THE EFFICIENCY OF FEDERAL INTER-REGIONAL TRANSFERS UNDER A REGIME OF POLITICALLY-MAXIMIZING REGIONAL GOVERNMENTS

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DISCUSSION PAPER 02.03

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*Corresponding author. We are grateful for research support from the Australian Research Council through a SPIRT grant and to Peter Dixon for useful discussion on the specification and simulation of the model.

1. Introduction

A common feature of the older federal systems such as the United States, Canada and Australia is that the federal government adopts an inter-regional redistributive role. In the case of the Australian federation, for example, the federal government taxes the six states (the members of the federation) uniformly. From its tax collections it then makes an annual grant to each of the six state governments. These annual grants, however, are *not* uniform; the states which suffer most from revenue-raising and cost disabilities get the largest grants in per capita terms. The federal government's system of annual grants is, therefore, redistributive in its effect as between the six states.

Of the economic questions which arise in connection with such federal redistributive grants possibly the most prominent are questions relating to the way in which the size of the grants should be fixed and questions concerned with their economic and welfare consequences. Both types of question have been widely discussed in the fiscal-federalism literature.

Studies which examine questions of the first type include Boadway and Keen (1997) and Petchey (1995) in both of which the issue is how the federal government should proceed if it wishes to determine the grants optimally. Studies in which the focus is on effects include the North American studies of Boadway and Flatters (1982), Boadway (1985), Cornes and Sandler (1986), Myers (1990) and Winer and Gauthier (1982) and the Australian studies of Petchey (1992), Swan and Garvey (1992), Petchey (1993), Petchey and Walsh (1993) and Petchey (1995).

The present study belongs with the second group to the extent that it, too, is concerned primarily with the economic and welfare consequences of federal redistributive grants. It differs from them, however, in two important ways. The first relates to the procedure used to develop the modelling framework for the study. The second concerns the way in which the conclusions about economic and welfare effects which the model implies are drawn. In the present study these conclusions are generated by numerical simulations resembling those which are to be found in studies based on CGE modelling.

In developing our modelling framework we adopted a two-stage approach. We began with a model from a class which has played an important part in the fiscal-federalism literature generally and in studies concerned with the effects of redistributive federal grants, in particular. We refer to models of multi-regional federations with a given freely-mobile supply of labour. In these models labour is allowed to migrate costlessly between regions in search of maximum welfare and they typically impose, as an equilibrium condition, that the utility of the representative household be the same in all regions. A mobility model of this type is to be found in three of the studies focussing on the effects of redistributive grants just referred to - those of Boadway and Flatters (1982), Myers (1990) and Petchey (1995).

The mobility model which formed our starting point has two regions, each with households, firms and governments. The households and firms are optimizers but the governments are not; the fiscal decisions of the regional governments are treated as exogenous. Labour is free to move between regions in response to utility differences and does so until such differences have been eliminated. Since the model is essentially Walrasian in character we refer to it as the GE (general equilibrium) component of the modelling framework.

The second step in developing our modelling framework was to extend the GE model by making the two regional governments behave in an optimizing way. Each regional government is now assumed to make its fiscal decisions so as to maximize its chances of re-election, subject to the constraints imposed by the structure of its economy, as depicted in the GE model. In carrying out its maximization process each regional government takes the fiscal decisions of the other as given. In effect, therefore, the two governments are engaged in a non-cooperative strategic game with a Nash equilibrium as the outcome.

We refer to the model which finally emerged from this two-stage procedure as the PEGE (political-economy GE) model. The PEGE model is highly non-linear. For this reason it cannot be solved analytically and so cannot be used, as it stands, to address the question with which the paper is concerned - the efficiency or otherwise of federal redistributive grants. We get round this difficulty by using a process of log-differentiation to linearize the model which is then calibrated from Australia data and used to simulate the effects on welfare in each of the two regions of a federal government transfer shock.

Six simulations were conducted. In the first New South Wales was the region to which the transfer is made and the rest of the country the region making the transfer. In the second simulation Victoria was the recipient region and the rest of the country the donor region; and so on for each of the other four states. Several important conclusions on the efficiency question emerge from these simulations.

The possibility that federal redistributive grants might be efficient, Pareto-wise or in some other sense, was recognized in North American studies in the early 1990s. (A survey of this literature is given in Petchey and Walsh (1993).) But not until Petchey (1995) was the efficiency question systematically examined in an Australian setting. Using a two-region model of the labour-mobility type (a model without regional governments) he confirmed the efficiency possibility and pointed to the conditions under which it might be realized.

With the help of our six simulations we have been able to take the matter a good deal further. In the first place the cases in which a transfer is Pareto-improving and those in which it is not, have been identified. The Pareto-improving cases are those in which the recipient regions are New South Wales, Victoria and Queensland. Here households are better-off in *both* regions because of the transfer. In the remaining cases households are worse-off in both regions.

Secondly, we have been able to show that in all of the three cases of Pareto-improvement the welfare gains are trivial and that the same is true of the welfare losses in the remaining cases.

Finally, the simulations make it clear that, while welfare is unaffected for all practical purposes, all other variable of interest change substantially – consumption, employment, taxes, wages, output and government expenditure. Households manage to offset the effects of these changes on welfare, however, by migrating from one region to the other. Thus, the federal government transfers effect substantial changes in regional economies but without changing welfare.

The rest of the paper consists of five main sections. In section 2 we begin by building the small two-region GE model. As mentioned already this model has optimizing private agents but not optimizing governments; government fiscal decisions are simply treated as exogenous. We then extend this two-region GE model by making the two regional governments behave in a vote-maximizing way. The result is the PEGE model. This model is linearized in section 3, calibrated in section 4 and put to work in section 5. We simulate the model by introducing a federal-government transfer shock. We do this for each of the six states in turn, in each case treating the rest of the country as the second region. The results of these simulations are then used to generate conclusions about the effects (both direct and indirect) of inter-regional federal transfers in a regime of optimizing regional governments. In the final section of the paper the major conclusions are dealt with in detail.

2. The Two-Region PEGE Model

2.1 The Two-Region GE Model

2.1.1 The Representative Household

We use the following explicit utility function for the representative household in region i:

$$(1) \qquad U_i = \beta_i C_i^{\gamma_i} G_i^{\delta_i}$$

where U_i = utility, region i,

C_i = real private consumption per household, region i,

G_i = real government-provided consumption per household, region i.

$\beta_i > 0$

$0 < \gamma_i < 1$

$0 < \delta_i < 1$

$\gamma_i + \delta_i = 1$

There is no saving in the model so that the constraint facing the household is:

$$(2) \qquad P_i C_i = M_i = \pi_i + W_i$$

Where P_i = price of the (single) consumption good, region i,

M_i = nominal income per household, region i,

π_i = nominal profit distribution per household, region i,

W_i = nominal wage, region i.

Equation (2) incorporates the assumption that each household supplies one unit of labour, so that labour income is W_i. The household takes G_i, π_i, and W_i as given and has only a single choice-variable, C_i. The utility-maximising level of C_i is:

$$(3) \qquad C_i = M_i/P_i = (\pi_i + W_i)/P_i$$

We assume that there are L_i households in region i. Since each household supplies one unit of labour it follows that L_i is also the labour supply in region i. Total private consumption in region i must be L_iC_i and total consumption of the government-provided good, L_iG_i.

2.1.2 The Representative Firm

We assume that there are N_i firms in region i. N_i is treated as exogenous. We assume that the production function has positive and declining marginal product of the single factor, labour. L_i represents employment in region i and, because of the decreasing returns to scale, each firm in region i will be of the same size. Hence output, Y_i, for the representative firm in region i is given by:

$$(4) \qquad Y_i = \left(\frac{L_i}{N_i}\right)^{\alpha_i} \qquad i = 1,2 \qquad 0 < \alpha_i < 1$$

The representative firm is assumed to operate in perfectly competitive output and labour markets and accordingly chooses employment to maximise profit:

$$(5) \qquad \Pi_i = P_i Y_i - W_i\left(\frac{L_i}{N_i}\right)(1 + T_i) \qquad i = 1,2$$

subject to the production function (4) with P_i and W_i taken as given. In (5) Π_i denotes profit per firm in region i and T_i the payroll tax rate imposed by region i's government. Substituting (4) into (5) and maximising with respect to L_i we get the single first-order condition:

(6) $$\alpha_i \left(\frac{L_i}{N_i}\right)^{\alpha_i - 1} = \frac{W_i}{P_i}(1 + T_i) \qquad i = 1,2$$

This is the standard marginal productivity condition adjusted for the presence of the payroll tax.

2.1.3 The Regional Government

The government of region i purchases output from firms in region i and receives revenue from the payroll tax levied in region i. The amount of output *purchased* is GR_i per household or a total of L_iGR_i. Total tax revenue is $T_iW_iL_i$. We assume that the government of region i balances its budget so that:

$$L_i GR_i = T_i W_i L_i$$

or

(7) $$GR_i = T_i W_i \qquad i = 1,2$$

2.1.4 The Federal Government

The federal government engages only in inter-regional transfers. In particular, it acquires part of the output purchased by the government of one region and supplies it to the households of the other region. It, too, balances its budget so that:

(8) $$L_1 GF_1 + L_2 GF_2 = 0$$

where GF_i is the amount of output supplied per household to the residents of region i.

The amount of the government good consumed per household in region i, G_i (the variable which appears in the utility function), is given by:

(9) $$G_i = GR_i + GF_i \qquad i = 1,2$$

where $GR_i \geq 0$, GF_i may have either sign but G_i is assumed to be > 0.

2.1.5 Equilibrium

There are three equilibrium conditions. The first is that the national labour market clears:

(10) $$L_1 + L_2 = \overline{L}$$

where $\overline{L}$ is the national labour supply, treated as exogenous.

The second governs inter-regional migration. It is assumed that households move in response to inter-regional differences in utility and that equilibrium occurs when such differences have disappeared so that:

$$U_1 = U_2$$

or

(11) $$\beta_1 C_1^{\gamma_1} G_1^{\delta_1} = \beta_2 C_2^{\gamma_2} G_2^{\delta_2}$$

Thirdly, we assume that the goods market clears in each region:

(12) $$N_i Y_i = L_i (C_i + GR_i) \qquad i = 1,2$$

Note that only regional governments purchase output and that the federal government simply transfers part of this from households in one region to households in the other.

The last equation of the GE model is:

(13) $$L_i \pi_i = N_i \Pi_i \qquad i = 1,2$$

which states that firms in region i distribute all of their profits to households in region i.

2.2 The Two-Region PEGE Model

Relationships (3) - (13) comprise the two-region GE model. To move to the two-region PEGE model we add optimisation by the regional governments.

The government of region i is assumed to have a vote-function of the form:

$$V_i = \sum_{j=1}^{N} \rho^{ji} n^{ji} f^{ji}(L_i GR_i) \qquad (i = 1,2)$$

In this vote-function N voting groups are identified in each region. In group j (j = 1,…,N) of region i there are n^{ji} voters. Each voter derives political satisfaction only from the aggregate government expenditure of its region (L_iGR_i) according to a political-satisfaction function, f^{ji} with properties $f^{ji} > 0, f'^{ji} > 0, f''^{ji} < 0$. Finally group j of region i has weight ρ^{ji} where $\rho^{ji} > 0$ (j = 1,…N) and $\sum_{j=1}^{N} \rho^{ji} = 1$. Thus we are assuming that the government of region i takes as its objective function a weighted-average of the political satisfaction generated in its region by the size of its expenditure.[1]

A special case of the above vote-function is the median-voter case where j = 1, the one group being the median-voter group numbering n^{mi} and having weight ρ^{mi}. In this special case we have:

$$V_i = \rho^{mi} n^{mi} f^{mi}(L_i GR_i) \qquad i = 1,2$$

[1] In adopting a political-satisfaction function with government expenditure as the only argument we are in effect dealing with voters who recognize that, given balanced regional-government budgets, higher government expenditure must mean higher regional tax collections but who ignore the possibility that some or all of this additional tax burden may fall on them. Such an approach is required for consistency with the GE model since in this model households (voters) pay no tax of any sort, the only tax-payers being firms.
We are also dealing with voters who have limited understanding of the ultimate consequences of the additional tax burden which may have to be imposed on firms if higher government expenditure is to be financed. In particular they make no allowance for the possibility that, in the end, their wage income or income from distributed profits or both may fall because of the higher government expenditure, so that, in the end, they have to pay even if they face no immediate additional tax burden. They may fail in this respect for one or all of three reasons. Firstly, they may not see that any additional tax burden on firms will have repercussions that will affect other variables, including their income. Secondly they may be aware that there will be repercussions but argue that they have no way of tracing their ultimate effects. Finally, while they may argue that any resultant drop in their income will take so long to materialize that it can be safely ignored. While this implied assumption of our voting function (myopic voters) is not required for consistency with the GE model it seems entirely reasonable, nevertheless.

We adopt this special case and assume that the government of the region fixes its rate of payroll-tax (T_i) so as to maximize V_i subject to the constraints imposed by the structure of its economy, as depicted by the GE model.

Since $\rho^{mi} > 0, n^{mi} > 0, f^{mi} > 0$ and $f'^{mi} > 0$ the maximization problem faced by the government of region i reduces to:

$$\max_{\{T_i\}} (L_i GR_i)$$

subject to the constraints imposed by the GE model of region i.

The first order condition for this maximization problem is:

$$(14) \quad L_i \frac{\partial GR_i}{\partial T_i} + GR_i \frac{\partial L_i}{\partial T_i} = 0, \qquad (i=1,2)$$

For this condition to be satisfied for positive L_i and GR_i we must have $\frac{\partial GR_i}{\partial T_i} > 0$ and $\frac{\partial L_i}{\partial T_i} < 0$. We assume this to be the case.

The PEGE model is obtained by adding (14) to the GE model and making T_i endogenous. The federal government is assumed to choose one of the GF_i values (say GF_1) with the second being determined *via* its budget constraint, equation (8). The PEGE model thus consists of 21 equations in the following 21 endogenous variables:

$$C_i,\ \pi_i,\ \Pi_i,\ W_i,\ P_i,\ O_i,\ L_i,\ T_i,\ GR_i,\ G_i,\ GF_2, \qquad (i=1,2)$$

and the following four exogenous variables:

$$N_i,\ GF_1,\ \overline{L} \qquad (i = 1,2)$$

We now write the model more compactly. First the endogenous variables are reduced to 19 by setting $P_i = 1$ ($i = 1,2$), thus treating output in each region as the numeraire.

Next we use (13), (4) and (5) to write (3) as:

$$\text{(15)} \quad C_i = (L_i/N_i)^{\alpha_i - 1} - W_i T_i \qquad i = 1,2$$

Equations (6), (7), (8) and (10) are reproduced as they stand:

$$\text{(16)} \quad \alpha_i \left(\frac{L_i}{N_i} \right)^{\alpha_i - 1} = W_i (1 + T_i) \qquad i = 1,2$$

$$\text{(17)} \quad GR_i = T_i W_i \qquad i = 1,2$$

$$\text{(18)} \quad L_1 GF_1 + L_2 GF_2 = 0$$

$$\text{(19)} \quad L_1 + L_2 = \overline{L}$$

We next use (9) to substitute for G_i in (11) and add (14):

$$\text{(20)} \quad \beta_1 C_1^{\gamma_1} (GR_1 + GF_1)^{\delta_1} = \beta_2 C_2^{\gamma_2} (GR_2 + GF_2)^{\delta_2}$$

$$\text{(21)} \quad L_i \frac{\partial GR_i}{\partial T_i} + GR_i \frac{\partial L_i}{\partial T_i} = 0 \qquad i=1,2$$

Finally, we use (4) to write the product-market-clearing condition, (12), as:

$$\text{(22)} \quad \left(L_i / N_i \right)^{\alpha_i - 1} = C_i + GR_i \qquad i = 1,2$$

This gives a total of 13 equations in 11 endogenous variables: C_i, L_i, W_i, T_i, GR_i, and GF_1 (say).

Two of the 13 equations are redundant, however. This can be seen by substituting (17) into (15) to obtain (22). We therefore drop (15) and as our final form of the PEGE model, take the eleven equations, (16)-(22) in the 11 endogenous variables listed above, exogenous variables N_i, $\overline{L}$ and GF_2 and parameters, β_i, γ_i, δ_i and α_i. We now proceed to linearise this model.

3. The Linearized Numerical Version of the Two-Region PEGE Model

The two-region PEGE model set out in the previous section is non-linear in the levels of the variables. For this reason it cannot be easily used to conduct comparative-static exercises which will throw light on the topic of the present paper - the regional effects of inter-regional federal transfers when regional governments behave as optimising agents. We circumvent this problem by deriving a linearized version of the model and then calibrating this linearized version.

3.1 Linearization of the PEGE Model

To linearize the PEGE model of section 2 we use a process of log differentiation. By this means the model is converted from one which is non-linear in the variables of the model to one which is linear in the proportional rates of change of the variables.

The linearized form of the PEGE model is:

(16′) $(\alpha_i - 1)l_i - w_i - \sigma_{t_i} t_i = (\alpha_i - 1)n_i$ $\quad i = 1,2$

where $x_i \equiv \dfrac{dX_i}{X_i}$ for all X_i and $\sigma_{t_i} \equiv \dfrac{T_i}{1+T_i}$.

(17′) $gr_i = w_i + t_i$ $\quad i = 1,2$

(18′) $l_1 + gf_1 = l_2 + gf_2$

(19′) $\sigma_{\ell 1} l_1 + \sigma_{\ell 2} l_2 = \bar{l}$

where $\sigma_{\ell i} \equiv L_i/\bar{L} = L_i/(L_1 + L_2)$

$$(20') \qquad \gamma_1 c_1 + \delta_1\left(\sigma^{g}_{gr1} gr_1 + \sigma^{g}_{gf1} gf_1\right) = \gamma_2 c_2 + \delta_2\left(\sigma^{g}_{gr2} gr_2 + \sigma^{g}_{gf2} gf_2\right)$$

where $\sigma^{g}_{gri} = \dfrac{GR_i}{GR_i + GF_i} = \dfrac{GR_i}{G_i}$

$\sigma^{g}_{gfi} = \dfrac{GF_i}{G_i}$

$$(21') \qquad \ell_i = gr_i \qquad\qquad i = 1,2$$

$$(22') \qquad \sigma^{y}_{ci} c_i + \sigma^{y}_{gri} gr_i - (\alpha_i - 1) l_i = -(\alpha_i - 1) n_i \qquad\qquad i = 1,2$$

where $\sigma^{y}_{ci} = \dfrac{C_i}{C_i + GR_i}$

$\sigma^{y}_{gri} = \dfrac{GR_i}{C_i + GR_i}$

Equations (16')-(22') constitute a linear system in the eleven endogenous variables: c_i, l_i, w_i, t_i, gr_i and gf_2 and the 4 exogenous variables: n_i, gf_1 and $\bar{l}$.

3.2 Numerical Version of the Linearized PEGE Model

We now put the linearized PEGE model of section 2 into numerical form by evaluating the various coefficients which appear there.

Six numerical versions are constructed. Australia has six states. The states are New South Wales (NSW), Victoria (Vic), Queensland (Qld), South Australia (SA), Western Australia (WA), Tasmania (Tas). One of the six numerical versions has NSW as region 1 and the rest of the country (ROC) as region 2, a second has Vic as region 1 and ROC as region 2 and so on for each of the other four states.

The linearized model contains seven parameters which have to be evaluated: α_i, γ_i, δ_i, σ_{ti}, σ_{li}, σ^{g}_{gri}, σ^{g}_{gfi}, σ^{y}_{ci} and σ^{y}_{gri}. These seven parameters fall into two groups. The first three appear in model relationships; γ_i and δ_i appear in the utility function (1) and α_i in the production function (4). The last six, on the other hand, are linearization parameters.

The model parameters can be evaluated with the help of model restrictions and appropriate past information on model aggregates. Start with α_i. Using (16) and (22) we get:

$$\alpha_i = \frac{W_i(1+T_i)}{C_i + GR_i}$$

This expression can be used to evaluate α_i for NSW as region 1 and ROC as region 2 given a figure for each W_i, T_i, C_i and GR_i for NSW and each of the other five states, i.e. given these figures for all six states; and similarly for the other five versions.

Turn now to γ_i and δ_i. Here we follow the approach conventionally adopted by GE modellers and calibrate the utility function to ensure that the initial solution is one of utility maximisation.[2] Since the relative price of C_i and G_i is unity, utility maximisation implies that the ratio γ_i/δ_i is equal to C_i/G_i. Then, using the restriction that $\gamma_i + \delta_i = 1$, we have

$$\gamma_i = C_i/(C_i+G_i)$$

and

$$\delta_i = G_i/(C_i+G_i), \qquad i = 1,2.$$

The linearization parameters can be evaluated directly from their definitions, as presented in section 3, given values for the model aggregates involved for each of the six states. To evaluate the linearization parameters we need values for T_i, GR_i, GF_i, G_i, C_i, and L_i. We use the model constraints to calculate $T_i = GR_i/W_i$ and $G_i = GR_i + GF_i$, thus ensuring that

[2] It should be noted that, while this parameterisation is conventional, it is not strictly implied by our model specification since there households maximise utility subject to a given level of G_i.

the parameter values are consistent with the constraints. The figures we use for the aggregates which appear in these constraints are the average values for the years 1994-95 to 1995-99.

The data used for parameter evaluation is given for each of the six versions of the linearized model in Appendix A.

4. Simulations with Numerical Versions of the Linearized PEGE Model

In this section we discuss six comparative-static simulations with the PEGE model in its numerical linearized form. In each simulation we choose one of the six states to be region 1 and the rest of the country to be region 2 and examine the effects of an increase in the federal government's transfer from the rest of the country to region 1. In this way we throw light on the topic of the present paper - the regional effects of inter-regional federal transfers when regional governments behave as optimizing agents.

4.1 Determination of Shocks

For each simulation we shocked GF_1 by choosing a non-zero value for gf_1 and setting the changes in the remaining exogenous variables at zero. In each case we chose a shock large enough to ensure perceptible results but not so large as to be implausible from an historical perspective. The assumed increase in the per capita transfer to region 1 was set at 10% of the average per capita transfer for all regions over the five-year base period. The average per capita transfer was calculated at $3226.20 so that gf_1 was shocked by an amount calculated to ensure a rise in GF_1 of $322.62 in each simulation.

We assume that, for whatever reason, the federal government undertakes this policy in order to improve the welfare of the residents of region 1, if necessary at the expense of the welfare of those living in region 2.

4.2 Results of Simulations with PEGE Model

Results for the six simulations carried out with the PEGE model in its numerical linearized form are shown in Table 1.

The initial effect of the increase in GF_1 is to increase the consumption of the government good in region 1 and decrease it in region 2. Both individuals and regional governments react to this shock.

Initially the residents of region 1 find that they are better-off and those living in region 2 find that they are worse-off. This is clear from the numbers in the row for "initial-u" in Table 1 which gives the effect of the shock on utility before either the regional governments or individuals themselves have responded. Individuals in region 2, therefore, find that they could improve their welfare by moving to region 1 and inter-regional migration occurs until the equality between utility in the two regions is re-established.

In the process of migration the labour force expands in region 1 but contracts in region 2. Since the total labour force is fixed, the increase in L_1 is exactly offset by the fall in L_2, as is evident from the results in Table 1.

Output also increases in region 1 and falls in region 2 although output per capita moves in the opposite direction reflecting the diminishing marginal product of labour in each region which ensures that average product falls as employment rises.

Table 1
Results of Simulations with gf Shock: Regional Government Expenditure Maximized

Variable	*Version*											
	1		*2*		*3*		*4*		*5*		*6*	
	Reg 1:NSW	*Reg 2:ROC*	*Reg 1:Vic*	*Reg 2:ROC*	*Reg 1:Qld*	*Reg 2:ROC*	*Reg 1:SA*	*Reg 2:ROC*	*Reg 1:WA*	*Reg 2:ROC*	*Reg 1:Tas*	*Reg 2:ROC*
c (%)	-1.210868	0.677691	-1.215165	0.469310	1.298782	0.287709	-1.354554	0.101093	-1.416298	0.152541	-1.319712	0.024015
l (%)	2.247505	-1.179588	2.346452	-0.813643	2.211936	-0.517600	2.098632	-0.182295	2.343510	-0.273918	1.744319	-0.043129
L (number)	63031	-63031	49226	-49226	34176	-34176	13666	-13666	19983	-19983	3429	-3429
w (%)	-1.325864	0.752257	-1.327872	0.520331	-1.460741	0.316477	-1.528681	0.111462	-1.561896	0.168478	-1.544156	0.026491
t (%)	3.573369	-1.931844	3.674324	-1.333974	3.672677	-0.834077	3.627312	-0.293757	3.905406	-0.442396	3.288475	-0.069619
gr (%)	2.247505	-1.179588	2.346452	-0.813643	2.211936	-0.517600	2.098632	-0.182295	2.343510	-0.273918	1.744319	-0.043129
GR($pc)	161.799530	-79.683945	151.502151	-57.479885	138.327972	-36.548321	158.132141	-12.493655	172.035110	-18.783627	152.800934	-2.959580
g (%)	6.793634	-3.648461	7.735434	-2.309292	7.434879	-1.579058	5.460960	-0.638121	7.177437	-0.797676	4.169600	-0.178083
G($pc)	484.419525	-247.775330	474.122101	-165.762024	460.947937	-111.698174	480.752167	-43.030762	494.655090	-55.118587	475.4209929	-12.104129
y (%)	-0.68717	0.387781	-0.699667	0.266307	-0.774382	0.162142	-0.754678	0.057689	-0.760284	0.087463	-0.723657	0.013691
ytot (%)	1.563788	-0.791807	1.646785	-0.547336	1.437554	-0.355458	1.343953	-0.124606	1.583226	-0.186455	1.020662	-0.029438
initial-u (%)	0.684083	-0.388088	0.728557	-0.241915	0.771577	-0.165900	0.722655	-0.068412	0.775085	-0.080763	0.676740	-0.020521
u (%)	-0.000629	-0.000629	0.023717	0.023717	-0.003803	-0.003803	-0.010581	-0.010581	0.006598	0.006598	-0.006810	-0.006810

Since output in region 1 rises and output in region 2 falls, the effect of the federal-government transfer on *national* output is of ambiguous sign. The results reported in Table 2 show that the percentage change in national output is positive for some simulations and negative for others.

Table 2
Effect on National Output of a Positive Shock to GF_1
Regional Government Expenditure Maximized

Simulation	*Output Change*
NSW as Region 1	0.0661
Vic as Region 1	0.0172
Qld as Region 1	-0.0366
SA as Region 1	-0.0106
WA as Region 1	-0.0119
Tas as Region 1	-0.0039

Whether national output falls or rises depends on the relative magnitudes of the regional marginal products of labour. To see this, note that the sign of y, the percentage change in per capita national output (which equals the percentage change in total national output given that total population is fixed), can be shown to depend on the relative magnitudes of regional wage costs including the payroll tax. Since in equilibrium the gross wage is equal to the marginal product of labour, it follows that national output increases if the labour reallocation is from the region with the lower marginal product of labour to the region with the higher marginal product.

In all of the six simulations covered by Table 1, gr and t are both negative for the donor region but are both positive for the recipient region. Thus the government of the recipient region reacts to the additional federal government expenditure in its region not by reducing its own expenditure but by increasing its own expenditure, thereby generating a healthy increase in total government expenditure in its region. The increase in g in region 1 ranges from nearly 4 per cent when Tasmania is region 1 to just over 8 per cent in the Victorian case.

This unexpected effect may be explained as follows. In setting its tax rate in order to maximise total expenditure, the regional government faces two conflicting effects of changing taxes. On the one hand, an increase in its tax rate increases employment costs (although this is tempered by a fall in wages) which reduces employment and therefore the number of households in the region. This leads to a fall in total expenditure, *cet. par.* On the other hand, rasing its tax rate allows it to increase expenditure per capita, thus increasing total expenditure. A positive transfer from the federal government draws population to the region which disturbs the previous balance between L and GR inn favour of L, thus requires the regional government to increase GR to re-establish the balance.

Another noteworthy feature of the results reported in Table 1 is that in three of the six cases (where the recipient regions are NSW, Victoria and Queensland, respectively) the final change in utility is positive in both regions and in the other three, negative in both regions. In other words in three cases the federal-government transfer is Pareto-improving while in the other three cases the reverse is the case. This result confirms the conclusion reached by Petchey (1995), based on a two-region analytical model, that efficiency-enhancing federal-government redistributive transfers are a definite possibility.

Finally, the results of Table 1 show that whether or not the federal-government transfer is efficient, its ultimate effects on welfare are trivial.

A question which arises from this last result is how much of the offsetting of the federal government initiative results from inter-regional migration and how much results from the endogenous policy response of the regional governments.

Table 3 throws light on this question. The table has two rows for each variable, the first of which replicates the relevant figures from Table 1 and the second of which shows the corresponding figures for the case when the regional governments are assumed not to react, i.e. when they are treated as exogenous, as in the GE model.

Table 3
Results of Simulations with gf Shock: GE Model

Variable	*Version*											
	1		*2*		*3*		*4*		*5*		*6*	
	Reg 1:NSW	*Reg 2:ROC*	*Reg 1:Vic*	*Reg 2:ROC*	*Reg 1:Qld*	*Reg 2:ROC*	*Reg 1:SA*	*Reg 2:ROC*	*Reg 1:WA*	*Reg 2:ROC*	*Reg 1:Tas*	*Reg 2:ROC*
c (%)	-1.210868	0.677691	-1.215165	0.469310	1.298782	0.287709	-1.354554	0.101093	-1.416298	0.152541	-1.319712	0.024015
	-0.6843	0.3881	-0.7047	0.2682	-0.7750	0.1623	-0.7495	0.0573	-0.7636	0.0878	-0.7213	-0.6843
l (%)	2.247505	-1.179588	2.346452	-0.813643	2.211936	-0.517600	2.098632	-0.182295	2.343510	-0.273918	1.744319	-0.043129
	2.2494	-1.1826	2.3632	-0.8194	2.2137	-0.5180	2.0842	-0.1810	2.3538	-0.2751	1.7385	2.2494
L (number)	63031	-63031	49226	-49226	34176	-34176	13666	-13666	19983	-19983	3429	-3429
	63085	-63085	49577	-49577	34204	-34204	13572	-13572	20071	-20071	3418	63085
w (%)	-1.325864	0.752257	-1.327872	0.520331	-1.460741	0.316477	-1.528681	0.111462	-1.561896	0.168478	-1.544156	0.026491
	-0.6843	0.3881	-0.7047	0.2682	-0.7750	0.1623	-0.7495	0.0573	-0.7636	0.0878	-0.7213	-0.6843
g (%)	6.793634	-3.648461	7.735434	-2.309292	7.434879	-1.579058	5.460960	-0.638121	7.177437	-0.797676	4.169600	-0.178083
	3.8336	-2.0891	4.5213	-1.2442	4.4220	-0.9004	3.0232	-0.3944	3.8678	-0.4357	2.2754	3.8336
u (%)	-0.000629	-0.000629	0.023717	0.023717	-0.003803	-0.003803	-0.010581	-0.010581	0.006598	0.006598	-0.006810	-0.006810
	0.0008	0.0008	0.0280	0.0280	-0.0035	-0.0035	-0.0118	-0.0118	0.0075	0.0075	-0.0070	0.0008

Two variables are seen to be relatively unaffected by keeping the regional governments exogenous - the percentage changes in employment and utility. Irrespective of whether regional governments optimise or not, substantial inter-regional migration follows the federal-government shock and this movement of labour from region 2 to region 1 serves to largely wipe out the welfare effects of the inter-regional transfer. Thus, in our model regional government optimisation does not materially affect welfare. On the other hand, the results in the table make clear that the endogenizing of regional governments substantially affects other variables, in particular consumption, the wage rate and total government expenditure. Thus the regional government's maximising behaviour has a strong impact on the allocation of a region's output between consumption and the government-provided good but the level of output in each region and the welfare of its representative household are largely determined by inter-regional migration.

The question just considered was the extent to which the economic and welfare effects of federal-government transfers are governed by whether or not the regional governments are optimizers. A related question is whether, given that they are optimizers, the effects of federal-government transfers are significantly dependent on the *nature* of the optimization.

Light can be thrown on this question by comparing the results presented in Table 1 with those presented in an earlier paper. In the paper in question (Groenewold, Hagger and Madden, 2001) the economic and welfare effects of federal-government transfers were examined by means of a set of six simulations identical with those used in the present paper but in terms of a modelling framework having *welfare*-maximizing, rather than vote-maximizing regional governments. Here the assumption was that each regional government chooses its rate of payroll-tax so as to maximize a social-welfare function consisting of a weighted sum of the utility functions of the households in its region.

The results of the six simulations carried out in terms of this welfare-maximizing framework are set out in Table 1 of the earlier paper. It will be seen that they differ in important respects from the results set out in Table 1 of the present paper.

One difference is that, with welfare-maximizing regional governments, the cases in which the federal-government transfer is Pareto-efficient were those where Victoria and Western Australia are the recipient regions whereas Table 1 shows them to be the cases where the recipient regions are NSW, Victoria and Queensland. This difference suggests that, with optimizing regional governments, the conditions which determine whether a particular redistributive transfer is welfare-enhancing are sensitive to the nature of the optimization. In turn this implies that the conditions for Pareto-efficiency presented in Petchey (1995) may not be generally applicable.

A second important difference relates to the reaction of regional governments to the transfer. Regional governments which seek to maximise welfare change their tax rates so that the effect on G of the change in GF is largely offset by an opposite change in GR. Thus in a welfare-maximising framework the government in the recipient region "takes advantage" of the transfer to lower its tax rate, while in the present vote-maximising framework it reacts in the opposite way.

It would appear, then, that the effects of federal-government transfers under a regime of optimizing regional governments differ significantly according to the nature of the optimization. It is interesting, though, that for one variable there is no difference between the results from the two sets of simulations. The variable in question is u. The reason for this feature of the results is that, in the equilibrium which is being perturbed, household utility is maximised both when regional governments are vote-maximizers and when they are welfare-maximizers; in the first case this is imposed by the parameterisation and in the second case it is ensured by the government's welfare-maximizing behaviour.

However, as noted earlier[3], the procedure used to calibrate the parameters of the utility function is not strictly implied by the CGE component of our model. The question to which this gives rise is to what extent the qualitative character of the results presented above would be affected by a change in the values used for γ_i and δ_i in the linearized

[3] See above, footnote 2.

version of our PECGE model. In Table 4 we give the results of a sensitivity analysis of the results in Table 1. The table relates only to the NSW simulation. However this simulation is typical as will be seen from Appendices B and C where the corresponding sensitivity analysis for the other five simulations can be found. In Appendix D we present sensitivity analysis of the effects of the federal government shock on national output, previously reported in Table 2.

Table 4
Sensitivity of Table Results to Changes in Values of γ and δ: NSW Simulation

	γ = C/(C+G)		γ = C/(C+G) - 0.05		γ = C/(C+G) + 0.05	
Variable	Region 1	Region 2	Region 1	Region 2	Region 1	Region 2
c (%)	-1.2109	0.6777	-2.1332	1.1939	-0.6540	0.3660
l (%)	2.2475	-1.1796	3.9595	-2.0781	1.2139	-0.6371
L (number)	63031	-63031	111044	-111044	34044	-34044
w (%)	-1.3259	0.7523	-2.3358	1.3253	-0.7161	0.4063
t (%)	0.7828	-0.4492	1.3791	-0.7914	0.4228	-0.2426
gr(%)	2.2475	-1.1796	3.9595	-2.0781	1.2319	-0.6371
GR($pc)	161.80	-79.6800	285.0500	-140.3800	87.3900	-43.0400
g (%)	6.7936	-3.6484	8.5221	-4.5284	5.7501	-3.1172
G ($pc)	484.42	-247.78	607.67	-307.53	410.01	-211.69
y (%)	-0.6837	0.3878	-1.2045	0.6832	-0.3693	0.2095
ytot (%)	1.5638	-0.7918	2.7549	-1.3949	0.8446	-0.4277
initial-u (%)	0.6841	-0.3881	0.9103	-0.5089	0.4578	-0.2652
u (%)	-0.0006	-0.0006	0.0106	0.0106	-0.0059	-0.0059

Table 4 makes it clear that with one exception, the general character of the results given in Table 1 is not affected by substantial changes in the values used for γ_i and δ_i in the simulations. The one exception relates to the u row where a sign change occurs in the "-0.05" column. This reflects the fact that whether the shock is welfare-enhancing depends on the initial equilibrium. The analysis reported in Petchey (1995) and Groenewold, Hagger and Madden (2001) show that a change in government transfers may be efficiency-enhancing depending on the balance between the size of the transfer and profits (which are also distributed on an equal-per-capita basis). Clearly, this balance is affected by the parameters of the utility function: decreasing the weight on C and therefore increasing the weight on G makes it more likely that the initial equilibrium is one where G is too small (from a welfare point of view) so that an increase in G is welfare-enhancing.

5. Conclusion

In this paper we have set out to analyse the effects of inter-regional transfers made by a federal government. We have done so with the help of a model in which each regional government determines its tax policy so as to maximise the level of its expenditure in the region subject to the constraints imposed by the economic structure of its region. Each regional government is assumed to take the other regional government's tax policy as given in carrying out its maximisation.

We conducted a series of six simulations with a linearized version of the model after calibration using Australian data. The shock was an increase in the federal government's grant to region 1 matched by a decrease to its grant to region 2. In each simulation one of the six Australian states was taken as region 1 and the rest of the country as region 2.

We found that substantial changes in the amount transferred by the federal government from one region to the other have large initial effects on utility but that once households are permitted to migrate in response to inter-regional utility differentials, the effect of migration is to substantially remove these welfare effects. We found that the changes in transfers result in significant changes in per capita consumption, government expenditure, wages and tax rates. The initial increase in welfare in the recipient region leads to an influx of people from the other region, increasing output but reducing productivity and wages. The regional government in the recipient region responds to the increase in population by increasing both its tax rate and expenditure level so that in the new equilibrium employment, taxes, output and government expenditure are all higher but wages, consumption and output per man are all lower. Welfare may be higher or lower depending on whether the initial level of government expenditure was above or below the welfare-maximising level.

Appendix A

Data-Base

	Total corresponding to						
	C ($m)	GR ($m)	LW ($m)	GF ($m)	W ($'000)	L ('000)	Y/L ($'000)
Region 1 NSW	112265.4	20189.8	92160.8	-192.3	32.8618	2804.5	47.2295
Region 2 ROC	195152.8	36096.6	15227.8	192.3	29.0498	5343.5	43.2768
Nation	307418.2	56286.4	247388.6	0.0	30.3619	8148	44.6373
Region 1 Vic	80040.8	13545.4	65680.6	-686.9	31.3078	2097.9	44.6095
Region 2 ROC	227377.4	42741	181708	686.9	30.0339	6050.1	44.6469
Nation	307418.2	56286.4	247388.6	0.0	30.3619	8148	44.6373
Region 1 Qld	55026	9662.6	42041.6	-83.3	27.2096	1545.1	41.8669
Region 2 ROC	252392.2	46623.8	205347	83.3	31.0995	6602.9	45.2856
Nation	307418.2	56286.4	247388.6	0.0	30.3619	8148	44.6373
Region 1 SA	23339.2	4906.8	18088.6	826.0	27.7773	651.2	43.3753
Region 2 ROC	284079	51379.6	229300	-826.0	30.5864	7496.8	44.7469
Nation	307418.2	56286.4	247388.6	0.0	30.3619	8148	44.6373
Region 1 WA	29616	6259.6	24236.8	-383.0	28.4236	852.7	42.0729
Region 2 ROC	277802.2	50026.8	223151.8	383.0	30.5884	7295.3	44.9370
Nation	307418.2	56286.4	247388.6	0.0	30.3619	8148	44.6373
Region 1 Tas	7130.8	1722.2	5180.2	519.4	26.3489	196.6	45.0305
Region 2 ROC	300287.4	54564.2	242208.4	-519.4	30.4611	7951.4	44.6276
Nation	307418.2	56286.4	247388.6	0.0	30.3619	8148	44.6373

Sources: C_i, L_i, LW_i and GR_i are from ABS times series averaged over the period 1994/95 - 1998/99. GF_i is computed as L_i $(MGF_i/L_i - MGF/L)$ where MGF_i is final consumption expenditure by the federal government plus grants to state i. All other data is calculated from these figures to ensure that the model constraints hold: $L = L_1 + L_2$, $W_i = W_iL_i/L_i$, $Y_i = GR_i + C_i$, $G_i = GR_i{+}GF_i$, $T_i = GR_i/W_iL_i$. It should be noted that, as the model excludes investment and net interstate and overseas exports, Y_i will not conform with official figures.

Appendix B

Results of Simulations with $\gamma = (C/C+G) + 0.05$

Variable	*Version*											
	1		*2*		*3*		*4*		*5*		*6*	
	Reg 1:NSW	*Reg 2:ROC*	*Reg 1:Vic*	*Reg 2:ROC*	*Reg 1:Qld*	*Reg 2:ROC*	*Reg 1:SA*	*Reg 2:ROC*	*Reg 1:WA*	*Reg 2:ROC*	*Reg 1:Tas*	*Reg 2:ROC*
c (%)	-0.654230	0.366040	-0.632862	0.244418	-0.702631	0.155648	-0.821103	0.061281	-0.787452	0.084812	-0.868257	0.015800
l (%)	1.213940	-0.637128	1.222040	-0.423478	1.196640	-0.280018	1.272148	-0.110503	1.302975	-0.152296	1.147612	-0.028375
L (number)	34045	-34045	25637	-25637	18489	-18489	8284	-8284	11110	-11110	2256	-2256
w (%)	-0.716136	0.406315	-0.691560	0.270990	-0.790249	0.171212	-0.926655	0.067566	-0.868403	0.093673	-1.015922	0.017429
t (%)	1.930076	-1.043443	1.913601	-0.694738	1.986889	-0.451229	2.198802	-0.178070	2.171379	-0.245969	2.163534	-0.045804
gr (%)	1.213940	-0.637128	1.222040	-0.423748	1.196640	-0.280018	1.272148	-0.110503	1.302975	-0.152296	1.147612	-0.028375
GR($pc)	87.392410	-43.039509	78.902847	-29.935734	74.834351	-19.772354	95.856476	-7.573399	95.650337	-10.443567	100.529884	-1.947149
g (%)	5.750128	-3.117229	6.550957	-1.949516	6.410756	-1.344133	4.753558	-0.550479	6.069095	-0.685808	3.711165	-0.157311
G($pc)	410.012421	-211.698166	401.522827	-139.937149	397.454315	-95.080238	418.476501	-37.120785	418.270325	-47.388584	423.149902	-10.692244
y (%)	-0.369295	0.209451	-0.364389	0.138694	-0.418935	0.087718	-0.457471	0.034970	0.422713	0.048629	-0.476104	0.009007
ytot (%)	0.844645	-0.427677	0.857652	-0.285054	0.777705	-0.192300	0.814677	-0.075534	0.880263	-0.103667	0.671508	-0.019368
initial-u (%)	0.457857	-0.265223	0.465375	-0.169132	0.511392	-0.113019	0.539419	-0.044287	0.541024	-0.055386	0.535266	-0.013191
u (%)	-0.005956	-0.005956	0.002283	0.002283	-0.003567	-0.003567	-0.000551	-0.000551	0.004984	0.004984	-0.001948	-0.001948

Appendix C

Results of Simulations with $\gamma = (C/C+G) - 0.05$

Variable	*Version*											
	1		*2*		*3*		*4*		*5*		*6*	
	Reg 1:NSW	*Reg 2:ROC*	*Reg 1:Vic*	*Reg 2:ROC*	*Reg 1:Qld*	*Reg 2:ROC*	*Reg 1:SA*	*Reg 2:ROC*	*Reg 1:WA*	*Reg 2:ROC*	*Reg 1:Tas*	*Reg 2:ROC*
c (%)	-2.133233	1.193914	-2.187219	0.844727	-2.252531	0.498986	-2.190997	0.163518	-2.467309	0.265739	-1.993453	0.036275
I (%)	3.959517	-2.078126	4.223463	-1.464505	3.836253	-0.897696	3.394545	-0.294863	4.082590	-0.477187	2.634831	-0.065147
L (number)	111045	-0.111045	-88604	-88604	59273	-59273	22105	-22105	34812	-34812	5180	-5180
w (%)	-2.335826	1.325279	-2.390084	0.936563	-2.533423	0.548879	-2.472647	0.180291	-2.720953	0.293503	-2.232480	0.040015
t (%)	6.295343	-3.403405	6.615470	-2.401068	6.369676	-1.446575	5.867192	-0.475154	6.803543	-0.770691	4.967312	-0.105162
gr (%)	3.959517	-2.078126	4.223463	-1.464505	3.836253	-0.897696	3.394545	-0.294863	4.082590	-0.477187	2.634831	-0.065147
GR($pc)	285.048492	-140.382278	272.694122	-103.460136	239.907944	-63.387268	255.779404	-20.208540	299.699524	-32.722641	230.809052	-4.470508
g (%)	8.522113	-4.528400	9.712715	-2.909876	9.073318	-1.954901	6.570155	-0.775541	9.029845	-0.984646	4.853757	-0.209084
G($pc)	607.668518	-307.533997	595.314087	-208.872253	562.527893	-138.284317	578.399414	-52.297512	622.319458	-68.037987	553.429077	-14.211195
y (%)	-1.204531	0.683169	-1.259355	0.479336	-1.343044	0.281210	-1.220695	0.093312	-1.324478	0.152368	-1.093099	0.020680
ytot (%)	2.754986	-1.394957	2.964108	-0.985169	2.493209	-0.616486	2.173850	-0.201551	2.758112	-0.324819	1.541732	-0.044467
initial-u (%)	0.910309	-0.508983	0.991739	-0.308929	1.031763	-0.218283	0.905890	-0.095682	1.009145	-0.104051	0.808214	-0.029024
u (%)	0.010568	0.010568	0.054887	0.054887	-0.006905	-0.006905	-0.025300	-0.025300	0.011174	0.011174	-0.013416	-0.013416

Appendix D

Effect on National Output of a Positive Shock to GF_1:
Sensitivity to the Values of the Parameters of the Utility Function

	Output Change		
Simulation	*γ = share*	*γ = share - 0.05*	*γ = share + 0.05*
NSW as Region 1	0.0661	0.1164	0.0357
Vic as Region 1	0.0172	0.0310	0.0090
Qld as Region 1	-0.0366	-0.0634	-0.0198
SA as Region 1	-0.0106	-0.0171	-0.0064
WA as Region 1	-0.0119	-0.0207	-0.0066
Tas as Region 1	-0.0039	-0.0059	-0.0026

References

Boadway, R. and Faltters, F. 1982. "Efficiency and Equalisation Payments in a Federal System of Government: A Synthesis and Extension of Recent Results", *Canadian Journal of Economics*, 15, 613-633.

Boadway, R. and Keen, M. 1997. Efficiency and the Optimal Direction of Federal-State Transfers in D.E. Wildasin (ed.). *Fiscal Aspects of Evolving Federations*, Cambridge University Press, Cambridge, 41-62.

Dixon, P.B., Madden, J.R. and Peter, M.W., 1993. "The Effects of Reallocating General Revenue Assistance Among the Australian States", *Economic Record* 69(207), 367-381.

Groenewold, N., Hagger, A.J. and Madden, J. R., 2000. "Competitive Federalism: A Political-Economy General Equilibrium Approach", *Australasian Journal of Regional Science*, 6(3), 451-465.

Groenewold, N., Hagger, A. J. and Madden, J. R., 2001. "The Effects of Federal Inter-Regional Transfers With Optimising Regional Governments", Discussion Paper, 01-15, Department of Economics, University of Western Australia.

Hoyt, W.H, 1993. "Tax Competition, Nash Equilibria, and Residential Mobility", *Journal of Urban Economics* 34(3), 358-79.

Jones, R. and Whalley, J., 1989. "A Canadian Regional General Equilibrium Model and Some Applications", *Journal of Urban Economics*, 25, 368-404.

Laussel, D. and Le Breton, M., 1998. "Existence of Nash Equilibria in Fiscal Competition Models", *Regional Science and Urban Economics* 28(3), 283-96.

Madden, J.R., 1993. "The Economics of Vertical Fiscal Imbalance: An Applied General Equilibrium Approach", *Australian Tax Forum* 10(1), 75-90.

Mintz, J. and Tulkens, H., 1986. "Commodity Tax Competition Between Member States of a Federation: Equilibrium and Efficiency", *Journal of Public Economics*, 29, 133-172.

Morgan, W., Mutti, J. and Rickman, D., 1996. "Tax Exporting, Regional Economic Growth, and Welfare", *Journal of Urban Economics* 39, 131-159.

Myers, G.M. 1990. "Optimality, Free Mobility and the Regional Authority in a Federation", *Journal of Public Economics*, 43, 107-121.

Nechyba, T., 1997. "Computable General Equilibrium in Local Public Finance and Fiscal Federalism", in D.E. Wildasin (ed.). *Fiscal Aspects of Evolving Federations*, Cambridge University Press, Cambridge, 168-193.

Pant, H.M., 1997. *Tariff Determination in the General Equilibrium of a Political Economy.* Ashgate Aldershot.

Petchey, J., 1993. "Equalisation in a Federal Economy with Inter-State Migration and Different Factor Endowments", *Australian Economic Papers*, 32,

Petchey, J., 1995. "Resource Rents, Cost Differences and Fiscal Equalization", *Economic Record* 71, 343-353.

Petchey, J. and Walsh, C., 1993. "Conceptual Foundations of Equalisation: A Survey", in *Horizontal Fiscal Equalisation in Australia: Economic, Historical and Political Perspectives*, Centre for Economic Studies, University of Adelaide, South Australia.

Swan, P. and Garvey, G., 1993. "The Equity and Efficiency Implications of Fiscal Equalisation", Swan Consultants, Sydney.

Wildasin, D.E., 1988. "Nash Equilibria in Models of Fiscal Competition", *Journal of Public Economics* 35(2), 229-40.

LONGITUDINAL ANALYSIS OF IMMIGRANT OCCUPATIONAL MOBILITY: A TEST OF THE IMMIGRANT ASSIMILATION HYPOTHESIS

by

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DISCUSSION PAPER 02.08

DEPARTMENT OF ECONOMICS

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35 STIRLING HIGHWAY
CRAWLEY, WA 6009
AUSTRALIA

February 2002

Preliminary
Not for citation without permission of an author.

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JEL Codes: J15, J24, J61, J62

* Miller acknowledges financial assistance from the Australian Research Council.

February 2002

LONGITUDINAL ANALYSIS OF IMMIGRANT OCCUPATIONAL MOBILITY: A TEST OF THE IMMIGRANT ASSIMILATION HYPOTHESIS

ABSTRACT

Using an immigrant assimilation framework, this paper develops a model of the occupational mobility of immigrants and tests the hypotheses using data on adult males from the Longitudinal Survey of Immigrants to Australia. The theoretical model generates hypotheses regarding a U-shaped pattern of occupational mobility from the "last job" in the origin, to the "first job" in the destination, to subsequent jobs in the destination, and regarding the depth of the "U." The survey includes data on pre-immigration occupation, the "first" occupation in Australia (at 6 months) and the occupation after about 3.5 years in Australia. The hypotheses are supported by the empirical analysis. (100 words).

February 2002

LONGITUDINAL ANALYSIS OF IMMIGRANT OCCUPATIONAL MOBILITY: A TEST OF THE IMMIGRANT ASSIMILATION HYPOTHESIS

I. Introduction

The labor market adjustment of immigrants has been of intense research interest among economists for the past two decades. Research in this area has been conducted for occupational attainment, earnings and employment/unemployment (for the earliest studies, see Chiswick, 1977, 1978, 1982). This research has been conducted primarily using cross-sectional data from the major immigrant receiving countries: primarily the United States, Canada, Australia, Israel and Germany. It has documented that the labor market attainment of immigrants varies systematically with human capital and demographic variables, and in particular increases with duration of residence in the destination. Yet the effect of duration, or years since migration, on labor market outcomes observed in cross-sectional data may not be an unbiased estimate of the longitudinal effect that individuals experience.[1] The cross-section may provide biased estimates of the longitudinal effects if there is selectivity in the return migration of immigrants or if there are changes over time in the unmeasured dimensions of the quality of immigrants. In particular, the cross-section provides upward biased estimates if the least successful of immigrants have a greater propensity to remigrate or if more recent immigrant cohorts have lower unmeasured dimensions of ability relevant for the labor market.

The "best" estimates of the longitudinal progress of immigrants would, of course, come from longitudinal data. Yet, longitudinal data on immigrants are quite

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[1] This point was first made and tested in Chiswick 1980.

scarce. Some studies have used longitudinal data on adult males: (1) occupation in 1965 and 1970 in the U.S. 1970 Census (Chiswick 1977), (2) earnings in the National Longitudinal Survey of Adult Males (Chiswick 1980), (3) earnings from matched samples from the Current Population Survey (Duleep and Regets 1997), and (4) earnings of scientists from National Science Foundation data (Borjas 1989), although the latter suffers from selective movement in and out of scientific occupations. An alternative approach has been to use "synthetic cohorts," that is, following over time samples defined by year of immigration and age (Borjas 1985). The latter approach has inherent problems due to selective emigration, changes in the composition of the samples over time, and the difficulty of disentangling longitudinal changes and period (timing) effects (Chiswick 1986, Duleep and Regets 1996).[2]

The approach taken in this paper is to exploit a true longitudinal survey of immigrants in Australia. This survey provides data on occupational attainment prior to immigration, as well as occupational attainment in three survey waves that span a period of approximately 3 ½ years following immigration. Thus, it provides data on occupation prior to and in the early period after immigration.

Section II develops the theory and the testable hypotheses regarding the occupational change of immigrants from the pre-immigration to the post-immigration period. Section III discusses the Longitudinal Survey of Immigrants to Australia, which provides the data for testing the hypotheses. The empirical analysis is presented in Section IV, first as descriptive statistics regarding occupational level and change, and then using multiple regression (econometric) techniques. Due to the categorical nature of the dependent variable, occupational level or change, a socioeconomic status variable for occupation that has been developed for Australia is used in the

[2] Other studies of occupational attainment in various countries include: Broom, et al. 1977, Brown, et al. 1980, Featherman, et al. 1975, Leigh 1975, Miller and Volker 1985, Nickell 1982, Schmidt and Strauss 1975.

econometric analysis. At this stage the analysis is limited to adult (non-aged) males for two reasons. One is that the labor force participation decision would be crucial for an analysis for females and aged males, and to do this would add additional complexity to the analysis. The other is the relatively small size of the sample of females and aged males. This paper closes (Section V) with a section that summarizes the findings and draws out implications.

II. The Theory of Immigrant Occupational Mobility[3]

Consider individuals in a country of origin who are contemplating international migration. They analyze the expected increase in their economic well-being by considering the present value of expected earnings in the origin and destination, and the costs of migration. The costs include not merely the time and transport costs of the move, but rather the full range of costs associated with leaving an origin and re-establishing oneself in a new location, including acquiring information specific to the destination. In this approach the migrants are not concerned with their occupational labels in the origin and destination, but rather with the real earnings that they can receive.

To the extent that there are differences in real wages across countries, migrants flow from the low-wage origin to the high-wage destination country. Yet "skills" may not be perfectly transferable across countries. These skills are to be defined broadly to include labor market information, destination language proficiency, occupational licenses, certifications or credentials, as well as more narrowly defined task-specific skills. Consider three high-level occupations, economist, medical doctor and lawyer. Country-specific skills for the economist may include language and style of practice.

[3] This analysis builds upon the model in Chiswick 1977.

The medical doctor has less transferable skills because, in addition to language and style of practice, medical license requirements prohibit the practice of medicine until after acquiring a license specific to the destination. The skills of lawyers are even less transferable across countries because, in addition to the above, the legal system (as distinct from economic theory and the human body) varies sharply across countries.

The lower the transferability of skills the greater will be the decline in occupational status from the "last" permanent job in the origin to the "first" job in the destination. After migration, however, immigrants make implicit and explicit investments that complement the skills they bring with them to increase the transferability of these skills to the destination.

These investments include learning about the labor market, the language, and the style of practice, as well as acquiring new skills and obtaining whatever licenses, certifications and other credentials that will enhance productivity in the destination labor market (Chiswick and Miller, forthcoming). As a result, occupational status and earnings would increase with duration in the destination. Thus, the refugee lawyer may start out as a restaurant dishwasher, move on to becoming a librarian, translator or para-legal, and then possibly move up to becoming a lawyer.

The decline in occupational status from the last job in the origin to the first job in the destination, followed by the subsequent rise with duration in the destination can be described as a "U-shaped" pattern. The degree of subsequent increase in the destination will be related to the initial decline from the origin to the destination. The steeper the decline, on average, the steeper the subsequent increase.

Immigrants from countries very similar to the destination, for example, an English-speaking Canadian moving to the United States, may experience little or no downward mobility on migration and hence will experience little subsequent increase.[4] When skills are highly transferable the immigrants will have a shallow "U". Immigrants without skills or with only very low levels of skill are not likely to make large investments in skills in the destination.[5] They will experience little or no decline in occupational status as they have few if any skills, and hence little or no subsequent increase. They, too, will have a shallow "U".

In the more typical case for economic migrants from a lower income origin to a higher income destination the immigrant has some skills that are not perfectly transferable. As a result, there will be a decline in occupational status from the last job in the origin to the first job in the destination (which may even provide a higher wage than was received in the origin), with a subsequent improvement. Those with the least transferable skills among potential migrants are not likely to become economic migrants. Economists and computer scientists have higher rates of international migration than do physicians, who in turn have higher rates of international migration than do lawyers.

Refugees and tied movers, on the other hand, base their migration decision on a different set of calculations. While incomes in the origin and destination are surely relevant, by definition refugees are those whose migration decision is influenced by

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[4] Consider the case of migration between two regions for which all skills are perfectly transferable and the wage (or earnings) distributions are the same. Initially workers select random draws from a distribution of wage offerings. Migration takes place only if the random wage draw from the "other place" (destination) is sufficiently in excess of the expected wage in the origin to at least compensate for the costs of migration. With the passage of time, the acquisition of location specific human capital in the labor market and in consumption raise the cost of subsequent moves. If there is a regression to the mean over time in wage draws it would appear that the wages (and occupational status) of migrants decrease with duration in the destination. While this phenomenon may be relevant for internal migration within countries (or groups of countries) that do not have regional differences in earnings or in the transferability of skills, it would not be generally applicable to international or even internal migration.

[5] For example, unskilled farm laborers from Mexico are likely to remain unskilled workers in the United States.

non-economic factors concerning their safety, security, freedom, ideology, ethnicity or social class (political, religious, or some other dimension).[6] As a result, refugee streams include a larger proportion of immigrants who are less adaptable for migration.[7] They would include workers skilled in the origin but whose skills have little international transferability (*e.g.*, lawyers, judges, and generals), individuals with fewer decision making skills or less allocative efficiency, and frequently individuals who did not plan for or prepare for the move. As a result, other things being the same, refugees would be expected to have a steeper decline than economic migrants in their occupational status from the origin to the destination, and would have a steeper improvement subsequently as they make investments that increase the transferability of their skills. Because of lingering disadvantages due to their refugee experience and motivations, the gap between them and economic migrants would narrow but in general it would never close. Thus, refugees would have a deeper "U" than economic migrants.

Similarly, tied movers are individuals whose migration decision is determined at least in substantial part by that of another, whether this person is an economic migrant, a refugee or another tied mover. Because their own economic incentives are not paramount, they too would experience a steeper decline and a steeper subsequent increase in occupational status, that is a deeper "U", than economic migrants. Yet, they too will experience lingering disadvantages.

This analysis has generated a number of testable hypotheses:

[6] There may be only a weak relation between the true but unknown motives for migration and the visa a migrant uses to enter a country. Whereas we think of refugees as being "pushed," ideological migrants are people who move voluntarily ("pulled") for political, religious or ideological reasons. They would be expected to have a similar occupational mobility pattern as do refugees.

[7] Refugees have lower earnings and employment and higher rates of unemployment than do economic migrants, other variables the same (Chiswick 1979, 1980, 1982).

(1) Immigrants would experience a decline in occupational status from the origin to the destination, with a subsequent increase with duration in the destination.

(2) This U-shaped pattern would be steeper for refugees and for tied (family) migrants than for economic migrants.

(3) The U-shaped pattern should be shallow for those migrating between countries with similar wage distributions and for which the skills of one are highly transferable to the other.

(4) The U-shaped pattern would be steeper for high-skilled immigrants and would be shallow for immigrants who are very low-skilled or unskilled in the origin.

III. The Longitudinal Data

The empirical analysis is based on the Longitudinal Survey of Immigrants to Australia (LSIA), a longitudinal survey of recently arrived immigrants who received their visas before entry into Australia.[8] The population represented in the sample is all Principal Applicants, aged 15 years and over, who arrived in Australia as offshore visaed immigrants in the two-year period of September 1993 to August 1995. The Principal Applicant is the person upon whom the approval to immigrate was based. Excluded from the survey are New Zealand citizens (for whom there is unrestricted mobility to Australia) and those granted a visa while living in Australia.

Principal Applicant immigrants selected for interview were those who settled in State and Territory capital cities (including major urban centers close to capital cities, such as Newcastle and Wollongong), as well as Cairns. Only 4 to 5 percent of the total of Principal Applicant immigrants are excluded from the coverage of the survey because they live outside of those areas.

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[8] For a study of immigrant earnings in Australia using Census data, see Chiswick and Miller, 1985.

The final LSIA sample was 5,192 Principal Applicant arrivals. This represents about 7 percent of the total Principal Applicants that arrived in the two-year survey period. The population from which the sample was selected at random was stratified according to visa eligibility category[9] and also by about fifty regions or countries of birth.[10]

The information collected in the personal interview includes demographic characteristics, socioeconomic status, family background, and location details. Data on the Principal Applicant's demographic characteristics include gender, age, marital status, country of birth, ethnicity, and general health. Education level, employment status (before and after migration), and income from all sources (with income from labor market activity being separately identified) are the major socioeconomic status variables.

Immigrants were to be interviewed three times. The first interview was to take place approximately five or six months after arrival, the second interview one year later, and the third interview a further two years later. Thus the third interview took place approximately 3 ½ years after migration. The first, second, and third waves of interviews commenced in March 1994, March 1995, and March 1997, respectively. Each wave of interviews was spread over a period of two years.[11]

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[9] The five main visa categories are Preferential Family (28.4 percent of the male sample), Concessional Family (19.5 percent), Business Skills and Employer Nomination (14.8 percent), Independent (20.3 percent), and Humanitarian (17.1 percent). The Humanitarian category includes individuals who are refugees under the UN definition and people treated as refugees by the Australian authorities.

[10] Principal Applicants in smaller States and Territories were over-sampled. Weights are available to adjust for this. These estimation weights were modified to account for sample attrition between the first and the third waves of the survey. All analyses in this study use relevant estimation weights. Relative weights are used so as not to inflate sample sizes. Experiments show that the use of weights has only a modest effect on the statistical results.

[11] Between 1994 and 1999 labor market conditions in Australia generally improved. According to the Australian Bureau of Statistics (2000), the aggregate male unemployment rate for each year is 1994: 9.1 percent, 1995: 8.8 percent, 1996: 8.8 percent, 1997: 8.5 percent, 1998: 7.8 percent, 1999: 7.0 percent.

In the first wave of interviews, immigrants were asked about their employment status in the year before they migrated, their current employment status, and also for details on jobs held before they started their current job. This information is used in some of the analyses conducted to determine the status of the "first" job immigrants obtained in Australia. Where the immigrant had held only one job in Australia, obtaining information on the first job is straightforward, whether it is the current job or a job that terminated prior to the first interview. Where the immigrant had held more than one job since arriving in Australia, the first job is not literally the first job but is taken as the job (other than the current job) in which the immigrant was employed for the longest period since arriving in Australia. As the first interview was held around six months after arrival, this method should approximate the status of the first job that the immigrants held after arriving in Australia.

The information collected on employment in the wave two and wave three interviews is obtained using a sequence of questions similar to that for wave one. This information is used in analyses of the status of the job held at the time of the interview, as well as in analyses of the first job that immigrants obtained in Australia. When determining the first job held in Australia for those immigrants who had not been employed in Australia by the time of the previous interview, information can be obtained on (i) the occupation of the first job in Australia where the immigrant has had only one job in Australia; (ii) the occupation of the job (other than for any current job) held for the longest time period for immigrants who have held more than one job. While the period between interviews is one or two years, and hence the information used on the longest job held for immigrants with more than one job over the reference period will not necessarily relate to what is literally the first job in Australia, it will relate to what might be termed the first substantive job. For many purposes, this will provide a more meaningful variable for analysis.[12]

The information on the occupations immigrants held before and after migration was coded by the Department of Immigration and Multicultural Affairs to the Australian Standard Classification of Occupations (ASCO) version 1 (see Australian Bureau of Statistics 1990). This coding of occupation is based on the type of work undertaken. Both skill level (*e.g.*, amount of formal education and on-the-job training) and skill specialization (*e.g.*, field of knowledge, tools or equipment used) are used to differentiate occupations. Information is available at the "unit group" level: 282 unit groups (occupational categories) are identified in the ASCO profile of occupations. For the purpose of descriptive statistics and frequency distributions, the data on occupations have been aggregated to the broadest level of the ASCO structure, namely the major group level. There are eight major groups: "Professionals", "Managers and Administrators", "Para-Professionals", "Tradespersons", "Clerks", "Salespersons and Personal Service Workers" (Salespersons), "Plant and Machine Operators and Drivers" (Operators) and "Laborers and Related Workers" (Laborers).

For many purposes, it is useful to work with summary measures of the occupational status of immigrants. The main measure of occupational prestige used in Australia is the ANU3 status attainment scale.[13] The ANU3 measure has its origin in the prestige ratings of occupations developed in ANU1 and ANU2 indices (Broom, et al., 1977, Jones 1988). The original ANU indices were obtained from a survey that

[12] This procedure will result in a more shallow "U" than if there were data on what was literally the very first job after arrival.

[13] Similar measures have been developed for the United States (see, for example, Featherman, et al. 1975) and the United Kingdom (see, for example, Goldthorpe and Hope 1974).

asked individuals in medicine, law, teaching and social work occupations to give a rating on a 9-point numeric scale of the general standing of 54 occupations. Regression analysis was then used to link these survey responses to the characteristics of the occupations so that an occupational status scale could be predicted for all occupations. These characteristics included sex, age, birthplace, parent's birthplace, schooling, educational qualifications, housing facilities, and vehicles, among other characteristics.

The ANU3 scale, developed by Jones (1989), measures relative differences in labor market power (authority), occupational prestige, occupational requirements (education and qualifications), and occupational rewards (earnings). The scale ranges from a minimum of zero (ASCO unit group 8901: Ushers and Door Attendants), to a maximum of 100 points (unit group 2303: Specialist Medical Practitioners).[14] Jones 1989 points out that although the ANU3 scale is based on prestige ratings, it is not strictly equivalent to a prestige scale. Some occupations enjoy a social standing higher than their socioeconomic status as measured by earnings would suggest, such as ministers of religion, dancers, writers and artists. For some other occupations (*e.g.* chiropractors), the opposite holds. The ANU3 scale has elements of a prestige scale and a measure of socioeconomic status.

The other variables used in the analysis include:

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[14] The ANU3 Score is an index of occupational prestige scores developed for Australia (see Jones 1989). The means and standard deviations of the ANU3 score for the eight major occupational categories for the Australian workforce are as follows:

Occupation	Mean ANU3 Score	Standard Deviation of ANU3 Score
Professionals	64.95	11.38
Managers and Administrators	52.35	11.96
Para-Professionals	44.66	7.84
Tradespersons	25.41	6.72
Clerks	27.13	5.05
Salespersons	27.00	9.13
Operators	12.09	5.22
Laborers	9.45	5.55

(1) Age – measured in years,

(2) Education Attainment – measured as years of education,

(3) ESDC – dichotomous variable equal to unity if born in an English-speaking developed country (US, UK, Canada and Ireland),

(4) Birthplace concentration – the percentage of the population in the respondent's postcode area born in the same country or region as the immigrant,

(5) Visa Category – Dichotomous variables equal to unity if Refugee (Humanitarian Category), Preferential Family Category, Concessional Family, or Business Skills/Employer Nominated Scheme, with Independent immigrants as the benchmark,[15]

(6) Length – number of weeks that it took the immigrant to obtain his first job in Australia,

(7) Quartiles – A measure of the occupational status (ANU3) of the last permanent job prior to immigration. Q1 is status scores under 26.2, Q2 is 26.2 to just under 40.5, Q3 is 40.5 to just under 62.5, and Q4 is 62.5 or higher,

(8) NoEnglish – Did not speak English at the time of immigration.

The means and standard deviations of these variables for males 15 to 64 years of age at immigration are reported in Appendix A.

[15] The Business Skills/Employer Nominated and Independent Category immigrants are skills tested and can be considered economic migrants. The Concessional Family and Preferential Family Categories are based on kinship to Australians, although the Consessional Family category includes more distant relatives and a "points test" based on skills and age. The Humanitarian Category is primarily refugees.

IV. Empirical Analysis

This section begins with a discussion of descriptive statistics for the occupational mobility of male immigrants in Australia from their pre-immigration job through their jobs in wave 1, wave 2 and wave 3 (3.5 years after immigration). It then proceeds to the multivariate (econometric) analysis of the level and change in occupational status.

(A) Descriptive Statistics

Table 1 reports for the male immigrants the occupational distribution in the last job before migrating and the first job in Australia, regardless of the wave in which the first job was reported. Of the 1,354 males reporting a first job in Australia in wave 1 (five to six months after immigrating), their occupational level was lower than the level held by these same workers prior to immigrating. While 55 percent were professionals or managers/administrators prior to immigration, only 43 percent were in these occupations in their first job reported in wave 1. On the other hand, while only 7.1 percent were in operative and laborer occupations prior to immigration, nearly one-quarter (24.4 percent) reported these occupations as their first job in wave 1. Clearly, there was a decline in occupational status from the last job to the first job.

The immigrants who did not have a first post-immigration job to report until a subsequent wave are included in the third and fourth columns of Table 1. These immigrants took longer to find their first job, either because of unemployment or absence from the labor force. The additions to the sample were less likely to be in high level occupations, and more likely to be in lower skilled occupations. For example, the proportion with a first job in professional and managerial/administrative occupations declines from 43 percent in wave 1 to 36 percent when all three waves are included. This is consistent with findings in the literature that among recent immigrants those with lower levels of skill have higher unemployment and lower labor force participation rates (Chiswick and Hurst 1998, Chiswick and Miller 1997).

The occupational status (ANU3) scores can be used to take advantage of information on detailed occupational status. The ANU3 score for those who reported their pre-immigration occupation and their first occupation in wave 1 declined from 47.9 (standard deviation 23.0) for the pre-immigration occupation to 39.41 (standard deviation 25.6) for the first job. Those who took longer to obtain their first job had lower occupational scores, 36.48 (s.d. 25.2) and 35.74 (s.d. 25.0) when wave 2 and wave 3 are also considered.

Table 2 reports by major occupation group the cross-classification of last pre-immigration and first post-immigration occupation for those who reported both by wave 3. The diagonals in bold are the proportions who remained in their major occupation group. Thus, 57 percent of professionals remained professionals, 34 percent of managers/administrators remained as managers/administrators and 56 percent of laborers also remained in their pre-immigration occupations. In general there is a decline in occupational status. Using the order of the listing as a rough rank ordering, 36 percent of pre-immigration professionals were in occupations lower than that of professionals and managers/administrators. Among para-professionals, 17 percent improved their occupational status, but 52 percent experienced a decrease in occupational status. Among laborers, perhaps the lowest ranked occupational category, 75 percent had their first job in operator or laborer occupations, 22 percent became tradespersons, clerks and salespersons, and less than 4 percent were in higher status occupations.

Table 3 reports the ANU3 score for the post-immigration occupations for the last job in the origin to the first job in wave 1 for the same persons, and then the first job for all those who reported an occupation in wave 3. The scores are reported by the pre-immigration major occupation group. Except for the two lowest occupations, operators and laborers, all the other occupations report a decline from the last occupation to the first occupation. The decline is larger the higher the occupational level.

Those who took more than six months to find a job, that is, they had no job in wave 1 but had one by wave 3, lower the ANU3 score within each pre-immigration occupational category. That is, those who took longer to find a job did less well in their initial job placement than others in their pre-immigration occupational category.

The mean and the standard deviation of the ANU3 score can be computed for the 1,105 males who reported their pre-immigration occupation, their first job and their occupations in waves 1, 2 and 3.[16] The mean ANU3 score declined from 48.2 to 40.8 from the last job to the first job, and then increased from 40.8 to 43.0 from the first job to the job in wave 3 (3.5 years after immigration).

(B) Multivariate Analysis

Table 4 reports the results of the multiple regression (OLS) analysis with the ANU3 occupational status score as the dependent variable. Column (1) is the change

[16] The mean and standard deviation of the ANU3 status attainment score for male immigrants age 15 to 64 years at immigration:

	Mean	Standard Deviation
Pre-Immigration job	48.21	23.02
First job	40.79	25.64
Wave 1	40.99	25.52
Wave 2	42.18	24.82
Wave 3	42.95	24.91

Sample size: 1,105
Source: Longitudinal Survey of Immigrants to Australia

in status, that is, it is the ANU3 score for the first job in Australia minus the score for the last job in the origin. Column 2 is the analysis for the level of the occupational status score for the first job in Australia. Greater pre-immigration human capital (*i.e.*, education, older age at migration) and a greater transferability of skills (born in an English-speaking developed country, speaks English at arrival) result in a more favorable occupational status situation, namely a more positive change and a higher level for the first job. Compared with Independent Migrants, Refugees (Humanitarian visas) and the partially tied movers (the two family categories) have a steeper decline from the last job before immigrating to the first job in Australia, and a lower level for the first job. Only those in the Business Skills/Employer Nominated Scheme have a larger improvement and higher first job level than Independent migrants.

Living in an area where many others of one's country of origin live (Birthplace concentration) enhances occupational status among recent immigrants. This may be due to network assistance in job search. However, those who took longer to obtain their first job (LENGTH) in Australia experienced a larger fall and a lower level of occupational status, although the later effect is not statistically significant.

Those who were in higher status jobs prior to immigration (Quartile 4 compared to Quartiles 1 and 2, with Quartile 3 as the benchmark) experienced the larger fall in occupational status. They also experienced a higher occupational status in their first job.

Column (3) in Table 4 reports the results from the change in status from the current job in wave 3 compared to the first occupation in Australia, while column (4) reports the regression results for the status of the wave 3 job. The improvement was greater for those who spoke English at arrival. Most important for explaining improvements over time was the visa category at entry. Refugees and family migrants experienced a larger improvement in occupation status in this three-year period than did Independent or Business Skills immigrants. The improvement in occupation over the short span of 3 years is greater for those with higher levels of schooling, who immigrated at a younger age, who were not from an English-speaking developed country and who lived among others from the same origin. While these four coefficients have the signs expected from the model, none of them is statistically significant.

The analysis of occupational attainment at wave 3 (Table 4, column 4) indicates that it is higher for those with more schooling, who immigrated from an English-speaking developed country and who entered under skills based visas as distinct from family or refugee visas. Indeed, the rankings are Business Skills, Independent, then Concessional/Family, and lowest for Refugee (Humanitarian) principal applicants.

V. Summary and Conclusions

Based on the immigrant assimilation model, this paper develops hypotheses regarding the occupational mobility of immigrants from their last permanent job in the origin, to their "first" job in the destination, to subsequent jobs in the destination. Due to the less than perfect international transferability of skills there is a decline in occupational attainment from the last job in the origin to the first job in the destination, but due to implicit and explicit post-immigration investments there would then be upward occupational mobility. This is referred to as a U-shaped pattern of occupational mobility. The depth or intensity of the post-migration improvement would be related to the depth or intensity of the decline in occupational status at immigration.

The depth of the U is hypothesized to be greater, the lower the international transferability of skills, the higher the level of skills in the origin, and among refugees and tied movers (family migrants) than among economic migrants.

The model and hypotheses are tested using data on adult (non-aged) male Principal Applicants from the Longitudinal Survey of Immigrants to Australia. Data are available on pre-immigration occupation and the occupation in Australia for the "first" job and the jobs held at wave 1 (six months after migration), wave 2 (one year later) and wave 3 (approximately 3.5 years after migration).

The simple cross-tabulation and econometric analyses (using an occupational status score) are supportive of the hypotheses even though the post-migration period is so brief. Occupational status from the last job to the first job fell by more for those whose skills were less readily transferable and who were Refugees or entered under family categories compared to Independent or Business Skills migrants. Higher levels of pre-immigration skill (schooling and experience) resulted in a smaller decline and a higher occupational level for the first job. The subsequent improvements in occupational status from the first job to the job held in wave 3 was greater for those with higher levels of pre-immigration skills and for refugees and those who entered under the family categories.

The analysis implies that the initial occupational status of immigrants may be a poor approximation of their ultimate occupational attainment. Those who have the highest pre-immigration level of skills, more highly transferable skills and who are economic migrants in contrast to refugees and family migrants appear to have the most successful occupational attainments. Living in an immigrant/ethnic concentration area appears to raise the occupational status of immigrants, although this effect is at the margin of statistical significance. These findings provide guidance for the design of an immigration policy to enhance the labor market success of those that are admitted.

These findings have been limited by the relatively small size of the sample and especially by the relatively short duration in the destination (3 ½ years). Yet they do suggest that the immigrant assimilation model can be used successfully to understand the occupational mobility of immigrants. They also suggest that there is substantial research potential from larger and longer term longitudinal surveys of immigrants.

TABLE 1: Occupational Distributions of Male Immigrants 15-64 Years of Age at Immigration, Longitudinal Survey of Immigrants to Australia
(Percent)

Occupation	(i) Last Job Before Migrating	(ii) First Job in Australia (Wave 1)	(iii) First Job in Australia (Waves 1 & 2)	(iv) First Job in Australia (Waves 1, 2 & 3)
Professionals	37.9	30.0	27.2	26.0
Managers/ Administrators	17.1	12.7	11.0	10.3
Para-Professionals	4.0	2.9	3.5	4.4
Tradespersons	25.3	20.3	18.7	17.3
Clerks	2.6	2.3	3.3	4.3
Salespersons[a]	6.1	7.5	7.9	8.5
Operators[b]	3.3	5.7	6.7	6.8
Laborers[c]	3.8	18.7	21.7	22.5
Total Males	100.0	100.0	100.0	100.0
Sample size	1354	1354	1914	2272

[a]Salespersons include personal service workers.
[b]Operators include plant and machine operators and drivers.
[c]Laborers include laborers and related workers.

Source: Longitudinal Survey of Immigrants to Australia.

TABLE 2: Occupational Change from Last Pre-Immigration to First Post-Immigration Job for Male Immigrants 15-64 Years of Age at Immigration, Longitudinal Survey of Immigrants to Australia (Percent)

	FIRST Post-Immigration Occupation									
Pre-Immigration Occupation[a]	Professionals	Managers/ Admin-istrators	Para-Professionals	Trades-persons	Clerks	Salespersons	Operators	Laborers	Total[b], [c]	% Distribution[c]
Professionals	**57.3**	7.0	3.8	5.4	5.1	5.0	2.7	13.6	100.0	32.3
Managers/ Administrators	9.6	**34.0**	1.6	9.7	3.0	10.0	10.2	21.9	100.0	14.3
Para-Professionals	15.2	2.2	**30.1**	12.0	5.6	7.8	8.8	18.3	100.0	5.4
Tradespersons	0.7	1.7	1.9	**56.4**	0.5	3.4	6.4	29.0	100.0	26.8
Clerks	6.0	0.8	1.8	2.0	**23.7**	24.4	1.7	39.6	100.0	3.8
Salespersons	11.3	4.2	0.0	5.3	2.5	**28.5**	10.7	37.7	100.0	9.3
Operators	1.5	0.3	0.0	11.5	0.0	7.2	**36.0**	43.5	100.0	3.1
Laborers	0.9	0.4	2.3	12.5	1.3	8.0	18.6	**56.0**	100.0	5.0
% Distribution[c]	22.3	8.2	3.8	20.4	3.7	8.6	7.6	25.4	100.0	100.0

[a]Salesperson include personal service workers; Operators include plant and machiner operators and drivers; Laborers include laborers and related workers.
[b]The total number of cases is 2039. All data are weighted using sample weights to reflect a population of 25,629.
[c]Total may not sum to 100.0 due to rounding.

Source: Longitudinal Survey of Immigrants to Australia

TABLE 3: Means of ANU3 Status Attainment Score for First Jobs in Australia by Pre-Immigration Occupational Group for Male Immigrants 15-64 Years of Age at Immigration, Longitudinal Survey of Immigrants to Australia

Pre-immigration Occupation[a]	Last Job Before Migrating	Wave 1[b]	Wave 3[c]
Professionals	67.96	55.78	49.82
Managers/ Administrators	61.16	46.95	43.54
Para-Professionals	41.59	34.79	33.61
Tradespersons	26.62	21.83	20.13
Clerks	25.83	25.46	24.37
Salespersons[a]	31.65	26.40	23.43
Operators	13.62	15.25	14.24
Laborers	10.54	15.42	14.33
Total	47.90	39.41	35.74
Sample size	1354	1354	2273

[a] Salespersons include personal service workers; Operators include plant and machine operators and drivers; Laborers include laborers and related workers.
[b] Means for the first job for those immigrants who had obtained a job in Australia by the time of the wave 1 interview.
[c] Means for the first job for the larger group of immigrants who had obtained a job in Australia by the time of the wave 3 interview.

Source: Longitudinal Survey of Immigrants to Australia

TABLE 4: Status and Changes in Status of Jobs in Australia of Males Immigrants 15- 64 Years of Age at Immigration, Longitudinal Survey of Immigrants to Australia

Variable	(1)[a]	(2)[b]	(3)[c]	(4)[d]
Constant	-44.244 (6.08)	-2.024 (0.27)	2.197 (0.67)	-13.953 (3.65)
Education	0.738 (3.88)	1.277 (6.59)	0.172 (1.03)	3.380 (17.70)
Age at migration	1.358 (3.75)	1.485 (4.02)	-0.046 (0.73)	0.113 (1.48)
(Age at migration)^2	-0.017 (3.62)	-0.019 (3.94)	(e)	(e)
English-speaking developed countries	8.038 (6.09)	8.572 (6.37)	-1.393 (0.98)	7.711 (4.41)
Visa Category (Independent)				
Refugee (Humanitarian)	-11.191 (6.16)	-12.361 (6.67)	3.430 (2.10)	-17.131 (9.78)
Preferential Family	-6.358 (5.85)	-6.966 (6.28)	2.477 (2.32)	-8.332 (6.43)
Concessional Family	-6.562 (4.77)	-7.078 (5.04)	1.719 (1.23)	-8.236 (4.77)
Business Skills/ENS[f]	13.021 (7.04)	15.337 (8.13)	-0.928 (0.50)	15.934 (7.13)
Birthplace concentration	0.239 (2.73)	0.156 (1.75)	0.052 (0.61)	0.191 (1.80)
Length (weeks)	-0.027 (1.97)	-0.017 (1.20)	-0.017 (1.33)	(e)
No English at arrival	-3.258 (2.63)	-4.497 (3.56)	-3.062 (2.60)	(e)
Quartile 1	14.142 (11.20)	-17.659 (13.72)	(e)	(e)
Quartile 2	4.150 (3.47)	-14.783 (12.11)	(e)	(e)

Quartile 4	-18.039 (14.73)	0.985 (0.79)	(e)	(e)
$\overline{R}^2$	0.309	0.466	0.008	0.390
Sample size	1678	1678	1296	1378

Note: 't' statistics in parentheses.

[a]Changes in status between pre- and post-immigration jobs.
[b]Status of first job in Australia.
[c]Changes in status of jobs held at time of wave 3 interview and first jobs in Australia.
[d]Status of job held at wave 3 interview.
[e]Variable not entered.
[f]ENS denotes Employer Nomination Scheme.

Source: Longitudinal Survey of Immigrants to Australia

REFERENCES

Australian Bureau of Statistics (1990). *Australian Standard Classification of Occupations* (First Edition), Australian Bureau of Statistics, Canberra.

Australian Bureau of Statistics (2000). *Australian Economic Indicators*, Catalogue 1350.0, December, Australian Bureau of Statistics, Canberra.

Borjas, George (1985). "Assimilation, Changes in Cohort Quality, and the Earnings of Immigrants", *Journal of Labor Economics*, Vol. 3, No. 4, pp. 463-489.

Borjas, George (1989). "Immigrant and Emigrant Earnings: A Longitudinal Study", *Economic Inquiry*, Vol. 27, No. 1, pp. 21-37.

Broom, Leonard, Paul Duncan-Jones, Frank L. Jones and Patrick McDonnell (1977). 'Investigating Social Mobility', Department of Sociology, the Research School of Social Sciences, Departmental Monograph no. 1, Australian National University.

Brown, Randall S., Marilyn Moon and Barbara S. Zoloth (1980). "Occupational Attainment and Segregation by Sex", *Industrial and Labor Relations Review*, Vol. 33, No. 4, pp. 506-517.

Chiswick, Barry R. (1977). "A Longitudinal Analysis of the Occupational Mobility of Immigrants" in Barbara D. Dennis, ed. *Proceedings of the 30th Annual Winter Meetings, Industrial Relations Research Association*, Madison, IRRA, pp. 20-27.

Chiswick, Barry R. (1978). "The Effect of Americanization on the Earnings of Foreign-Born Men", *Journal of Political Economy*, Vol. 85, No. 5, pp. 897-921.

Chiswick, Barry R. (1979). "The Economics Progress of Immigrants: Some Apparently Universal Patterns", in William Fellner, ed. *Contemporary Economic Problems 1979*, American Enterprise Institute, Washington, pp. 357-399.

Chiswick, Barry R. (1980). *An Analysis of the Economic Progress and Impact of Immigrants*, National Technical Information Services, NTIS No. PB80-200454, Washington, August 1980.

Chiswick, Barry R. (1982). *The Employment of Immigrants in the United States*, American Enterprise Institute, Washington.

Chiswick, Barry R. (1986). "Is the New Immigration Less Skilled than the Old?" *Journal of Labor Economics*, Vol. 4, No. 2, pp. 168-192.

Chiswick, Barry R. and Michael Hurst (1998). "The Labor Market Status of Immigrants: A Synthesis", in Hermann Kurthen, et al., eds., *Immigration, Citizenship and the Welfare State in Germany and the United States: Immigrant Incorporation*, JAI Press, Stamford, CN, pp. 73-94.

Chiswick, Barry R. and Paul W. Miller (1985). "Immigrant Generation and Income in Australia", *Economic Record*, Vol. 61, No. 173, pp. 540-553.

Chiswick, Barry R. and Paul W. Miller (1997). "Literacy, Numeracy and the Labour Market", in *Aspects of Literacy: Assessed Skill Levels*, Australian Bureau of Statistics, Canberra, Catalogue No. 4228.0, pp. 73-79.

Chiswick, Barry R. and Paul W. Miller (forthcoming). "The Complementarity of Language and Other Human Capital: Immigrant Earnings in Canada" *Economics of Education Review*.

Duleep, Harriet and Mark Regets (1996). "The Elusive Concept of Immigrant Quality: Evidence from 1970-1990", Discussion Paper PRIP-UI-41, Program for Research on Immigration Policy, Urban Institute, Washington, DC.

Duleep, Harriet and Mark Regets (1997). "Measuring Immigrant Wage Growth Using Matched CPS Files", *Demography*, Vol. 34, No. 2, pp. 239-249.

Featherman, David L., Frank L. Jones and Robert M. Hauser (1975). "Assumptions of Social Mobility Research in the US: The Case of Occupational Status", *Social Science Research*, Vol. 4, pp. 329-360.

Goldthorpe, John H. and Keith Hope (1974). *The Social Grading of Occupations: A New Approach and Scale*, Clarendon Press, Oxford.

Jones, Frank L. (1988). "Stratification Approaches to Class Measurement", *Australian and New Zealand Journal of Sociology*, Vol. 24, No. 2, pp. 279-284.

Jones, Frank L. (1989). "Occupational Prestige in Australia: A New Scale", *Australian and New Zealand Journal of Sociology*, Vol. 25, No. 2, pp. 187-199.

Leigh, Duane E. (1975). "Occupational Advancement in the Late 1960s: An Indirect Test of the Dual Labor Market Hypothesis", *Journal of Human Resources*, Vol. 11, pp. 155-171.

Miller, Paul W. and Paul A. Volker (1985). "Economic Progress in Australia: An Analysis of Occupational Mobility", *Economic Record*, Vol. 61, No. 172, pp. 463-475.

Nickell, Stephan (1982). "The Determinants of Occupational Success in Britain", *Review of Economic Studies*, Vol. 49, pp. 43-53.

Schmidt, Peter and Robert P. Strauss (1975). "The Prediction of Occupation Using Multiple Logit Models", *International Economic Review*, Vol. 16, No. 2, pp. 471-486.

APPENDIX A

TABLE A1: Means and Standard Deviations of Variables, Male Immigrants 15-64 Years of Age at Immigration, Longitudinal Survey of Immigrants to Australia.

Variable	Mean	Standard Deviation	Variable	Mean	Standard Deviation
Socioeconomic			*Visa Category*		
ANU3 status score	35.429	25.041	Refugee	0.082	0.275
Age	34.166	8.040	Preferential Family	0.246	0.431
Educational Attainment	15.079	2.998	Concessional Family	0.249	0.432
Birthplace Concentration	2.670	4.357	Business Skills/ENS[a]	0.185	0.388
No English at arrival	0.294	0.456	Independent	0.239	0.427
Length (weeks) to first job	25.892	36.954	*Pre-Immigration Skill Level*		
			Quartile 1[b]	0.223	0.416
Birthplace			Quartile 2	0.215	0.411
English-speaking Developed Countries	0.095	0.293	Quartile 3	0.247	0.432
			Quartile 4	0.315	0.465

[a]ENS denotes Employer Nomination Scheme.
[b]The quartiles are formed using unweighted data for all workers. Deviations from 0.25 are due to the restriction of the sample to males and the use of weighted data.

Source: Longitudinal Survey of Immigrants to Australia.