumstances. The size (N) of the 'at risk' group ($\tilde{N}$) will depend on some general demographic and social characteristics as well as more particular factors such as the availability of information about other countries. N is specified as a function of these factors :

$$N = H(\cdot) \quad . \tag{4.1}$$

The next step is to define a function which specifies the probability that any member of the set $\tilde{N}$ will, given a particular set of economic circumstances, actually decide to move. This probability function is based on the assumed distribution of a 'decision variable' (X_i) calculated for each $i \varepsilon \tilde{N}$. The X_i in turn are generated by decision functions $\phi_i(:)$, which have as arguments economic variables considered to be of importance in deciding whether or not to move. If, for any individual, the value X_i exceeds his threshold value T_i, then he will decide to move. Thus if

$$X_i \equiv \phi_i(:) > T_i \ , \quad i \varepsilon \tilde{N} \ , \tag{4.2}$$

then individual i will move. Since each person will evaluate the current economic circumstances in different ways, we could expect the various X_i to form a random distribution (defined by the density functions $f_i(x)$), whose form and location are determined by the distribution over individuals of the arguments of the functions $\phi_i(:)$.

Let us now ignore the differences in the individual threshold values $\{T_i\}$, and replace them by a common value, T. This amounts to nothing more substantial than a suitable standarization of the units in which each X_i is measured. Then, the proportion of any potential migrant (or 'at risk') population who decide to move is the probability,

$$\Pr\{X > T\} .$$

Since successful estimation of the model probably would require the derived behavioural relationships to be linear in the variables and parsimonious in the use of parameters, the choice of a density function for the decision variable X is severly restricted.

The exponential density function,

$$f(x) = ke^{-kx} \qquad (x > 0) , \tag{4.3}$$

which has only one parameter (k), appears to suit our purpose.

This approach yields

$$\Pr\{X > T\} = \int_T^{\infty} ke^{-kx}dx$$

$$= e^{-kT} \tag{4.4}$$

$$= F(T) \quad \text{(say)} .$$

We expect that the parameter of the density function will be determined by the explanatory variables entering the decision function, i.e.,

$$k = R(:) \quad . \tag{4.5}$$

If the variables entering the decision functions are specified so as to make the ϕ_i monotonic increasing (i.e., an increase in any argument within the set (:) will cause an increase in X_i and hence increase the probability of individual i deciding to move), then we expect increases in (:) to cause the centre of mass of the distribution to move to the right. The expectation of the exponential distribution is

$$E(X) = \frac{1}{k} \quad , \tag{4.6}$$

and hence the desired movement of the distribution will be achieved if R is monotonically decreasing.

The specification of $f(x)$ in this way causes changes in both the expectation and variance of the function due to changes in the form rather than location[1] of the distribution. Changes in the latter can be achieved through the introduction of an additional parameter Θ to give density

$$f^*(x) = ke^{-k(x-\Theta)} \qquad (x>\Theta) \quad , \tag{4.7a}$$

1. It is the location of the distribution relative to the threshold value T which is important. Thus a change in location can be achieved by either moving the entire distribution along the axis or by moving T .

and cumulative distribution

(4.7b) $$F^*(T) = 1 - e^{k(T-\Theta)} \quad .$$

Again, a specification

(4.8) $$\Theta = J(:)$$

(with J monotonic increasing) could be used to capture the expected behaviour.

In order to determine the number (M) opting to move from a particular potential migratory group, it is simply necessary to multiply the number at risk of moving (N) by the probability that any member of that group will decide to move under the prevailing conditions, i.e.,

(4.9) $$M = N \times Pr(X>T) \quad ,$$
$$= H(\cdot) \times F(:) \quad .$$

In many categories there are no institutional impediments to potential movers realizing their intentions and hence the observed number of movers will coincide with the number deciding to move. Consequently (4.9) will represent a satisfactory estimating equation. A notable exception to this, however, is the case of permanent arrivals in Australia. This category is subject to substantial government manipulation and consequently the model will have to be expanded in order to recognise these influences.

It is anticipated that there will be some measure of interdependency between the various migratory flows. As a consequence, a systems estimation procedure may be called for.

The above specification provides a dichotomy between the economic decision variables on the one hand and the more general demographic, social and institutional influences on the other. This will lead, hopefully, to greater clarity in the subsequent empirical analysis.

4.2.1 Permanent Arrivals I_t

Because of the constraints placed on the flow of migrants into Australia it is necessary, for this particular category, to distinguish between the stock of potential migrants (i.e., those persons who decide they will attempt to migrate to Australia) and the number actually allowed to enter. The difference between these two figures depends, to a large extent, on decisions taken by the Australian government. In this section, an attempt is made to endogenise these government decisions and to model explicitly their effect on the level of permanent arrivals.

Determinants of the Size of the Pool of Potential Immigrants

The size of the population of persons who may contemplate migrating to Australia is influenced in some measure by the Australian government. It is postulated that at any particular time there will be a 'base' level of persons evaluating the consequences of moving. This level (A) will be determined by such factors as the absolute level of the population and the general level of consciousness of conditions and opportunities in other countries. No attempt is made to explain this level other than to claim that it is not unreasonable to assume that the general population growth and improved communications would have caused it to increase over time. Say,

$$(4.10) \qquad A_t = A_0 e^{\gamma t} \quad ,$$

where t represents time.

By undertaking advertising campaigns and providing other readily accessable informational services the government can expand the 'at risk' population above the base level. New people are drawn into the set $\tilde{N}$, firstly, by being made aware that Australia exists as a potential host country and encouraged to think about migrating, and secondly, by providing them with the information necessary to make a decision on the matter.

A further factor that could be considered relevant to the determination of N is the number of people who have migrated in recent years (over the last three years, say). Movement of relatives or friends in some previous period presumably would provide information and incentive for other people to contemplate a similar move themselves.

We can therefore write

$$(4.11) \qquad N_t = H\left(A_t,\ (AD)_t,\ G_t,\ \left[\sum_{i=1}^{3} I_{t-i}\right]\right) \quad ,$$

where A is as defined in (4.10), (AD) is the level of advertising undertaken, G is a measure of other relevant activities undertaken by the Australian government and $\left[\sum_{i=1}^{3} I_{t-i}\right]$ is the number of migrants arriving in Australia in the preceding 3 years. Figures on advertising costs are available and are used for (AD), while the number of staff at overseas posts is used as a measure of G .

Using a log-linear form for H , (4.11) becomes :

$$(4.12) \qquad \ell n N_t = \alpha_0^* + \alpha_0 t + \alpha_1 \ell n (AD)_t + \alpha_2 \ell n\, G_t + \alpha_3 \ell n \left[\sum_{i=1}^{3} I_{t-i}\right] ,$$

where ℓn indicates logarithms to the base e .

<u>The Decision Variables</u>

Whether or not a particular person in the set $\tilde{N}$ actually decides to present himself as a potential migrant depends on whether or not he will be 'better off' after arriving in Australia. There are two factors of obvious importance in this decision. These are the relative wage rate (W) and relative unemployment (U) comparisons between the two countries.

Another factor which could be expected to influence the decision is the expected cost (especially fares) of making the move. The expectational element is introduced to recognize the fact that some people will be forced to pay the full amount while others will receive assisted passages and make the trip for a nominal amount. We define the expected cost $(\overline{FO})$ as the current fare multiplied by the probability of not receiving an assisted passage. If (LR), (AP), (UP) and (FO) are the expected values of the Australian immigration target, the numbers of assisted and unassisted passages, and the fare to Australia respectively, the expected fare in prospect for a randomly selected prospective immigrant is[1]

$$(4.13) \qquad (\overline{FO}) = \left[\frac{(LR) - (AP)}{(LR)}\right] \equiv \frac{(UP)}{(LR)}\,(FO) \quad .$$

Following the arguments used above to derive the cumulative probability function (4.7b) we arrive at :

$$(4.14) \qquad \Pr\{X>T\} = e^{-R(W,U,(\overline{FO}))\{T-J(W,U,(\overline{FO}))\}} \quad .$$

The most convenient assumption that could be made about R and J is that they are both linear in the logarithms. Even when this assumption is made, however, multiplying out the exponent in (4.14) leads to a number of quadratic and cross product terms which greatly increases the number of parameters that appear in the derived estimating equation. Although there is no a priori reason for suspecting that changes in location of the density distribution (caused by J) are any

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1. Implicit in this treatment is the idea that immigration targets are feasible, i.e., that there is always an excess of applicants over approvals. Historically, this has been the case.

less important than changes in its form (caused by R), it has been decided - - for convenience only - - to set $\theta = 0$ (i.e., $J = 0$ for all $W, U, (\overline{FO})$). To the extent that changes in the critical value T can be used as a substitute for relocation of the distribution of X , this simplification does not lead to any great loss of generality.

The R function is written as[1]

$$(4.15)\quad R(W_t, U_t, (\overline{FO})_t) = \tilde{\beta}_0 - \tilde{\beta}_1 \ln W_t - \tilde{\beta}_2 \ln \left(\frac{1}{U_t}\right) - \tilde{\beta}_3 \ln \left[\frac{1}{(FO)_t}\right]$$

$$= k_t \quad .$$

By (IP) we denote the stock of applicants for migration to Australia. Then, by definition

$$(4.16)\qquad (IP)_t = H\left(A_t, (AD)_t, G_t, \left(\sum_{i=1}^{3} I_{t-i}\right)\right) \Pr\{X>T\} \quad .$$

1. It is assumed that the variables W and U are constructed such that increases in W and U respectively imply increases in wages and unemployment in Australia relative to overseas levels.

Substituting from (4.15) into (4.14), and thence into (4.16), we obtain

$$(4.17) \qquad (IP)_t = e^{-\tilde{\beta}_0 T} W_t^{\tilde{\beta}_1 T} U_t^{-\tilde{\beta}_2 T} (\overline{FO})_t^{-\tilde{\beta}_3 T} H(\cdot) \quad .$$

Writing $\beta_i \equiv (\tilde{\beta}_i T)$ $(i = 0,1,2,3)$ and substituting from (4.12) for H, finally we obtain

$$(4.18) \quad (IP)_t = e^{\alpha_0^* - \beta_0 + \alpha_0 t} (AD)_t^{\alpha_1} G_t^{\alpha_2} \left(\sum_{i=1}^{3} I_{t-i} \right)^{\alpha_3} W_t^{\beta_1} U_t^{-\beta_2} (\overline{FO})_t^{-\beta_3} \quad .$$

Role of the Government

We now introduce a stylized model of the role of the Australian government in determining the actual number of immigrants admitted in the permanent arrivals category. Australia's policy of active encouragement of immigration is seen as being determined by the values of the following five instruments; viz., the

(a) selection criteria, the long-run severity of which is summarized by a selectivity ratio, s_t;

(b) announced annual targets for migrant inflows $(TR)_t$,

(c) number of officers in Australian immigration posts overseas, G_t;

(d) number of assisted passages offered to intending immigrants, $(AP)_t$;

(e) overseas advertising, $(AD)_t$.

Long-run Production Function for Immigration

It is important in what follows to distinguish between long-run and short-run targets. The official short-run target for any given year is usually announced three to four months beforehand. By varying the rate at which approvals are granted, these targets $(TR)_t$ can be met, at least approximately, in every year. Thus, the short-run targets $(TR)_t$ are a flexible instrument of policy and can be modified at relatively short notice to take account of cyclical conditions in the labour market. We hypothesise that there is, in addition, a notional background or long-run target, $(LR)_t$, which is the average size of the program implicit in the action of the authorities. If $(LP)_t$ is the stock of applicants which could be expected to exist in the long-run if the authorities continued to set the instruments s, G, (AP) and (AD) at their values current in t, then the implicit long-run target is, by definition,

(4.19) $$(LR)_t = (LP)_t \div (1+s_t) \quad .$$

By obvious analogy with (4.18), the 'production' function for $(LP)_t$ is postulated to depend multiplicatively on the instruments (AD), G and

$(\overline{FO})$ - - overseas advertising, overseas postings, and the expected fare to Australia, respectively.[1] Thus, we write

$$(4.20) \qquad (LP)_t = (constant)_t e^{\mu t} (AD)_t^{\alpha_1} G_t^{\alpha_2} (\overline{FO})_t^{-\beta_3} .$$

The only difference between (4.18) and (4.20) is that the variables W_t and U_t have been incorporated into the constant by setting them at their expected long-term average values; the variable $\left(\sum_{i=1}^{3} I_{t-i}\right)$ is now incorporated in the trend term, $e^{\mu t}$. Substituting for $(\overline{FO})_t$ from (4.13), we obtain

$$(4.21) \quad (LP)_t = (constant)_t e^{\mu t} (AD)_t^{\alpha_1} G_t^{\alpha_2} (FO)_t^{-\beta_3} (LR)_t^{\beta_3} \left[(LR)_t - (AP)_t\right]^{-\beta_3} .$$

If the expected fare and the trend term are incorporated into the (dated) constant, we have :

$$(4.22) \qquad (LP)_t = (constant)_t (LR)_t^{\beta_3} (AD)_t^{\alpha_1} G_t^{\alpha_2} \left[(LR)_t - (AP)_t\right]^{-\beta_3} .$$

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1. $(\overline{FO})$ is a function of the instrument assisted passages (AP).

We leave the 'long-run immigration production function' (4.22) for the time being in order to focus on the short-run behaviour of the target and actual immigration flows.

Short-run Target

The short-run target, $(TR)_t$ is assumed to be a constant elasticity function of three variables, and log-linear in a fourth. The choice of variables reflects :

(i) the current state of the labour market, as measured by the ratio of registered unemployed to the labour force in Australia, V_t ;

(ii) the size of recent flows of out-migration, E_{t-1} ;

(iii) the influence of 'friends and relatives' - - i.e., former immigrants - - applying for admission of spouses, siblings, parents and/or other dependants. This is measured by a variable $(FR)_t$, defined as a weighted sum of previous levels of immigration; i.e.,

$$(FR)_t = \sum_{\tau=1}^{5} \omega_\tau I_{t-\tau}$$

$$(\omega_1=0.1,\ \omega_2=0.4,\ \omega_3=0.2,\ \omega_4=0.2,\ \omega_5=0.1) \quad .$$

(iv) A tendency to modify the current target to compensate for 'overshoot' or 'undershoot' in the preceding year. The variable used to measure under/overshoot is $(TR)_{t-1}/I_{t-1}$.

This leads to the following stochastic equation :

$$(4.23) \qquad \ell n\ (TR)_t = a_0 + a_1 V_t + a_2\, \ell n\ E_{t-1} + a_3\, \ell n\ (FR)_t$$

$$+ a_4\, \ell n \left((TR)_{t-1}/I_{t-1}\right) + u_{1t} \quad ,$$

in which u_{1t} is regarded as a zero-mean random error. Notice that the variable with coefficient a_4 in (4.23) incorporátes an autoregressive element in the time profile of (TR) (hence $|a_4|<1$).

Actual Flow of Immigrants

The actual flow of immigrants, we postulate, is some multiple (reasonably close to unity) of the short-run target, $(TR)_t$. The factor causing actual immigration (viz., permanent arrivals) I_t to differ from the short-run target, $(TR)_t$, is a pressure variable generated by the difference between the number of applicants $(IP)_t$ and the number of applicants which is 'tailor-made' to satisfy the target $(TR)_t$, given the selectivity ratio, s_t . We write

$$(4.24) \qquad I_t = (TR)_t \left[\frac{(IP)_t}{(TR)_t\ (1+s_t)}\right]^{\varepsilon} \qquad (\varepsilon>0) \quad .$$

If the number of applicants is in equilibrium both with the short-run target and the long-run selectivity criteria - - i.e., if $(IP)_t = (TR)_t\ (1+s_t)$ - - then actual and targeted permanent arrivals coincide. If the short-run influences which cause $(TR)_t$ to change cause some disequilibrium surplus of applicants, then this leads to actual immigration overshooting the target by an amount which depends on the elasticity ε .

Substituting for the stock of applicants, $(IP)_t$ from (4.18) into (4.24), and simplifying, we obtain the following almost final form of the structural equation for I_t, the number of actual permanent arrivals[1] :

$$(4.25) \qquad \ell n\ (I_t) = -\varepsilon\ \ell n\ (1+s) + \varepsilon\alpha_0^* - \varepsilon\beta_0 + (1-\varepsilon)\ \ell n\ (TR)_t$$

$$+ \varepsilon\alpha_0 t + \varepsilon\alpha_1\ \ell n\ (AD)_t + \varepsilon\alpha_2\ \ell n\ G_t$$

$$+ \varepsilon\alpha_3\ \ell n \left(\sum_{i=1}^{3} I_{t-i} \right) + \varepsilon\beta_1\ \ell n\ W_t - \varepsilon\beta_2\ \ell n\ U_t$$

$$- \varepsilon\beta_3\ \ell n\ (\overline{FO})_t \ .$$

1. In equation (4.25) the t subscript on s , the selectivity ratio, has been dropped. In empirical work it proved impossible to derive a time series for such a variable. Attempts were made, however, to allow for different values of s as between high and low unemployment periods (see section 6.1).

In this short-run equation we replace the definition (4.13) of $(\overline{FO})_t$ by

$$(\overline{FO})_t = \frac{(UP)_{t-1}}{I_{t-1}} (FO)_t \quad . \tag{4.26}$$

Substituting from (4.26) into (4.25) and adding a zero-mean error, u_{2t} , we obtain the final form of the structural equation for permanent arrivals :

$$\begin{aligned} \ell n\,(I_t) = & -\varepsilon\,\ell n\,(1+s) + \varepsilon\alpha_0^* - \varepsilon\beta_0 + (1-\varepsilon)\,\ell n\,(TR)_t + \varepsilon\alpha_0 t \\ & + \varepsilon\alpha_1\,\ell n\,(AD)_t + \varepsilon\alpha_2\,\ell n\,G_t + \varepsilon\alpha_3\,\ell n\left(\sum_{i=1}^{3} I_{t-i}\right) + \varepsilon\beta_1\,\ell n\,W_t \\ & - \varepsilon\beta_2\,\ell n\,U_t - \varepsilon\beta_3\,\ell n\,(UP)_{t-1} - \varepsilon\beta_3\,\ell n\,(FO)_t \\ & + \varepsilon\beta_3\,\ell n\,I_{t-1} + u_{2t} \quad . \end{aligned} \tag{4.27}$$

Advertising, Overseas Postings and Assisted Passages

The short-run target has been discussed above, where its role as a flexible instrument of policy was stressed. We postulate that the policy mix of advertising, staffing of overseas posts and assisted passages, on the other hand, tends to adjust more slowly. In particular, we assume that the long-run goal of the authorities is to maximize the cost effectiveness of these policies in achieving the desired average level of migrant in-flow. That is, in the long-run the policy mix would adjust so as to

(4.28a) <u>minimize</u> $p_1\ (AD) + p_2G + \pi\ (AP)$

(4.28b) <u>with respect to</u> (AD), G, and (AP)

(4.28c) <u>subject to</u> $(LP) = (1+s)\ (LR)$,

in the context of exogenous expected unit costs p_1, p_2 and π of advertising, staffing of overseas posts and assisted passages respectively. In (4.28c), (LR) represents the long-run target to be met; its relationship to the long-term stock of applicants has been discussed above [equation (4.19)]. Substituting the long-run production function (4.22) into (4.28c), and using the (long-run) definitional identity $(UP) = (LR) - (AP)$, we obtain

(4.28c') $$(LR)^{(1-\beta_3)}\ (1+s) \div (\text{constant}) = (AD)^{\alpha_1}\ G^{\alpha_2}\ [(LR)-(AP)]^{-\beta_3} \ .$$

Denote the left-hand side of (4.28c') by K. Then the Lagrangean for problem (4.28a,b,c) is

$$\text{(4.29)} \qquad L = p_1 \text{ (AD)} + p_2 G + \pi \text{ (AP)} + \Psi \left\{ K - \text{(AD)}^{\alpha_1} G^{\alpha_2} \left[\text{(LR)} - \text{(AP)}\right]^{-\beta_3} \right\},$$

in which Ψ is a (scalar) Lagrange multiplier. To simplify the analysis, we streamline the notation as follows :

$$\text{(4.30)} \quad \begin{cases} \text{(AD)} \equiv x_1; \quad G \equiv x_2; \quad \text{(LR)} \equiv y; \\ \\ \text{(UP)} \equiv x_3 \equiv \text{(LR)} - \text{(AP)}; \quad p_3 \equiv -\pi; \quad \text{(AP)} \equiv z \equiv y - x_3 \ . \end{cases}$$

In this notation problem (4.28a,b,c) becomes :

$$\text{(4.31a)} \qquad \text{minimize} \qquad \sum_{i=1}^{3} p_i \, x_i - p_3 y \quad (p_1, \, p_2, \, p_3, \, y \text{ constant})$$

$$\text{(4.31b)} \qquad \text{with respect to} \quad \{x_1, \, x_2, \, x_3\}$$

$$\text{(4.31c)} \qquad \text{subject to} \qquad K = x_1^{\alpha_1} \, x_2^{\alpha_2} \, x_3^{-\beta_3} \quad ,$$

where K has the following fixed value :

(4.31d) $$K = y^{(1-\beta_3)}\,(1+s)/\kappa \quad ,$$

in which κ is the constant of (4.28c') .

The first-order conditions for minimizing the cost of achieving any given long-run target, y , are

(4.32a) $$p_i\,x_i = \Psi\,\alpha_i\,K \qquad (i=1,2)\ ;$$

(4.32b) $$p_3\,x_3 = -\Psi\,\beta_3\,K\ ;$$

(4.32c) $$K = x_1^{\alpha_1}\,x_2^{\alpha_2}\,x_3^{-\beta_3} \quad .$$

The last of these is just the target constraint, (4.28c'), in the new notation. Summing (4.32a) and (4.32b), and rearranging, we obtain

(4.33) $$\Psi = p'x \big/ \left[K(\alpha_1+\alpha_2-\beta_3)\right] \quad .$$

where $p'x$ is shorthand for $\{p_1 x_1 + p_2 x_2 + p_3 x_3\}$. Now by definition

$$p'x = p_1 (AD) + p_2 G - \pi [(LR)-(AP)]$$

(4.34) $$= \underbrace{p_1 (AD) + p_2 G + \pi (AP)} - \pi (LR)$$

$$= \qquad B' \qquad - \pi (LR) = B \text{ (say)} .$$

Above, B' is that part of the immigration budget spent on advertising, staffing overseas posts, and assisted passages. $(p'x)$, or B, is this amount less the imputed cost of assisting the passages of all target immigration. Substituting (4.34) into (4.33), we obtain

(4.35) $$\Psi = B/[K(\alpha_1+\alpha_2-\beta_3)] .$$

Further substituting for Ψ from (4.35) into (4.32a) and (4.32b), we obtain the following expenditure system :

(4.36a) $$p_i \, x_i = \frac{\alpha_i}{(\alpha_1+\alpha_2-\beta_3)} \, B \qquad (i=1,2) \quad ;$$

(4.36b) $$p_3 \, x_3 = \frac{-\beta_3}{(\alpha_1+\alpha_2-\beta_3)} \, B \quad .$$

The long-run production function (4.28c') is in fact, a modified Cobb-Douglas form. This can be seen when that equation is rewritten in the new notation :

(4.37) $$k \, y^{(1-\beta_3)} \left[y-z\right]^{\beta_3} = x_1^{\alpha_1} \, x_2^{\alpha_2} \quad ,$$

in which k is $(1+s)/\kappa$. The imposition of constant-returns-to-scale (CRTS) on this implicit functional form results in the restriction

(4.38) $$\alpha_1 + \alpha_2 = 1 \quad .$$

With this simplification, the structural form of the model becomes

(4.39a) $$p_i\ x_i = \frac{\alpha_i}{(1-\beta_3)}\ B \qquad (i=1,2) \quad ;$$

(4.39b) $$p_3\ x_3 = \frac{-\beta_3}{(1-\beta_3)}\ B \quad .$$

Recall that B' is the size of the budget spent on the (non-inferior) factors x_1, x_2, z (viz., (AD), G and (AP)). Under the CRTS assumption, at any fixed given set of prices p_1, p_2 and π, output y must be proportional to B' ; i.e.,

(4.40) $$a\ y = B' \quad ,$$

where a is a proportionality factor chosen to convert units. (The dimension of a is $ per person; its interpretation at any point of time is that part of the expected unit cost of generating a long-run immigrant flow equal to (LR) (i.e., y).) From (4.34) we recall that, by definition,

(4.41) $$B = B' - \pi\ (LR) = B' + p_3\ y \quad ;$$

so that

(4.42) $$B = (a+p_3)\ y = \left(1+\frac{p_3}{a}\right) a\ y$$

$$= \left(1+\frac{p_3}{a}\right) B' \quad .$$

Substituting from (4.42) into (4.39a&b), we obtain the following alternative representation of the structural form

(4.43a) $$\sigma_i^* = \alpha_i^\circ \left(1-\frac{\pi}{a}\right) \qquad (i=1,2);$$

(4.43b) $$(p_3 x_3/B') = -\beta_3^\circ \left(1-\frac{\pi}{a}\right) \quad .$$

in which σ_1^* and σ_2^* are the budget shares of the instruments (AP) and G ; viz.,

(4.43c) $$\sigma_i^* = p_i\, x_i/B' \qquad (i=1,2) \ .$$

The parameters α_1°, α_2° and β_3° are obtained by normalizing their unsuperscripted counterparts; i.e.,

(4.43d) $$\alpha_i^\circ = \alpha_i/(1-\beta_3) \text{ for } (i=1,2) \ ; \quad \beta_3^\circ = \beta_3/(1-\beta_3) \quad .$$

Notice that, by construction

(4.44) $$\alpha_1^\circ + \alpha_2^\circ - \beta_3^\circ = 1 \quad .$$

To convert (4.43b) into share form, we substitute $(y-z)$ for x_3, obtaining (after use of (4.40)) :

(4.45) $$\sigma_3^* = \frac{\pi z}{B'} = -\beta_3^\circ \left(1 - \frac{1}{\beta_3}\frac{\pi}{a}\right)$$

On checking, we find that on adding (4.43a) and (4.45), both left and right hand sides add to unity.

Equations (4.43a) and (4.45) define the long-run shares of the three instruments (AD), G and (AP). As expected, these equilibrium shares are driven by the relative costs of the three instruments. Interpreting a as the overall unit cost associated with the application of these three instruments, $\left(\frac{\pi}{a}\right)$ may be interpreted as the price of assisted passages relative to the composite cost of all three instruments. The variable π is observable. The variable a can be calculated from official estimates of the costs of the immigration programme.[1]

To keep the production function (4.37) well behaved under CRTS, the following parameter constraints are sufficient

(4.46) $$0 < \alpha_1, \alpha_2, < \beta_3 \; ; \qquad \beta_3 \neq 1 \; .$$

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1. Ideally, the variable a would be computed using equilibrium shares of the three instruments as weights. In the empirical work the demands of operational simplicity have resulted in our using the actual weights.

Given this, (4.43a) and (4.45) represent a minimal generalization over the Cobb-Douglas case. Cost-shares now are no longer invariant, but respond to relative prices. Only one price ratio, however, is needed to determine the three factor shares. The elasticities of factor demands in the Cobb-Douglas case are plus and minus unity respectively with respect to the size of the budget (B') and own price; the former but not the latter result holds here. Similarly, cross price elasticities, which are minus unity in the Cobb-Douglas case, are no longer so, but become a function of the relative price variable $\left(\frac{\pi}{a}\right)$. Finally, we note that the direct substitution elasticities between assisted passages (z) and the other two instruments are variable, approaching $(+\infty)$ as $z \to 0$ and approaching zero as $z \to y$; i.e., as assisted passages approach unit share of the budget. The exact form of the direct substitution elasticities is given by :

$$\text{(4.47)} \quad \left(\begin{array}{c}\text{direct substitution elasticity} \\ \text{between } z \text{ and } x_i\end{array}\right) = \frac{1 + \frac{\alpha_i}{\beta_3}\left(\frac{y-z}{z}\right)}{1 - \frac{\alpha_i}{\beta_3}} \quad (i=1,2) \; .$$

Equations (4.43a) and (4.45) are interpreted as giving the long-run optimal policy mix of the three instruments (AD), G and (AP) given exogenous expectations on their prices p_1, p_2 and π. For estimation work we assume naive forecasting of relative prices; i.e., the prices used to define the optimal mix of instruments are the currently prevailing ones in each year.[1] We do not assume, however, that

1. Thus if inflation is taken into account, it is assumed that inflationary expectations are uniform with respect to the three instruments.

the optimal policy-mix is quickly attained; rather we use a geometric lag distribution to characterize adjustment; i.e., if σ_{it} is the actual share of instrument i in year t, then we postulate

$$(4.48)\qquad \left(\sigma_{it}-\sigma_{it-1}\right) = \lambda_i \left(\sigma^*_{it}-\sigma_{it-1}\right) \qquad (i=1,2,3) \quad .$$

The systems constraints connecting the σ_i are sufficient to imply

$$(4.49)\qquad \lambda_i = \lambda \text{ for all } i \quad (i=1,2,3) \quad .$$

Combining (4.48) in the light of (4.49) with (4.43a) and (4.45) and adding zero mean errors, we obtain the final form for estimation of the structural equations; i.e.,

$$(4.50a)\qquad \sigma_{it} = \lambda\alpha^\circ_i \left(1- \frac{\pi_t}{a_t}\right) + (1-\lambda)\ \sigma_{i,t-1} + u_{i+2,t} \qquad (i=1,2) \quad ;$$

$$(4.50b)\qquad \sigma_{3t} = -\lambda\beta^\circ_3 \left(1- \frac{1}{\beta_3}\frac{\pi_t}{a_t}\right) + (1-\lambda)\ \sigma_{3,t-1} + u_{7t} \quad .$$

The accounting discipline requiring the right and the left-hand sides of the sum of (4.50a) and (4.50b) to be unity in each case means that any two of the error terms $\{u_{3t}, u_{4t}, u_{7t}\}$ fully predetermine the value of the third; i.e.,

(4.51)
$$\sum_{i=3,4,7} u_{it} \equiv 0 \quad .$$

Full information estimation is carried out by eliminating any one of the three equations involved, the FIML estimates being invariant to the choice.[1] In practice we chose to delete (4.50b).

The five structural equations characterizing the determination of the short-run target, permanent arrivals, and the associated policy mix of spending on overseas advertising, staffing of overseas posts and assisted passages, are listed in Table 1.

In the estimation phase described below, we used Wymer's (1973) extraordinarily flexible RESIMUL package for computing FIML estimates under virtually any differentiable set of equality constraints on the parameters. This package does require, however, linearity in the variables.[2] Since the shares of the instruments (AD) and (AP)

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1. Barten (1969), pp. 7-73; Powell (1969), pp. 913-922.

2. Wymer has also developed software for the FIML estimation of systems which may be non-linear in all of the variables except the stochastic error terms. See Wymer (1973a).

Table 1

Final Structural Form of Behavioural Equations Explaining Permanent Arrivals

Variable	Eqn.No.	Equation
Short-run target, $(TR)_t$	(4.23)	$\ell n\ (TR)_t = a_0 + a_1 V_t + a_2 \ell n\ E_{t-1} + a_3 \ell n\ (FR)_t + a_4 \ell n \left[(TR)_{t-1}/I_{t-1}\right] + u_{1t}$
Permanent arrivals, I_t	(4.27)	$\ell n\ I_t = -\varepsilon \ell n\ (1+s) + \varepsilon\alpha_0^* - \varepsilon\beta_0 + (1-\varepsilon) \ell n\ (TR)_t + \varepsilon\alpha_0 t + \varepsilon\alpha_1 \ell n\ (AD)_t + \varepsilon\alpha_2 \ell n\ G_t + \varepsilon\alpha_3 \ell n \left[\sum_{i=1}^{3} I_{t-i}\right] + \varepsilon\beta_1 \ell n\ W_t - \varepsilon\beta_2 \ell n\ U_t - \varepsilon\beta_3 \ell n\ (UP)_{t-1} - \varepsilon\beta_3 \ell n\ (FO)_t + \varepsilon\beta_3 \ell n\ I_{t-1} + u_{2t}$
Partial Immigration budget shares of :		
Overseas advertising, σ_{1t}	(4.50a)	$\sigma_{1t} = \lambda \frac{\alpha_1}{(1-\beta_3)} \left(1 - \frac{\pi_t}{a_t}\right) + (1-\lambda)\ \sigma_{1,t-1} + u_{3t}$
Postings overseas, σ_{2t}	(4.50a)	$\sigma_{2t} = \lambda \frac{\alpha_2}{(1-\beta_3)} \left(1 - \frac{\pi_t}{a_t}\right) + (1-\lambda)\ \sigma_{2,t-1} + u_{4t}$
Assisted passages, σ_{3t}	(4.50b)	$\sigma_{3t} = -\lambda \frac{\beta_3}{(1-\beta_3)} \left(1 - \frac{1}{\beta_3} \frac{\pi_t}{a_t}\right) + (1-\lambda)\ \sigma_{3,t-1} - u_{3t} - u_{4t}$

are endogenous, and because the latter variables appear on the right of the structural equation for permanent arrivals I_t, it is necessary to introduce equations linearizing the two share variables which have equations appearing in the FIML computations; viz., σ_1, and σ_2 . Now, by definition

$$(4.52a) \qquad \sigma_{1t} \equiv (AD)_t \, p_{1t} \,/\, \{a_t \, (TR)_t\} \quad ,$$

and

$$(4.52b) \qquad \sigma_{2t} \equiv G_t \, p_2 t \,/\, \{a_t \, (TR)_t\} \quad ;$$

which in logarithms become

$$(4.53a) \qquad \ell n \, (AD)_t \equiv \ell n \, \sigma_{1t} + \ell n \, a_t + \ell n \, (TR)_t - \ell n \, p_{1t} \quad ,$$

and

$$(4.53b) \qquad \ell n \, (G_t) \equiv \ell n \, \sigma_{2t} + \ell n \, a_t + \ell n \, (TR)_t - \ell n \, p_{2t} \quad .$$

Taking a first-order Taylor expansion of $\ln(\sigma_{it})$ about sample mean budget shares $\bar{\sigma}_1$ and $\bar{\sigma}_2$, we obtain

$$(4.54a) \qquad \ln(AD)_t \equiv [\ln(\bar{\sigma}_1)-1] + \left(\frac{1}{\bar{\sigma}_1}\right)\sigma_{1t} + \ln a_t + \ln(TR)_t - \ln p_{1t} + \xi_{it} \ ,$$

and

$$(4.54b) \qquad \ln(G_t) \equiv [\ln(\bar{\sigma}_2)-1] + \left(\frac{1}{\bar{\sigma}_2}\right)\sigma_{2t} + \ln a_t + \ln(TR)_t - \ln p_{2t} + \xi_{2t} \ ,$$

in which ξ_{it} are the Taylor linearization remainders,

$$(4.54c) \qquad \xi_{it} \equiv \ln(\sigma_{it}) - \left(\frac{1}{\bar{\sigma}_i}\right)\sigma_{it} - [\ln(\bar{\sigma}_i)-1] \qquad (i=1,2) \ .$$

Following a suggestion by Bacon[1] we have computed the series ξ_{it} (i=1,2) within the sample period, and regarded them as exogenous. Viewed this way, (4.54a) and (4.54b) are identities which, when added to

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1. Bruce Bacon, private communication, 1977.

(4.23), (4.25) and (4.50a) produce a system of four stochastic equations and two identitites which are linear in the variables, including the six endogenous variables $\ell n\ (TR)_t$, $\ell n\ (I_t)$, σ_{1t}, σ_{2t}, $\ell n\ (AD)_t$ and $\ell n\ (G_t)$. Such a system is suitable for estimation using RESIMUL.

4.2.2 Permanent Departures E_t, Long-Term Arrivals of Overseas Visitors $(LAV)_t$ and Long-Term Departures of Australian Residents $(LDA)_t$

Since emigration (permanent departures) is essentially immigration 'viewed from other side', one would expect to be able to use a symmetrical treatment for the two. However, since there are few restrictions on the exit of persons from Australia, and because there are no major factors influencing the decision which could be regarded as endogenous to an Australian migration model, the specification is considerably simpler than the one derived above for immigration. This is also the case for long-term arrivals of overseas visitors and long-term departures of Australian residents.

Determinants of the Size of the Pool of Potential Permanent Departures

As we presumably have more information about, and a greater understanding of, the factors determining the 'at risk' population in Australia as compared to that for overseas countries, this aspect will be modelled in a little more detail. In particular we will attempt to explain what was formerly termed the 'base' level and which was simply specified as a function of time in equation (4.10).

When we postulate that the number of people who would be contemplating moving at any time is a function of the level of population, we are now in a position to quantify this level and include it explicitly in the function. With respect to the 'general awareness of conditions and opportunities existing in other countries', some measure of the 'openness' of the economy would appear to be appropriate. The concept is that increased communication with the international business community is likely to lead to an increase in the 'at risk' population $(\tilde{N})$. Firstly, by providing information about, and a better understanding of, the people and customs of other countries; and secondly, by increasing the potential mobility of Australians through the provision of employment opportunities and contacts overseas.

The number of migrants arriving in Australia in previous years could also be expected to have a positive influence on $\tilde{N}$. The proportion of former settlers in the permanent departures component has been quite high throughout the period under consideration. (It rose from 0.49 in 1959/60 to 0.75 in 1967/68 and then fell to 0.63 in 1975/76.) This group is subjected to a variety of pressures not experienced by other groups in the community which may influence their decision to leave. Such pressures include homesickness, discrimination, communication problems, employment problems and migrant education.[1]

Also, the number of Australians departing permanently in previous years may have a positive influence on the number of current departures since there may be some form of demonstration effect as well as previous emigrants providing information and assistance with the integration process in the new country of residence.

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1. More detailed information relating to reasons for departure for former settlers can be found in Immigration Advisory Council (1973), International Labour Office (1959), Price (1973), Organisation for Economic Co-operation and Development (1967) or Australian Department of Labor and Immigration (1974).

Finally, it is possible that the number of assisted passages in previous years will influence the number of permanent departures. Persons arriving under the assisted passage scheme pay only a nominal amount towards the cost of travel to Australia, and are only required to repay part of the fare if they leave Australia less than two years after arrival. It could be argued that some persons in this category will have less motivation to integrate into the Australian community than unassisted settlers since they did not have to pay the full fare. To capture the possible influence of this effect, a variable representing previous assisted passages is included in the function representing the pool of potential emigrants.

The following function can therefore be written to explain the number of persons in Australia who are 'at risk' of emigration :

$$(4.55) \quad N_t = H\left[P_{t-1}, (OE)_t, \left(\sum_{\tau=1}^{5} \omega_\tau I_{t-\tau}\right), \left(\sum_{i=1}^{3} E_{t-i}\right), \left(\sum_{i=2}^{4} (AP)_{t-i}\right)\right]$$

where P is defined as the Australian population, (OE) is a measure of the openness of the economy (i.e. ratio of exports plus imports to gross domestic product), $\left(\sum_{\tau=1}^{5} \omega_\tau I_{t-\tau}\right)$ is a distributed lag on previous immigration (with $\omega_1 = 0.1$, $\omega_2 = 0.4$, $\omega_3 = 0.2$, $\omega_4 = 0.2$, $\omega_5 = 0.1$) which acts as a proxy for the number of former settlers who are likely to leave Australia, $\left(\sum_{i=1}^{3} E_{t-i}\right)$ is the number of persons departing permanently from Australia in the previous three years and $\left[\sum_{i=2}^{4} (AP)_{t-i}\right]$ is the sum of assisted passages over the previous two to four years.

Using a log-linear form for H, (4.55) becomes :

$$(4.56) \quad \ell n\, N_t = \zeta_0 + \zeta_1\, \ell n\, P_{t-1} + \zeta_2\, \ell n(OE)_t + \zeta_3\, \ell n \left[\sum_{\tau=1}^{5} \omega_\tau\, I_{t-\tau}\right]$$

$$+ \zeta_4\, \ell n \left[\sum_{i=1}^{3} E_{t-i}\right] + \zeta_5\, \ell n \left[\sum_{i=2}^{4} (AP)_{t-i}\right] \quad .$$

The Decision Variables

The economic factors which determine whether or not a particular person in the set $\tilde{N}$ will actually decide to emigrate (i.e., the arguments of the decision function) are assumed to be the same as those operating on potential migrants (i.e., relative wages, relative unemployment and fares). Following the approach outlined previously, these variables can be used to determine the probability of a person in the 'at risk' population $(\tilde{N})$ actually deciding to move. Since we are using the same variables as measures of relative wages and relative unemployment as before, we would expect them to enter the probability function with the opposite signs to those in the function for potential immigrants. In the case of the fares variable the disincentive effect of an increase in fares is still operative, hence the sign should remain the same. Since there are no schemes to reduce the expected fare as in the case of assisted passages for potential immigrants, the fares variable (FA) simply represents the real cost of the fare from Australia to the country of intended future residence.

The cumulative probability function can then be written as :

$$(4.57) \qquad \Pr\{X>T\} = e^{-R(W,\ U,\ (FA))\{T-J(W,\ U,\ (FA))\}} \quad .$$

As in equation (4.14), we assume that both R and J are linear in the logarithms and J = 0 for all W, U, (FA) .

The number of persons emigrating from Australia can be expressed as :

$$(4.58) \qquad E_t = N_t \times \Pr\{X>T\}$$

which leads to the following estimation equation :

$$(4.59) \quad \ell n\, E_t = \zeta_0 + \zeta_1 + \ell n\, P_{t-1} + \zeta_2\, \ell n(OE)_t + \zeta_3\, \ell n \left(\sum_{\tau=1}^{5} \omega_\tau\, I_{t-\tau} \right)$$

$$+ \zeta_4\, \ell n \left(\sum_{i=1}^{3} E_{t-i} \right) + \zeta_5\, \ell n \left(\sum_{i=2}^{4} (AP)_{t-i} \right) + \eta_0 + \eta_1\, \ell n\, W_t$$

$$+ \eta_2\, \ell n\, U_t + \eta_3\, \ell n(FA)_t \quad .$$

Determinants of the Size of the Pool of Potential Long-Term Arrivals of Overseas Visitors

As in the case of permanent immigrants the 'base level' of persons evaluating the consequences of moving is specified as :

$$A_t = A_0 e^{\gamma t} \quad . \tag{4.60}$$

Since forty percent[1] of overseas visitors arriving state their reason for travel as business or employment, it could be argued that, as in the case of permanent departures, an increase in the level of business contact between Australia and other countries should lead to an expansion in the 'at risk' population. Seven percent of visitors stated their reason as visiting relatives and it is likely that many of these relatives were foreign born. Therefore, it is also possible that the number of previous migrants will have a positive influence. Some previous long-term visitors could encourage their friends and relatives to contemplate a visit to Australia and hence a variable to measure this demonstration effect should also be included.

As a consequence of cut-backs in the targeted level of permanent migration, some potential migrants may seek to enter Australia as long-term visitors, either to evaluate whether they would

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1. Australian Bureau of Statistics, Reference No.4.23, 1975, p.18.

actually want to migrate here if the possibility existed at a later date, or to circumvent the restrictions on permanent entry by initial use of a long-term visa and subsequent attempt to change status. It was therefore decided to include a variable to indicate the 'pressure' for this latter motive for long-term entry which may exist as a result of the current target being less than actual immigration in the previous year.

The function to explain the number of persons at risk of becoming long-term visitors to Australia is therefore as follows :

$$(4.60) \quad N_t = H\left[A_t,\ (OE)_t,\ \left(\sum_{\tau=1}^{5} \omega_\tau\ I_{t-\tau}\right),\ \left(\sum_{i=1}^{3} LAV_{t-i}\right),\ \left(D\ \frac{(TR)_t}{I_{t-1}}\right)\right]$$

where $\left(\sum_{i=1}^{3} LAV_{t-i}\right)$ is the sum of long-term visitors arriving over the previous three years, $\left(D\ \frac{(TR)_t}{I_{t-1}}\right)$ represents the 'pressure' on the long-term visitors category as a result of a decrease in the target ($D = 1$ if $(TR)_t < I_{t-1}$, $D = 0$ elsewhere) and the other variables are as previously defined.

Again, using a log-linear form for H , (4.60) becomes :

$$(4.61) \qquad \ell n\, N_t = \upsilon_0 + \upsilon_1 t + \upsilon_2\, \ell n\, (OE)_t + \upsilon_3\, \ell n \left[\sum_{\tau=1}^{5} \omega_\tau\, I_{t-\tau} \right]$$

$$+ \upsilon_4\, \ell n \left[\sum_{i=1}^{3} LAV_{t-i} \right] + \upsilon_5\, \ell n \left[D\, \frac{(TR)_t}{I_{t-1}} \right]$$

The Decision Variables

The economic factors which determine whether a particular person in the set $\tilde{N}$ will actually decide to enter Australia as a long-term visitor are assumed to be the same as those operating on potential migrants except that the fares variable (FO) simply represents the current fare to Australia. A further factor which may influence the decision to visit Australia for purposes of education (13% of visitors state this as a reason[1]) is the possibility of obtaining financial assistance from the Australian Government. We have therefore included a measure of Australian Government expenditure on overseas students as a proxy for this influence.

The probability function is

$$(4.62) \qquad Pr\,\{X>T\} = e^{-R(W,\ U,\ (FO),\ (ED))\{T-J\ (W,\ U,\ (FO),\ (ED))\}}$$

and, using the same assumptions as previously, the number of persons entering Australia as long-term visitors is expressed as

1. Australian Bureau of Statistics, Reference No.4.23 op.cit., p.18.

$$(LAV)_t = N_t \times Pr\{X>T\} \tag{4.63}$$

which yields the following estimation equation

$$\ell n(LAV)_t = \nu_0 + \upsilon_1 t + \upsilon_2 \, \ell n \, (OE)_t + \upsilon_3 \, \ell n \left[\sum_{\tau=1}^{5} \omega_\tau \, I_{t-\tau} \right] \tag{4.64}$$

$$+ \upsilon_4 \, \ell n \left[\sum_{i=1}^{3} (LAV)_{t-i} \right] + \Omega_0 + \Omega_1 \, \ell n \, W_t$$

$$+ \Omega_2 \, \ell n \, U_t + \Omega_3 \, \ell n \, (FO)_t + \Omega_4 \, \ell n \, (ED)_t \quad .$$

Determinants of the Size of the Pool of Potential Long-Term Departures of Australian Residents

The treatment of this category is very similar to that for permanent departures. Population and openness of the economy variables are again included, as is the variable representing a distributed lag on previous immigrants though with a slightly different interpretation. In this case, the variable is intended to reflect the incentive for previous migrants to go home on an extended visit some years after their arrival in Australia. The number of previous long-term departures is also included as a measure of the demonstration effect.

The number of Australian residents at risk of departing from Australia for a long term visit can then be expressed as :

$$(4.65) \qquad N_t = H\left\{P_{t-1},\ (OE)_t,\ \left\{\sum_{\tau=1}^{5} \omega_\tau\ I_{t-\tau}\right\},\ \left[\sum_{i=1}^{3} (LDA)_{t-i}\right]\right\} \quad ,$$

where $\left[\sum_{i=1}^{3} (LDA)_{t-1}\right]$ is the sum of long term departures of Australian residents over the preceding three years and all other variables are as previously defined.

Again, using a log-linear form for H , (4.65) becomes :

$$(4.66) \quad \ln N_t = \chi_0 + \chi_1 \ln P_{t-1} + \chi_2 \ln (OE)_t + \chi_3 \ln\left[\sum_{\tau=1}^{5} \omega_\tau\ I_{t-\tau}\right]$$

$$+ \chi_4 \ln\left[\sum_{i=1}^{3} (LDA)_{t-i}\right] \quad .$$

The Decision Variables

The decision variables for this category are exactly the same as for permanent departures, therefore the probability function is equation (4.57) and the same assumptions are applicable.

The number of Australian residents departing for long-term visits is expressed as

$$(LDA)_t = N_t \times \Pr\{X>T\} \tag{4.67}$$

which leads to the following estimation equation :

$$\ell n\ (LDA)_t = \chi_0 + \chi_1\ \ell n\ P_{t-1} + \chi_2\ \ell n\ (OE)_t + \chi_3\ \ell n \left(\sum_{\tau=1}^{5} \omega_\tau\ I_{t-\tau} \right) + \chi_4 \left[\sum_{i=1}^{3} (LDA)_{t-i} \right] + \psi_0 + \psi_1\ \ell n\ W_t + \psi_2\ \ell n\ U_t + \psi_3\ \ell n\ (FA)_t \quad . \tag{4.68}$$

4.2.3 Long-Term Departures of Overseas Visitors $(LDV)_t$ and Long-Term Arrivals of Australian Residents $(LAA)_t$

The approach adopted for long-term departures of overseas visitors is to assume that all persons who leave their source country to enter Australia with the status of long-term visitors and who subsequently actually do return without changing their status, do so within the next one to five years. Without attempting to model any economic or social factors which may influence the actual timing of their departure within these five years, we can relate departures to arrivals via a distributed lag. (A similar treatment can be applied to the arrivals of Australian residents who have been overseas on a long-term basis). Suppose Q_t = long-term arrivals in t , S_t = long-term departures in t , and $S_{t,\tau}$ = number of persons leaving in τ who arrived in t . Then we postulate

$$(4.69) \qquad \sum_{\tau=t}^{t+4} S_{t,\tau} = \Theta Q_t \qquad (\Theta < 1)^1 .$$

Unfortunately, we do not observe $S_{t,\tau}$, but only the total number of persons departing in any particular year, i.e., S_τ , where

$$(4.70) \qquad S_\tau \equiv \sum_t S_{t,\tau} .$$

If we assume that persons leaving in τ arrived no earlier than $(\tau-6)$ and no later than $(\tau-1)$, then equation (4.70) becomes

$$(4.71) \qquad S_\tau = \sum_{t=\tau-6}^{\tau-1} S_{t,\tau} .$$

Suppose that the fraction of persons leaving in any time period τ who arrived in period t , to the total number who arrived in period t , is a function only of the time interval, i.e.

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1. The inclusion of the parameter Θ allows for the possibility that some long-term arrivals may change their status after arrival (e.g. apply for permanent residence in Australia). If all persons arriving did leave as long-term departures within the specified time period then Θ would be equal to 1 . Similar considerations apply to Australians whose period of absence overseas initially is stated to be long-term in intent.

(4.72) $$\frac{S_{t,\tau}}{Q_t} = f(\tau-t) \qquad \text{for all} \quad (\tau,t) \quad .$$

Then

(4.73) $$S_\tau = \sum_{t=\tau-5}^{\tau-1} Q_t \ f(\tau-t) \quad .$$

In a notation closer to that of Dhrymes[1] we can express (4.73) (after the addition of a stochastic component u_τ) as[2]

(4.74) $$S_\tau = \sum_{i=1}^{5} W_i \ Q_{\tau-i} + u_\tau \quad .$$

If we adopt a polynomial lag distribution of degree 2 and order 5 to represent the structure of the function f (i.e., W), then

(4.75a) $$W_i = \beta_0 + \beta_1 i + \beta_2 i^2 \quad ,$$

(4.75b) $$= \sum_{j=0}^{2} \beta_j i^j \quad .$$

$$(i = 1, \ldots, 5)$$

Substituting from (4.75b) into (4.74), we obtain

$$S_\tau = \sum_{i=1}^{5} \sum_{j=0}^{2} \beta_j i^j \ Q_{\tau-i} + u_\tau$$

(4.76) $$= \sum_{j=0}^{2} \beta_j \left[\sum_{i=1}^{5} i^j \ Q_{\tau-i} \right] + u_\tau$$

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1. Dhrymes (1971) pp. 30-33.

2. If all persons who arrive in a country, depart in the specified following periods, then $\sum W_i = 1$

The estimation equations for long-term departures of overseas visitors $(LDV)_t$ and long-term arrivals of Australian residents $(LAA)_t$ can therefore be written as :

$$(4.77) \qquad (LDV)_\tau = \sum_{j=0}^{2} \beta_j^{(1)} \left[\sum_{i=1}^{5} i^j \, (LAV)_{\tau-i} \right] + \mu_\tau \quad ,$$

and

$$(4.78) \qquad (LAA)_\tau = \sum_{j=0}^{2} \beta_j^{(2)} \left[\sum_{i=1}^{5} i^j \, (LDA)_{\tau-i} \right] + \nu_\tau \quad ,$$

where on the right of (4.77) and (4.78) the expressions in square parentheses are weighted five year-moving averages formed respectively from long-term arrivals in Australia of overseas visitors and long-term departures overseas of Australian residents. If the error terms (μ_τ, ν_τ) are not serially correlated, (4.77) and (4.78) can be estimated as a seemingly unrelated regressions problem.[1] By substituting the estimated values of $\beta_j^{(1)}$ or $\beta_j^{(2)}$ respectively, the W_i can be recovered using (4.75a). If we allow Θ of (4.69) to be different from unity -- and indeed, we shall do so, both for $(LDV)_t$ and $(LAA)_t$ -- then Θ can be estimated from

$$(4.79) \qquad \Theta = \sum_{i=1}^{5} W_i \quad .$$

This leads to an alternative representation of (4.74), namely

$$(4.80) \qquad S_\tau = \Theta \sum_{i=1}^{5} \omega_i \, Q_{\tau-i} + \mu_\tau$$

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1. Zellner (1962).

in which

$$(4.81) \qquad \sum_{i=1}^{5} \omega_i \equiv 1 \quad ,$$

which implies

$$(4.82) \qquad W_i = \Theta\omega_i \quad .$$

5. THE DATA

As mentioned above in Section 4, data relating to migration flows are collected from cards which are filled out by all persons entering or leaving Australia. For the period July 1959 to December 1966, the Australian Bureau of Statistics provided us with summary sheets of the information collected from the incoming and outgoing passenger cards. Data relating to the period 1966 onwards are provided in the form of computer tapes with the data cross-classified by sex, age, occupation and country of birth.[1] Since

1. Hopefully this cross-classified data will be of use for future, more disaggregated studies in the area of migration for the IMPACT Project.

the model described in this paper relates only to aggregate flows, it was possible to derive an accurate and consistent series for the various components of movement over the time period considered. These data series are given in Table 1 of the Appendix.

The cost minimization framework of the model required data series for the amount of overseas advertising undertaken by the Australian Department of Immigration and Ethnic Affairs (and its variously named predecessors), the number of Australian based staff in overseas immigration posts, expenditure on the Assisted Passage Program and the average unit costs of these instruments of government policy. These data series were not readily available in published form, but were supplied by the Department of Immigration and Ethnic Affairs. These data series are given in Table 2 of the Appendix.

The remainder of the variables used in the model were the exogenous variables. Data series for these variables were available from published sources and the series are given in Table 3 of the Appendix.

An explanation of the derivation of the data series, where necessary, is provided at the end of the Appendix.

6. RESULTS

The analytical framework discussed in Section 4 provides an *a priori* structure for the behavioural equations determining migratory flows. Given the brevity of our time-series sample (17 annual observations) and that many (on the whole, very collinear) explanatory variables are involved, a rather tightly constrained structural specification is needed for estimation to have any reasonable hope of success. As we will see, the theory turned out, for the most part, to be only of limited use in compensating for the deficiencies of the data. The high degree of multicollinearity among the series finally forced us, in many instances, to give up the attempt to estimate structural parameters, but instead to settle for estimates of the coefficients of the first few principal components of the explanatory variables.

6.1 Permanent Arrivals I_t

Perusal of Table 1 will convince the reader that estimation of the parameters α_1, α_2 and β_3 depends critically on the successful estimation of the structural equations for the policy instruments overseas advertising, postings overseas, and assisted passages. This dependence on these equations arises because the only other equation in the system containing the parameters α_1, α_2, β_3 is (4.25). Successful estimation of them from (4.25) is not remotely feasible, given that the ten right hand variables of this equation are highly collinear, as may be verified from Table 2.

Table 2

Simple Correlations Between Explanatory Variables in Structural Equation (4.25)

for Permanent Arrivals : Annual Data, 1959-60 through 1975-76

	$\ell n(TR)$	t	$\ell n AD$	$\ell n\ G$	$\ell n\left[\sum_{i=1}^{3} I_{t-i}\right]$	$\ell n\ W$	$\ell n\ U$	$\ell n(UP)_{t-1}$	$\ell n(FO)$
t	- 0.09								
$\ell n(AD)$	0.89	0.03							
$\ell n\ G$	0.59	0.55	0.69						
$\ell n\left[\sum_{i=1}^{3} I_{t-i}\right]$	0.61	0.63	0.70	0.92					
$\ell n\ W$	- 0.09	- 0.98	- 0.20	- 0.64	- 0.72				
$\ell n\ U$	0.04	- 0.92	- 0.16	- 0.67	- 0.69	0.89			
$\ell n(UP)_{t-1}$	0.27	0.79	0.26	0.52	0.61	- 0.87	- 0.61		
$\ell n(FO)$	0.22	- 0.99	0.09	- 0.47	- 0.52	0.94	0.91	- 0.73	
$\ell n\ I_{t-1}$	0.82	0.31	0.75	0.84	0.85	- 0.45	- 0.36	0.53	- 0.20

Initial attempts to fit the structural system set out in Table 1 using FIML were not successful, as convergence could not be obtained. Imposing an arbitrary growth rate of 2 per cent per annum on the size of the relevant potentially migratory population ($\alpha_0 = 0.02$ in equation (4.25)) was sufficient to obtain convergence,[1] but in the cases of several coefficients, the estimates were unsatisfactory from the viewpoint of prior expectations on signs and/or on magnitudes.[2] The problem was traced to the unsatisfactory performance of equations (4.50a). Since these contain only exogenous variables on the right, they can be estimated consistently either separately by OLS or by ML as a block. The results of separate OLS estimations, shown in Table 3, indicate that the shares of the policy

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1. Perusal of the second column of Table 2 will suggest why α_0 defied estimation.

2. The FIML estimates (from annual data, 1959-60 through 1975-76) of the main parameters of the model set out in Table 1, conditional on $\alpha_0 = 0.02$, were as follows :

Parameter	Estimate	Sign as Expected ?	Ratio of Estimate to Estimated Asymptotic Std. Error
a_0	- 10.299	--	3.44
a_1	.00469	No	0.26
a_2	- 0.69516	No	4.93
a_3	2.47590	Yes	7.06
a_4	- 1.11787*	Yes	5.10
ε	0.55647	Yes	12.62
α_1	0.25429	Yes	4.77
α_2	0.74571	Yes	14.00
β_1	1.41900	Yes	3.16
β_2	0.01322	Yes	0.17
β_3	0.30381	Yes	2.45
λ	- 0.00311*	No	0.42

* Violates stability conditions.

In these estimations, the constant in equation (4.25) was left unconstrained.

Table 3

Unconstrained OLS Estimates of Equations (4.50a) from Annual Data.
1959-60 through 1975-76

Coefficient or Parameter	Appearing in Equation for	Estimate	Student's $\|t\|$ Ratio	$\overline{R^2}$ (a)	Durbin-Watson Statistic
$\lambda \frac{\alpha_1}{(1 - \beta_3)}$	σ_{1t}	.0073	0.88	0.92	1.45
$\lambda \frac{\alpha_2}{(1 - \beta_3)}$	σ_{2t}	- .0491	0.95	0.96	1.51
$(1 - \lambda)$	σ_{1t}	1.040	8.56		
λ	σ_{1t}	- 0.040	0.33		
$(1 - \lambda)$	σ_{2t}	0.9925	7.08		
λ	σ_{2t}	0.0075	0.05		

(a) Coefficient of multiple determination corrected for degrees of freedom.

instruments do not differ significantly from a random walk; viz., the hypothesis

$$\sigma_{it} = \sigma_{i,t-1} + u_{2+i,t} \qquad (i = 1,\ 2) \ , \tag{6.1}$$

cannot be rejected. This in turn means that the theory of section 4 contains no usable information with which to compensate for the sparse degrees of freedom and high degree of multicollinearity afflicting (4.25). At this point equations (4.50a) and (4.50b) were deleted from the system, it being accepted that structural estimation of (4.25) had failed.

Of the two equations remaining in the system, i.e., (4.23) and (4.25), our main focus is on the latter. All of the variables on the right of (4.25) are predetermined, with the exception of the (log of the) short-run target, $\ell n(\mathrm{TR})$. The target equation itself (4.23) contains only predetermined variables, and may be estimated consistently by OLS. The OLS estimates are given in Table 4. While the serial properties of the residuals in this equation are far from satisfactory, search for an obvious, simple, misspecification of the relationship among, and/or of the definitions of, the variables of equation (4.23), failed. We treat the estimated values of $\ell n(\mathrm{TR})_t$, denoted $\widehat{\ell n(\mathrm{TR})}_t$, as purged of stochastic variation of the type which would cause simultaneity bias in (4.25), and we use the $\widehat{\ell n(\mathrm{TR})}_t$ series as a regressor on the right of a modified equation (4.25).

Table 4

OLS Estimate of Short-run Target Equation (4.23)

Explanatory Variable	Notation for Coefficient	Estimated Coefficient	Sign as Expected ?	Student's |t| Ratio	Other Summary Measures	
Constant term	a_0	- 1.135	--	0.25	$\overline{R^2}$	0.791
Australian Un-employment Rate	a_1	- 0.2015	Yes	5.11	Sample size	17
Log of Lagged Out-migration	a_2	- 0.6356	No	2.65	Degrees of freedom	12
Log of Weighted Sum of Previous Immigration Flows	a_3	1.677	Yes	2.91	Durbin-Watson Statistic, d	1.545
Log of Lagged (Target/Actual Immigration) Ratio	a_4	- 0.0377	Yes	- 0.06	Pattern of signs in residuals : - - + + - + - + + + + + - - - + -	

As explained above, the separate structural influences on permanent arrivals of variables in the set $\{t, \ln(AD)_t, \ln G_t, \ln\left[\sum_{i=1}^{3} I_{t-i}\right], \ln W_t, \ln U_t, \ln (UP)_{t-1}, \ln (FO)_t, \ln I_{t-1}\}$ could not be untangled from the available evidence. The variables in this set were replaced by their first two principal components $(PC1)_t$ and $(PC2)_t$, respectively, which accounted respectively for 95.56 and 4.22 per cent of the generalized variance of the nine-variable set listed above.[1] Thus instead of equation (4.25) we proposed to estimate

$$(6.2) \qquad \ln I_t = -\varepsilon \ln(1 + s) + \varepsilon\alpha_0^* - \varepsilon\beta_0 + (1 - \varepsilon) \widehat{\ln(TR)}_t + \varepsilon\{\phi_1 (PC1)_t + \phi_2 (PC2)_t\} + u_{2t}^* \ .$$

Before attempting this estimation, however, the residuals of the FIML estimate of equation (4.25) were analysed for possible specification error. (Equation (6.2) is, after all, a condensed version of (4.25).) The pattern of signs in the residuals suggested that the responsiveness of ε to pressure to exceed the short-run target $(TR)_t$, and possibly also the

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1. The first two principal components are : $(PC1)_t = 0.994903\, t + 0.00634045 \ln(AD)_t + 0.0088961 \ln G_t + 0.0267208 \ln\left[\sum_{i=1}^{3} I_{t-i}\right] - 0.0148248 \ln W_t - 0.0757734 \ln U_t + 0.0238841 \ln (UP)_{t-1} - 0.0480428 \ln (FO)_t + 0.0147177 \ln I_{t-1}$;

 and $(PC2)_t = 0.0551240\, t + 0.00514282 \ln (AD)_t - 0.167154 \ln G_t - 0.0334269 \ln\left[\sum_{i=1}^{3} I_{t-i}\right] - 0.0471825 \ln W_t + 0.831264 \ln U_t + 0.447215 \ln (UP)_{t-1} + .0650004 \ln (FO)_t + 0.265377 \ln I_{t-1}$.

selectivity ratio s, ought to be respecified as functions of the Australian unemployment rate. The evidence supporting this conjecture was as follows. The sign pattern of the residuals from the FIML fit of equation (4.25) (as reported above) was

$$\underbrace{(-\ -\ -\ -)}_{\substack{\uparrow \\ 1959\text{-}60}}\ (+\ +\ +\ +\ +\ +\ +)\ \underbrace{(-\ -\ -\ -\ -\ -)}_{\substack{\uparrow \\ 1975\text{-}76}}\ .$$

When the Australian unemployment rate was classified over the same 17 year period into its ten highest (H) and seven lowest (L) values, the resultant pattern was :

$$\underbrace{(H\ H\ H\ H)}_{\substack{\uparrow \\ 1959\text{-}60}}\ \{(L\ L\ L)\ H\ (L\ L\ L\ L)\}\ \underbrace{(H\ H\ H\ H\ H)}_{\substack{\uparrow \\ 1975\text{-}76}}\ .$$

This striking (indeed, almost perfect) correspondence led us to partition the sample according to the Australian unemployment rate at the median of that variable. The resultant partition is shown in Table 5 . After partitioning of the data, equation (6.2) was estimated as

$$(6.3)\qquad \ell n\, I_t = -\varepsilon_H\, \ell n(1 + s_H) + \varepsilon_H(\alpha_0^* - \beta_0) + (1 - \varepsilon_H)\, \widehat{\ell n(TR)}_t$$

$$+\ \varepsilon_H\, \{\phi_1\, (PC1)_t + \phi_2\, (PC2)_t\} + u_{2t}^* \qquad (t\varepsilon\tilde{H})\ ,$$

and

$$(6.4)\qquad \ell n\, I_t = -\varepsilon_L\, \ell n(1 + s_L) + \varepsilon_L(\alpha_0^* - \beta_0) + (1 - \varepsilon_L)\, \widehat{\ell n(TR)}_t$$

$$+\ \varepsilon_L\{\phi_1\, (PC1)_t + \phi_2\, (PC2)_t\} + u_{2t}^* \qquad (t\varepsilon\tilde{L})\ ,$$

Table 5

Partition of Sample Data According to Condition of Australian Labour Market

Years during which unemployment was relatively high (≥ 1.6 per cent)		Years during which unemployment was relatively low (< 1.6 per cent)	
Financial Year	Unemployment Rate (per cent) [a]	Financial Year	Unemployment Rate (per cent) [a]
1959-60	2.41	1963-64	1.42
1960-61	2.66	1964-65	1.19
1961-62	4.04	1965-66	1.34
1962-63	2.92	1966-67	1.60
1971-72	1.98	1967-68	1.55
1972-73	1.77	1968-69	1.45
1973-74	1.62	1969-70	1.33
1974-75	4.23	1970-71	1.50
1975-76	4.07		

(a) Source : The unemployment rate represents unemployment as a percentage of the civilian workforce. The data series used was that derived in Filmer and Silberberg (1977).

where $\tilde{H}$ is the set of sample dates at which unemployment was relatively high (i.e., the left of Table 5) and $\tilde{L}$ is the set at which unemployment was relatively low (the right of Table 5). With appropriate use of summary variables equations (6.3) and (6.4) were estimated as a single equation using RESIMUL.

The estimated values of ε_H and ε_L are almost identical.[1] Whilst in view of the evidence from the residuals mentioned above this lack of significant difference was surprising, the two sub-periods were nevertheless recombined and the model re-estimated using only one ε . A summary of the results of this estimation are given in Table 6.

---

1. The estimates of the parameters of equation (6.2) were as follows:

Parameter or Coefficient	Estimate	Ratio of Estimate to Estimated Asymptotic Std. Error
$\varepsilon(\alpha_o^* - \beta_o)$	-115.2	*
$- \varepsilon \, \ell n \, (1 + s_H)$	107.5	*
$- \varepsilon \, \ell n \, (1 + s_L)$	107.2	6.87
ε_H	0.8574	6.72
ε_L	0.8630	2.62
ϕ_1	-0.006461	-1.64
ϕ_2	0.2129	9.88
Sign Pattern of Residuals	+ + - - - + - - - + + + + - - + -	

* Not available due to negative variance estimate at FIML convergence.

Table 6

Single Equation Estimate of Equation (6.2)*

Explanatory Variable (when applicable)	Notation for Coefficient or Parameter	Estimated Coefficient or Parameter	Ratio of Estimate to Estimated Asymptotic Standard Error	Other Summary Measures	
Constant term	$-\varepsilon\left[\ell n\ (1+s) + \alpha_o^* - \beta_o\right]$	5.093	3.38	R^2	.880
Log of short-run target purged of stochastic variation of the type which would cause simultaneity bias	$(1-\varepsilon)$	0.3828	2.32	Sample size	17
				Degrees of freedom	13
First principal component of remainder of variables from Equation (4.25)	$\varepsilon\phi_1$	-0.00654	-1.28	Pattern of signs in residuals	
Second principal component of the remainder of variables from Equation (4.25)	$\varepsilon\phi_2$	0.1765	4.04	- - - - + + + + - + + + - -	
	ε	0.6172	3.75		
	ϕ_1	-0.01060	-1.26		
	ϕ_2	0.02860	6.68		

* Estimation used RESIMUL .

The most interesting aspect of results was the difference between the estimated value of ε from the equation using pooled data and the values obtained from the estimation using two values for ε (ε_H and ε_L) . Given that the estimated values for ε_H (0.857) and ε_L (0.863) were almost identical, it was surprising that the estimate of ε from the pooled set was so much lower (0.617).. However, all three values are interpretable as elasticities lying in the theoretically acceptable interval (0, 1) .

As no attempt has been made to separate the individual influences in the constant, it is not possible to offer any interpretation of the estimated value.[1] This is also the case for the coefficients on the two principal components variables. The R^2 value (0.88) is satisfactory but the pattern of signs in the residuals is similar to that from the split period estimation and is still not satisfactory. In view of the small sample size and the other problems encountered in fitting and interpreting the model, refinement of the estimates to allow for serial correlation was not attempted.

6.2 Permanent Departures E_t, Long-Term Arrivals of Overseas Visitors $(LAV)_t$ and Long-Term Departures of Australian Residents $(LDA)_t$

As mentioned in Section 4.2.2, there are no major factors influencing the decision to move for any of the three components under consideration which could be regarded as endogenous to an Australian migration model. The three final equations ((4.59), (4.64) and (4.68)) were therefore estimated using unrestricted OLS which could be expected

1. The reader may verify from the results reported above for the split sample periods that successful interpretation of the estimate for s seems unlikely.

A summary of the results is given in Table 8. The sign pattern in the residuals was unsatisfactory and the first weight in equation (4.78) was negative.

Table 8

Initial Estimates of Distributed Lag Models for Long-Term Departures of Overseas Visitors and Long-Term Arrivals of Australian Residents

Eqn No.	Parameter	Estimate	Ratio of Estimate to Conditional Estimated Asymptotic Standard Error
(4.77)	W_1	0.33	2.38
	W_2	0.18	2.40
	W_3	0.10	0.80
	W_4	0.09	1.30
	W_5	0.14	0.87
	Θ	0.85	32.21
(4.78)	W_1	-0.10	0.69
	W_2	0.17	2.10
	W_3	0.31	2.48
	W_4	0.32	4.18
	W_5	0.19	1.09
	Θ	0.90	27.53

Pattern of signs in the residuals :

(4.77) - + + + + + - - - + - - + + - + -

(4.78) - - - - - - - - + - - - + + + - +

A first order Markov scheme of the form

$$u_t = \rho u_{t-1} + v_t$$

(where v_t is white noise error), was used to transform the data. This was repeated for different values of ρ in the range $[0,1]$. The estimation using $\rho = 1.0$ gave the highest value of the likelihood function and the most easily interpretable results, but the serial properties of the two equations were still unsatisfactory[1] and again one of the weights had a negative value. Both values of Θ were greater than one which contradicted *a priori* expectations.

A first order moving average scheme of the form

$$u_t = v_t - \gamma v_{t-1} ,$$

where v_t has classical properties, was then used to transform the data and a scanning approach was adopted with the moving average parameter γ being varied from -0.9 to +0.9 .

In this case, the best results for the two equations occurred at different values of γ ($\gamma = -0.5$ for (4.77) and $\gamma = -0.9$ for (4.78)). These results are summarized in Table 9.

---

1. Pattern of signs in the residuals

   (4.77) + - + - + - - - + - - + + - + -

   (4.78) - + - - - - - + - + + + + + - -

Table 9

Final Estimates of Distributed Lag Models for Long-Term Departures of Overseas Visitors and Long-Term Arrivals of Australian Residents

Eqn No.	Parameter	Estimate	Ratio of Estimate to Conditional Estimated Asymptotic Standard Error
(4.77)	W_1	0.35	1.99
$\gamma = -0.5$	W_2	0.19	1.93
	W_3	0.098	0.59
	W_4	0.073	0.81
	W_5	0.12	0.56
	Θ	0.83	22.27
(4.78)	W_1	0.078	0.64
$\gamma = -0.9$	W_2	0.085	1.23
	W_3	0.14	1.92
	W_4	0.25	3.57
	W_5	0.40	2.66
	Θ	0.96	22.96

Pattern of signs in the residuals :

(4.77) - + + + + + - + - + - - - + - + -

(4.78) + - + - + - + - + - - - - - + + -

For equation (4.77) the results when $\gamma = -0.5$ were chosen on the following grounds. A non-parametric sign test[1] on the residuals did

1. Let y = number of changes of sign in a sequence of n residuals. Assuming positive and negative values are equally likely to occur, the probability of a sign change is 0.5.
Thus y is Binomial with parameters n-1 and 0.5.
For n large, $\frac{y - 0.5(n-1)}{\sqrt{0.25(n-1)}} \sim N(0,1)$
The null hypothesis assumes independence of the residuals. The test is two-tailed.

not detect significant autocorrelation. Whilst the power of the test undoubtedly is low, it seemed unlikely that the results could be improved without recourse to higher order moving average schemes. The relatively small sample size precluded this. The value for the quasi-R^2 was 0.81 and the results conformed with prior expectations in that there were no negative weights and the value for Θ was close to, but slightly less than, one. It is interesting to note that the likelihood value was not maximized at this point (log-likelihood value = -0.299 compared to -0.291 for $\gamma = -0.9$).

With respect to equation (4.78) the result for $\gamma = -0.9$ was chosen. Again, the non-parametric sign test did not reveal significant autocorrelation. The quasi-R^2 value was 0.97 and the weights were all positive, with $\Theta = 0.96$, which conforms with prior expectations. The log-likelihood value was maximized for this value of γ.

In both cases the shape of the estimated lag distribution was not consistent with that derived from the stated intentions data (viz., of overseas visitors on arrival and of Australian residents at the time of their departure from this country).[1] Since there are no statistics collected relating to actual length of stay of long-term movers, it may well be that the stated intentions data is not an accurate reflection of what subsequently occurs.

A general remark should be made about the results over the whole range of values of γ. There was considerable instability in the

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1. Australian Bureau of Statistics, Reference No. 4.23 op. cit. p. 18.

weights over the range of γ's scanned. For equation (4.77) there were negative weights for the estimations at both ends of the scanning range and all positive weights in the middle of the range. For equation (4.78) the weights were all positive for values of $\gamma \leq 0.5$ and one negative weight occurred for all values of $\gamma > -0.5$. The quasi-R^2 values for equation (4.77) varied substantially, while those for equation (4.78) were quite stable.

Thus, the choice of a most preferred result for each equation was not clear cut, since some of the elements of the criteria for choice were maximized for different values of γ .

7. SUMMARY

The purpose of this paper was to provide an analysis of migration flows suitable for input to the BACHUROO module of the IMPACT medium-term model. Background information relating to the recent history of Australian migration and a brief review of the quantitative literature in the area were covered in the early sections of the paper. An analytical framework was then developed to allow the modelling of migration flows in the various component groups.

For the components permanent arrivals, permanent departures, long-term arrivals of overseas visitors and long-term departures of Australian residents, the procedure used was to distinguish a population "at risk" of undertaking the particular type of migration and then to define a function which specified the probability that any member of the at risk population would actually decide to move. In order to determine actual numbers opting to move in a particular migratory group, it was simply necessary to multiply the number at risk of moving by the probability that any member of that group would decide to move under prevailing conditions.

In the case of the remaining components, long-term departures of overseas visitors and long-term arrivals of Australian residents, the approach adopted assumed that all persons who leave a source country with the status of long-term visitors and who subsequently return without changing their status, do so within the following five years. Without attempting to model any economic or social factors which may influence the timing of their departures within these five years, departures were related to arrivals (or vice versa) via a fifth-order quadratic distributed lag.

Results of the estimations for all components are outlined in Section 6. The results were not entirely satisfactory, particularly with respect to serial properties and the ability of the models to identify the individual contribution of many of the variables. It is likely however, that much of the responsibility for these problems can be attributed to the small sample size available and the large information load which was placed on the sample.

In spite of these problems, the estimations reported constitute a systematic description of Australian international migration flows over the decade of the sixties. Because in the latter half of the seventies

Appendix

Table 2 - Government Expenditure Data*

Year	Advertising 'Units' (AD)	Staff in Overseas Migration Posts (G)	Expenditure on Assisted Passage Programme (p_3AP)	Average Price/Unit of Advertising (p_1)	Average Cost/ Staff Member in Overseas Migration Posts (p_2)	Average Cost/ Assisted Passage (p_3)
			$			
1959/60	1,084	398	15,133,060	199.7	4,687	218.3
1960/61	1,439	427	14,695,704	204.3	5,217	219.4
1961/62	1,394	436	11,967,160	211.8	5,080	284.5
1962/63	1,967	422	14,417,740	218.6	5,696	252.2
1963/64	1,958	409	18,611,142	224.1	6,351	261.9
1964/65	2,367	403	25,457,548	233.2	7,358	287.3
1965/66	2,914	445	26,185,648	243.2	7,168	293.6
1966/67	2,660	485	26,331,961	251.3	8,302	296.8
1967/68	5,210	488	27,817,521	237.6	9,077	328.7
1968/69	6,868	561	41,001,859	234.0	9,616	346.1
1969/70	8,623	645	42,846,579	247.7	10,492	324.9
1970/71	7,258	688	40,065,199	267.5	11,218	334.3
1971/72	5,615	617	29,997,506	292.0	12,377	364.3
1972/73	4,123	552	18,655,822	278.9	13,108	327.5
1973/74	3,918	516	16,237,703	267.4	12,101	320.6
1974/75	1,484	471†	14,858,463	339.4	10,786	410.1
1975/76	107	425	7,534,649	375.1	10,724	406.9

* For an explanation of the derivation of these series, see the notes at the end of this Appendix.

Source : Department of Immigration and Ethnic Affairs.

† Estimate.

Appendix

Table 3 - Exogenous Variables*

Year	Population[1] (P)	Proxy for Openness of the Economy (Exports + Imports/GDP) (OE)	Australian Govt.[3] Expenditure on Overseas Students (ED)	Fares (Australia[4] as destination country) (FO)	Fares (Australia[4] as source country) (FA)	Relative Wages[5] (Australia/ source country) (W)	Relative[5] Unemployment (Australia/ source country) (U)	Australian[6] Unemployment/ Labour Force (V)
			$'000	$	$			%
1958/59	10,160,968							
1959/60	10,275,000	.3633	2,477.78	829.1	770.1	1.24	1.38	2.41
1960/61	10,508,200	.3680	2,656.77	764.5	695.1	1.21	1.32	2.66
1961/62	10,700,500	.3506	3,173.97	736.3	692.0	1.18	1.36	4.04
1962/63	10,906,900	.3547	3,555.23	713.5	690.4	1.15	1.57	2.92
1963/64	11,121,600	.3759	3,718.53	696.6	684.3	1.13	1.59	1.42
1964/65	11,340,900	.3704	4,327.35	670.3	659.6	1.12	1.47	1.19
1965/66	11,550,500	.3684	4,785.41	640.5	636.6	1.09	1.34	1.34
1966/67	11,799,078	.3541	5,040.00	620.0	620.0	1.07	1.16	1.60
1967/68	12,008,635	.3573	5,146.60	598.5	600.2	1.04	.97	1.55
1968/69	12,263.014	.3372	5,257.35	569.9	585.0	1.03	.81	1.45
1969/70	12,507,349	.3539	6,027.00	538.3	566.8	1.02	.73	1.33
1970/71	12,937,200	.3444	5,652.84	498.9	541.1	1.02	.68	1.50
1971/72	13,177,000	.3281	5,909.60	484.7	533.0	1.01	.62	1.98
1972/73	13,380,400	.3263	6,082.14	466.1	522.8	1.00	.56	1.77
1973/74	13,599,100	.3385	6,035.44	413.5	462.9	.99	.52	1.62
1974/75	13,771.400	.3720	5,576.87	392.1	452.8	.97	.53	4.23
1975/76	13,915,500	.3422	5,214.10	359.9	441.6	.98	.65	4.07

* For an explanation of the derivation of these series see the notes at the end of this Appendix.

Sources:
1. Intercensal Estimates, Australian Bureau of Statistics and Population and Vital Statistics, Australian Bureau of Statistics, Reference No.4.16.
2. Australian National Accounts, Australian Bureau of Statistics, Reference No.7.1 and Quarterly Estimates of National Income and Expenditure, Australian Bureau of Statistics, Reference No.7.5.
3. Australian Development Assistance Bureau.
4. Qantas Airways; Consumer Price Index, Australian Bureau of Statistics, Reference No.9.1; Yearbook of Labour Statistics, International Labour Office and Statistical Yearbook, United Nations.
5. Yearbook of Labour Statistics, International Labour Office; Statistical Yearbook, United Nations.
6. The data series used was that derived in Filmer and Silberberg (1977).

Notes

Table 1 : Data for the years preceding 1959/60 (and preceding 1964/65 in the case of target) was required to generate the lagged series,

$$\sum_{i=1}^{3} I_{t-i}, \quad TR_{t-1}, \quad \text{etc.},$$

required for the model.

In the case of the target, data were available only on the target for the permanent and long-term arrivals. The following formula was used to obtain a series for the target for permanent arrivals :

$$(\text{permanent target}) = \frac{(\text{permanent arrivals})}{(\text{permanent + long-term arrivals})} \times (\text{permanent + long-term target})$$

In order to derive the arrivals' series prior to 1959/60 from the available aggregate permanent + long-term series, it was assumed that the ratios of the various components to the total (i.e. permanent + long-term arrivals) was the same as that for the year 1959/60. This is not unreasonable since the ratios were fairly uniform for the following few years.

With respect to the departures series, only calendar year data were available.[1] A two period moving average was therefore taken to obtain a financial year series. The same assumptions were made as above in order to obtain the individual series.

Table 2 : In the case of government expenditure on overseas advertising only the total expenditure series was available. In order to obtain a series for real 'units' of advertising the expenditure series was converted to £UK by multiplying by the United Kingdom exchange rate and then deflating by the United Kingdom Consumer Price Index. This procedure is tantamount to assuming that advertising costs in the U.K. moved proportionately with the CPI, an assumption which was necessary because of the lack of alternative data. The U.K. CPI divided by the exchange rate (£/$) is identified as our price index for advertising.

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1. Demography Bulletin, Commonwealth Bureau of Census and Statistics.

Table 3 : (FO) and (FA) represent the Sydney-London one-way economy class airfare deflated by the United Kingdom Consumer Price Index and the Australian Consumer Price Index respectively.

The relative wages variable (W) represents the ratio of Australian wages to United Kingdom wages. The values for the individual series were derived according to the following formula :

$$\text{Wages}_t = \sum_{\tau=1}^{5} \omega_\tau \, (\text{Wages})_{t-\tau}$$

(where $\omega_1 = .2403$ $\omega_2 = .23256$ $\omega_3 = .21706$ $\omega_4 = .18605$ $\omega_5 = .12403$) where the original wages series was an index of minimum hourly wage rates in manufacturing.

The relative unemployment variable represents the ratio of Australian unemployment (see Appendix Table 3) to official United Kingdom unemployment. The same weighting procedure was used as above, and in this case the original series was unemployment as a percentage of the civilian workforce.

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