

MIGRATION IN MALAYSIA: HETEROGENEITY AND PERSISTENCE

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November, 1996

Regional disparities in earnings persist over time. This paper assesses the sources of persistence that impede people from migrating despite the income gains they would realize. A decision-making model is developed that is consistent with the underlying microeconomic theory and incorporates dynamic aspects of the migration decision. Unobserved heterogeneity is estimated by a new method, suitable for longitudinal data on individuals, which avoids the problems of parametric two-step techniques. The estimator is a simple, general method for calculating individual effects in nonlinear models.

Malaysian male migrants exhibited risk averse behavior, avoiding regions with high earnings variance, despite any search-theoretic motive to seek them out. The unobserved characteristics which raise people's earnings (unobserved heterogeneity) made these people more likely to migrate, in a way quite similar to education. Who is left behind by the regional disparities in growth? All but the young and unmarried, those who must travel far or have never moved before, and to a lesser degree, the less educated.

I would like to thank Pranab Bhardan, Art Havenner, Tran Lien Huong, Alain de Janvrie, Ronald Lee, Bryan Lincoln, Dan Mcfadden, Jim Powell, and Ken Train for helpful comments, and Christine Peterson for patient answers about the data. An earlier version of this paper was presented in seminars at Berkeley, Davis, Riverside, Arizona, and the 1996 Population Association of America meetings in New Orleans.

1. INTRODUCTION

Economics growth occurs unevenly across the regions of a country. Migration from the regions of stagnation to the regions of growth helps to mitigate regional disparities. But migration is an imperfect adjustment mechanism, impeded by personal attachments and inertia. People differ in their ability to take advantage of opportunities far from home. This paper measures the sources of persistence that cause people not to migrate despite likely income gains to try to answer the question “Who is left behind?” by the regional imbalances in growth.

Estimating the influence of factors affecting migration presents particular statistical problems. First, one of the main variables of interest, the potential income of migrants in different regions, cannot be observed except in the region chosen by the migrant. Income opportunities in other regions must be inferred in order to estimate the influence of income and other variables on migration. The usual method for doing this, a self-selection correction, has several problems when applied to migration.

A second statistical issue is the dynamic nature of migration. By definition, migration is a change from one time period to the next, and it affects the course of the migrant's life far into the future. The dynamic nature of migration is usually ignored when specifying an estimation model for migration.

Inferring the income prospects of migrants in the regions they decide *not* to settle is easy if migrants are the same as non-migrants. One can simply attribute the average income of people with similar characteristics in the other regions as the income prospects of the migrant in those other regions. However, if migrants are characteristically different from non-migrants in ways that affect their income, but are not observed by the researcher, this attribution is not appropriate. There are reasons to think that migrants are characteristically different. As Kuznets put it:

[U]nless we are willing to assume that such selection is exclusively a matter of push produced by the incidence of failure, and one that betokens a concentration among the migrants of failures and misfits, it must be allowed that the migration choice reflects either some venturesomeness and courage - since even under fairly adverse economic conditions, short of downright starvation, many may feel that it is the better part of valor to stay at home - or a greater responsiveness to economic than to other attractions. (Kuznets, 1964, p. xxxii, quoted in Schmertmann, 1988)

Migrants, perhaps due to this “venturesomeness”, are found to have a higher income than non-migrants with the same observable traits (Mazumdar, 1981). If the lower income of non-migrants is attributed to migrants, this can lead to faulty inferences about the effect of income and other factors on migration. This is a problem of *unobserved heterogeneity*, or differences between the decision-makers which affect the decisions they make, but which are not observed by the researcher. The usual method to correct for unobserved heterogeneity in migration is to assume a parametric form (almost always normal) for the correlation between income and the probability of moving, and use a two step procedure (as in Heckman, 1979) where the first stage estimate of the probability of moving is used to correct the second-stage income estimates for migrants. This correction method has two problems when applied to migration. First, since the probability of moving is used to correct the income estimates, and income is an

explanatory variable for the probability of moving, the correction method introduces simultaneity between the income and migration equations. The first stage must be estimated in reduced form which is very difficult if the model is dynamic. Second, estimated income is used as an instrument for actual income in the migration estimation which will not provide consistent estimates of the parameters since the migration estimation is a nonlinear discrete choice. Furthermore these correction methods are generally inefficient and lack robustness to the parametric assumptions.¹

This paper presents a general method for calculation individual effects in discrete choice models which is used to estimate unobserved heterogeneity in migration. The method is simple to calculate but requires panel data with a long panel. It does not require conditioning like Chamberlain's (1980) model of fixed effect estimates for the logit model, nor parametric assumptions like Heckman's heterogeneity correction. The estimation method is a complement to Chamberlain's since his method is only feasible for short panels.

The individual effects method provides direct estimates of the effect of unobserved heterogeneity on migration, and its simple form makes it feasible to incorporate more realistic dynamics. The framework provides estimates of the sources of persistence in terms of income equivalent, giving a measurement of their impact on migration. I use Malaysian data to measure the importance of the factors which cause people not to move despite potential income gains as well as test several theoretical results about migration.

The next section briefly describes and critiques two typical estimation models of migration with unobserved heterogeneity. I present a new model that addresses the problems with the earlier models. Section 3 describes the method of estimating individual effects in discrete choice models, and Section 4 incorporates dynamics. Section 5 discusses migration in Malaysia and the data used for estimation. Section 6 describes the model estimation, and Section 7 presents the results. Section 8 concludes.

2. MIGRATION MODELS WITH UNOBSERVED HETEROGENEITY

Most estimation models of migration fall into two categories: "move-stay" models and "choice of location" models. Move-stay models characterize the migration decision as a choice of migrating or staying put without specifying any specific destinations (Da Vanzo & Hosek 1981, Robinson & Tomes 1982, Tunali 1985, Pessino 1991, Vijverberg 1994). This specification is easy to calculate, but does not include any region specific information. In particular, it does not include the effect of potential income gains on migration, probably the most important determinant of migration.²

Since income is not an argument in the migration equation, there is no problem of simultaneous equations or instrumental variables mentioned above. Migration in this model occurs with no regard for the intended destination nor for income prospects there,

¹Schmertmann (1994) discusses the inefficiency of the two-stage self-selection correction methods and particularly criticizes the restrictions implicit in Lee's (1983) method, which is the most convenient to calculate for a multinomial migration choice. Goldberger (1983) and Lee (1981a) provide evidence of the sensitivity of the two-stage estimates to the parametric assumptions about the error distribution.

²For example, Mazumdar (1987, p. 1107) writes "Almost all migration research in developed and developing countries comes to the strong conclusion...that gross migration flows are very sensitive to income differences."

so the specification estimates some of the correlates of migration rather than embodying the individual's decision to migrate.

Choice of location models (Falaris 1987, Schmertmann 1988) do incorporate region-specific information including income. The cost is that with more than two regions, the model becomes a multinomial rather than a binomial choice problem. Two-step Heckman-type heterogeneity correction becomes very cumbersome in multinomial models, especially when the simultaneity between the income and migration equations is taken into account. The main drawback of these choice of location models is that they describe the decision of where to live without reference to whether or not the person must move there, i.e. there is no decision to *migrate*. This means the heterogeneity correction does not capture the intuition that migrants are characteristically different from non-migrants. Instead it corrects for people in certain *locations* being different in a way that affects their income, whether they are migrants or not.

A Static Model with Individual Effects

Migrants maximize expected utility across regions with uncertain job prospects. The migrant i chooses a region k to maximize expected utility u_{ki}^e . The expected utility of a location is:

$$u_{ki}^e = \gamma_y y_{ki}^e + \gamma_k' \mathbf{z}_i + \rho_k \mu_i + \varepsilon_{ki} \quad (2.1)$$

where u_{ki}^e is the expected utility of residing in region $k \in \{1, \dots, L\}$ for person $i \in \{1, \dots, N\}$. y_{ki}^e is the income expected by person i in region k , and \mathbf{z}_i is a vector of observed characteristics of the person, and μ_i is an unobserved individual characteristic known to the migrant. γ_y , γ_k , and ρ_k are parameters, and ε_{ki} is an error term that captures unobserved variations in taste among individuals as well as errors in perception and optimization by the migrants. We do not observe individuals' utility in each region, but we do observe where they have chosen to live, so we have an indicator of which region has the highest utility. Let d_{ki} be a binary variable that equals 1 if person i chooses to live in region k , and 0 if he or she does not. Let $\Delta u_{(k,l)i} \equiv u_{ki}^e - u_{li}^e$. Then d_{ki} is an indicator variable for the latent variable $\Delta u_{(k,l)i}$ where

$$\begin{aligned} d_{ki} &= 1 \text{ if } \Delta u_{(k,l)i} \geq 0 \text{ for } l = 1, \dots, L \\ d_{ki} &= 0 \text{ otherwise.} \end{aligned} \quad (2.2)$$

The probability that the migrant will choose to live in region k is given by:

$$(2.3)$$

The unobserved individual characteristic, μ_i , which affects choice of location also affects the migrant's income:

$$y_{ki} = \beta_k' \mathbf{x}_i + \mu_i + \eta_{ki} \quad (2.4)$$

where y_{ki} is the income of person i in region k , \mathbf{x}_i is a vector of explanatory variables for person i , β_k is a vector of parameters, and η_{ki} is a mean zero error term. μ_i is the

unobserved individual characteristic known to the migrant, which also appears in Equation 2.3.³

If we assume that the migrant's expectations are rational, i.e. the migrant forms his or her expectation the same way the statistician does, then expected income

$$y_{ki}^e = E(y_{ki}) = \beta_k' \mathbf{x}_i + \mu_i \quad (2.5)$$

because $E(\eta_{ki}) = 0$.

If μ_i is not separately estimated, μ_i is part of the error terms in Equations 2.3 and 2.4. If the migration decision is estimated ignoring the unobserved heterogeneity, and μ_i is correlated with other individual characteristics \mathbf{z}_i in Equation 2.4 then none of the parameters in the equation will be estimated consistently. If we have multiple observations on each person, though, we can calculate the unobserved characteristics of each person as a residual fixed effect in the income equation, and net out its influence on earnings and choice of location directly.

The unobserved heterogeneity in this model allows for a correlation between unobserved individual characteristics that both affect people's income and what region they want to live in, similar to the “choice of location” models. For instance, an ambitious person may both have high income and want to live in the city or a rapidly growing region. The traditionalist may earn a lower income and prefer to live in a more tranquil rural area. However, this still does not capture the intuition about unobserved heterogeneity, as expressed by Kuznets above. The main concern is that people who *move* are characteristically different from those who stay, not that people who live in a certain region are different from those who like to stay in other regions. To capture a characteristic difference of *migrants*, it is necessary to make the model dynamic.

3. A GMM INDIVIDUAL EFFECTS ESTIMATOR

The model in the previous section includes individual fixed effects (μ_i) and region-specific parameters (β_k) in a first-stage linear regression (2.4) which also occur in a second-stage nonlinear estimation (2.3). The fixed effects and other parameters are estimated in the first stage and substituted for the true parameter values in the second stage to estimate the remaining second stage parameters. The consistency and asymptotic normality of the second stage estimates can be demonstrated by applying Newey's (1984) results for sequential generalized method of moment (GMM) estimators.

Suppose that w_i ($i = 1, \dots, N$) are observations on a $p \times 1$ random variable w , which are drawn from a stationary population. Let β be a $q \times 1$ vector of parameters with population moment β_0 , and γ be an $r \times 1$ vector of parameters with population moment γ_0 . Let $g(w; \beta)$ and $h(w; \beta, \gamma)$ be $q \times 1$ and $r \times 1$ vectors of functions, and $g_N(\beta) = \sum_{i=1}^N g(w_i, \beta) / N$ and $h_N(\beta, \gamma) = \sum_{i=1}^N h(w_i, \beta, \gamma) / N$ be vectors of sample moments. The method of moment estimators $\hat{\beta}$ and $\hat{\gamma}$ are based on the population moment conditions $E[g(w_1, \beta_0)] = 0$ and $E[h(w_1, \beta_0, \gamma_0)] = 0$, and are

³ Venturesomeness may be a trait which declines with age, so that it would not be fixed for the individual. As long as age is included as a regressor in the income and choice equations, though, this presents no estimation problems. Age is likely to be included for other reasons besides capturing the trend in venturesomeness, in which case the effect of age on venturesomeness could not be identified separately from its influence for other reasons.

obtained by setting

$$g_N(\hat{\beta}) = 0 \text{ and } h_N(\hat{\beta}, \hat{\gamma}) = 0. \quad (3.1), (3.2)$$

By stacking g and h , we can form a single moment function

$$f_N(\hat{\beta}, \hat{\gamma}) \equiv [g_N(\hat{\beta})', h_N(\hat{\beta}, \hat{\gamma})']' = 0 \quad (3.3)$$

Newey had the insight that the sequential estimation of $\hat{\beta}$ from $g_N(\hat{\beta}) = 0$ and $\hat{\gamma}$ from $h_N(\hat{\beta}, \hat{\gamma}) = 0$ taking $\hat{\beta}$ as known, can be interpreted as a simultaneous solution to generic GMM problem in 3.3, and the properties of the GMM estimates of β and γ obtained from $f_N(\hat{\beta}, \hat{\gamma})$ (from Hansen 1982) apply to the sequential estimates.

Assume regularity conditions (i)-(iv) of Newey (1984, p.202). Assume also that

$$E[g(w_1, \beta) h(w_1, \beta, \gamma)'] = 0. \quad (3.4)$$

Then Newey shows that

$$\sqrt{N}(\hat{\gamma} - \gamma_0) \xrightarrow{d} N(0, V_\gamma + H_\gamma^{-1} H_\beta V_\beta H_\beta' H_\gamma^{-1}) \quad (3.5)$$

where V_γ is the covariance of $\hat{\gamma}$ treating β_0 as known, $H_\gamma \equiv E[\partial h(w_1, \beta_0, \gamma_0) / \partial \gamma]$, $H_\beta \equiv E[\partial h(w_1, \beta_0, \gamma_0) / \partial \beta]$, and V_β is the covariance of $\hat{\beta}$ from 3.1. If the second stage estimator $\hat{\gamma}$ is a maximum likelihood estimator, then $H_\gamma^{-1} = -V_\gamma$.

Newey's condition (iii) is a restrictive assumption: the moment functions $g(w; \beta)$ and $h(w; \beta, \gamma)$ are serially uncorrelated. However, this assumption is relaxed in Hansen (1982) and 3.5 remains valid with more complicated covariance matrices.

Newey's assumptions also require that the first stage estimates $\hat{\beta}$ are consistent, so if $\hat{\beta}$ includes fixed effects estimates, the panel data must have enough observations per individual for the fixed effects to be estimated consistently. Newey dispenses with the assumption in 3.4, allowing for cross-correlation between $g(w; \beta)$ and $h(w; \beta, \gamma)$ which results in a more complicated asymptotic covariance matrix for $\hat{\gamma}$, but 3.4 is likely to hold in most applications.⁴

Result 3.5 can be applied to estimation of individual effects in a discrete choice model. The trick is to choose a simple-to-estimate first stage to obtain estimates that replace hard-to-estimate parameters in the second. The model in the previous section estimates parameters in a first stage linear regression (2.4) which are substituted for the true parameters in a second stage non-linear regression (2.3). By showing that this model fits in the GMM framework above, we know the second stage estimates are consistent and asymptotically normal.

The region-specific income equation for region k from 2.4 is

$$y_{ki} = \beta_k' x_i + \mu_i + \eta_{ki}.$$

Stacking the L regions for each person i ,

$$y_i = W_{gi} \beta + e_{gi}$$

where $y_i \equiv (y_{i1}, \dots, y_{iL})'$ and W_g is an $L \times (JL + N)$ matrix where J is the number of elements in x_i , and N is the number of individuals in the sample. W_g is made up of an $L \times JL$ matrix with x_i 's on the diagonal and zeros elsewhere, and an $L \times N$ matrix with

⁴ An example where 3.4 would not hold is a model of self-selection bias.

a column of ones in the i^{th} column and zeros elsewhere. $\beta \equiv (\beta_1', \dots, \beta_L', \mu_1, \dots, \mu_N)'$ and $e_{gi} \equiv (\eta_{1i}, \dots, \eta_{Li})$. The mean zero moment function for estimating the individual fixed effects and the region-specific income parameters is then $g(w_i, \beta) \equiv W_{gi}' e_{gi}$.

The log likelihood of an individual choosing between L alternatives as in 2.3 is $l_i = \sum_{k=1}^L d_k \ln P_k$ where the individual subscript i is suppressed from d_k and P_k , and $P_k \equiv P(d_k = 1)$. The first order conditions for maximum likelihood estimation of the

parameters γ are $\frac{\partial l_i}{\partial \gamma} = \sum_k \frac{d_k}{P_k} \frac{\partial P_k}{\partial \gamma}$. Since $\sum_k P_k \equiv 1$ then $\sum_k \frac{\partial P_k}{\partial \gamma} \equiv 0$ and

$\frac{\partial l_i}{\partial \gamma} = \sum_k \frac{d_k - P_k}{P_k} \frac{\partial P_k}{\partial \gamma}$. Let $e_{hi} \equiv \left(\frac{d_1 - P_1}{P_1}, \dots, \frac{d_L - P_L}{P_L} \right)'$ be a vector of mean zero

“errors” and $W_{hi} \equiv \frac{\partial P_1}{\partial \gamma}, \dots, \frac{\partial P_L}{\partial \gamma}$ be a matrix of weights, then define the moment

function $h(w_i, \beta, \gamma) \equiv W_{hi}' e_{hi}$.

This framework can be applied generally to the estimation of individual effects in nonlinear models. If the individual effects also occur in a related linear equation, and the nonlinear estimation is GMM, then consistent estimates of the fixed effects in the linear equation can be substituted for the actual fixed effects in the nonlinear equation. The proviso is that the data used for the estimation of the linear fixed effects must have sufficiently many observations per individual to provide consistent estimates of the fixed effects. The small sample properties of fixed effects estimators depend on the number of observations per individual (or firm, etc.) rather than the number of individuals or the total sample size. The number of observations per individual necessary to achieve acceptable accuracy in the second stage parameter estimates of the sequential method is difficult to judge. The accuracy of the first stage fixed effects is not of interest per se, and the accuracy of the second stage parameter estimates will depend on the nonlinearity of the model. On a crudely practical note, though, using first stage fixed effects estimates subject to error is no different from using other variables subject to measurement error in discrete choice estimation, such as reported expenditure or years of schooling in place of education.

This method of estimating discrete choice models with individual effects complements Chamberlain's (1980) method of calculating fixed effects directly in logit models. Chamberlain's method is only computationally practical for panels with less than ten observations per individual, while the sequential estimation used here requires at least ten observations per individual to get consistent estimates. The sequential method also has advantages. Chamberlain's method conditions out all the variables which are constant for the individual such as sex, education, race, etc., so no independent effect of these variables can be estimated. The sequential method makes it possible to estimate parameters as well as interactions between the fixed effects and other variables. The first stage estimation often gives a useful metric for evaluating the influence of the fixed effects in the second stage estimation. For example, the fixed effects in the migration estimation from the first stage have the units of income.

4. DYNAMICS

Without dynamics, there is no migration. There are just people living in different places. Migration is inherently dynamic; it means that a person lives in a different place this period than he or she did last period. Moreover, factors may affect whether people move in a different way than they affect where people live. For example, an educated person may prefer to live in a certain location, but she may also be more mobile than others so that she would be more likely to move away from such a location once she is there.

The most obvious dynamic factors in migration are the costs of migration, which are incurred only when location is different from one period to the next. These costs are more than just the monetary costs of transportation and moving belongings. They include the utility cost of losing contact with family and friends, the transaction costs of selling off and repurchasing land, housing, and possessions, and losing the familiarity and knowledge of home that Da Vanzo (1981) calls “location-specific capital”. These utility costs are likely to be substantial for migration.

The benefits of migration also have a dynamic component. In accordance with viewing migration as an investment decision (Sjaastad, 1962), migrants will consider their whole expected future stream of income at each location, not just their expected current income, when choosing the best location. Expected income in future time periods affects the migration decision.

The costs of moving and the value of the future stream of benefits enter the model as follows. Expected utility of location k for individual i in time $t \in \{1, \dots, \tau_i\}$ is

$$u_{kit}^e = \gamma_y \sum_{s=t}^T y_{kit}^e \delta^{s-t} - \gamma_c \mathbf{c}_{kit} \cdot \mathbf{l}(d_{kit} \neq d_{ki(t-1)}) + \gamma_d \sum_{s=1}^t d_{ki(t-s)} + \gamma_k \mathbf{z}_{it} + \varepsilon_{kit} \quad (4.1)$$

The first term on the right hand side is the present discounted value of the stream of expected future earnings. δ is the subjective rate of discount, assumed to be the same for all individuals. T is the time horizon for the migrant, the end of his working life. \mathbf{c}_{kit} is a vector of variables which affect the cost of moving (e.g. distance), and $\mathbf{l}(\cdot)$ is an indicator function which equals 1 if the condition in the parentheses is true and 0 otherwise. The costs of moving are only incurred if the person actually moves: if location this period does not equal location last period, or $d_{kit} \neq d_{ki(t-1)}$. The third term is locational tenure, or the number of years that the person has already lived at this location.⁵ The fourth term, \mathbf{z}_{it} , is a vector of individual characteristics. γ_y , γ_c , γ_d , and γ_k are parameters to be estimated.

⁵If only uninterrupted tenure in a location affects utility (i.e. all previous locational capital is lost at each move) the tenure term in Equation 4.1 would have the form of $\gamma_d \sum_{s=1}^t \prod_{r=0}^{s-1} d_{ki(t-r)}$.

The probability of living in region k is

$$\begin{aligned}
 P(d_{kit} = 1) = P \left\{ \varepsilon_{lit} \cdot \varepsilon_{kit} \leq \gamma_y \left(\sum_{s=t}^T y_{kit}^e \delta^{s-t} \cdot \sum_{s=t}^T y_{lit}^e \delta^{s-t} \right) \right. \\
 \left. \cdot \gamma_c \left(\mathbf{c}_{kit} \cdot 1(d_{kit} \neq d_{ki(t-1)}) \cdot \mathbf{c}_{lit} \cdot 1(d_{lit} \neq d_{li(t-1)}) \right) \right. \\
 \left. + \gamma_d \left(\sum_{s=1}^t d_{ki(t-s)} \cdot \sum_{s=1}^t d_{li(t-s)} \right) + \mathbf{z}_{it}' (\gamma_k \cdot \gamma_l); \quad \forall l \right\} \quad (4.2)
 \end{aligned}$$

The dynamic nature of the model is clear from the lagged dependent variables, $d_{ki(t-s)}$, on the right hand side of the equation.

The income equation in the dynamic model is the same as income in Equation 2.5 with the addition of the time subscript t :

$$y_{kit} = \beta_k' \mathbf{x}_{it} + \mu_i + \eta_{kit}. \quad (4.3)$$

The fixed effect μ_i does not appear explicitly in Equation 4.1, but it enters in two possible places. When the unobserved characteristic is part of \mathbf{z}_{it} , it indicates that persons with that characteristic have an affinity for certain locations as in the static model; the characteristic does *not* indicate they have a particular propensity to migrate. If the unobserved characteristic μ_i in the income equation is positively correlated with a propensity to migrate, it enters Equation 4.1 as part of \mathbf{c}_{kit} , since people with a high μ_i have a lower utility cost of migration. This is the specification that corresponds to the hypothesis that migrants are characteristically different from non-migrants, as expressed by Kuznets above.

5. DATA ON MALAYSIAN MIGRATION

The Malaysian economy has undergone great structural change during the rapid economic growth since Independence from the British in 1957. The average annual growth rate of GNP per capita was 4% from 1965 to 1988 (World Bank 1990). Malaysia's economy in the 1950s was based in rice and rubber cultivation and tin mining. By the 1980s the leading sectors were food processing, assembly industries and tropical oils exports. Natural rubber remained a leading export due to remarkable productivity growth, and rice productivity improved to a lesser extent.

The transformation of Malaysian economy stimulated substantial internal migration. This was likely encouraged because all the main ethnic groups were themselves migrants to the Malaysian peninsula. The Malays who make up about half the population, have migrated to Malaysia for three millennia - in recent centuries, mostly from Indonesia.

The Chinese, who make up a third of the population, have migrated to Malaysia since the 15th century, but most numerous in the mid 19th century to the early 20th century to mine tin on the Malaysian peninsula. The Indians, who make up about 10% of the population, were brought to Malaysia in the early 20th century to work as laborers on British plantations.

Malaysia has not borne the degree of social dislocation and flooding of the cities seen in many industrializing countries. There has been active migration, but most of it is from one rural region to another. The high rate of productivity growth in agriculture aided by government rural development programs, as well as expanded rural educational opportunities, has kept the countryside attractive for Malaysians.

The data used for migration estimation are from the second Malaysian Family Life Survey (MFLS2). MFLS2 is one of the few datasets for a non-industrialized country that provides detailed longitudinal information on migration and labor market experience.⁶ The life histories were collected in peninsular Malaysia covering a period from the early 1950s to the date of the survey in 1988. 1,412 men have suitable information, providing just over 30,000 person-years of data. This paper focuses on male migration because unlike female migration it does not seem to be complicated by the migration prospects of the spouse, as discussed below.

Surveys with recall data like MFLS2 are often considered the poor cousins of panel data surveys, because the survey respondents must remember what happened at different times in the past. However, for migration in particular, recall data have real advantages. Migration itself is usually a memorable event in people's lives, but most importantly, recall data is not subject to sample attrition bias. Almost by definition, migrants are the most susceptible to attrition. If they don't inform the panel surveyors of their moves, they are lost from the panel.⁷

The MFLS2 survey includes life histories of work and migration. The work history records every job held by the survey respondent as well as the starting and ending earnings. The earnings in the intervening years were calculated with a quadratic interpolation, where the rate of curvature with age was estimated from the starting and ending earnings (see Gallup 1994b for details). The MFLS2 migration life history records every change of residence across district boundaries. The seventy-eight districts of peninsular Malaysia are subdivisions of the twelve states. All survey respondents resided in peninsular Malaysia at the time of the survey. For those who migrated from abroad, or left the peninsula and returned, the survey indicates whether they came from the two distant East Malaysian states, or from a foreign country.

Smith, Thomas, and Karoly (1992) find rather good agreement between the reported migration of males (in a part of the MFLS2 survey not used here), and a previous sample of the same men twelve years earlier. There is surely some recall error (probably omission of long-ago moves), but surprisingly Smith *et al.* don't find that the discrepancies between the two surveys are correlated with the time between the move and the survey. This may be because there is little difference between what is forgotten from twelve years ago versus twenty years ago.

A potentially serious problem of recall bias in the MFLS2 earnings data is considered in Gallup (1994b). The anomalous trends in earnings by ethnic group are not consistent with other data sources, probably due to recall error that differs by ethnic group. However, for the purpose of investigating the factors causing migration, what is necessary is that *differences* in earnings across regions be reported accurately. Otherwise,

⁶The first Malaysian Family Life Survey collected in 1976-77 had similar migration information, but the data on male migration had serious coding errors.

⁷For example, in the U.S. Panel Study of Income Dynamics, the response rate fell below 50% after 10 years into the study due to attrition, and several studies have found that the characteristics of those who dropped out were different from those who remained in the sample (Randolph and Trzcinski, 1989).

errors in the earnings trend or level will not affect inferences about migration. If the recall error is consistent within an ethnic group across regions, errors in the reported level of past earnings will not cause a problem for studying the effect of relative earnings on migration. In particular, if Malay respondents overreported past earnings as seems likely, there is no problem as long as Malays who live in different parts of the country overstated earnings in a similar way.

The survey respondents were only classified as changing “jobs” when their occupation classification changed. Hence, only 42% of the reported moves corresponded to a reported “job” change. Some of these people were transferred within the same organization to another part of the country, like members of the military and police, but most of them were people changing jobs while remaining in the same occupation.

Treating migration as an individual decision is a convenient simplification, but an appropriate one for men in MFLS2. In a study of the relationship between marriage and migration using MFLS2, Smith and Thomas (1992, p.15) find that “in contrast with the evidence for the United States (Mincer, 1978), the characteristics of the wife matter very little for post-marriage mobility.” In the terminology of Mincer, Malaysian men are almost never “tied movers” nor “tied stayers”. Furthermore, if either spouse moves in order to get married, it is usually the wife that moves, not the husband (Smith and Thomas, 1992, p.20). As long as one controls for whether or not the men are married, a model of individual decision-making is suitable.⁸

The Malaysian men in the MFLS2 survey move a lot. Only 26% of Malaysian men in the sample have never migrated, and the average man had moved 2.4 times by the date of interview. Figure 1 shows the type of places the migrants chose. The type of destination place depends on how the survey respondent interpreted it. For example, the migrant decided whether a location was a “small town” or a “large town”. A “kampung” is a traditional Malay village, and an “estate” is a private plantation. “Land Schemes” are large scale plantations built by the government to resettle poor rural farmers, and “New Villages” are government-built towns for resettlement.⁹ At least 60% of “other destinations” are military bases (personal communication with Christine Peterson, RAND Corporation), but the rest are unspecified.

⁸More complex strategies of family member migration for risk diversification, to overcome family credit constraints, etc. may be relevant for Malaysia, but since MFLS2 has no information on the location or movement of family members other than the husband and wife, it is not possible to investigate them with this data.

⁹ The original New Villages were part of the government’s counter-insurgency strategy and the inspiration for “strategic hamlets” in Vietnam.

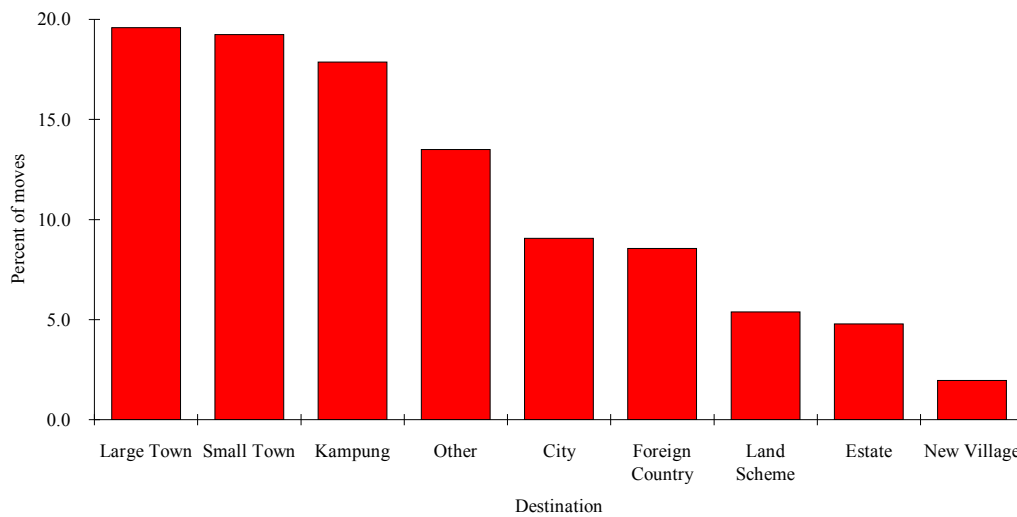


FIGURE 1 TYPE OF MIGRATION DESTINATION PLACE

Malaysian migration is dominated by movements between rural locations. Only nine percent of the migrants in the sample were destined for cities. A common explanation for heavy migration to rural areas has been the migration to new government Land Scheme plantation and to a lesser extent government-built New Villages.¹⁰ However, Land Schemes and New Villages together only account for 7% of destinations. The extensive program of rural development projects and infrastructure investment (of which the Land Schemes were only a part) may still have had a large impact in encouraging people to stay in the countryside or move to other rural areas, even though relatively few people were directly resettled by these projects. One indication of the scale of the movement into Land Schemes is that from the 1960s to 1982, FELDA, the largest of the government Land Scheme agencies, only resettled 80,000 families (see Bahrin, n.d.). This compares to 1.9 million lifetime interstate migrants in the 1980 census (Peng 1980). The government's programs to improve the productivity of rice and rubber smallholders reached many more farmers and were more successful than the resettlement on government Land Schemes.

¹⁰ The strongest statement of this is by Lean (1988, p.123), "Despite official indications that rural-rural migration is still the dominant form of mobility, the movement was almost exclusively into land schemes." Other examples are Department of Statistics (1988, p.65), and Baydar *et al.* (1990).

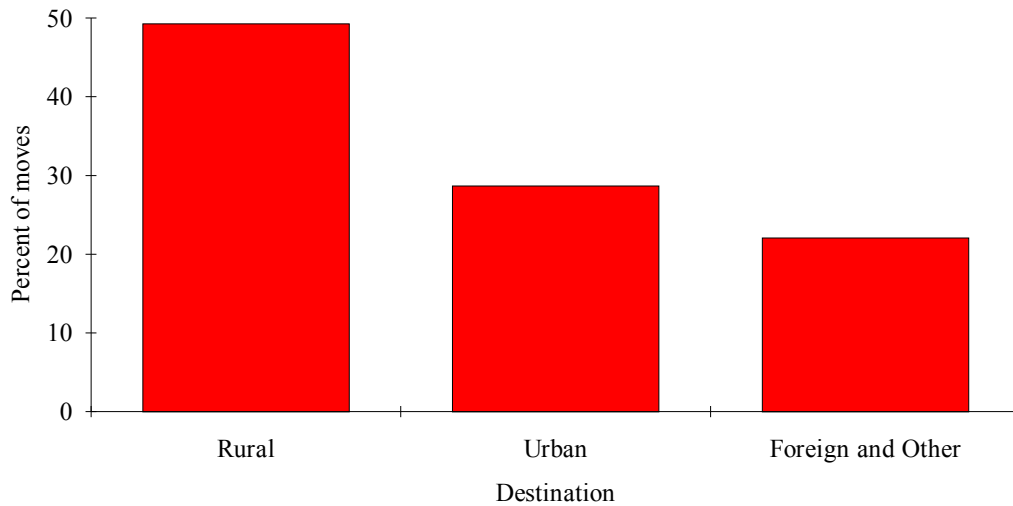


FIGURE 2 URBAN AND RURAL DESTINATIONS

By grouping the destination categories City and Large Town into Urban, and everything else into Rural except for Foreign and Other destinations, we can see the propensity for movement to rural locations in Malaysia (Figure 3).

To study the factors influencing migration decisions, peninsular Malaysia is divided into five characteristic regions. The regions and their component states are shown in Table I along with the person-years that survey respondents lived in each.

The North is predominantly agricultural, rural, poor, and Malay. The northern states of Kedah are the site of some of the largest government rice irrigation projects. Kelantan, Kedah, and Perlis are the poorest and least developed Malaysian states, as was Terengganu until oil and gas were discovered offshore in the late 1970s.

Pahang is a large state that is also agricultural, but it has been the site of many government plantation projects and the opening up of previously untilled land in the forest, so it saw considerable immigration in the last two decades. It is more wealthy than the North and has more links with neighboring Kuala Lumpur and the South.

The West is the most economically developed region and the center of political life, as it has been for more than five hundred years. The capital, Kuala Lumpur, is its focus and most industry is located in this region.

The South is also an old region in terms of its involvement with political events on the peninsula, but it has been less economically dynamic until recently. Johor has grown rapidly since Independence aided by its proximity to Singapore with an economy based on plantation agriculture, and increasingly, industry.

TABLE I
REGIONS AND THEIR COMPONENT STATES

Region	State	Person- Years	Percent
North	Kedah	2,062	21.6
	Kelantan	1,586	
	Pulau Pinang	1,181	
	Perlis	223	
	Terengganu	1,429	
Pahang	Pahang	2,871	9.6
West	Perak	4,522	39.0
	Selangor	4,380	
	Kuala Lumpur	2,836	
South	Johor	4,761	25.0
	Melaka	1,037	
	Negri Sembilan	1,731	
Abroad	Sabah	78	4.8
	Sarawak	188	
	Labuan	41	
	Foreign Countries	1,147	
Total		30,073	

“Abroad” is everything else, including foreign countries and the large and distant East Malaysian states of Sabah and Sarawak on the island of Borneo, which only joined Malaysia in 1963 and still are not closely integrated into the peninsula's economy. Labuan is a military base on an island off of Sabah. Since none of the survey respondents were Abroad at the time of the sample, it has a large net outmigration rate in the sample. Besides the states of East Malaysia, many Malaysians have gone to work in Singapore, Thailand, other surrounding countries, and the Middle East during the oil boom. There is no information in the survey about what foreign country the migrants chose as a destination.

Table II shows a matrix of origin and destination regions for all inter-district moves in the sample. The table includes all the moves by survey respondents after the age of fifteen, occurring over a 30 year period from the late 1950s to 1988. The most popular destination in each region is that region itself. Migration has the paradoxical character of international trade: although one might expect the best opportunities to be in regions that differ from the home region, most migration is between similar, and nearby, regions.

TABLE II. MOVES BY ORIGIN VERSUS DESTINATION

Origin	Destination					Total
	North	Pahang	West	South	Abroad	
North	245	65	165	71	67	613
Pahang	33	89	66	49	23	260
West	123	114	614	198	163	1212
South	49	69	253	313	129	813
Abroad	61	27	214	122	73	497
Total	511	364	1312	753	455	3395

In order to get a sense of which region has more movement, Table III presents the rates of migration controlling for the person-years of exposure in each region. The North, which is the poorest region, has a high rate of outmigration, and the lowest rate of immigration. The richer West has net immigration, and the lowest outmigration rate. The state of Pahang has by far the highest immigration rate. The state that is the closest second is Selangor in the West, which surrounds the capital Kuala Lumpur, with a net migration rate of -1.6% per year (not shown). The rates for Abroad are not very meaningful because in order to be in the sample, one had to leave this region.

TABLE III. MIGRATION RATES BY REGION (PERCENT PER YEAR)

Region	Outmigration	Inmigration	Net Migration
North	5.1	3.5	1.5
Pahang	4.8	8.4	-3.6
West	4.4	5.2	-0.8
South	5.6	5.0	0.6
Abroad	25.0	21.9	3.2

The age pattern of migration, controlling for the person-years that the men in the sample were “at risk” of migration, is shown in Figure 4, bracketed by 95% binomial confidence intervals. The age pattern in Malaysia is typical of the pattern in other countries. It is heavily skewed towards young men, with peak migration at 20 years of age.

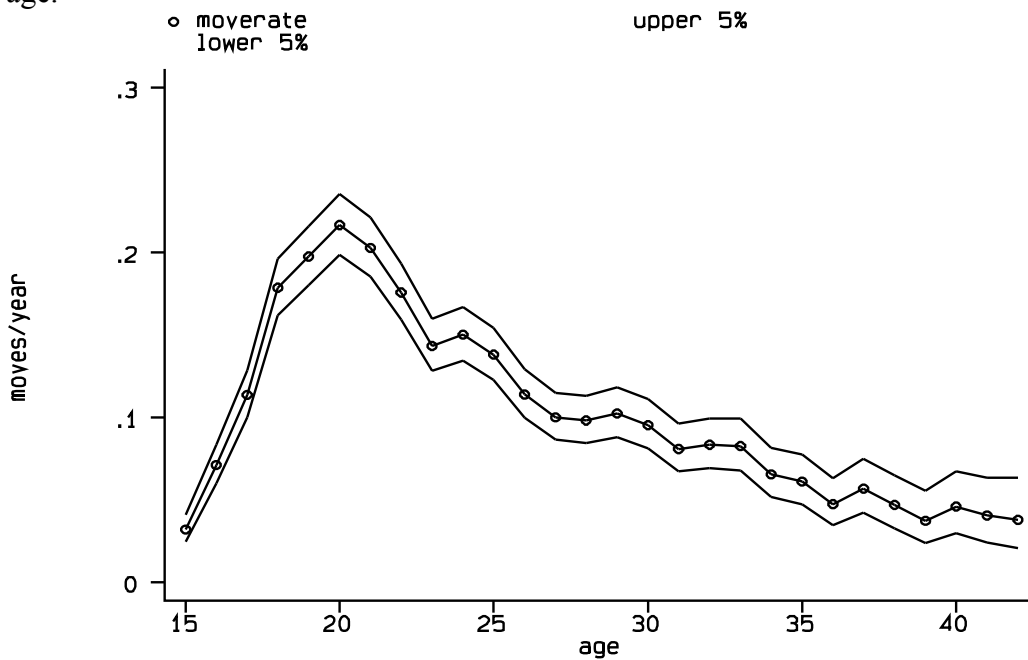


FIGURE 5 MIGRATION RATE BY AGE

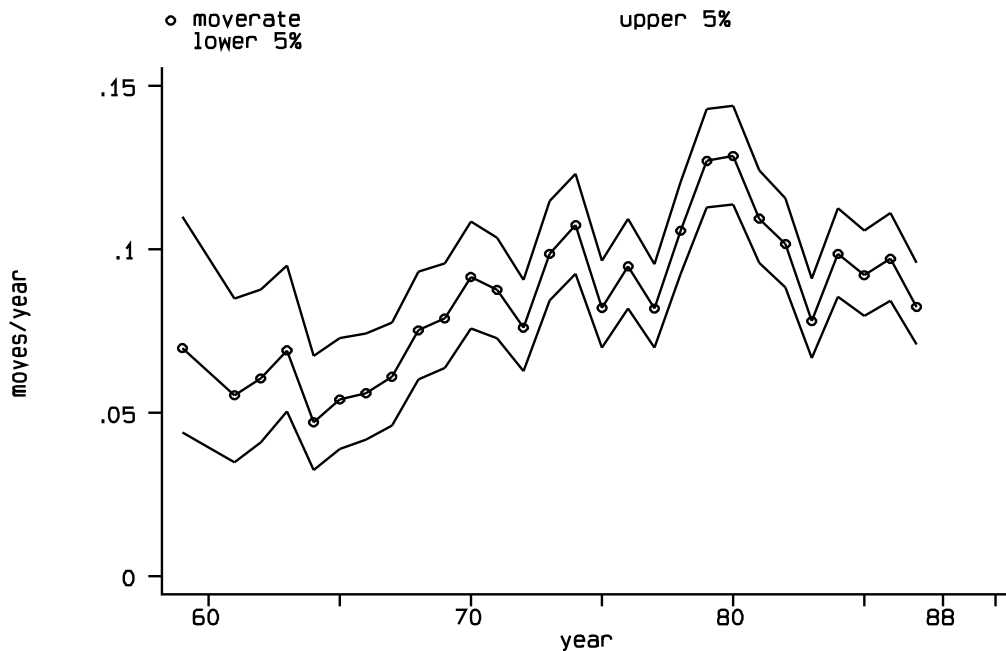


FIGURE 6 MIGRATION RATE BY YEAR

The time trend of migration requires standardization by more than just the person-years of exposure in the sample. The average age in the sample increases with time because of the nature of the recall data, and age-specific migration rates vary widely as seen in Figure 7. Figure 4 is the age-standardized migration rate over time with binomial 95% confidence intervals.¹¹ Migration seems to have a slight upward trend from the 1960 to 1980, rising from about 6% to about 12%, and a decline afterwards to about 8% in 1988, perhaps related to the economic slump in the early 1980s. Recall data is not ideal for constructing time trends. Some of the upward trend in the period before 1980 may be due to failure to recall long-ago moves. However, the number of interstate lifetime migrants, though not precisely comparable, increased from 1 million in the 1970 census to 1.9 million in the 1980 census, indicating an increasing trend in migration (see Peng, 1990).

6. ESTIMATION

The structure of dynamic models depends on the assumptions about the initial conditions. There is good reason in this case to think that initial location is exogenous - taken as given by the decision maker. The initial observation for each individual is his location at age fifteen, which is rarely the result of a decision by the fifteen-year-old. If the choice probability $P(d_{kit} = 1)$ is taken conditional on the past values of $d_{ki(t-s)}$, and the initial value d_{ki0} is assumed to be exogenous, then the estimator is the same as for a static equation (see Hsiao, 1986, Section 7.4). The choice of location is estimated as a logit model with the five alternative regions described in the Data Section.

¹¹The migration rate at each age is a mix of migrants from different years, so the migration rate by age could be standardized for time trends. Both age and year migration rates may also be subject to cohort effects. However, since both the migration rate by year and by cohort (not shown) do not vary systematically as age-specific rates do, no further standardization was made.

The discount rate in (4.2) is estimated by taking a first order Taylor series expansion of δ^{s-t} around $\delta = \delta^*$:

$$\sum_{s=t}^T y_{kis}^e \delta^{s-t} \cong \sum_{s=t}^T y_{kis}^e \delta^{*s-t} + \left(\frac{\delta}{\delta^*} - 1\right) \sum_{s=t}^T y_{kis}^e \delta^{*s-t} (s-t).$$

δ^* is set at a plausible initial value, and then δ can be estimated since all the elements within the summations are known or have been estimated in the income equation (4.3).

Distance usually has a strong effect on migration. As with earnings, though, it is not possible to use the reported distance of the move as a regressor since only actual, not potential, moves are observed. Predicted distance to all potential locations was calculated as the straight-line distance between the population center of gravity in each region. The center of gravity of the region was found by weighting each district in the region by the number of residents in the sample who lived there.

The estimation of the migration equation requires both precise regional earnings estimates and estimates of the fixed effects from the earnings equation. The fixed effects are easily estimated. However, when predicting earnings it is important to include as many region-specific correlates as possible since the migration decision depends on regional differences in earnings. The fixed effects model is not well suited to this, because it precludes estimating region-specific returns to fixed characteristics of individuals, like education and race. The approach taken here is to estimate earnings separately from the fixed effects with a panel-data first-order autocorrelation model. This accounts for the strong autocorrelation in the earnings data and approximates the persistence of the fixed effects. It also permits the estimation of different autocorrelation for people stay put and for people who move. Since the persistence of earnings is likely to be higher for people who stay where they are, this should give more accurate predictions of the earnings changes faced by migrants.

TABLE IV FIXED EFFECTS EARNINGS REGRESSIONS
(absolute value of *t* statistics in parentheses)
Significant at the 1% level

	Earnings by Race		
	Malay	Chinese	Indian
Experience	0.0402 (6.07) **	0.1226 (13.98) **	0.0788 (6.11) **
Experience ²	-0.0021 (30.97) **	-0.0038 (35.22) **	-0.0019 (20.32) **
Time	0.0275 (4.52) **	0.0199 (2.47) **	-0.0061 (0.50)
Adjusted R ²	0.08	0.38	0.18

The fixed effect earnings regressions by ethnic group are shown in Table IV. Experience is the number of years the person has ever been employed, and Time indicates the year, equal to zero in 1960. The fixed effects estimates are equal to the average earnings for the individual minus the average predicted earnings not including the fixed effects.

Earnings are estimated by race and by region with autoregressive errors. In addition to the regressors in the fixed effect estimation, there is education, the number of years the person has attended school. The results are shown in Appendix A. The different ethnic groups have quite different rates of return to education and experience profiles of earnings across the regions.

The autocorrelation coefficient, ρ , is remarkably consistent for the three ethnic groups, ranging from 0.939 for Malays to 0.949 for the Chinese. This is the autocorrelation for workers when they do not migrate. One would expect the autocorrelation of earnings for workers when they do migrate to be lower, because there

are more likely to be discontinuities in their working environment between the old location and the new one. The autocorrelation of earnings for migrants was calculated using only migrants who also changed occupation.¹² Using the year of the move, and the years before and after, the autocorrelation of earnings for migrants is 0.720, which is surprisingly high. If the earnings are predicted for a region that is the same as the previous period, the autocorrelation for stayers is used, and if earnings are predicted for a different region than last period, autocorrelation for movers is used.

The predicted variance of earnings is used as a measure of earnings risk in the different regions. The earnings regressions permit prediction of the variance of earnings in each region conditional on the observed characteristics of individual (experience, education, and race).

With estimated fixed effects, predicted present value of future earnings, and conditional variance of earnings in hand, we can turn to estimating the factors inducing or impeding migration.

¹² Measuring this autocorrelation with MFLS2 data is complicated by the fact that earnings are not reported at the beginning and end of every job, but at the beginning and end of every change of occupation classification. If workers migrate and change jobs, but do not change occupation, there is only information on the starting earnings for the job before the move and the ending earnings for the job after the move.

7. RESULTS

^a The standard errors in the logit regression are not corrected for the fact that the present value of future earnings and the fixed effects are estimated from the same data. The standard errors for doing this is described in Newey (1994) but the calculations become unwieldy when the estimated coefficients enter the logit model in a complicated way as they do in the present case of future earnings, especially because the income estimates are also from a dynamic equation.

Variable	Coefficient	Standard Error
Present Value of Future Earnings	0.000573	0.00087
Discount Factor (δ)	-5.896	1.309
Variance of Earnings		
Costs of Moving:		
Age	0.158	0.036
Over Age 20	5.18	0.69
Over Age 20 * Age	-0.282	0.036
Education	0.0089	0.0128
Education * Distance	0.000221	0.000061
Fixed Effect	0.134	0.049
Distance of Move	-0.00357	0.00075
Fixed Cost	-5.41	0.70
Fixed Cost: Abroad	0.363	0.125
Tenure of Residence	-0.0538	0.0022
Previous Moves	0.370	0.001
No Earnings	-0.543	0.089
Married	-0.322	0.075
Malay	0.236	0.077
Chinese	0.302	0.103
Pahang		
Constant	0.707	0.183
Fixed Effect	-0.255	0.112
Education	-0.0395	0.0179
West		
Constant	-0.042	0.158
Fixed Effect	0.194	0.086
Education	0.0639	0.0151
South		
Constant	0.217	0.175
Fixed Effect	0.143	0.094
Education	0.0014	0.0166
Abroad		
Constant	-0.839	0.199
Fixed Effect	0.078	0.098
Education	0.096	0.0171
Number of Observations	28644	
Number of Choices	143220	
ln Likelihood	-7326	
Likelihood Ratio Index	0.82	
Ratio of Hits/Misses	0.937	
Ratio of Hits/Misses for Moves	0.013	

Earnings and the discount rate

Earnings opportunities are a strong inducement for migration, as seen in Table V. The discount factor, δ , is estimated to be 68.2%. This means that income five years in the future is valued at only 15% of current income. Migrants are unlikely to move unless

they higher return in the near future by doing so. However, fixing the discount rate at zero, as most migration models implicitly do, is a misspecification.

Risk Aversion

Search models of migration, starting with David (1974), predict that risk neutral individuals will seek out labor markets with high variance to test their luck (see Gallup, 1994a for discussion). Since searchers can reject bad offers, and accept good ones, they fare better where there is a wide range of offers. For risk-averse people, the prediction is ambiguous. It depends on the relative strength of the search motive versus the risk aversion.

Migrants' reaction to risk is considered by looking at the effect of the conditional variance of earnings in each region on the likelihood that people will move there. The predicted earnings variance in each region is conditioned on the observed characteristics of the individual: experience, education, race, time, and autocorrelation. Currently employed individuals do not face the variance of earnings of the general population with the same characteristics, because they are not thrown into the general pool of job seekers every period. However, the migrant usually is. As a first approximation, the estimated variance of earnings in the region where the individual lives is set to zero, and the estimated variance in all other regions is the population variance conditional on individual characteristics.

A higher variance of earnings deters migration. If there is a search-theoretic attraction of variance, it is overwhelmed by risk aversion in the migration regression.

Unobserved Heterogeneity

The individual effects enter the model in two ways. They are interacted with moving to capture the heterogeneity bias story: individuals with unusually good earnings are more likely to move. Second, they are entered directly to see if individual characteristics are correlated with particular choices of location. The two-stage estimation technique makes it possible to estimate the effects of unobserved heterogeneity directly, rather than just indirectly controlling for its influence as other methods do. The regression shows that people who have a positive fixed effect, or a higher income than their observed characteristics would predict, are also more likely to migrate. This is consistent with Mazumdar's (1981, p. 207) finding that controlling for education and other factors, Malaysian migrants earn significantly more than natives over most of their working lives. People with high fixed effects prefer the Western region, where the capital is, to the North, the excluded region, and they avoid the new agricultural territory of Pahang.

The pattern of impacts of individual effects, both on moving and on choice of location, are similar to the effects of education. If the fixed effects are capturing an unobserved characteristic like venturesomeness or ability, then venturesome or able persons prefer to live in the same regions as more educated persons and are more likely to migrate like the educated. This suggests that education and fixed effects are measures of similar kinds of human capital, one easily observable and the other not.

Age and Education

There has long been discussion of the reasons for the observed age and education patterns of migration. The patterns for Malaysia shown in the Data Section are typical of other parts of the world. Migration is highly selective of the young, and more educated people have higher rates of migration at all ages. Most proposed explanations for the relationship rely on the effect of age and education on the earnings gains from moving. The young have a longer time horizon for their working life, so that for a given earnings differential between regions, they have a stronger investment motive for moving. Authors like T.P. Schultz (1982), though, have expressed skepticism that the investment motive is strong enough to explain the sharp decline in migration rates with age for adults. It is likely that the costs of migration also increase with age, both monetary costs, due to accumulated possessions and family obligations, and psychic costs, as age brings a fondness for the familiar.

By incorporating the expected benefits of the future earnings stream, which includes the influence of age on earnings profiles, it is possible to distinguish whether age affects migration through the earnings motive, or by changing the costs of migration. This distinction is not possible with the usual specification where migration only depends on current expected earnings in different regions.

The effect of age is fitted with a linear spline with a knot at age twenty, as suggested by the marginal distribution of migration by age. Despite the impact of age on the present value of predicted future earnings, age still has a strong direct effect on the cost of migration.

Educated workers typically have steeper earnings profiles, so for a given difference in current earnings between regions, the educated also have a stronger motive for moving. Educated workers also have more specialized skills, so they have an incentive to search for a job match over a wider area. The educated, besides experiencing different earnings profiles, may have lower search costs of migration, since they have a wider knowledge, and a more extensive information network. T.W. Schultz (1975) emphasized the role of education in enabling people to cope with disequilibria and change, one form of which is changing where one lives.

The effect of education on moving is not significant, but it makes migrants more willing to move a longer distance. If distance is a proxy for the extensiveness of the individual's network of information, the education-distance interaction shows that the educated cast a wider net, knowing more about distant places, or perhaps the educated are better able to adapt to distant places.

Persistence versus movers/stayers

Inertia is likely to have a strong role in migration. People develop ties to friends, contacts in business, local knowledge, and other kinds of location-specific human capital which induce them to remain where they are. When looking for the effect of residential tenure on migration, though, it is always difficult to distinguish between observing different kinds of people or observing a true effect of tenure on behavior. If some people are by nature “movers”, and some are “stayers”, the movers will move a lot and have few years of tenure, and the stayers will not move, and have long tenure, so it appears that tenure deters people from moving when in fact it has no effect on behavior¹³. To be able

¹³The distinction between movers and stayers is a form of unobserved heterogeneity. The unobserved heterogeneity already captured by the fixed effects is heterogeneity correlated with income, so

to distinguish a true tenure effect from heterogeneous individuals, the regression also contains the number of previous moves by the migrant, which is uncorrelated with current tenure, but is correlated with being a mover by nature (*cf.* Mincer and Jovanovic, 1981). There is not a clean distinction between true tenure effects and unobserved types of people, though. Migrants may become more amenable to moving through practice, a sort of “learning by doing”. Moving may gradually turn stayer types into movers if stayers are induced to move and thereafter their response to residential tenure would be different.

Tenure of residence is measured in years, and it is the cumulated time spent in each region, not just the length of stay in the current region of residence. Inertia makes migration less likely the longer the individual remains where they are. Practice, or perhaps innate characteristics, also encourages migration as indicated by the effect of the number of previous moves. Migrants who have moved before are strongly predisposed to move again.

Unemployment

Empirical study of the effect of unemployment on migration has found mixed results (Mazumdar 1987, Pissarides and McMaster, 1990, and Blanchard and Katz, 1992). The unemployed are usually in economically depressed regions, so their job prospects are often better in other regions causing them to migrate. Peng (1990, p.3) reports that a sizable fraction of people sampled in certain locations in Malaysia reported losing work was the main reason for moving. On the other hand the unemployed are less able to move to more favorable region because they lack the means.

The MFLS2 data are not ideal for considering the effect of losing a job because unemployment is only reported for people who have been without a job for at least a year.

Having no income makes men less likely to migrate in Malaysia. Having few resources limits their ability to seek opportunities in new regions. The system of family production probably also limits mobility. Most individuals reporting no income classified themselves as unpaid, but employed, workers on a family farm or enterprise. The extended family provides a safety net for numbers who cannot find work, but this insurance is not transferable to new locations which may have better employment opportunities.

Other factors

The fixed costs of moving are substantial. This is a residual category for all the impediments to migrating not correlated with the other included variables. The costs of migrating increase sharply with distance. The effect of distance captures not only the costs of transport, but the psychic cost of being far from family and friends. Since there is no way to measure the distance to foreign countries, and the mode of transportation is different, the “distance” to locations abroad is set to zero, and a fixed cost of moving abroad is included.¹⁴ Since it is positive, the fixed cost of moving Abroad (psychic as

the distinction between movers and stayers refers to an additional propensity to migrate that is not correlated with income.

¹⁴As explained in the Data Section, “abroad” includes destinations in the distant East Malaysian states.

well as monetary) appears to be lower than the cost of moving within the peninsula, but it hard to know why this should be true. Some workers going abroad, such as those going to the Middle East, may have their move arranged and paid for by a labor recruiter, but this would be a minority of workers. Some workers may also find the adventure of traveling abroad outweighs the monetary costs, but most likely the positive coefficient is due to the sample selection of workers going abroad. Among men who have migrated abroad, only those who have returned to Malaysia are include in the sample. These return migrants may not have liked what they found abroad and be willing to return despite little monetary gain.

Marriage slows down migrants. Married men face larger monetary costs of moving with a wife and family, and they may be more reluctant to uproot their family from their home. When other factors are taken into account, the Chinese are slightly more likely to migrate than the Malays, though the marginal frequencies show that Malays migrate more. Both ethnic groups move more than the Indians.

There is a danger of attributing the correlates of living in specific regions in a simple way to a conscious choice of location. For instance, the more educated may be found in a certain region not because the educated choose to move there, but because the region has a better school system, and due to inertia, the educated do not move away. Whether it is due to choice or circumstance, the educated are more likely to be found in the West, where the capital is, and Abroad compared to the rural North, the excluded region, and they are found less in Pahang.

The likelihood ratio index (LRI) and the ratio of hits to misses show that the model fits the choice of location very well.¹⁵ The meaning of measures of goodness of fit and predictive accuracy depend on the characteristics of the observed data in discrete choice models. Here the model usually predicts that people stay put, and since migration is a rare event, the model is usually correct. When we look at the ratio of hits to misses for people who *did* move, however, the model predicts only 1% of the destination regions that people actually chose. This low predictive ability is a general weakness of discrete choice models for rare events.

How big an effect?

The coefficient estimates in Table V show whether the included covariates have a statistically significant effect on the probability of migrating and (because their signs happen to coincide with the signs of the estimated marginal effects) shows whether their effect is positive or negative. Discrete choice estimates indicate whether the effect of the covariate is statistically significant (i.e. not zero) but not whether their effect has practical significance. They do not provide a readily interpretable measure of the impact of the

¹⁵The likelihood ratio index (LRI), a measure of the goodness of fit of the model, is a pseudo-R² measure. If $\ln L$ denotes the maximized value of the log likelihood function, and $\ln L_0$ is the value when only regional constants are included in the regression, $LRI = 1 - \ln L / \ln L_0$. If the value of the coefficients on all the regressors are equal zero, the LRI is zero. The LRI can never reach 1, but it can come close.

The ratio of hits to misses is a measure of the predictive accuracy of the model. It is calculated as follows: the model is said to predict a certain region if the predicted probability of being in that region is higher than the predicted probability of being in all other regions. A hit occurs if the predicted region is the same as the observed region, and a miss otherwise.

Measures of goodness of fit and predictive accuracy for discrete choice models are discussed in McFadden (1984, p.1410), Maddala (1983, p.76) and Greene (1993, p. 651).

covariates on migration. The estimated marginal effects show the effect of a unit increase in the covariate on the probability of migrating, but knowing, for instance, that a destination 100 kilometers further reduces the probability of migrating there by (----)% is not a very intuitive measure either. The most easily interpretable common metric is to the effect of the covariates to the effect of a unit earnings gain. This is the ratio of marginal effect of the covariate to the marginal effect of earnings. Whereas the marginal effects depend on the value of the covariate at which it is evaluated, the ratio of marginal effects are independent of the level of the covariates (see Appendix B).

TABLE VI
TRADE-OFF BETWEEN MIGRATION COSTS AND EXPECTED EARNINGS

Variables	Units	\$ of Earnings
Fixed Cost (if age>20)		401
Age (if age>20)	years	216
Education	years	-16
Education*Distance	years*100km.	-39
Distance	100km.	623
Individual Effect	\$ of earnings	-234
Previous Moves		-646
Tenure of Residence	years	94
Malay (compared to Indian)		-412
Chinese (compared to Indian)		-527
Married		562
Has No Earnings		948
Move Abroad		-634
Variance of Earnings	10 percent	90

= Malaysian Ringgit, 1 Ringgit = 0.37 U.S. dollars in 1988

Table VI shows the effect of the independent variables on migrating equal to the effect of a unit gain in future earnings. Age and distance have large effects on moving compared to income gains. With an average annual earnings of \$2762, a potential migrant aged thirty will need a greater incentive to move than a twenty year-old almost equal to the average earnings of one year. The effect of education is measurable, but clearly dominated by age and distance. The individual effect is very large compared to education, equal to about 14 years of education for nearby moves. Previous moves, marriage, no paid employment all have strong effects on moving. One previous move has a greater effect on migration than the fixed cost. The negative fixed cost of moving abroad

is large, but likely due to the sample selection procedure. Migrants are also sensitive to variance in earnings, so that a doubling of earnings variance must be compensated with about a third of a typical annual income to induce the person to migrate.

8. CONCLUSION

The econometric model for migration developed here provides a simple way to incorporate unobserved heterogeneity that is not subject to the statistical problems of the

self-selection model. The decision-making model is consistent with the underlying microeconomic theory of migrant behavior and incorporates dynamic aspects of the migration decision.

The method of estimating the unobserved heterogeneity of migrants, a fixed effect estimate, avoids parametric assumptions about the distribution of the heterogeneity. It provides a feasible method for estimating individual effects in nonlinear models, in contexts where there is an auxiliary linear equation also affected by the individual factors. The model is much simpler to calculate than two-stage parametric estimates of the self-selection model and solves serious specification problems in previous estimation models of migration.

A broad set of variables affecting migration were examined, particularly various sources of persistence that impeded people from migrating despite the income gains they would realize. Migrants exhibited risk averse behavior, avoiding regions with high earnings variance, despite any search-theoretic motive to seek them out. The unobserved characteristics which raise people's earnings (unobserved heterogeneity) also made these people more likely to migrate, consistent with the idea that certain people have an enterprising spirit that makes them both more successful in the labor market, and also more mobile. The unobserved characteristics influence migration in a way quite similar to education.

A useful and simple-to-calculate method for comparing the effects of the independent variables in discrete choice models is developed. It provides a measure of which characteristics make people less able to take advantage of new economic opportunities in faster growing regions.

Who is left behind by the regional disparities in growth? All but the young and unmarried, those who must travel far or have never moved before, and to a lesser degree, the less educated.

(*t* statistics in parentheses) ** significant at the 1% level *significant at the 5% level

APPENDIX A: EARNINGS REGRESSIONS

TABLE A.1. AR(1) EARNINGS ESTIMATES FOR MALAYS

Income by Region: Malays					
	North	Pahang	West	South	Abroad
Constant	5.06 (59.58) **	5.31 (31.37) **	4.74 (41.54) **	4.67 (39.22) **	5.21 (15.89) **
Experience	0.092 (11.04) **	0.060 (4.01) **	0.107 (11.80) **	0.101 (10.50) **	0.145 (5.31) **
Experience ²	-0.00264 (10.79) **	-0.00152 (3.89) **	-0.00276 (10.21) **	-0.00237 (8.81) **	-0.00423 (2.97) **
Education	0.064 (7.06) **	0.031 (1.68) *	0.095 (8.39) **	0.109 (8.58) **	0.041 (1.35)
Time	-0.0109 (2.02) *	-0.0029 (0.30)	-0.0090 (1.50)	-0.0144 (2.34) **	-0.0066 (0.41)
ρ	0.94	0.94	0.94	0.94	0.94
Adjusted R ²	0.77	0.69	0.74	0.78	0.67

TABLE A.2. AR(1) EARNINGS ESTIMATES FOR CHINESE

Income by Region:					
	North	Pahang	West	South	Abroad
Constant	4.28 (20.96) **	4.47 (11.24) **	4.67 (34.35) **	4.71 (28.59) **	5.04 (6.20) **
Experience	0.207 (10.94) **	0.109 (3.53) **	0.140 (12.80) **	0.173 (10.94) **	0.277 (4.75) **
Experience ²	-0.00550 (11.49) **	-0.00324 (3.63) **	-0.00375 (11.85) **	-0.00480 (12.29) **	-0.00951 (4.51) **
Education	0.082 (3.68) **	0.044 (1.14)	0.077 (5.77) **	0.045 (2.53) **	0.081 (1.29)
Time	-0.0005 (0.04)	0.0386 (1.79) *	0.0137 (1.89) *	0.0089 (0.79)	-0.0216 (0.52)
ρ	0.95	0.95	0.95	0.95	0.95
Adjusted R ²	0.63	0.56	0.67	0.58	0.52

(*t* statistics in parentheses) ** significant at the 1% level *significant at the 5% level

TABLE A.3. AR(1) EARNINGS ESTIMATES FOR INDIANS

	Income by Region: Indians				
	North	Pahang	West	South	Abroad
Constant	4.97 (16.37) **	5.24 (13.56) **	5.07 (49.99) **	5.33 (33.48) **	3.40 (1.93) *
Experience	0.116 (4.36) **	0.083 (2.75) **	0.095 (11.49) **	0.071 (5.22) **	0.207 (2.81) **
Experience ²	-0.00306 (3.23) **	-0.00176 (1.83) *	-0.00253 (10.76) **	-0.00142 (3.27) **	-0.00766 (2.60) **
Education	0.075 (2.22) *	0.080 (2.35) **	0.041 (4.19) **	0.054 (3.95) **	0.135 (1.00)
Time	-0.0152 (1.15)	-0.0203 (1.22)	0.0056 (1.09)	-0.0090 (1.08)	0.0280 (0.50)
ρ	0.94	0.94	0.94	0.94	0.94
Adjusted R ²	0.71	0.70	0.79	0.84	0.53

APPENDIX B: THE RATIO OF MARGINAL EFFECTS IN MULTINOMIAL CHOICE MODELS

Consider the multinomial choice model

$$P_{ij} = P(Y_i = j) = F(\beta' z_{ij})$$

where P_{ij} is the probability the individual i chooses alternative j . Y_i is the choice made among the j alternatives. $F(\cdot)$ is a cumulative distribution function, β is a K -vector of parameters and z_{ij} is a K -vector of individual and choice specific independent variables. This model also incorporates parameters that vary across alternatives and independent variables that are constant across alternatives by suitably defining β and z_{ij} (e.g. see Greene, 1993, p. 665).

The marginal effect of z_{ij} on the probability of the j th outcome is

$$\gamma = \frac{\partial P_{ij}}{\partial z_{ij}} = f(\beta' z_{ij}) \beta$$

where $f(x) \equiv \frac{\partial F(x)}{\partial x}$. Let $\gamma_k = f(\beta' z_{ij}) \beta_k$ be an element of γ . The ratio of the marginal effect of the k th variable to the marginal effect of the first variable is

$$\frac{\gamma_k}{\gamma_1} = \frac{f(\beta' z_{ij}) \beta_k}{f(\beta' z_{ij}) \beta_1} = \frac{\beta_k}{\beta_1}$$

which involves only the original parameters β and, unlike the marginal effects, does not depend on the level of z_{ij} at which it is evaluated.

Let

$$\underline{\gamma}^* \equiv \begin{matrix} \gamma_2^*/\gamma_1^* & \beta_2^*/\beta_1^* \\ \gamma_K^*/\gamma_1^* & \beta_K^*/\beta_1^* \end{matrix} = \underline{\beta}^*$$

be the ratios of estimated marginal effects as a function of consistent and asymptotically

normal estimates β^* of the parameters β . Then by the delta method (e.g. Greene, 1993, p. 297), $\underline{\gamma}^*$ is also consistent and asymptotically normal with an asymptotic variance of GVG' where V is the asymptotic variance of β^* and $G(\beta^*) \equiv \frac{\partial \underline{\gamma}^*}{\partial \beta^*} = \frac{1}{\beta_1^*} \left[\underline{\beta}^* \ I_{K-1} \right]$, where I_{K-1} is the $K-1$ dimensional identity matrix.

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