LABOUR ALLOCATION ACROSS LABOUR MARKETS UNDER DIFFERENT INFORMATIONAL SCHEMES AND THE COSTS AND BENEFITS OF SIGNALLING

by

Oded Stark
and
Eliakim Katz
Harvard University

Development Research Department
Economics and Research Staff
World Bank

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Abstract

The effect of informational asymmetry on the level and skill composition of international migration and on the level of output are examined first, in the absence of signalling and, second, when a signalling device is available. Using total output as a criterion we find, inter alia, that signalling may not perfectly compensate for informational asymmetry and that reduction in the costs of signalling may not raise output.
The purpose of this paper is to examine some implications of the likely lack of information about the true skill level of international migrants in their new countries. Using a simple diagrammatic framework the effects of this informational asymmetry (workers are assumed to know their skill level whereas their new country employers do not) on the pattern and quantity of international migration and on total output are examined. In addition an analysis is offered of the effects of the availability of a signalling device on both the patterns and quantity of migration and on total output.

We shall proceed as follows. In section II the basic model is presented. In section III we consider the case of perfect information. In section IV we look at the effects of imperfect information (in the sense discussed above) on migration and global output, as well as on the existence of a competitive equilibrium. In section V we analyze the effect of the availability of a signalling device and examine how the cost of such a device affects migration and global output. In section VI we offer some concluding comments.
II

Our basic model is as follows: Consider a world consisting of a poor country P and a rich country R. Workers in P receive a wage $W_P(A)$ where A is their skill level which is assumed to be perfectly identified by P country employers. If their true skill level is perfectly known to employers in R the P workers when in R receive their true marginal product $W_R(A)$ where $W_R(A) > W_P(A)$ for all A. We call this the case of perfect information. However, if employers in R cannot observe the true skill level of individual P workers – skill information is imperfect – but the distribution function of A is known to them, they pay migrants a wage equal to the average productivity of the migrant group.3

To ease derivation of some suggestive initial results we assume the following specific functional forms:4

$W_P(A) = p_0 + pA, \ W_R(A) = r_0 + rA$ where $p_0, p, r_0, r$ are all positive and A is uniformly distributed on the closed interval $(0,1)$.

We shall assume that to reach their migrating decision P workers compare their income in P with k times their income in R, $0 \leq k \leq 1$, reflecting their preference (all things being equal) for living in their country of origin. From here on, therefore, $W_R(A)$ should be interpreted as $kW_R(A)$, so that it may be below $W_P(A)$. 

Let us consider now perfect information. We distinguish between two cases. In the first case the constellation of the $W_P(A)$ and $W_R(A)$ curves is as in Figure 1a. In this case, skill levels in the interval $(0, \tilde{A})$ will migrate, whereas skill levels in the interval $(\tilde{A}, 1)$ will not.

In Figure 1b the constellation of the curves is reversed and hence, as is clear from the Figure, skill levels up to $\tilde{A}$ will not migrate whereas skill levels above $\tilde{A}$ will migrate.

The reader should note that though at this stage this categorization of cases may appear uninteresting, once imperfect information is introduced, the results will be very different for the two cases.

The basis for the result relating to Figure 1 is as follows: In Figure 1a the difference between $W_R(A)$ and $W_P(A)$ declines as $A$ increases. Such a circumstance may occur for a variety of reasons: Progressive taxation, diminishing marginal returns to skill level, etc. Hence, the relative attraction of the rich country declines as workers' skill level rises so that for high skill workers $W_R(A) < W_P(A)$, whereas for low skill workers $W_R(A) > W_P(A)$.

In contrast, in Figure 1b the absolute difference between $W_R(A)$ and $W_P(A)$ rises as $A$ rises. This may occur if the difference between the marginal product functions of the rich and poor countries is convex because, say, there exists a production...
complementary between labor and capital. In such a case, the relative attraction of migration will be higher for the high skill workers than for the low skill workers and hence $W_R(A) - W_P(A)$ is positive for high levels of $A$ and is negative for low levels of $A$.

IV

Let us now introduce imperfect information, so that the employer in $R$ cannot distinguish between individual skill levels of $P$ workers. Our first result regarding this state of affairs is as follows:

Result 1: For the case depicted in Figure 1a the effect of imperfect information is that in competitive equilibrium there will be a lower number of migrants $A^* < \hat{A}$.

The rationale behind this result is as follows: At $A = 0$, clearly $W_R(A) > W_P(A)$ and therefore some low skill workers will migrate. As $A$ rises, however, the higher skill workers will earn less than they would otherwise since due to imperfect information they are "pulled down" by the lower skill workers. Hence, the cut-off migration level will be at a lower skill level than in the presence of perfect information and the outcome here, is therefore $A^* < \hat{A}$.

In more technical terms, the results may be proved as follows: The shape of the earning curves sets an upper limit on
the skill distribution of potential migrants; if all migrants are paid a wage equal to the average productivity of the total migrant group, then this wage \( \hat{W}_R(A) \) is given by

\[
\int_0^\hat{A} (r_0 + rA) dA/\hat{A} = r_0 + (r/2)\hat{A}
\]

where \( \hat{A} \) is the highest skill in the group. This \( \hat{W}_R(A) \) curve is depicted by the broken line in Figure 2a, with the new equilibrium level of migration \( A^* < \hat{A} \).

We now have a result regarding the net output effect of imperfect information.

**Result 2:** For the case depicted in Figure 2a, the net loss of output due to imperfect information is given by the area of the triangle BCD.

This result may be seen by noting that output due to workers in the \((A^*, \hat{A})\) range was the area bounded by \( A^*DBA \) under perfect information and the area bounded by \( A^*CBA \) under imperfect information. Hence the loss in output is the area bounded by \( A^*DBA - \) the area bounded by \( A^*CBA = \) area bounded by BCD.

Let us now turn to the case described in Figure 1b, i.e. where the \( \hat{W}_R(A) \) curve is steeper than the \( W_p(A) \) curve. In this case, a competitive equilibrium may not exist under imperfect information.

**Result 3:** If the constellation of the \( \hat{W}_R(A), W_p(A) \) and \( \hat{W}_R(A) \) is as depicted in Figure 2b, a competitive equilibrium does not exist, under imperfect information.

This result may be seen by noting that in Figure 2b
W_p(l) > W_R(l) i.e. the wage payable to P workers in R when all skill levels migrate is below the wage payable to the top skill workers in P. Hence, top skill workers from P will not migrate. Moving to the left on the W_R(A) curve, it is easily seen that no one will migrate. Thus an equilibrium will appear to be established with no migration. But if no one migrates, it now pays high skill workers to migrate since, unencumbered by the presence of low skill workers, they do better in R than in P. However, once the top skill workers migrate the low skill workers will have an incentive to do so under the cover of the high skill workers. This reduces the mean marginal product and thereby reduces the R wages of high skill workers who now no longer find it worthwhile to migrate, etc. Thus no competitive equilibrium exists. However,

Result 4: If the constellation of W_R(A), W_p(A) and W_R(A) is as depicted in Figure 2c, a competitive equilibrium exists in which all workers migrate. This result follows from the fact that \( \hat{W}_R(1) > W_p(1) \) so that the highest skill workers benefit from migration even if all workers migrate thereby pulling down the wage payable to all migrants.

Result 5: In Figure 2c the net loss in output is given by the triangle FBE.

To see this, note that the original output of the OA skill group was the area bounded by OABF whereas the new output is the
area bounded by $O\tilde{A}BE$. Hence the loss in output is area bounded by $O\tilde{A}BF$ - area bounded by $O\tilde{A}BE = area$ bounded by $FBE$.

V

Let us now examine the effects of introducing a perfect signalling device which can be bought by workers at a constant price $S$ and which enables them to accurately signal their skill level to $R$ employers.

**Result 6:** In the case described by Figure 3, the availability of a signalling device costing a fixed amount $S$ will increase migration.

The original, imperfect information equilibrium is at $A^*$. To introduce the fixed cost signalling device, we draw a curve $W_R(A)-S$ which is parallel to $W_R(A)$. The resulting equilibrium is that workers in the $(0,A_1)$ skill range migrate without acquiring the signalling device, and that workers in the $(A_1,A_2)$ skill range migrate having acquired the device. Migration now takes place in the $(0,A_2)$ range, exceeding the $(0,A^*)$ range which is the pattern in the absence of the device.

**Result 7:** In the case described by Figure 3, the availability of the signalling device may raise or reduce net output. This depends on the sign of the difference between the areas bounded by $KLB$ and $GLCD$. 
To see this note that the resources spent on the device by migrants in the skill range \((A_1, A_2)\) are the area CDMB. The gain in output due to the employment of \((A^*, A_2)\) in \(R\) is the area MBKG. Hence the total effect of the signalling device, including the resources spent on its acquisition, is area MBKG – area CBMD = area BKL – area GLCD, which may be positive or negative.

Now clearly, if the cost of the device, \(S\), is zero we are back in a perfect information setting and net output unambiguously rises. If, on the other hand, \(S\) is very large, no one will buy it and we have an imperfect information setting, so that such a device does not affect output. Thus, given result 7 we find that the level of total output need not vary monotonically with the price of the signalling device. As the price of signalling goes down, output may go down also, at least for some given range of signal price. Such a possibility is depicted in Figure 4.

Clearly, output is highest at \(S=0\). In the range \(0S_1\) output falls in response to a rise in the price of the signalling device, as we move away from perfect information. Between \(S_1\) and \(S_2\) net output rises, a situation which corresponds to area KLB – area GLCD in Figure 3 being negative. Beyond \(S_2\) net output falls once again as \(S\) rises, until at \(S_3\) no one acquires the device and net output is invariant to further increases in the price of \(S\).

**Result 8:** In the case depicted in Figure 5, migration declines as a signalling device is introduced.
In this figure we use the same notation as in Figure 3. To see the result note that in this case all workers migrated prior to the introduction of the device, whereas after the introduction of the device only those in the range \((A_1,1)\) migrate. This occurs because the high skill workers who now use the signalling device no longer shelter the low skill ones. The low skill workers, therefore, do not find it worthwhile to migrate as the mean wage to them declines.

**Result 9:** In the case depicted in Figure 5, the effect of the signalling device on net output is given by area CDE - area EHGF.

To see this note that migration now takes place in the \((A_1,1)\) range. These skilled workers all migrated before, so that their output does not alter, but they all incur the cost of the device - area HGFB. Workers in the skill range \(\tilde{A}A_1\) also migrate in the absence of the device but do not do so once the device is introduced. The net loss of output is thus area \(\tilde{A}A_1\)BE - area \(\tilde{A}A_1\)HE = area HEB. Finally, workers in the skill range \(O\tilde{A}\) migrated before but no longer do so. This brings about a gain in output equal to area \(O\tilde{E}D\) - area \(O\tilde{E}C\) = area CED. Hence, since area HEB + area HGFB = area EHGF, the change in output is area CDE - area EHGF.

Note that here also a change in the price of the signalling device may bring about an increase or a decrease in net output.
VI

In this paper we considered the effects of imperfect information and of the availability of skill signalling devices on patterns of migration and global output. First, we showed by providing appropriate examples that in comparison with the perfect information case, imperfect information may cause equilibrium migration to rise or fall or that it may cause there to be no competitive equilibrium. In those cases where an equilibrium exists, however, global output unambiguously declines in response to imperfect information. Second, we showed that the availability of a signalling device may raise or reduce equilibrium migration. In as much as the signalling device may be viewed as a "cure" for imperfect information this may not be surprising. However, we also found that the availability of the signalling device may, for a certain price range, reduce output. In that sense at least, therefore, a signalling device cannot be viewed as the antithesis of imperfect information. Hence, if output maximization is the criterion, a reduction in signalling costs may reduce rather than raise welfare.
1. The analysis presented in this paper would be equally applicable to inter-regional migration within one country when the regions are heterogeneous or distant from one another.


3. If employers are risk neutral and the production functions are linear in skills the employers do not suffer from their ignorance of the true skill level of each worker so that paying the average product per worker will be the competitive outcome.

4. While the type of results obtained here may be derived with more general assumptions as shown in a companion paper (Katz and Stark (1986)), in the current paper we adopt specific forms to facilitate use of an intuitive, diagrammatic approach.
REFERENCES


Figure 1
Figure 2
Figure 3
Figure 4
Figure 5
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