MOBILITY, SKILL AND INFORMATION

by

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Abstract

In this paper we state and prove several results which may arise as a result of international migration taking place under asymmetric information. We note that whereas under symmetric information several distinct skill groups along the skill continuum may migrate, under asymmetric information there will only be one distinct migratory group along the skill continuum; that asymmetric information will not increase and may decrease the top skill level migrating; and that devices which tend to restore informational symmetry can give rise to interesting patterns and welfare implications of migration. Two main examples are given. First, in the presence of signalling, a U shaped pattern of migration with respect to skill may emerge. Second, an increase in the welfare of the low skill migrant workers can occur if eventual discovery is introduced.
The notion that the labour market is often characterized by asymmetric information - either workers or the firm (or both) have information to which the other party is not privy - is by now well accepted. Indeed, some researchers have even gone as far as to suggest that informational asymmetry is the major feature of labour employment arrangements and the nature of worker-firm relations (Hall and Lazear 1984).

Perhaps the most natural application of the informational asymmetry concept is to situations where (at least initially) employers do not know the productivity level of individual employees. Two such contexts come readily to mind. First, when workers are young and hence relatively unknown to any firm, no firm has as yet good information pertaining to their individual productivity. Second, when markets are isolated in the sense that information does not ordinarily flow across them (or does not flow costlessly and freely) a firm (or firms) in one market may possess information on individual worker productivity - for example, such information may be revealed to the firm over time as a by-product of its normal monitoring and coordinating activities - but the information is firm or market specific.

Obviously, when labour markets are in two different countries the idea of such information asymmetry is particularly appealing. It is from these considerations that the main impetus for our study arises. The patterns of labour migration under
asymmetric information seem likely to differ from the patterns of labour migration under symmetric information. And indeed, our analysis suggests that the differences may be substantial; it can generate results which differ from traditional models of labour mobility, in some cases dramatically so. The present paper thus takes us a step beyond the early contributions to this topic by Kwok and Leland (1982), Katz and Stark (1984, 1986) and Stark (1984). It should be noted, however, that what we offer here is not an attempt to put forward a definitive theory of migration under informational asymmetries. Rather, what we try to do is to show how migration under such conditions may give rise to interesting and plausible migratory patterns.

In the following sections we spell out our assumptions in full and present our main results. In Section II we present our basic model of labour mobility under asymmetric information. Two devices might work to reinstate informational symmetry: Signalling, which is costly, and revelation of true productivity through observation, which is time consuming. We deal with these two mechanisms and the ensuing migration implications in Sections III and IV respectively. In Section V we report our main conclusions and outline some directions along which future research in this area may be of interest.
II. ASYMMETRIC INFORMATION: THE BASIC MODEL

Assume a world consisting of two countries: A rich country, R, and a poor country, P. In a given occupation let the net wages for a worker with skill level $S$ be $W_R(S)$ and $W_P(S)$ in the rich country and the poor country respectively (such that $\partial W_R / \partial S > 0$, $\partial W_P / \partial S > 0$). To reflect the fact that R is rich and P is poor, it is assumed that $W_R(S) > W_P(S)$ for all $S$. Also, without loss of generality, let $S$ be defined upon the closed interval $[0,1]$ and let the density function of P workers on $S$ be $F(S)$.

In addition, given that P workers are likely to have a preference for P life style because of cultural factors, family relationships, etc., it is assumed that P workers apply a discount factor to R wages when comparing them to P wages. Thus, when making the migration decision, they compare $kW_R(S)$ with $W_P(S)$ where $k < 1$. A P worker will, therefore, migrate from P to R if

$$kW_R(S) > W_P(S)$$

Clearly, without further restrictions on $W_R(S)$ and $W_P(S)$ there may be several values of $S$ for which $kW_R(S) - W_P(S) = 0$. Hence, as illustrated in Fig. 1, there may be several distinct skill groups along the skill axis. Thus, in Fig. 1 the workers
in skill intervals $0S_1, S_2S_3, S_4$ migrate whereas those in the complementary intervals do not. We shall refer to a case in which there are at least three distinct groups (e.g. along the $S$ axis, migrating, non-migrating, migrating) - a situation which can only occur if at least one of the $W_P(S)$ and $W_R(S)$ functions is non-linear in $S$ - as the non-convex case. Similarly, we shall refer to the type of case in which there are only two or less distinct groups as the convex case.

Let us now assume that the skill of each potential migrant is known in $P$ where he or she has been observed for many years, but is unknown in $R$. Also, for the moment, let us exclude the possibilities that either migrants or employers can invest in devices which may identify the worker's true skill level or that true skill is revealed over time.

Faced with a group of workers where the individual productivity of each worker is unknown to him or her, the wage offered by the employer will be the same for all such workers and will be related to the average product of all members of the group. Let us assume that the actual individual wage offered is equal to the average product of the group$^3$ and that wage offers are known to all workers.

Hence, denoting by $\bar{W}$ the wage payable in the rich country to a migrant of unknown skill level and assuming $n$ distinct migrating groups, $\bar{W}$ is given by
\[ \bar{W} = \sum_{i=1}^{n} \frac{\bar{S}_i}{\bar{S}_i} W_R(S)F(S) dS/ \sum_{i=1}^{n} F(S) dS \] (2)

where \(\bar{S}_i\) and \(\bar{S}_i\) are respectively the lowest and highest skill levels migrating in group \(i\), where \(i\) is one of the continuous groups migrating and where the skill level increases with \(i\). (note that \(0 < \bar{S}_i < \bar{S}_n < 1\) for a non-empty migrating set). It follows immediately that \(\bar{W} < W_R(\bar{S}_n)\).

Using these assumptions we establish our first main result.

**Theorem 1:** Under asymmetric information if the top skill level migrating is \(\bar{S}_n\) then any skill level \(S^*\) where \(S^* < \bar{S}_n\) will also migrate.

**Proof:** Consider any \(S^*\), such that \(S^* < \bar{S}_n\). Now, since by assumption \(\bar{S}_n\) migrates, it must be that

\[ k\bar{W} > W_P(\bar{S}_n) \] (3)

Also, since \(S^* < \bar{S}_n\) then \(W_P(S^*) < W_P(\bar{S}_n)\) and hence \(k\bar{W} > W_P(S^*)\) so that \(S^*\) skill levels also migrate. (Q.E.D).

This theorem has three major implications. First, since everyone with a skill level which is smaller or equal to \(S_n\) migrates, there can be only one continuous skill group of migrants under asymmetric information, in contrast with the situation under full information as depicted in Fig. 1. This result is independent of the shapes of \(W_P(S)\) and \(kW_R(S)\) as well as of the shape of \(F(S)\).
Second, since $S^* < S^n$, if any workers migrate under asymmetric information, it is clear that in particular zero skill workers will migrate.

Third, combining the above two implications of Theorem 1 yields that if the highest skill workers migrating under asymmetric information are workers with skill $S^n$ then all workers with skill levels in the interval $[0, S^n]$ migrate.

Thus, under asymmetric information the wage payable to all migrating workers in $R$ is

$$\bar{W} = \frac{\int_0^S W_R(S)F(S)\,dS}{\int_0^S F(S)\,dS}$$

where $S$ is the top skill level migrating. Thus $\bar{W}$ can be written as $\bar{W}(S)$.

We now have a characterization of the migration pattern under asymmetric information and can therefore proceed to establish the main differences between migration patterns under alternative informational regimes.

**Theorem 2:** Under symmetric information the top skill level migrating will never be lower and may be higher than the top skill level migrating under asymmetric information.
Proof: Let the top skill level workers migrating under asymmetric information be $S^*$. Then, clearly $k\bar{W}_R(S^*) \geq W_P(S^*)$. But $k\bar{W}_R(S^*) \geq k\bar{W}_R(S^*)$ so that if $S^*$ migrate under asymmetric information, they will definitely migrate under symmetric information. Indeed, if $0 < S^* < 1$ then $k\bar{W}_R(S^*) = W_P(S^*)$ and $W_R(S^*) > \bar{W}_R(S^*)$ so that by continuity the top skill level migrating under symmetric information will exceed $S^*$. (Q.E.D).

Clearly, this Theorem is very reminiscent of the result obtained by Akerlof (1970) concerning the effect of asymmetric information on reducing the quality of second hand cars' reaching the market, and our intellectual debt to Akerlof's work should be emphasized.4

Finally, in this section we can establish the result that if $k\bar{W}_R(0) > W_P(0)$ then the lowest skill level workers migrate regardless of the informational regime. This follows from the fact that $k\bar{W}_R(0) = k\bar{W}_R(0)$ so that if $k\bar{W}_R(0) > W_P(0)$ then $k\bar{W}_R(0) > W_P(0)$ and hence 0 skill level workers always migrate.

The intuition of this is that for the lowest skill workers who find it attractive to migrate from P to R under symmetric information, the introduction of informational asymmetry cannot reduce their R wage so that their decision to migrate is invariant to the informational regime.
III. THE BASIC MODEL UNDER ASYMMETRIC INFORMATION WITH SIGNALLING

Assume now that migrants may invest in a signalling device such as an examination or professional qualifications. Several such devices may exist and each may bring about a different equilibrium. However, given that our main aim here is not to extend the now prolific signalling literature but, rather, to indicate how the existence of a signalling device might affect migratory patterns, we focus on a single type of signalling device. Thus our results should be taken as reflecting only one outcome of many possible ones and revealing some of the richness of this research direction.

Specifically, let us assume that there exists a signalling device which enables a worker's skill level to be completely identified. We shall also assume that the cost of the device is a constant C which does not vary with skill level and that workers must bear the cost of this device - probably having to invest in it before leaving P. (For example, all workers can take an accurate pre-employment test at a fixed cost). Also, we shall assume a positive and non-decreasing discounted wage differential, i.e., that \( k W_R(S) - W_P(S) \) is non-decreasing in \( S \). Notice that for a worker who invests in the device and migrates, \( k W_R(S) \) rather than \( k W_R(S) \) is relevant. A worker's choice whether or not to invest in the device is made after the employers' skill/wage function is known.
Using the above assumptions we establish the following theorem.

Theorem 3: Given asymmetric information, then if \( k_{WR}(S) - W_p(S) \) is non-decreasing in \( S \) and if a signalling device costing \( C \) is available, then if migrating workers with skill level \( S^{**} \) invest in the signalling device, all migrating workers with a skill level \( S \geq S^{**} \) will also invest in the device.

Proof: If a worker of skill level \( S^{**} \) finds it beneficial to invest in the signalling device, then, since \( k_{WR} - W_p \) is increasing in \( S \) so that the net benefit to the device increases with \( S \), all workers with \( S \geq S^{**} \) will also invest in the device.

(Q.E.D).

One direct implication of this Theorem is that if anyone at all finds it worthwhile to migrate and invest in the signalling device, those with skill level \( S=1 \) will definitely do so. Hence top skill individuals are the most likely to signal.

A second implication of the Theorem is that a migration pattern may emerge where the least skilled migrate without signalling; the next skill group do not migrate, and there is a higher group still that migrate with a signal. Since this possibility is of considerable interest it may be useful to
illustrate this potential situation by way of a numerical example.

Assume that there are only three distinct skill groups I, II, and III. The wages payable to these skill groups in R and S are given in Table 1 as are the proportion of these skill groups in the population of potential migrants.

Table 1

<table>
<thead>
<tr>
<th>Skill group</th>
<th>I</th>
<th>II</th>
<th>III</th>
</tr>
</thead>
<tbody>
<tr>
<td>$W_P$ (in $)</td>
<td>1</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>$W_R$ (in $)</td>
<td>2</td>
<td>6</td>
<td>20</td>
</tr>
<tr>
<td>Proportion in population</td>
<td>3/10</td>
<td>3/10</td>
<td>4/10</td>
</tr>
</tbody>
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In addition let the discount factor attached to R wages by P workers be 0.6 and let the signalling device cost $1.8.

Consider initially the situation in the absence of a signalling device. If the top migrating group is I, the wage payable to migrants in R will be 2 so that since $\bar{kW_R} = 0.6 \times 2 = 1.2 > W_P(I) = 1$, group I will migrate. If the top migratory group were II the wage payable to migrants in R would
be the weighted average of I's and II's wages in R i.e.,
\((0.5 \times 2 + 0.5 \times 6) = 4\) so that \(k\bar{W}_R = 0.6 \times 4 = 2.4 < W_p(II) = 3\)
and hence group II will not migrate. Finally, if the top
migrating group were III the wage payable to migrants in R
would be \((0.3 \times 2 + 0.3 \times 6 + 0.4 \times 20) = 10.4\) so that
\(k\bar{W}_R = 0.6 \times 10.4 = 6.24 < W_p(III) = 10\) and hence group III will
not migrate. Hence under asymmetric information only group I
migrates.

Now introduce the signalling device at a cost of 1.8.
Clearly group I will not purchase it since it obtains its true
wage - 2 - without it. Group II will also not purchase it and
will not migrate since if it does purchase it and migrates it
will have \(k\bar{W}_R(II) - C = 0.6 \times 6 - 1.8 = 1.8\) as compared with 3 if
it stays put. Finally, group III will purchase it and migrate
since if it does it receives \(k\bar{W}_R(III) - C = 0.6 \times 20 - 1.8 = 10.2\)
as opposed to the 10 it receives if it stays at home.

This then provides a possible information-based explanation
for the often observed U shaped pattern of migration by skill.

IV. REINSTATING SYMMETRIC INFORMATION BY DISCOVERY

In this section we consider the effect on the migration
pattern of the possibility that after spending some time in R,
migrants' true skill levels will be discovered through
observation by R employers. Early periods of employment thus act
as a screening device. In this case we have the following result which is, essentially, an application of Theorem 2 above.

**Theorem 4:** Under eventual discovery of true skill level, the top skill level migrating will not be lower and may be higher than in the absence of eventual discovery.

**Proof:** Let the top skill level migrating under asymmetric information be $S^*$. Let the weights attached to pre-discovery and post-discovery earnings be $\alpha$ and $1-\alpha$ ($0 < \alpha < 1$) respectively. Then since $W_R(S^*) \geq W_R(S^*)$, $\alpha W_R(S^*) + (1-\alpha) W_R(S^*) \geq W_R(S^*)$ so that the top migrating skill under asymmetric information will definitely migrate with eventual discovery. Indeed, if $0 < S^* < 1$, then $kW_R(S^*) > kW_R(S^*) = W_P(S^*)$ and by continuity the top skill level migrating will rise. (Q.E.D).

In addition the following result is obtained.

**Theorem 5:** Under eventual discovery the welfare of lower skill workers may be higher than in its absence.

**Proof:** We prove the existence of this possibility by providing a numerical example. Once again we assume three distinct skill groups. The relevant data regarding these groups is given in Table 2.
Table 2

<table>
<thead>
<tr>
<th>Skill group</th>
<th>I</th>
<th>II</th>
<th>III</th>
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<td>$W_p$ (in $)</td>
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<td>6</td>
<td>20</td>
</tr>
<tr>
<td>Proportion in population</td>
<td>1/20</td>
<td>6/20</td>
<td>13/20</td>
</tr>
</tbody>
</table>

In addition we assume that $k = 0.6$.

Initially consider the situation in the absence of eventual discovery. If the top migrating group is I then $W_R = 2$ and $kW(I) = 0.6 \times 2 = 1.2 > W_p(I) = 1$ so that group I migrates. If the top migrating group is II, $W_R = (1 \times 2 + 6 \times 6)/7 = 5.43$ so that $kW(II) = 0.6 \times 5.43 = 3.26 > W_p(II) = 3$. Hence both groups I and II migrate. If, however, the top migrating group is III, then $W_R = (1 \times 2 + 6 \times 6 + 13 \times 20)/20 = 14.9$ so that $kW(III) = 0.6 \times 14.9 = 8.94 < W_p(III) = 10$. Thus group III does not migrate under asymmetric information. And under asymmetric information groups I and II migrate and both receive a $k$ discounted wage of 3.26.

Now, let eventual discovery of the skills take place in $R$ and assume that this occurs after a period of time such that the
appropriate weighting factors for wage earned before discovery \((\alpha)\) and for wage earned after discovery \((1-\alpha)\) are 0.5 each. Consider what happens to group III. As before its earnings for the asymmetric information period are \(W_R(III) = 14.9\). Its post discovery earnings are, of course, 20. Hence its appropriate average earnings are \(0.5 \times 14.9 + 0.5 \times 20 = 17.45\) which, applying the location discount factor \(k\), yields \(10.47 > W_p(III) = 10\). Hence in the presence of eventual discovery as described above, group III migrates.

Consider now what this does for groups I and II. For group I the pre-discovery R wage is 14.9. Hence its average wage is \(0.5 \times 2 + 0.5 \times 14.9 = 8.45\) so that group I's location discounted wage is \(0.6 \times 8.45 = 5.07\) which exceeds its benefit under no discovery which was 3.26. Group II, of course, does better: Its average wage is \(0.5 \times 6 + 0.5 \times 14.9 = 10.45\) which after the location discount yields \(0.6 \times 10.45 = 6.27\) which also exceeds the no discovery equilibrium wage of 3.26.

Eventual discovery may thus benefit low skill workers. (Q.E.D).

This result is at first sight counter-intuitive since one would have thought that eventual discovery will lower the benefits to those who have most to hide, namely the low skill level workers. However, this does not happen in our case since the higher skill level workers attracted by eventual discovery
provide a benefit to low skill workers by raising their pre-discovery wages. This outweighs the cost of eventual discovery to the low skill workers.

V. CONCLUSIONS

In this paper we state and prove several results pertaining to migration under asymmetric information. We note that at least one migration pattern possible under symmetric information can be ruled out under pure asymmetric information, i.e. discontinuity cannot exist in the presence of pure asymmetric information; that asymmetric information will not increase and may decrease the skill level migrating; and that devices which tend to restore information symmetry can give rise to interesting patterns and welfare implications of migration e.g. in the presence of signalling - a U shaped pattern with respect to skill or, in the presence of eventual discovery - an increase in the welfare of the low skill migrant workers.

Our analysis can be extended in a number of interesting directions. For example, allowing for risk aversion on the part of employers may alter the nature of the results by making the wage offered to a group of migrants dependent not only on their mean skill level but also on the spread of skills among workers. In turn, employers' risk aversion may give them some motivation to invest in an early (or immediate) skill determining device, an
action which may alter the nature of the equilibrium. Another interesting extension would be to model a bilateral asymmetric information scenario, in which information is in part private to the workers and in part private to the employers.

Patterns of investment in location specific vis-à-vis transferable human capital are clearly affected by the opening of international migration. Further, investments by the high skilled to reduce cost and lag of precise discovery - and subsequent upward revision of wages, and investment by the low skilled to reduce ease of discovery - and subsequent downward revision of (average) wages may also need to be studied. The dynamics of allowing workers to quit an employer at the end of the first period and move to another in an attempt to prolong the prediscovery period would also be of interest.

Furthermore, it should be noted that our model has several applications beyond the context of international migration. For example, it is pertinent to analyses of rural-to-rural migration, rural-to-urban migration, inter-regional migration and return migration (which may, for example, be explained by a decline in the initial informational advantages of low skilled workers). Our model also pertains to general labour market mobility, e.g., occupational change, quitting one firm and
joining another, etc. We hope to present some results on these topics in future work.

Finally, a word of warning. Our model has abstracted from the dynamics of social attitudes and government policies towards migration when confronted with actual migration. These dynamics may be of great importance in the overall migration picture and should at a later stage be incorporated into the theory if it is to be used for formulating policy.
1. To make the analysis tractable we assume throughout that the wages in both R and P are dependent only upon a worker's skill level. In this we follow the similar assumption made in the optimal income tax literature.

2. This may, for example, result from a higher capital labour ratio in R.

3. If employers are risk-neutral and production functions are linear in skills, the employer does not suffer from his ignorance of the true skill level of each worker, so that paying the average product per worker will be the competitive outcome. These assumptions of risk neutrality and linearity in production are the commonly accepted assumptions in the screening literature. (See, for example, Stiglitz (1975)). Nonetheless, it may be of interest to examine wage schemes that are dependent on both the mean and the spread of the skill levels of individual workers.

4. See also the work by Hirshleifer and Riley (1979).

5. It appears that in rural India some farm hands continuously shift from one village to another rather than back and forth within a specific well-defined group of villages. These "permanently mobile" are very low productivity workers who secure the average rural wage upon arrival at a village.
But once their true productivity is revealed, they face the prospect of a lower wage. Apparently to avoid this they move to a new village, and so on.
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