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**Institutional Development: Skill Transference Through  
a Reversal of “Human Capital Flight” or Technical Assistance**

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**Abstract**

We examine the issue of technical assistance versus brain drain repatriation as alternative strategies for transferring scarce skills to a skill-poor economy. Technical assistance relies mainly on expatriate skills and labor from the host country, while brain drain repatriation seeks to effect a return of skills that might have been lost in migration. We show that, even in the simplest setting with imperfect information, a surprisingly rich menu of responses is obtained.

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## SUMMARY

The question asked in this paper can be simply put: Should aid to a skill-poor economy (say, Ruralia) be given in the form of skilled labor from the donor country (say, Urbania) or in the form of a repatriation of talent that might have previously migrated from Ruralia to Urbania? Alternatively, should aid funds that have been earmarked for technical assistance for Ruralia be focussed more on the repatriation of migrants with requisite skills or on the market for expatriate professionals? From the standpoint of wages available in Urbania, Ruralian labor will skill for skill be cheaper than its Urbanian counterpart; it will also be more effective in its home country and may be willing to take a discount of the Urbanian wage. However, the fact that brain drain repatriation programs remain the exception rather than the rule suggests either that Urbanian residency renders Ruralian labor less adaptable to Ruralia than Urbanian labor or that political or noneconomic considerations may be involved.

The primary concern of this paper is not with reversing the brain drain but with assessing the efficacy of aid policies that do not take resident labor of the targeted country into account. The paper shows that the choice between the two policy options--repatriation and expatriate consultant advice--depends on the way that the wage and the size of the labor force are distributed over skills, and in particular on how these distributions in the two countries interact. Only under certain restrictive conditions such as the total dominance of the Ruralian skill distribution by the Urbanian distribution, is concentration on expatriate technical advice the preferred alternative. In most cases the preference of the Ruralian emigrants for their home country would make repatriation the more cost-effective choice.

## I. Introduction

The question that we ask in this paper can be simply put: should aid to a skill-poor economy be given in the form of skilled labor from the donor country, or in the form of repatriation of talent that might have migrated in the past from the skill-poor country resident to the donor country, with wages in either case being determined with respect to those prevailing in the donor country? In more concrete terms, should the US government use aid funds that have been earmarked for technical assistance for, say Pakistan, by focussing on the repatriation of Pakistani residents in the US, or should it look more generally at the market for expatriate professionals?<sup>1</sup> Viewed in such specificity, the answer seems obvious in terms of the economics. Given that both policies are pegged to US wage levels, it stands to reason that skill for skill, Pakistani labor will be cheaper than its US counterpart. As emphasized by Kwok-Leland (1982), the former will be more effective in their home country and may also be willing to take a slight discount of the US wage, considerations that will be reversed for labor foreign to Pakistan. Since brain drain repatriation programs are the exception rather than the rule, this suggests either that US residency renders Pakistani labor less adaptable to Pakistan than US labor, or that political or extra-economic considerations may be involved.

We show that the analysis is richer and more complicated than this somewhat naive intuition suggests. The answer to the question that we pose in this note depends on the way that the wage and the size of the labor force are distributed over skills, and in particular on how these distributions in the two countries interact. It is frequently the case that a particular policy is either ineffective, or has consequences different from those that are intended.

A final introductory remark before we turn to the formal analysis. Existing work on the economics of the brain drain, and on international migration more generally, investigates the effects of immigration on the economies of the source and the host countries.<sup>2</sup> Since our concern here is with the replacement of needed scarce skills for a poor country, we move our attention away from the general equilibrium ramifications and instead take the wage distributions in either country as given. We thus formulate our problem in the context of work that explicitly faces up to the problem of imperfect

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<sup>1</sup> The current

<sup>2</sup> See Bhagwati-Partington (1976) and the references therein. We also comment on this literature in a concluding remark below.

information in the context of several skill levels as in the work of Kwok-Leland (1982), Stark (1991) and their followers. The discussion presented here may be regarded as an application to a specific policy question of the basic conception articulated in these references.

## II. The Formulation and the Basic Analysis

We assume that there are two countries which we shall call Ruralia and Urbania in order to not draw unjustified inferences as to policy.<sup>3</sup> We shall assume that Ruralia is the skill-poor economy and Urbania the skill-rich donor economy. We shall assume that there are a continuum of skill levels represented in each country by the same closed interval  $[\underline{\theta}, \bar{\theta}]$ , and that the wage functions of the two countries,  $w_r(\theta)$  and  $w_u(\theta)$ , are non-decreasing over this interval. Following Kwok-Leland (1982; p. 92), we shall assume that there is “some fraction  $k < 1$  such that a [Ruralian] worker would be indifferent between working in [Urbania] for a wage  $w$  and returning to [Ruralia] for a wage  $kw$ .” Analogously, we shall assume that there is some fraction  $\beta > 1$  such that an [Urbanian] worker would be indifferent between working in [Urbania] for a wage  $w$  and in [Ruralia] for a wage  $\beta w$ .

Given the wage functions and the parameters  $k$  and  $\beta$ , we can appeal to standard arbitrage conditions to assert that there will be no brain drain if

$$w_r(\theta) \geq kw_u(\theta) \text{ for all } \theta \in [\underline{\theta}, \bar{\theta}],$$

and there will be a total brain drain if

$$w_r(\theta) \leq kw_u(\theta) \text{ for all } \theta \in [\underline{\theta}, \bar{\theta}].$$

There is nothing to analyze in the case where there is no brain drain, and we shall see that a total brain drain is a special case of the simplest version of the analysis case of a partial brain drain presented below, at least in the context of the issues considered here. We begin with this analysis.

### A. Skill-Independent Wages in Ruralia

Assume, to begin with, that skill levels cannot be monitored in Ruralia, but can be

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<sup>3</sup> Kwok-Leland (1982, 1984) and Katz-Stark (1984) use Taiwan and the US as the relevant labels for the two countries.

perfectly monitored in Urbania.<sup>4</sup> We can then use the basic parameters of the model to calculate three skill levels of interest. The first of these is the equilibrium skill level  $\theta^*$  such that all Ruralian workers with higher skill levels reside in Urbania and earn Urbanian wages. We can characterize  $\theta^*$  as the solution to the equation

$$w_r(\theta) = kw_u(\theta).$$

Given our focus on a partial brain drain and our assumptions on the wage functions, it is clear that there exists a unique  $\theta^*$ . We depict this in the Katz-Stark (1984) diagram labelled as Figure 1. In this and succeeding diagrams the  $w_u$  schedule is not shown but is assumed to lie everywhere above the  $w_r$  schedule.

The equation above represents the basic equilibrium situation that a donor agency in Urbania is confronted with. In order to evaluate the desirability of a policy of technical assistance *vis a vis* one of brain drain repatriation, the agency has to decide on a particular wage level that will be paid to workers returning to Ruralia. If this is chosen to be  $\bar{w}$  as shown in Figure 1, we obtain the skill levels  $\theta_t$  and  $\theta_b$ . The former is the highest skill level at which Urbanian workers will consider working in Ruralia as part of the technical assistance program, and the latter is the highest skill level at which Ruralian workers will consider returning to Ruralia as part of a brain drain repatriation program. We can characterize these skill levels as

$$kw_u(\theta_b) = \bar{w} = \beta(\theta_t).$$

Again, given our assumptions *and* the particular wage that is governing the aid program,  $\theta_t$  and  $\theta_b$  will be uniquely determined.

Before proceeding further, we record the observation that under our specific parametrizations, the skill levels  $\theta^*$ ,  $\theta_b$  are strictly increasing functions of  $k$ , and  $\theta_t$  is a strictly decreasing increasing function of  $\beta$ . This is simply the statement that the smaller the discount of the Urbanian wage that the returning Ruralian workers will accept, the lower the minimum Ruralian skill level resident in Urbania, and the lower the maximum skill level of Ruralian labor that can be induced to return to Ruralia through brain repatriation at the given wage. Analogously, the higher the foreign country allowance that is demanded by Urbanian workers, the lower the maximum skill level of Urbanian labor that can be induced to work in a technical assistance program.

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<sup>4</sup> This is in keeping with the Kwok-Leland assumption that foreign degrees cannot really be distinguished in terms of productivity from the local degrees by the local employers.

Figure 1  
Skill Independent Wages in Ruralia

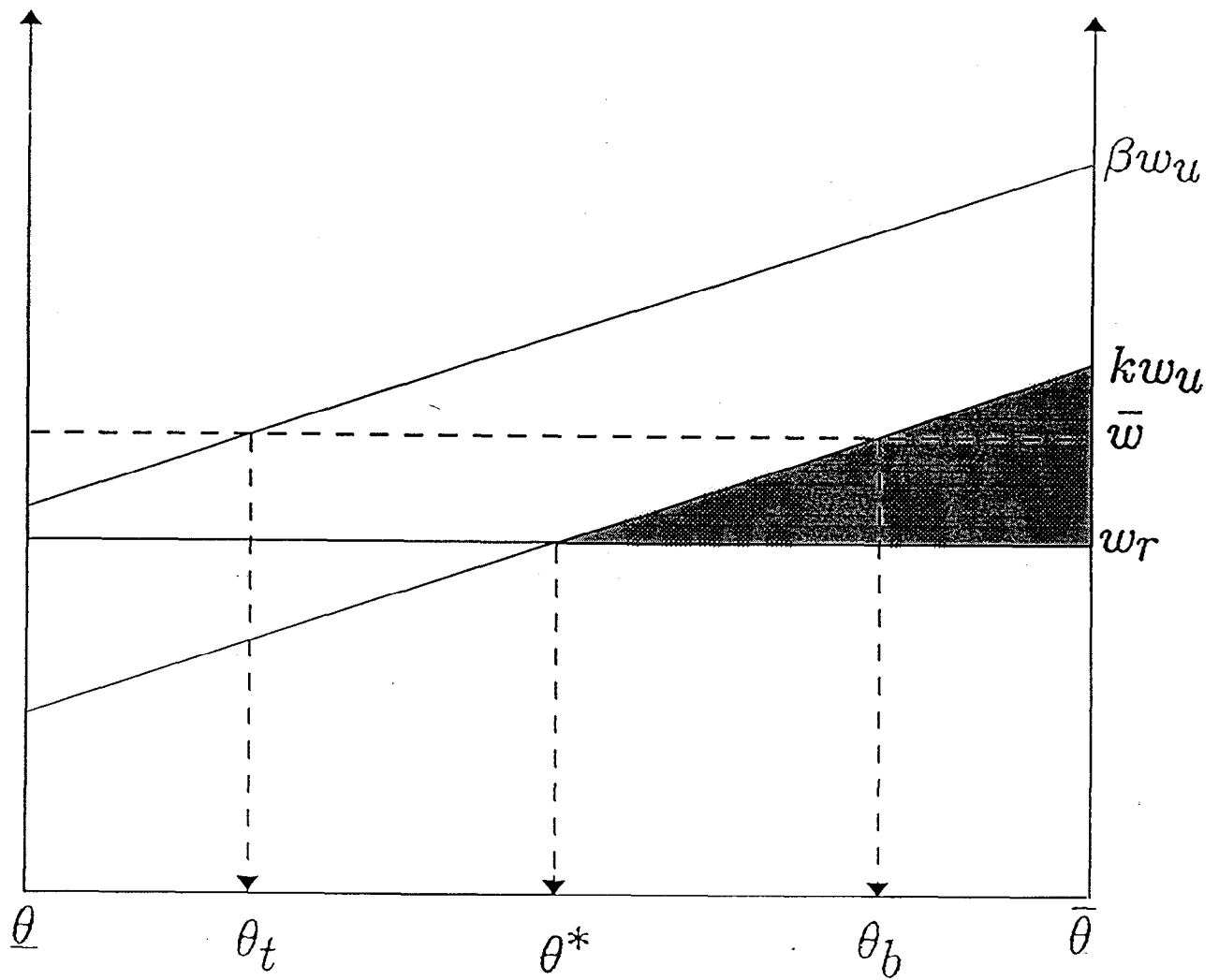


Figure 1 also brings out the importance of the wage level at which the two policy options are being evaluated. If  $\bar{w}$  is less than  $w_r$ , then neither policy is *viable*. Indeed, a policy of technical assistance as conceived here becomes *viable* if and only if  $\bar{w}$  lies in the interval  $[\beta w_u(\underline{\theta}), \beta w_u(\bar{\theta})]$ , and the policy of brain drain repatriation is viable if and only if  $\bar{w}$  lies in the interval  $[w_r, k w_u(\bar{\theta})]$ . This definition of viability is premised on wage levels which will have an impact; one could higher wage levels but they would have no impact on the size of the relevant labor pool irrespective of how much they are increased.

If the only policy objective is to attract the highest possible skill levels to Ruralia, it is clear that a policy of brain drain repatriation is unambiguously superior to that providing technical assistance. Under a viable policy of repatriation, one is guaranteed to attract skill levels higher than the existing ones; something which is not true for a viable policy of technical assistance. In formal terms, this is simply saying that  $\theta_b > \theta^*$  and that  $\theta_t$  can be greater or lower<sup>5</sup> than  $\theta^*$ . Indeed, as exhibited by the parameters of Figure 1, a policy of technical assistance may well end up by transferring to Ruralia only those skill levels which it already has, but at premium wages owing simply to the fact that it carries the Urbanian label.

One other point deserves to be emphasized, and this concerns the asymmetry in incentives. Under brain drain repatriation, workers with the highest skill level under either policy –  $\theta_b$  as opposed to  $\theta_t$  – are indifferent between the two locations Urbania and Ruralia, but this is no longer true for workers with the lowest skill levels. Workers with the lowest skill levels under a policy of brain-drain repatriation have a higher incentive to locate to Ruralia than those under the regime of technical assistance. As the reader will recall, we have already shown that the skill level in the second case is lower than in the first. All this can be formally expressed as

$$\bar{w} - \beta w_u(\underline{\theta}) < \bar{w} - k w_u(\theta^*) = w - w_r,$$

where the equality follows from the equilibrium condition. The inequality now follows from the fact that

$$\bar{w} - \beta w_u(\underline{\theta}) < \bar{w} - w_u(\bar{\theta}) \leq w - w_r.$$

One possible way of looking at this result is to see it as simply asserting that, if either

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<sup>5</sup> The case  $\theta_t < \theta^*$  is already exhibited in Figure 1; for the converse, one simply needs a value of  $\beta$  such that the  $\beta w_u$  intersects the  $\bar{w}$  schedule to the right of  $\theta^*$  while remaining above the  $w_r$  curve. We leave it to the reader to modify Figure 1 so that this case obtains. We shall also meet this possibility in the sequel but without the assumption of skill-independent wage-levels in Ruralia; see Figure 3 and 6 below.



policy is to be supplemented by additional inducements, lower quality Urbanian labor will require higher levels of inducements than higher quality Ruralian labor.

Note that the above results are all independent of the population densities of Ruralian labor resident in Urbania, and that of Urbanian labor that is candidate for technical assistance programs. These densities attain importance for sharper results. In particular, consider the case when<sup>6</sup>  $\theta_t > \theta^*$ . The cost of a program which can finance all the Urbanian residents willing to locate to Ruralia is given by

$$R_t \equiv \beta \int_{\underline{\theta}}^{\theta_t} w_u(\theta) f_u(\theta) d\theta,$$

while the corresponding cost for the brain-drain repatriation program is

$$R_b \equiv k \int_{\theta^*}^{\theta_b} w_r(\theta) f_r(\theta) d\theta,$$

where  $f_u(\theta)$  and  $f_r(\theta)$  are the respective population densities of the relevant Urbanian and Ruralian labor. If the budget constraint of the donor agency is given as  $R$ , and no resources are left unused under either policy, there are two additional skill levels,  $\theta_t^{\min}(R)$  and  $\theta_b^{\min}(R)$ , that are relevant to the discussion. These are given by the equations

$$R = \beta \int_{\theta_t^{\min}(R)}^{\theta_t} w_u(\theta) f_u(\theta) d\theta ; \quad R = k \int_{\theta_b^{\min}(R)}^{\theta_b} w_r(\theta) f_r(\theta) d\theta.$$

Since both  $\theta_t$  and  $\theta_b$  depend on  $\bar{w}$ , we also have in the above two equations a locus showing the wage-resource trade-off for each policy. More importantly, depending on these densities, the equations show that for a given value of  $R$ , it is entirely conceivable that technical assistance policies will yield a higher skill labor force than repatriation policies.

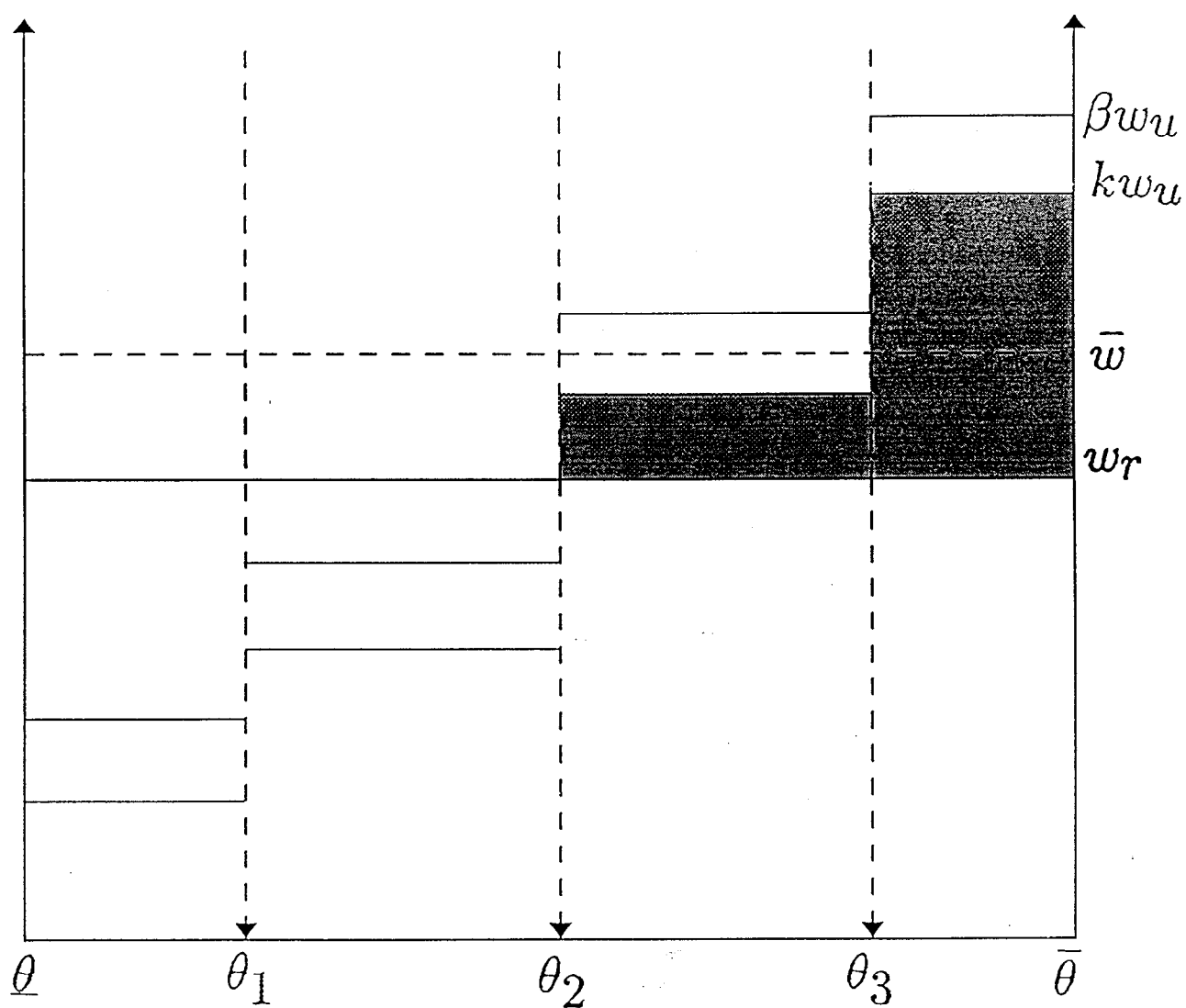
Once costs and resources are explicitly brought into the picture, we can highlight two particular values of the skill levels computed above. The first is the minimum skill level that a technical assistance program will engender if the budget constraint of the Urbanian donor agency is precisely that which is required to repatriate all of the Ruralian resident in Urbania. This is given by  $\max[\underline{\theta}, \theta_t^{\min}]$  where  $\theta_t^{\min}$  is given by the equation

$$\beta \int_{\theta_t}^{\theta_t^{\min}} w_u(\theta) f_u(\theta) d\theta = k \int_{\theta^*}^{\theta_b} w_r(\theta) f_r(\theta) d\theta.$$

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<sup>6</sup> See the footnote above. Also Figures 3 and 6 below

Figure 2  
Level Dependent Wages in Urbania



In this determination, we are being consistent in our assumption that the skill levels can be perfectly monitored in Urbania, and that therefore the Urbanian donor agency, in its recruiting efforts, works from the highest skill downwards.

The second particular skill level is dual to the one above. It is the minimum skill level that a repatriation program will engender if the budget constraint of the Urbanian donor agency is precisely that which is required to repatriate all of the Urbanian residents willing to locate in Ruralia. This is given by  $\max[\theta^*, \theta_b^{\min}]$  where  $\theta_b^{\min}$  is given by the equation

$$k \int_{\theta^*}^{\theta_b^{\min}} w_r(\theta) f_r(\theta) d\theta = \beta \int_{\underline{\theta}}^{\theta_t} w_u(\theta) f_u(\theta) d\theta.$$

Once we have characterized all of these various benchmark skill levels, we can ask how they change with respect to changes in the scalar parameters  $k, \beta, R, \bar{w}$ , and the parametric densities  $f_r(\cdot)$  and  $f_u(\cdot)$ . For the latter analyses, we would have to use notions of stochastic dominance that are now routine in the comparative static analyses of changes in risk and in inequality. However, rather than pursue this direction, it may be more insightful to relax the assumption of skill-independent wage levels in Ruralia.

Before we turn to this, we record two additional observations. The first concerns the assumption of perfect information on skill levels in Urbania. It may well be that the Urbanian market only registers skill levels within certain ranges with a consequent modification of the above results. The wage resource trade-off is essentially discontinuous in this case. Figure 2 exhibits the case where only four element partition of Urbanian skill levels is relevant; it is easy to see that there is no change in the resource cost or engendered skill levels of either policy as  $\bar{w}$  is perturbed within a small enough range. Note also that in this case, the assumption that the donor agency works downwards from the highest skill level is no longer tenable; it will either have to recruit randomly or will have to put into effect additional signalling and monitoring mechanisms.<sup>7</sup>

Our second observation considers the case which we have deferred all this while: that of the total brain drain. In this case, Figure 1 applies with  $\theta^*$  simply identical to  $\underline{w}$ , and  $\theta_t$  if it exists, cannot of necessity lie to the left of  $\theta^*$ . The reader should also note that,

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<sup>7</sup> For a discussion of these as well as for references to related literature, see Katz-Stark (1986) and Stark (1991; Chapters 12 and 13).

Figure 3  
Skill Dependent Wages in Both Countries

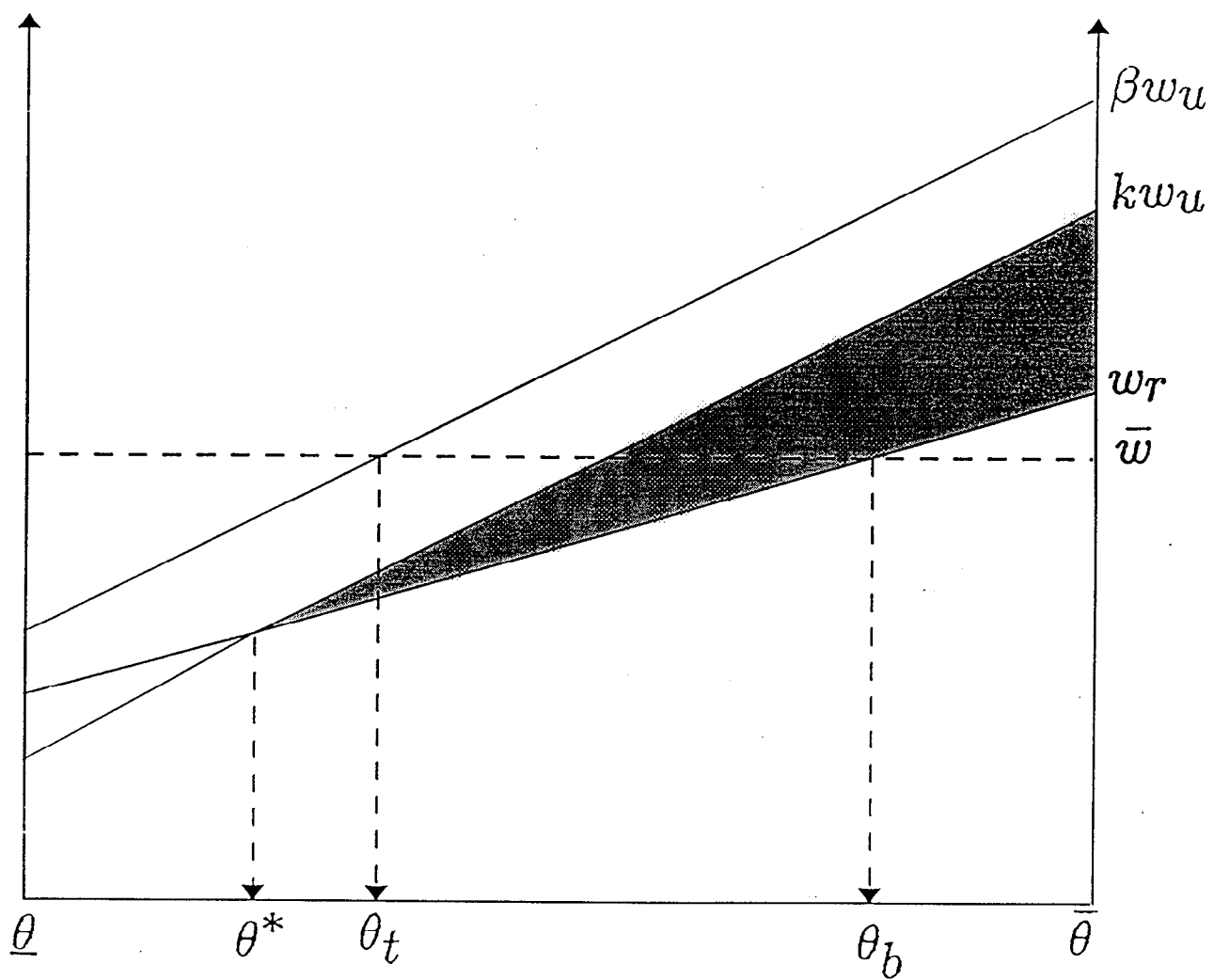
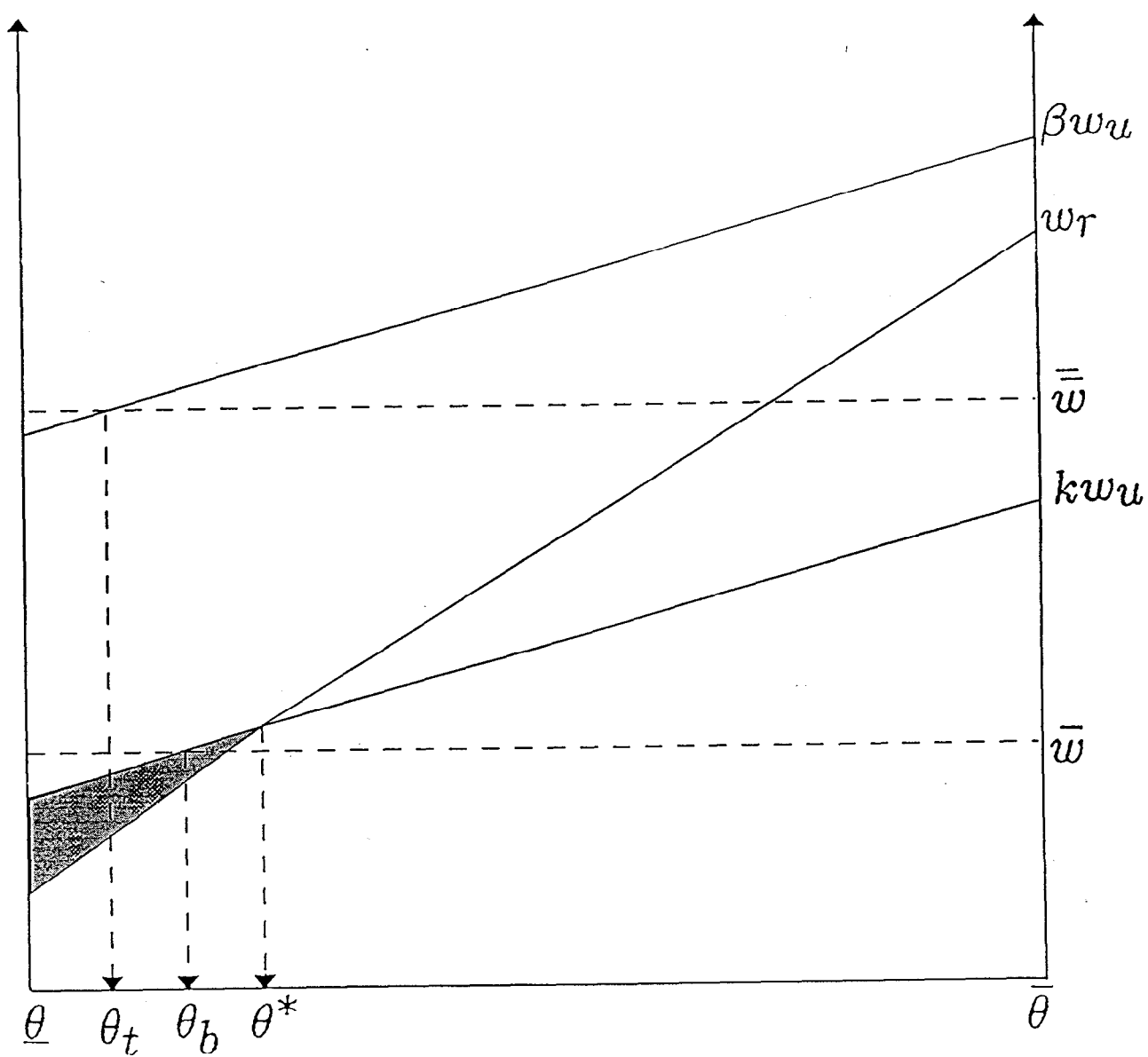


Figure 4  
The Case of Unskilled Migration



unlike the case of a partial brain drain, the assumption of skill-independent wage levels in Ruralia is of no consequence to the general results.

### B. Skill-Dependent Wages in Both Countries

We now relax the assumption of skill-independent wage levels in Ruralia but keep the linearity assumption for both countries. What stands out in this regime is the possibility of a brain drain consisting skill levels only at the lower end of the skill spectrum. Thus in Figure 3, the brain drain consists of all levels higher than  $\theta^*$ , but Figure 4 exhibits the case where the Ruralian labor resident in Urbania belongs to skill interval  $[\theta^*, \bar{\theta}]$ . Note that in this case we have the possibility that does not occur in the case of skill-independent Ruralian wages that  $\theta_b < \theta^*$ . Remaining with the parametrizations of Figure 4, note that the policy of brain-drain repatriation is viable<sup>8</sup> for wage levels lying in the interval  $[w_r(\underline{\theta}), \theta^*]$ , whereas technical assistance policies have the entire interval  $[\beta w_u(\underline{\theta}), \beta w_u(\bar{\theta})]$  at their disposal. What is interesting is that the policy of technical assistance is viable only at wage levels much higher than those required to repatriate all Ruralian labor back to Ruralia. Formally, for all wage levels between  $kw_u(\theta^*) = w_r(\theta^*)$  and  $\beta w_u(\underline{\theta})$ , there is nothing more to be gained by either policy; repatriation policies have already generated their maximum yield, and technical assistance policies are not yet viable.

Furthermore, the difference in resource cost between the two policies, assuming that both policies yield identical skill levels, is given by

$$\beta \int_{\underline{\theta}}^{\theta^*} w_u(\theta) f_u(\theta) d\theta - k \int_{\underline{\theta}}^{\theta^*} w_u(\theta) f_r(\theta) d\theta.$$

If the densities  $f_u(\cdot)$  and  $f_r(\cdot)$  are identical over the interval  $[\underline{\theta}, \theta^*]$ , then the above cost reduces to

$$(\beta - k) \int_{\underline{\theta}}^{\theta^*} w_u(\theta) f_u(\theta) d\theta.$$

The wage  $\bar{w}$  brings out an extreme instance of the superiority of brain drain repatriation to the policy of technical assistance.

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<sup>8</sup> We continue to use the definition of viability employed in the subsection above.

### C. Increasing but Non-Linear Wages in One Country

In all of the cases considered so far, the brain drain consisted of skill levels that are at one of the polar ends of the skill spectrum. Once we relax the linearity assumption, we see a richer variety of possibilities. Thus in Figure 5, the brain drain consists of both the highest as well as the lowest skill levels,<sup>9</sup> while Figure 6 illustrates a brain drain of only intermediate skill levels. In either case, the equation  $w_r(\theta) = kw_u(\theta)$  has two solutions  $\theta^*$  and  $\theta^{**}$ . We shall leave it to the reader to check for herself how the discussion in the earlier cases gets modified to apply to cases where the wage functions in one of the countries are concave or convex. However, two points are worth noting.

First, the importance of the assumption of perfect information of Urbanian wages. A donor agency may well decide in favor of repatriation policies, but without careful monitoring, may be subsidizing Ruralian labor of skill level that is already available in Ruralia. In terms of the parametrization of Figure 5, such caution is warranted for all wage levels in the interval  $[kw_u(\theta^{**}), kw_u(\bar{\theta})]$ . Note that at such wage levels, technical assistance policies are not even viable. Furthermore even for wage levels in the interval  $[kw_u(\theta^{**}), \beta w_u(\bar{\theta})]$  the density of Ruralian labor resident in Urbania may be such that repatriation policies may be attracting Ruralian labor with skill levels that are already abundant in Ruralia. Of course, as has been the rule rather than the exception throughout this discussion, this problem is endemic to technical assistance policies.

Our second observation is made in the context of Figure 6, and concerns the case where the Ruralian economy is suffering from the paucity of intermediate skill levels. In this case, there is no Ruralian labor of skill level lower than  $\theta^*$  resident in Urbania, and hence repatriation policies at wage levels of  $kw_u(\theta^{**})$  or higher will relocate all of the Ruralian labor back to Ruralia. In this case, the need for the perfect information assumption, or that of a monitoring mechanism being in place, applies only to technical assistance policies.

The case that remains is one where the wage function of one or both of the countries is concave for some range of skill levels and convex over others. We then obtain

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<sup>9</sup> This case may well apply to pakistani labor resident in the UK – low skill agricultural labor and high skill medical doctors.

Figure 5  
Non-linear Wage schedule in Ruralia

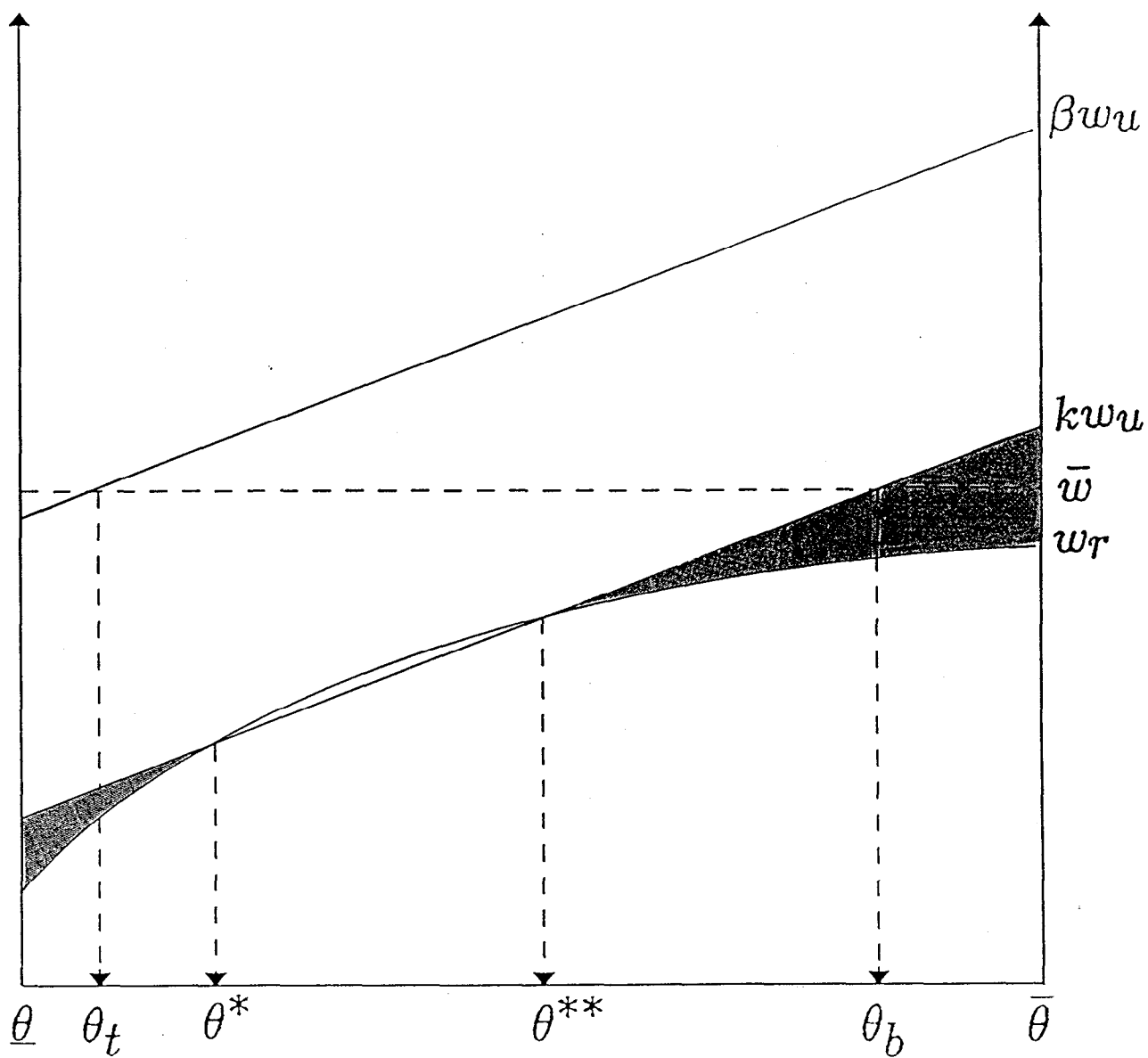
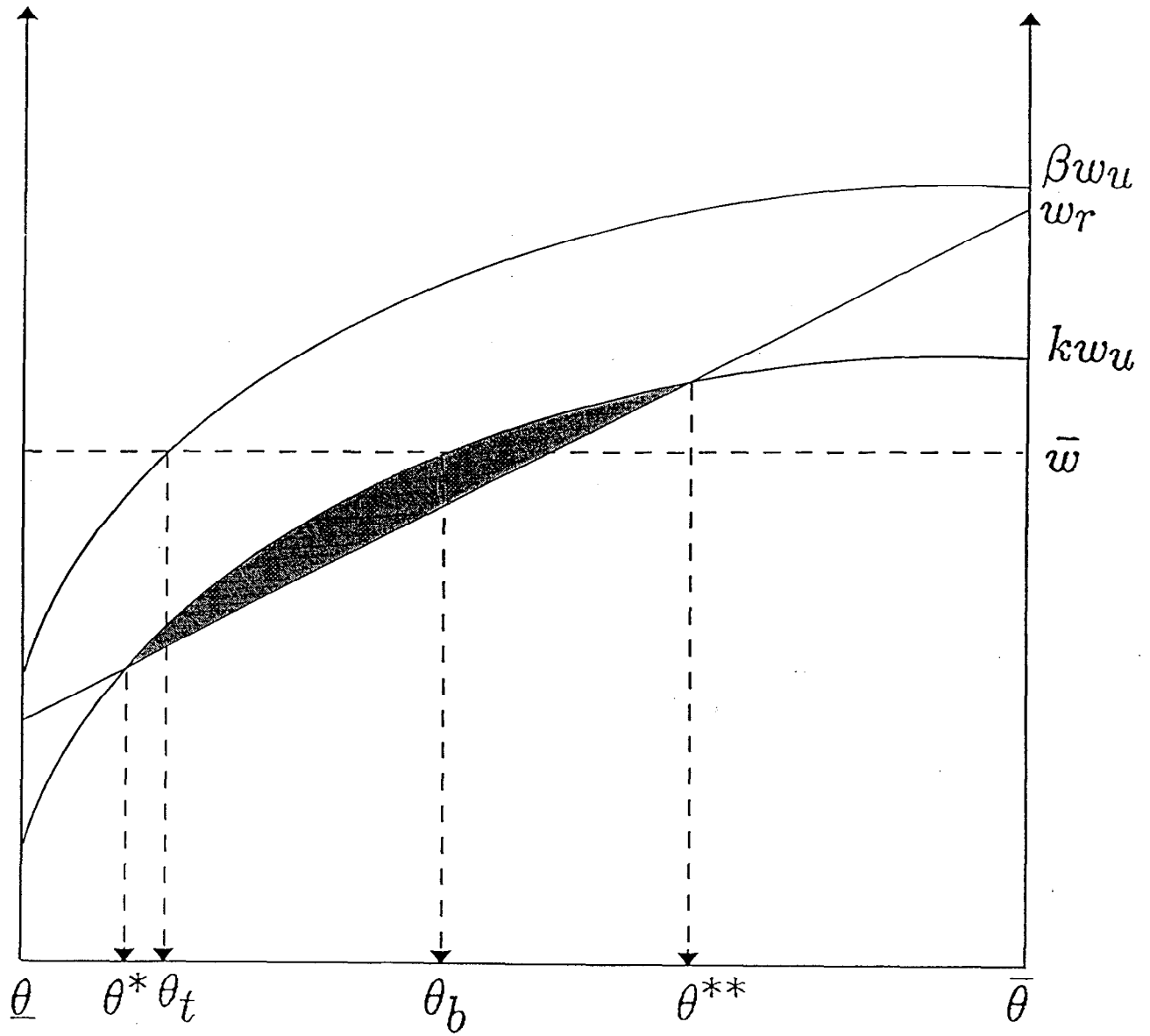




Figure 6  
Non-linear Wage schedule in Both Countries



several levels of  $\theta$  in equilibrium,<sup>10</sup> and we leave it to the reader to provide for herself as detailed an analysis as she wishes by stitching together the arguments above.

### III. Conclusion

Despite reform and technical assistance, key institutions in developing countries have not been developed to a desirable level of efficiency. The thrust of this paper is that one dimension of this problem might be the approach that is taken towards the allocation of talent. Skill transference that is required for institutional development is provided through technical assistance the current arrangements for which give preference to foreign nationals. On the other hand, many of the same institutions suffer from a loss of talent that occurs through migration or mobility to competing sectors. Technical assistance programs forbid or actively discourage a reallocation of talent, including a reversal of human capital flight. We show in this paper that, under a wide range of possibilities, the alternative of brain drain repatriation may be a more cost- effective instrument and one that may provide higher quality skills.

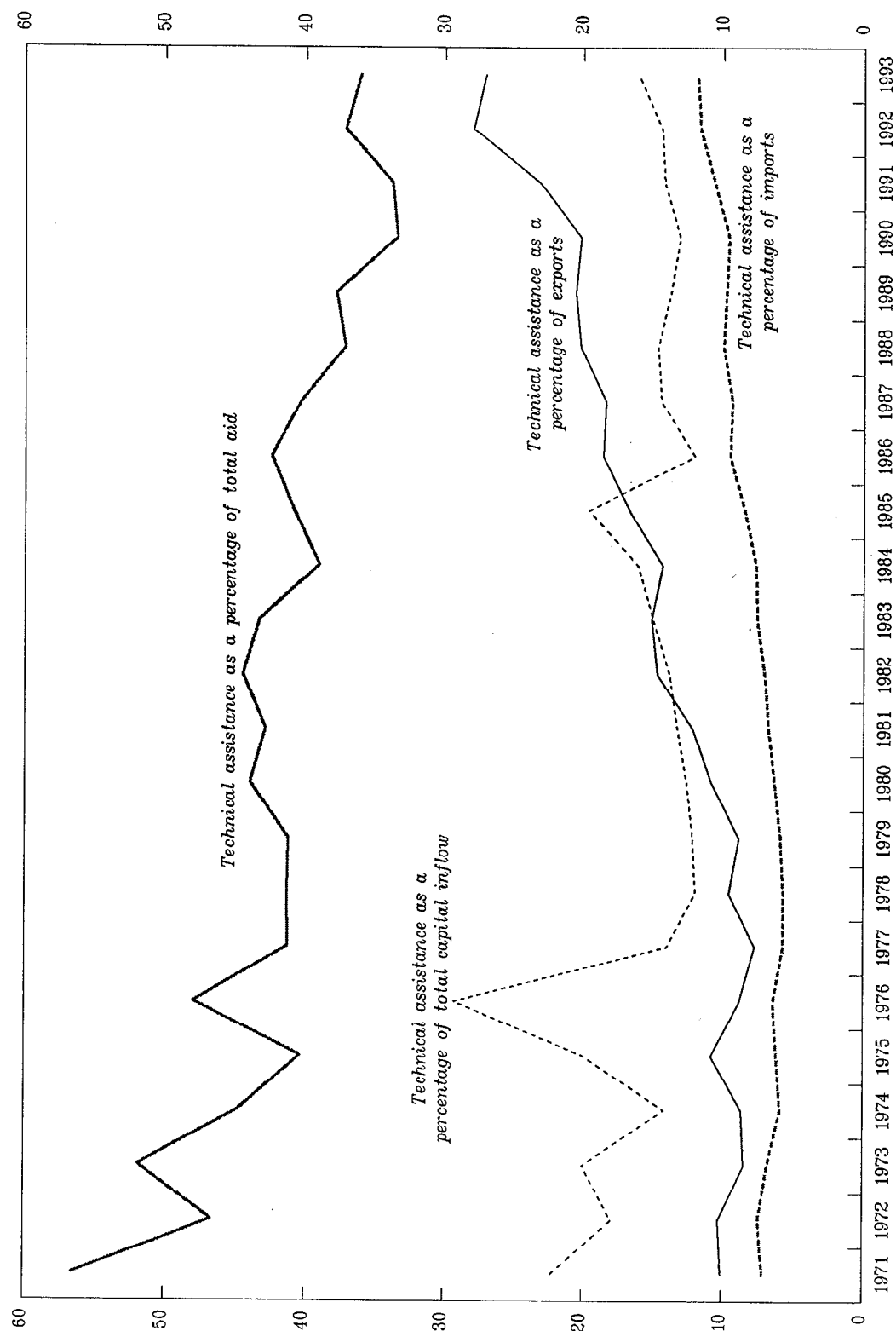
Technical assistance is a significant part of donor funds and an area that is seldom scrutinized in the spirit of this paper. As a percentage of total aid funds, technical assistance has been declining over the seventies and eighties to a level of level of 37 percent by 1993 (see Figure 7). However, as a percentage of exports and imports, the technical assistance funds have actually been increasing over this time period. For the nineties, technical assistance can be seen to remain important for Asia, Africa, Latin America and transition economies (see Figure 8). These figures illustrate the importance of the problem that is being discussed here and suggest that the alternative policy choices considered here—brain drain repatriation and donor consultant— should be carefully considered if the objective is that of delivering development through skill transfer.

Finally before ending the paper, we would like to outline some technical qualifications and extensions of our analysis. First, our discussion here should be viewed as pertaining to sectoral markets within the two countries, and with target labor groups being small enough that the assumption of given wage functions can be sustained.

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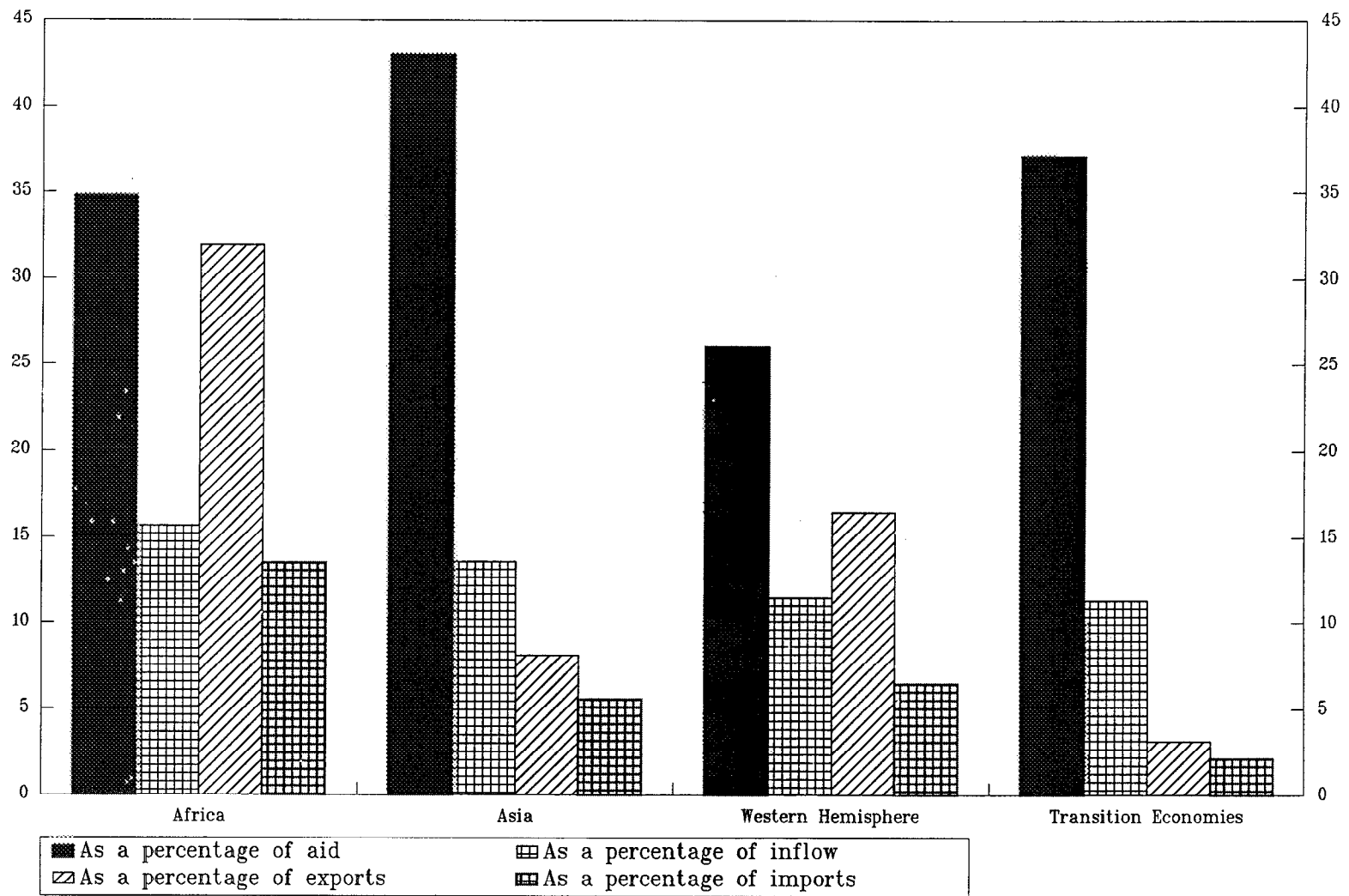
<sup>10</sup> See Figure 13.1 in Stark (1991), and also Figure 1 in Kwok-Leland (1982), but of course their concern is different from ours.

FIGURE 7  
TECHNICAL ASSISTANCE FLOWS OVER TIME  
(In percent)



Source: IMF, International Financial Statistics.

FIGURE 8  
TECHNICAL ASSISTANCE FLOWS ACROSS REGIONS  
(In percent)



Source: IMF, International Financial Statistics.

Second, note that we have set up our problem narrowly in terms of repatriation and assistance policies. An alternative and equally important question is whether technical assistance be provided in terms of physical or human capital, or to pose the problem even more generally, should a fixed amount of aid resources be spent on machinery, repatriation of labor resident in the donor country or assistance by sending technically qualified nationals of the donor country. However, once physical capital is brought into the picture, we can no longer avoid the explicit introduction of technology and some articulation of the general equilibrium type of how wages, especially those in the target country, are being determined. This takes us closer to the Harris-Todaro type models with homogeneous labor,<sup>11</sup> and a synthesis between this and the imperfect information literature may by now be overdue.

Third, unlike Kwok-Leland and their followers, we have not examined the adverse selection problems that arise from average productivity wage policies; we have been eclectic as to wage policies and shown how with any given wage, our problem involves the interaction between adverse selection in two markets. There is no presumption in the discussion above that there is any implicit distortion in the wage functions  $w_r$  and  $w_u$ .

Fourth, it bears emphasis that unlike the policy proposals of the early seventies and the underlying literature on which they were based,<sup>12</sup> our primary concern is not with reversing the brain drain but simply on the efficacy of aid policies which do not take resident labor of the targeted country into account.

Finally, we note that the whole point of the analysis is to show the various analytical possibilities that arise for the question at hand even in the simplest formulation. It would be interesting to see how these considerations feed into a setting where growth in Ruralia depends on the two policies studied here, and when Ruralian residents make their decision to acquire human capital in Urbania taking into account the particular policy that is in effect.<sup>13</sup>

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<sup>11</sup> See Harris-Todaro (1970), Khan (1987) and Stark (1991; Chapters 19 and 24) for details.

<sup>12</sup> See Bhagwati-Partington (1976) and related references therein.

<sup>13</sup> See Haque-Kim (1995) for a model of brain drain in the context of endogenous growth and human capital acquisition.

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