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# Equilibrium urban unemployment in developing countries

## Is migration the culprit?

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This paper challenges the prediction of Todaro's model of rural-to-urban migration that an 'increase in urban employment increases urban unemployed.' It is shown that if the urban demand for labor is isoelastic or inelastic, creation of urban jobs causes urban unemployment to decline *and* urban-to-rural migration to take place. Moreover, urban job creation *always* reduces the rate of urban unemployment. The paper then remodels the urban job search process and derives the result that equilibrium urban unemployment would not vanish even if the urban-rural wage gap were eliminated.

### 1. Introduction

For two decades now, the 'Todaro Paradox' has attracted considerable attention and induced a search for 'paradox-free' unemployment-reducing policies. In a nutshell, the paradox is due to the assumptions that in choosing between labour markets, risk-neutral agents consider *expected* wages; that the probability of obtaining urban employment is approximated by the ratio of urban jobs to the urban labour force; and that the urban wage rate is considerably and consistently higher than the rural wage rate. Under these assumptions, inter-labour market (rural-urban) equilibrium mandates urban unemployment. This unemployment ensures that the expected urban wage is equal to the rural wage (which, for simplicity, may be assumed constant throughout). The repercussion of this simple set of assumptions is that contrary to received wisdom, once the migration response is factored in, several policies aimed at *reducing* urban unemployment are bound to backfire: they will *raise* urban unemployment rather than reduce it. For example, in response to the creation of

extra urban jobs, additional rural labourers attracted by the increased employment probability will swell the urban labour force until the new ratio of jobs to urban labour force is restored to the earlier ratio. However, for this as well as for similar paradoxical results to hold, it must be assumed that the urban wage rate is fixed or that it changes only by a negligible amount. But this requires explicit assumptions about the elasticity of the urban demand for labour. When the demand elasticity is considered, as it should be, it is easy to see that in two out of three distinct cases the paradox cannot possibly hold. In the third possible case it may hold although even then it need not arise. More importantly, though, the urban rate of unemployment will always decline as a result of the creation of extra urban jobs, that is, even when the migration response is duly incorporated, and regardless of the demand elasticity.

In section 2 of this paper we consider formally the validity of the Todaro paradox. In section 3 we turn to yet another widespread belief associated with the expected income model of migration: if the incentive of rural workers to migrate could somehow be eliminated then, at the wake of urban job creation, the equilibrium urban level of unemployment will shrink to zero. Upon a remodelling of the urban job search process we derive the surprising implication that urban unemployment would not vanish even if the urban–rural wage gap were eliminated. This is in sharp contrast with the Todaro model. It is *not* the dampening of the incentive to migrate – an incentive arising from an intersectoral wage differential – that will entail full employment. We thus derive a strong counter-example to the widely held view as to the route to the elimination of equilibrium urban unemployment in an expected income model of rural-to-urban migration.

## 2. A formal validation of the Todaro paradox

Perhaps the most vivid illustration of the widespread belief in the Todaro paradox can be provided by reading through the development economics textbooks. A random sample generates the following examples: Gillis, Perkins, Roemer, and Snodgrass (1983, p. 190) tell the reader that: '[The Todaro model] implies that migrating workers are essentially participants in a lottery of relatively high-paid jobs in the towns. When new urban jobs are created, the lottery becomes *more* attractive to potential migrants' (emphasis added). This results not only in forgone output but also in increased 'costs of urbanization ...: social services which are provided only to the urban population or are more expensive in the town, pollution, congestion, additional security requirements.' Herrick and Kindleberger (1983, p. 404) state: 'Faced with urban unemployment, governments ... frequently try to alleviate poverty there by job-creation programs ... [T]he response by migrants who had been discouraged from moving previously because of their dismal prospects in the city might be so great ... that the effect of the job-creation program would be to *raise* the measured rate of unemployment rather than to lower it.' In Nafziger (1984, p. 238) we read: 'According to ... Todaro, creating urban jobs ... is insufficient to solve the urban unemployment problem.' Yotopoulos and Nugent (1976, p. 229) conclude: 'Policies that ... increase the urban employment are likely, *ceteris paribus*, to increase the rate of rural-urban migration by increasing the probability of finding a job. Policies that tend to increase urban wages ... also tend to increase the pool of the urban unemployed.' Finally, in a recent state-of-the art review article, we read the following statement: '[In] this model an increase in urban employment *increases* urban unemployment' [Stern (1989, p. 656)].

Denote by  $L_i$ ,  $i = 1, 2$ , the urban labour force, 1; and the rural labour force, 2; such that  $L_1 + L_2 = L$  where  $L$  is the total (given) labour force. Denote by  $E$  the number of job openings in the urban sector and by  $\pi$  the probability of urban employment where  $\pi = E/L_1$ . The sectoral wages are denoted by  $W_i$ ,  $i = 1, 2$ . We focus attention on  $W_1$  where  $W_1 = W_1(E)$ ,  $W_1'(E) < 0$ . With

a large rural sector relative to the urban sector, labour exits from and labour entries into the rural sector are assumed to result in negligible changes in the sector's wage. We therefore treat  $W_2$  as if it were a constant. The intersectoral equilibrium condition is thus  $\pi W_1(E) = W_2$  or

$$EW_1(E)/L_1 = W_2. \quad (1)$$

Note that  $L_1$  is determined such that eq. (1) holds. To find out how urban unemployment changes when extra urban jobs are created, we check how the urban labour force changes. If, for example, the creation of new jobs were to be accompanied by a decline in the urban labour force, we would conclude that urban unemployment has necessarily fallen. From eq. (1) we obtain:

$$\frac{dL_1}{dE} = \frac{1}{W_2} \frac{d}{dE} [EW_1(E)] = \frac{W_1(E)}{W_2} \left[ 1 + \frac{1}{\eta} \right], \quad (2)$$

where

$$\eta = \frac{dE}{E} \bigg/ \frac{dW_1(E)}{W_1(E)}$$

is the elasticity of the demand for labour. Thus, if demand is inelastic ( $|\eta| < 1$ )  $dL_1/dE < 0$ ; if demand is unielastic ( $|\eta| = 1$ )  $dL_1/dE = 0$ ; and if demand is elastic ( $|\eta| > 1$ )  $dL_1/dE > 0$ .

Thus only in this latter case does the creation of new urban jobs result in an increase in the urban labour force. That is, rural-to-urban migration is induced. It is, however, impossible to say whether in this case unemployment will rise. If, however, demand is isoelastic or inelastic, the creation of extra jobs will result in a smaller urban labour force – a case in which urban unemployment declines *and* urban-to-rural migration takes place. In these two cases then, and possibly also in the first case, creation of new urban jobs is associated with migration *away* from the urban sector, a result which is exactly the opposite of the response predicted by Todaro.

Note that if the underlying production function is a CES (constant returns to scale) production function with elasticity of substitution  $\sigma < 1$ , the case most typically assumed, then, provided that capital is scarce relative to labour – a provision characteristic of developing countries – the elasticity of the demand for labour is smaller than 1.

To show that in the expected wage migration model, the urban rate of unemployment will always decline as a result of job creation (that is, regardless of the elasticity of the demand for labour), we need examine the sign of  $(d/dE)(E/L_1)$  that is, of the change in the urban rate of employment arising from the creation of extra urban jobs. We observe that

$$\frac{d}{dE} \left( \frac{E}{L_1} \right) = \left[ d \frac{W_2}{W_1(E)} \right] / dE = \frac{-W_2 W_1'(E)}{[W_1(E)]^2} > 0, \quad (3)$$

as  $W_1'(E)$  is negative. Thus the urban rate of unemployment must decline even if induced rural-to-urban migration arises.

Note that by similar considerations it can be easily shown that under a unielastic urban labour demand, a lowering of the urban wage rate will not have any induced (rural-to-urban or urban-to-rural) migration effect. Hence, such a policy will lead to lower urban unemployment. Under an inelastic demand, a lowering of the urban wage will entail urban-to-rural migration and lower equilibrium urban unemployment. Only in the case of a highly elastic demand for labour will a

lowered urban wage rate result in so many more urban jobs that the expected urban wage will be raised. Rural-to-urban migration will be induced and urban unemployment will *rise*. Interestingly then, under highly elastic demand, the unemployment-reducing wage policy should be to *raise* the urban wage rate.

To summarize, it is clear that the prevalence of a 'Todaro Paradox' is not an automatic feature of the model but rather a possible result of a specific configuration of assumptions which generates a specific sub-model. Of course, whether or not the real world corresponds to this specific sub-model is an empirical question. Casual observation leads us to believe that by and large, urban labour markets in LDCs are not at such a quantity–price locus that it takes a small (proportional) decline in the wage rate to produce a large (proportional) increase in jobs. These economies are typically at a low point on the demand schedule which, by definition, corresponds to a low elasticity range. The paradox may not then exist at all.

### 3. Urban unemployment and the urban–rural wage gap

Let  $U$  be the number of urban residents who are unemployed and seek urban employment, and  $M$  the number of rural-to-urban migrants who seek urban employment. As before,  $0 < E < U$  is the number of urban job openings. Of course, the urban residents may all constitute earlier migrant cohorts. If all  $E$  jobs are equally open to all job seekers  $U + M$ , their probability of urban employment will be given by

$$\pi = \frac{E}{U + M}. \quad (4)$$

Since for urban wage rate  $W_1$  and rural wage rate  $W_2$  the equilibrium rural-to-urban migration condition is

$$\pi W_1 = W_2, \quad (5)$$

the equilibrium level of urban unemployment  $\hat{U}$  will be

$$\hat{U} + M = \frac{E}{\pi} = \frac{W_1}{W_2} E,$$

with the first equality coming from (4), the second – from (5). Since in steady state equilibrium <sup>1</sup>

$$\frac{W_1}{W_2} E - M = \frac{W_1}{W_2} E - E = \left( \frac{W_1}{W_2} - 1 \right) E,$$

<sup>1</sup> Suppose the  $E$  jobs are randomly allocated to job seekers whose number we assumed is  $U + M$ .  $[U/(U + M)] E$  jobs will go to U-type job seekers,  $M/(U + M) E$  will go to M-type job seekers. Then, when  $E$  new jobs open up,

$$U + M - \left( \frac{U}{U + M} E + \frac{M}{U + M} E \right) = U + M - E$$

job seekers will be left to compete for them. To restore equilibrium, that is, to have  $U$  in equilibrium, we must have  $M = E$ .

we obtain

$$\hat{U} = \left( \frac{W_1}{W_2} - 1 \right) E. \quad (6)$$

Inspection of (6) reveals that since

$$E > 0, \hat{U} = 0 \Leftrightarrow \frac{W_1}{W_2} = 1;$$

urban unemployment can be wiped out only through elimination of the urban-rural wage gap. The causal relationship between rural-to-urban migration and urban unemployment lies here; it is the response of rural workers to an urban-rural wage differential, that is, their rural-to-urban migration, that results in urban unemployment.

The assumption that all urban job openings are equally open to all urban job seekers is quite heroic. Typically, access to new urban jobs is an increasing function of the duration of stay in the urban economy, as if all job seekers were to register upon their entry into the urban labor market and be given a chance to secure a job based on the order of their registration. Thus viewed, it is appropriate to assume that the  $E$  job openings are offered first to  $E$  urban residents who may or may not qualify for them, with the 'left-overs' being then offered to all remaining job-seekers.

Suppose then that the  $E$  new jobs are offered to the first registered  $E$  urban residents who are tested or interviewed, such that the probability of success, assumed identical for all candidates, is given by  $p$ . If  $m$  ( $\leq E$ ) of these job candidates succeed, the remaining  $E - m$  jobs are opened up to the rest of the  $U + M - E$  job-seekers, in a manner akin to that postulated by the received, expected income model of rural-to-urban migration. That is, these jobs are taken up by a random drawing with a probability

$$p_{2m} = \frac{E - m}{U + M - E}.$$

Since the probability of exactly  $m$  of the first  $E$  job candidates passing the test (or interview) is

$$p_{1m} = \binom{E}{m} p^m (1 - p)^{E - m},$$

the probability  $\tilde{p}$  that a rural-to-urban migrant will end up with a job is

$$\begin{aligned} \tilde{p} &= \sum_{m=0}^E p_{1m} p_{2m} = \frac{E}{U + M - E} \sum_{m=0}^E p_{1m} - \frac{1}{U + M - E} \sum_{m=0}^E p_{1m} m, \\ &= \frac{E}{U + M - E} - \frac{pE}{U + M - E} = \frac{E(1 - p)}{U + M - E}. \end{aligned} \quad (7)$$

With a rural-to-urban equilibrium condition analogous to (5), that is

$$\tilde{p}W_1 = W_2, \quad (5')$$

the equilibrium level of urban unemployment,  $\tilde{U}$  will be given – from (7) and (5') – by

$$\frac{W_2}{W_1} = \frac{E(1-p)}{\tilde{U} + M - E},$$

that is

$$\tilde{U} = \frac{W_1}{W_2} E(1-p). \quad (6')$$

Several points now warrant mention. First,  $\partial \tilde{U} / \partial p < 0$ ; that is, the less lenient the job interview, the higher the level of unemployment in migration equilibrium. Second (with  $W_1 > 0$  and  $E > 0$ )  $\tilde{U} = 0 \Leftrightarrow p = 1$ . In this case the  $E$  new slots are filled up according to the order of registration only. [The tests (interviews), if any, are dummy tests; all pass.] Since there are  $U > E$  unemployed urban residents, rural-to-urban migration will not take place. [Inspect (7) to verify that  $\tilde{p} = 0$  and (5') to verify that the expected urban wage is zero too.] Third, and this is the point of main interest here, in the case in which  $p < 1$ ,  $\tilde{U} > 0$ , even if  $W_1 = W_2$ ! Clearly, this result is in sharp contrast with the result arising from (6): in an expected income model of rural-to-urban migration, elimination of the urban-rural wage gap is insufficient to wipe out urban unemployment.

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