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Rural to Urban Migration and Network Effects in an Extended Family Framework

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Abstract

Literature on migration and network effects suggests that the rate of migration is positively related to the extent or degree of personal and community level networks potential migrants have at the destination. However in this particular paper it is shown that when the decision making unit is the extended family and there is a minimum wage induced Harris-Todaro type job rationing in the urban sector having greater numbers of previous migrants at the urban end does not necessarily lead to more migration from the hinterland. This counter intuitive result is generated as a consequence of juxtaposing an extended family framework with urban equilibrium unemployment in the model. A larger stock of previous migrants at the urban end has a positive effect on new migration which comes specifically through a greater flow of remittance income from the migrants to their rural counterparts - the two households comprising the extended family. The increased remittance income provides a positive stimulus to migration as it relaxes the migration cost constraints facing the extended family. On the other hand limited jobs in the urban sector and the resultant job rationing implies that a greater number of previous migrants also crowds out job opportunities for the new ones thus simultaneously reducing incentives to migrate. The direction of the net effect however depends on the economic characteristics of the extended family and the initial employment conditions in the urban sector.

1   Introduction

In both the case of internal and cross border migration a widely observed pattern is that people tend to flock to areas or destinations which already have a stock of previous migrants. Thus along with the neo-classical wage differential motives behind labour mobility it is now widely accepted that the presence of a pre established migrant community is also a key factor behind attracting new migrants. Hence it has become imperative within the field of migration studies to analyze both the relationship between these established incumbents and the prospective migrants and the mechanisms through which the latter facilitate greater migration. There is a vast and growing literature on these so called network effects or externalities within the field of anthropology, sociology and economics.

Empirical investigation into the issue has analyzed the characteristics and functioning of these networks. Banerjee (1984, 91) for example found that in the sample survey of Delhi almost 85% of migrants had urban based contacts which facilitated their migration from villages through the provision of information about urban jobs, help in job search and also pre-arrangement of jobs. A similar study on rural to urban migration in Pakistan by Frits Selier (1988) divulged that almost all the respondents in the survey conducted in the city of Karachi had friends or relatives already in the city who provided the first place of residence and initial monetary assistance. The author also found strong evidence of the creation of 'expanded families/households' with economic ties in the form of income transfers or remittances linking the migrants in the city to the origin or native household. This latter effect was highlighted in an earlier paper by Caces *et. al* (1985) for both Manilla and Hawaii who examined the role of spatially separated extended family units in facilitating more migration through both income sharing within households and remittance linkage between them. Thus in the whole migration dynamic, specially in the context of developing countries, the emergence of extended families, the flow of remittances and the establishment of networks are all closely connected.

Most of the theoretical literature on migration networks has tried to model these network effects by specifying the utility of the potential migrant as a positive function of the stock of previous migrants. This acts as a catch-all term for a wide range of benefits including the social capital the networks provide (see for example, Bauer. *et. al* (2002) and Heitmueller (2003)). Alternatively the costs of migration are made endogenous or the informational externality is modelled by making the employment rate of the new migrants a positive and increasing function of the incumbents, (see Carrington *et. al* (1996), Winters *et. al* (1999) and Graaff (2003)). These studies almost always predict that at least in the short run the presence of established migrant communities increase the flow of new migrants to urban areas. Although interestingly some of these do indicate that increases in the stocks of previous migrants beyond a certain threshold might actually reduce new migration as wages in the destination fall and hence outweigh the positive network effect (see Bauer *et. al* (2002) and Graaff (2003)).

There is strong empirical evidence on rural to urban migration in developing countries which suggests that migration leads to the formation of geographically separated but economically linked extended family units (see Caces *et. al* (1985) and Banerjee(1984, 91)). The established migrant household in the urban area not only provides job related information and shelter to the new migrants but also economic support to the origin or rural household in the form of remittances, thus, in a way, complementing or taking on the role of community level networks. Therefore in this particular paper we try to construct an analytical framework of migration integrating both the extended family to the analysis of networks. The model is setup within a Harris Todaro type urban environment of institutionally fixed wages and resultant unemployment. Hence, the so called network effect of migration has been analyzed in a general equilibrium type framework in which changes in the stock of previous migrants not only influence migration decisions and hence supply of new migrants directly, but, due to urban job rationing, also have an impact on migration decisions through changes in the expected wages of the new migrants.

The extended family in our model comprises of two households the urban migrant, which consists of previous and new migrants, and the rural origin household. Thus the migrant after leaving the countryside joins friends or relatives in the urban migrant household which than acts as a support to the migrant in the instance of unemployment as we assume income sharing within the households. The link between these two households is maintained through remittances flowing from the migrants to their rural counterparts. Hence remittances is an integral part of the extended family framework developed in the paper allowing us to model what would be termed as the partial network effect in the subsequent analysis.

Throughout the analysis we assume that individuals and the family at large is altruistic and therefore the decision of migration as well as remittance is based on maximizing the welfare of the entire extended family. We believe that in light of the empirical literature this extended family based approach in modelling migration is more comprehensive and hence closer to reality in analyzing migration issues in the context of developing countries than the standard method of focusing on individual decision making processes (see Stark (1985, 91) and Banerjee (1981, 91)).

The similarity with the Harris Todaro analysis comes from the modelling of the urban sector which for simplicity has been assumed to comprise of just one formal sector in which the firms pay a fixed minimum wage to its employees hence resulting in a fixed demand for labour and equilibrium unemployment, another persistent feature in cities in the developing world. Due to this minimum wage distortion and the resultant job rationing increases in the stocks of previous migrants lowers the employment prospects for the new migrants and thus subsequently effects their supply. This is termed as the crowding out effect in the analysis. In the model we assume that labour in the urban sector consists of just the migrants, the previous and the new, while the urban born are the owners of capital. Thus in equilibrium we can determine the number of migrants, the fraction of remittance, the employment probability and subsequently

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the output levels in both the sectors. The Harris-Todaro type migration deci-
sion and its impact on migration levels in the urban sector appears as a special
case of our framework. The rest of the paper is organized as follows.

In Section 2 we construct the model with the assumption of unemployment
in the new migrant group only. Subsequently in Section 3 the effect of an
increase in the stock of previous migrants i.e., the network effects of migration,
on equilibrium new migration levels and employment probability is carried out
under this assumption. In Sections 4 and 5 we modify our model by assuming
unemployment in both the migrant groups, which is similar to the standard
Harris Todaro assumption, and see whether the results obtained in Section 3
change qualitatively or not. The comparative static exercise is done under the
case of both exogenous and endogenous remittances.

2 The Model

There are two sectors urban (X) and rural (Y) in the economy. The urban
competitive sector produces X units of output using both labour and a fixed
capital endowment. The labour in the urban sector is assumed to comprise of
migrants only, which are further categorized into two distinct groups. The first
group is the exogenously given endowment of previous migrants, $\overline{M}$, in the urban
sector, and, the second are the endogenously determined new migrants, M, from
the rural sector. These two groups are assumed to inhabit one household in the
urban sector which we would refer to as the migrant household. Therefore the
total supply of labour in the urban sector is given by[1]

$$L = \overline{M} + M \tag{1}$$

The fixed capital, $\overline{K}$, in the urban sector is assumed to be owned exclusively
by the endowment of urban born native population, $\overline{L}$, all of whom comprise
the urban born capitalist household. Assuming constant returns to scale the
production function in the urban sector is therefore:

$$X = X\left(\widetilde{L}, \overline{K}\right); \qquad X_L > 0, \qquad X_{LL} < 0, \tag{2}$$

where, $\widetilde{L}$, is the employed migrant labour force.

Now looking at the rural sector, for conceptual simplicity we assume that it
consists of a single household, where the total supply of labour is equal to the
total endowment of labour in that sector, $\bar{l}$, minus the number of new migrants,
M, that is

$$l = \bar{l} - M \tag{3}$$

The household uses its labour, the only factor of production, to produce an
output, Y, given by the following constant returns to scale production function:

$$Y = Y(\bar{l} - M); \qquad Y_l > 0, \qquad Y_{ll} = 0 \tag{4}$$

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[1] In this model no distinction has been made in terms of skilled and unskilled workers in
the urban sector therefore implicitly we are assuming that the two groups, previous and new
migrants, are homogenous in terms of skills.

We assume a small open economy where the product prices are exogenous and without loss of generality assumed to be equal to one. Given exogenous product prices the firms in the urban sector are assumed to be perfectly competitive and therefore their profit maximizing conditions is

$$\overline{W} = X_L\left(\widetilde{L}, \overline{K}\right),\tag{5}$$

where, $\overline{W}$, is the institutionally fixed urban minimum wage received by each employed migrant in the urban sector.[2]

From (5) we can determine the firms demand for migrant labour, $\widetilde{L}$. Now as mentioned before, $\widetilde{L}$, constitutes the previous and the new migrants

$$\widetilde{L} = \overline{M} + \widetilde{M}\tag{6}$$

As is clear from above we assume here that the previous migrants are fully employed in the urban sector while there is unemployment only amongst the new migrant group as a consequence of the fixed urban minimum wage. We can justify this assumption on the grounds that the previous migrants are an established group in the urban sector and hence are at an advantage over the new migrants in terms of employment opportunities. Thus instead of assuming a higher employment rate than the new migrants, in order to keep the analysis simple, we restrict ourselves to the case of full employment amongst the previous migrants. The employment rate, p, amongst the new migrants is therefore

$$p = \frac{\widetilde{M}}{M},\tag{7}$$

where

$$0 < p < 1$$

The above employment rate is also taken as the probability of employment for the new migrants. As all previous migrants are employed, the numerator, $\widetilde{M}$, are the residual jobs available for the new migrants, therefore the new migrants take their specific employment rate as the relevant employment probability.

Now using (7) the income per capita of the members of the urban migrant household, y_M, and the rural household, y_R, is therefore

$$y_M = \left[\frac{\overline{W}(\overline{M} + pM)(1 - \alpha)}{M + \overline{M}}\right],\tag{8}$$

$$y_R = \left[\frac{Y(\bar{l} - M) + \alpha\overline{W}(\overline{M} + pM) - CM}{\bar{l} - M}\right],\tag{9}$$

where, α, is the fraction of income the migrant household remits to the rural, and, C, is the direct cost of migration of a family member which is borne by

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[2] We maintain the standard Harris-Todaro assumption that the urban minimum wage, $\overline{W}$, is greater than the constant rural marginal product, Y_l, that is, $\overline{W} = X_L > Y_l$.

the rural household, hence CM is the total cost of migration. The per capita utility levels of the members of the migrant household and the rural household are given by their indirect utility functions:[3]

$$V_M = V_M(y_M) \quad and \quad V_R = V_R(y_R), \tag{10}$$

where the indirect utility functions satisfy positive and diminishing marginal utilities

$$V_M' > 0; V_R' > 0 \quad and \quad V_M'' < 0; V_R'' < 0 \tag{11}$$

In this model the migrant household in the urban sector is assumed to be the extension of the rural household, hence both the households make up one extended family unit. The decision to migrate in this framework is made at the family level, and we assume that the family size is large, so that, appealing to the Strong Law of Large Numbers, we can assume away the existence of aggregate uncertainty for the family, although new migrants face the probability of not getting a job in the urban sector and individually each member of both the households is risk averse.[4] The extended family therefore decides the optimal number of new migrants, M, to send to the urban sector by maximizing the following utilitarian family welfare function which is the sum of the utilities of the members of both the migrant and rural household:[5]

$$w = \left(M + \overline{M} \right) V_M + (\bar{l} - M) V_R \tag{12}$$

Differentiating the above welfare function with respect to M using (8), (9) and (10) and taking the probability, p, of getting a job as given we get the following first order condition, assuming that the solutions are in the interior:[6]

$$\frac{\partial w}{\partial M} = [V_M - V_R] + V_M'[p\overline{W}(1 - \alpha) - y_M] + V_R'[y_R - Y_l + \alpha p\overline{W} - C] = 0 \tag{13}$$

The above migration equilibrium condition can be rewritten as

$$V_M - V_R = V_M'[v_M] + V_R'[v_R], \tag{14}$$

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[3] Here we are assuming that members of one household have the same preferences hence implicitly we making the assumption that new migrants instantaneously change their preferences upon arrival in the city.

Although we could have distinguished between the preferences of the new and previous migrants in the urban sector, this would not however qualitatively change the results obtained in the next section, though the first order condition of migration would be slightly different.

[4] For a similar assumption in the context of international migration see Lahiri and Fregoso (2000).

[5] Since we assume that there is no aggregate uncertainty, we do not need to consider expected utility. If we did not make this assumption we would have to consider risk premium which would entail possibly different comparative static results than the ones derived in this paper.

[6] Second Order Condition (S.O.C):

$$\frac{\partial^2 w}{\partial M^2} = \frac{V_M''(v_M)^2}{(M + \overline{M})} + \frac{V_R''(-v_R)^2}{(\bar{l} - M)} < 0$$

where

$$v_M = y_M - p\overline{W}(1-\alpha) > 0,$$

and

$$v_R = -y_R + Y_l - \alpha p\overline{W} + C \lessgtr 0$$

Now, v_M, is the marginal cost of migration borne by each member of the migrant household. It is the net deficit to each member of the migrant household resulting from marginal migration and is always positive.[7] Similarly, v_R, is the net marginal cost of migration per member of the rural household including both the direct and indirect costs of migration. Where, C, is the direct cost of migration and, $-y_R + Y_l$, is the surplus or deficit which the marginal migrant produces for each member in the rural household, and, $\alpha p\overline{W}$, is what a marginal migrant remits to the rural household and is therefore a negative cost (benefit) of migration. Hence in equilibrium the utility differential for the migrants, $V_M - V_R$, or the marginal benefit of migration is equal to the marginal costs of migration given that these costs are shared equally between the respective family members of the urban migrant and the rural household.

It has to be noted that the marginal cost to the rural household can be either positive or negative, but, in the presence of high direct costs of migration and low levels of initial income in rural areas, it is likely to be positive. Though, there exists a theoretical possibility in our model that if these costs are negative i.e., there are net benefits accruing to the rural household from the departure of a member, and if these outweigh the costs of migration to the urban household, we would have a migration equilibrium, see (14), with the utility of the migrants less than those of their rural counterparts.[8] Hence we could have a scenario in which the family sends a migrant even when the per-capita utility of the rural household members is greater than that of the migrant, that is, the migrant is worse off than his or her rural family members. This interesting possibility in our model arises due to the fact that migration decisions are made at the level of the family and not the individual. However we shall assume here that the net marginal costs of migration to the rural household are positive, $v_R > 0$, so that $V_M - V_R > 0$. This condition simply ensures that there are gains from migration.

This completes the description of the model.

3   Network Effects and Equilibrium Migration

In this section we would analyze the effect of an increase in the number of previous migrants on equilibrium levels of new migrants and their employment probability with both exogenous and endogenous remittances. The equilibrium

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[7]Substituting in, y_M, we obtain:

$$v_M = \frac{\overline{M}\,\overline{W}\,(1-p)\,(1-\alpha)}{M+\overline{M}} > 0$$

[8]If $v_R < 0$ and $|v_R| > v_M$.

migration level and probability of employment or employment rate in our model is simply determined by solving simultaneously the equation for the employment probability derived from the first order condition of firms and the implicit migrant supply function derived form the first order condition of migration.

3.1 The Case of Exogenous Remittances

The Function for the Employment Rate:

From (5) the first order condition of profit maximization we get the fixed demand for labour by firms in the urban sector given by:

$$\widetilde{L} = \widetilde{L}(\overline{W}) \tag{15}$$

Now substituting (15) into (6) using (7) and solving for p we get the following explicit equation for the employment rate of new migrants as a function of the new migrants, M, and the number of previous migrants, $\overline{M}$:

$$p = \frac{\widetilde{L}(\overline{W}) - \overline{M}}{M}, \tag{16}$$

where

$$\frac{\partial p}{\partial M} = -\frac{p}{M} < 0$$

The above partial indicates that given a fixed wage in the urban sector and hence a fixed employment level an increase in the number of new migrants would result in a fall in their employment rate so as to maintain the number of employed migrants, $\widetilde{M}$, constant.[9]

The Employment Crowding Out Effect:

$$\frac{\partial p}{\partial \overline{M}} = -\frac{1}{M} < 0$$

Now given the fixed urban wage and hence employment level, an increase in the number of the fully employed previous migrants would necessarily lead to a decrease in the employment rate or probability of finding a job for the new migrants. This latter effect can be termed as the 'crowding out' of the employment prospects of new migrants as a consequence of an increase in the stock of fully employed previous migrants.

The Migrant Supply Function:

With remittances exogenous in the framework we can re-write the migration equilibrium condition (13) as an implicit function of M, p and $\overline{M}$

$$\frac{\partial w}{\partial M} = w_1(M, p, \overline{M}) = 0 \tag{17}$$

Totally differentiating the above function we get

$$dw_1 = w_{11}dM + w_{12}dp + w_{13}d\overline{M} = 0 \tag{18}$$

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[9] The employment rate or probability graphically, is a rectangular hyperbola, the area under which is constant: $pM = \widetilde{M}$ (constant).

Solving for dM we obtain the following implicit migrant supply function:

$$dM = -\frac{w_{12}}{w_{11}}dp - \frac{w_{13}}{w_{11}}d\overline{M}, \tag{19}$$

where

$$\left.\frac{\partial M}{\partial p}\right|_{d\alpha=0} = -\frac{w_{12}}{w_{11}}$$

The above partial effect is:

$$w_{12} = V_M'[\overline{W}(1-\alpha)] + V_R'\left[\alpha\overline{W}\right] - V_M''\left[\frac{M\overline{W}(1-\alpha)}{M+\overline{M}}\right][v_M] - V_R''\left[\frac{\alpha M\overline{W}}{\overline{l}-M}\right][v_R] > 0 \tag{20}$$

Therefore, given that $w_{11} < 0$, (SOC), we have:

$$\left.\frac{\partial M}{\partial p}\right|_{d\alpha=0} > 0$$

The migrant supply function is increasing in employment probability, $\partial M/\partial p > 0$, see (20). That is holding $\overline{M}$ constant an increase in the probability of getting a job would result in increased migration. The reason behind this is that an increase in the probability of employment reduces the marginal costs of migration for both the urban migrant and the rural household directly, stimulating more migration, the first two terms in (20). Secondly, the increase in p also raises the income per capita of the urban migrant household and the remittance income of the rural household therefore diminishing the marginal utility of income of its members. Now in the presence of positive marginal costs of migration to both the household ($v_R, v_M > 0$) this decrease in marginal utility reduces these costs in terms of utility hence increasing migration, the last two terms in (20).

From (16) we can see that as an increase in the stock of previous migrants would lower the employment rate of the new migrants, the crowding out effect, which would subsequently, from (20), dampen the level of new migration. Literature on network effects does highlight a similar possibility in an environment of perfectly flexible labour markets at the destination and the homogeneity of labour. The continued increase in the stocks of previous migrants by lowering the wages at the destination would reduce the incentive for new migrants to locate to that area (see Graaff (2003) and Bauer *et. al* (2002)). In our model it is the fall in expected urban wage rather than the actual wage which brings about this negative effect.

The Partial Network Effect:

$$\left.\frac{\partial M}{\partial \overline{M}}\right|_{d\alpha=0} = -\frac{w_{13}}{w_{11}}$$

where

$$w_{13} = -V_M''\left[\frac{\overline{W}(1-\alpha) - y_M}{M+\overline{M}}\right][v_M] - V_R''\left[\frac{\alpha\overline{W}}{\overline{l}-M}\right][v_R] > 0 \tag{21}$$

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As, $w_{11} < 0$, (SOC), we have:

$$\left.\frac{\partial M}{\partial \overline{M}}\right|_{d\alpha=0} > 0$$

Now (21) captures what would be subsequently termed as the 'partial network effect' - $\partial M/\partial \overline{M}$ - the effect on new migration levels due to an increase in the number of previous migrants, $\overline{M}$, with p constant. An increase in the number of fully employed previous migrants would increase the income of both the urban migrant and the rural household, the former directly and the latter through an increase in the size of their remittance income. This increase in income for both the households would subsequently reduce the marginal utility of income of its members and in the presence of positive costs of migration (v_R, $v_M > 0$) would reduce these costs in terms of utility therefore stimulating more migration. This partial network effect arises essentially from the modelling of migration from an extended family perspective where changes in income of the migrant household also have an impact on the incomes of the members of the rural household through the remittance linkage. The increased amount of remittances by increasing the income per-capita of the origin household facilitates more migration by relaxing their direct and indirect migration cost constraint.

The existence of this particular type of network effect can be corroborated by empirical literature which indicates that rural households receiving more frequent and higher remittance income from their established urban-migrant households have a greater ability to finance the costs of sending new migrants and hence display a greater propensity of migration relative to households which either have no such pre-established urban satellite households or receive smaller income supplements (see Caces (1985), Banerjee and Kanbur (1981) and Hodinnott(1994)).

In terms of modelling the network effect the main difference between the partial network effect characterized here and that in the theoretical literature surveyed in the last chapter is that ours is implicit in the extended family framework while the standard exposition of it is more explicit. As mentioned in the introduction in some literature the utility of the prospective migrant, amongst other variables, is modelled to be an increasing function of the stock of incumbents thus encapsulating all the positive externalities accruing to the new migrants from having contacts at the destination (see Bauer *et. al* (2002)). In others the direct costs of migration are made endogenous and decreasing in the stock of incumbent migrants or the employment probability of new migrants is specified to be an increasing function of previous migrants, (see Carrington *et. al* (1996) and Graff (2003)). While the former cost reducing effect of networks is captured somewhat indirectly by the partial network effect, the latter positive employment probability effect modelled in the literature however is exactly opposite to that in our framework, i.e., the employment crowding out effect.

It is worthwhile to note that if the fraction of remittance is assumed to be zero, thus eliminating the link between the two households, the partial network effect, above, would still be positive. This is because an increase in previous

migrants would still lower the positive costs of migration in terms of utility facing the urban-migrant household members, that is

$$w_{13} = -V_M'' \left[\frac{\overline{W} - y_M}{M + \overline{M}} \right] [v_M] > 0 \tag{22}$$

therefore

$$\left. \frac{\partial M}{\partial \overline{M}} \right|_{\alpha=0} > 0$$

Graphically this partial network effect is a rightward shift of the migrant supply function.

3.1.1   The Equilibrium

We can solve the function for the employment rate, (16), and the implicit migrant supply, (19), simultaneously for equilibrium number of new migrants and their employment rate, i.e., (p^*, M^*). This equilibrium is shown in the figure below.
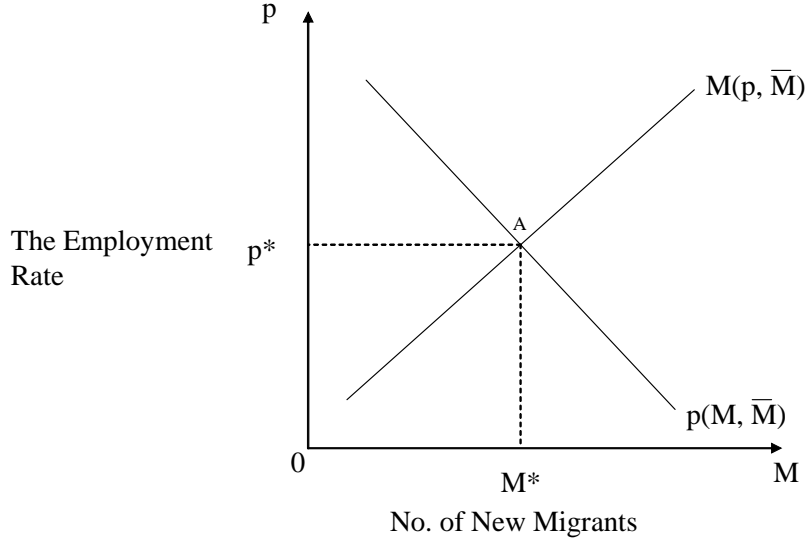

Figure 1: The Equilibrium

Now before doing the comparative statics for the network effect it has to be mentioned that the equilibrium outcome of this model is inefficient compared to the standard first best bench mark of allocative efficiency which, given exogenous product prices, is characterized by the absence of any unemployment in the

urban sector ($p = 1$), and, a labour distribution between the two sectors such that the marginal products in both are equal, ($X_L = Y_l$). This social optimum is depicted by the equilibrium point D on the Production Possibility Frontier EDCF in the Fig. 2 below. This standard first best benchmark can be derived using either an ordinal specification of a social welfare function or a weighted utilitarian welfare function where the weights are chosen to be the inverse of the marginal utility of income of each member of the economy.[10]

It is important to note here that the source of this inefficiency is the minimum wage ($\overline{W}$) regulation in the urban sector which prevents the urban labour market from clearing and hence results in equilibrium unemployment amongst the migrant labour ($p^* < 1$) and a labour distribution or equilibrium migration between the sectors such that the urban minimum wage and hence marginal product is greater than the rural marginal product, that is, $\overline{W} = X_L > Y_l$, resulting in a sub-optimal level of output in both the sectors. In the Fig. 2 below the inefficient or sub-optimal equilibrium of our model has to lie along the line ABC, such as the equilibrium point B.

3.1.2 Comparative Statics

Now assuming that an equilibrium solution (p^*, M^*) exists we can write (16) and (19) as

$$dp = \frac{\partial p}{\partial M} dM + \frac{\partial p}{\partial \overline{M}} d\overline{M} \tag{23}$$

$$dM = \frac{\partial M}{\partial p} dp + \frac{\partial M}{\partial \overline{M}} d\overline{M} \tag{24}$$

We can now determine the effect of an increase in the number of previous migrants on equilibrium migration and employment probability with exogenous remittances by solving (23) and (24) simultaneously to obtain:

$$\left. \frac{dM^*}{d\overline{M}} \right|_{d\alpha=0} = \frac{\left. \frac{\partial M}{\partial \overline{M}} \right|_{d\alpha=0} + \left. \frac{\partial M}{\partial p} \right|_{d\alpha=0} \frac{\partial p}{\partial \overline{M}}}{|J|}, \tag{25}$$

where $|J|$ is the Jacobian determinant

$$|J| = 1 - \left. \frac{\partial M}{\partial p} \right|_{d\alpha=0} \frac{\partial p}{\partial M} \tag{26}$$

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[10]Welfare of the society with exogenous product prices can be expressed simply by either the sum of the outputs of both the sectors:

$$W = X + Y$$

or alternatively as a weighted sum of the indirect utilites of all the members ($N = \overline{L} + \overline{M} + \overline{l}$) in the economy:
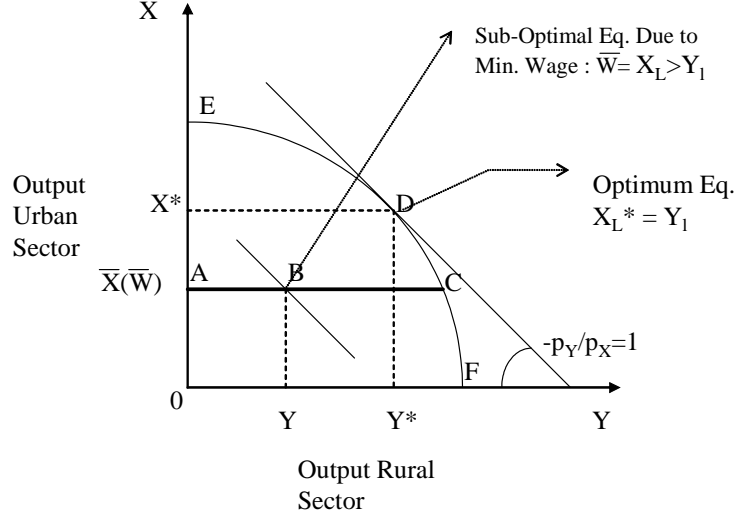
$$W = \sum_{i=1}^{N} a_i V_i(y_i)$$

Figure 2: The Optimum and the Minimum Wage Distortion

From (16) and (20), $|J| > 0$, hence a solution to the above two equations exists. In (25) the first term in the numerator is the positive partial network effect and the additional term is the negative employment crowding out effect, both of which have been discussed in detail. Now we would see the direction of the overall effect on equilibrium level of new migrants from an increase in the stock of previous migrants by putting all the terms in the expression together. On simplification the entire expression in the numerator reduces to

$$\frac{1}{w_{11}} \left\{ V_M' \left[\overline{W}(1-\alpha) \right] + V_R' \left[\alpha \overline{W} \right] - MV_M'' \left[\frac{y_M}{M + \overline{M}} \right] [v_M] \right\} < 0, \qquad (27)$$

therefore

$$\left. \frac{dM^*}{d\overline{M}} \right|_{d\alpha=0} < 0$$

and substituting the above result into (23) yields

$$\left. \frac{dp^*}{d\overline{M}} \right|_{d\alpha=0} < 0,$$

Proposition 1 *With unemployment in the new migrant group only and exogenous remittances an increase in the number of previous migrants would decrease the equilibrium level of new migrants and their equilibrium employment rate in the urban sector.*
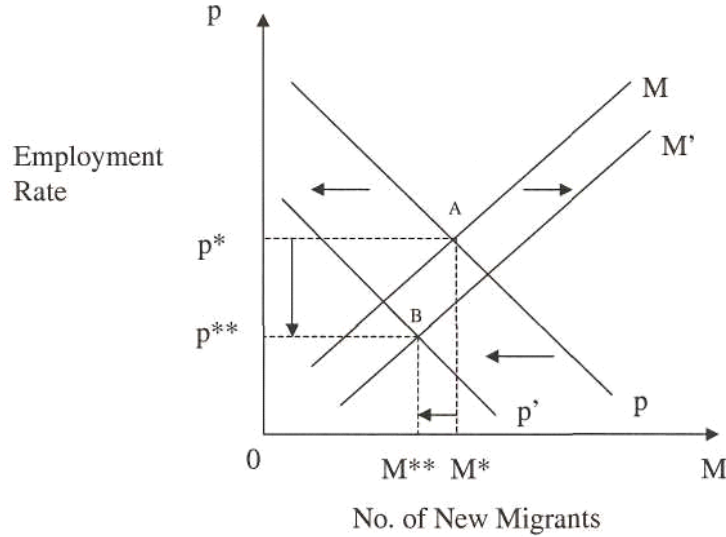
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Figure 3: The Net Effect: *Partial Network and the Crowding Out Effect*

The above result seems counter intuitive[11] and rather strong as one would expect higher migration levels owing to a greater stock of previous migrants in the urban sector just appealing to the network effects of migration. The reason behind this surprising result is that, in this framework, an increase in the stock of previous migrants has two simultaneous and opposite effects on new migration, the positive partial network effect and the negative employment crowding out effect. The latter unambiguously dominates the former giving us an equilibrium fall in new migration on account of an increase in the stock of previous migrants, see the Figure above. Here we summarize these two partial effects again.

The so called partial network effect stimulates more migration as an increase in the stock of previous migrants increases the income of both the migrant and the rural household, the former directly and the latter via an increase in the total amount remitted. This increase in income by lowering the marginal utility of income reduces the direct and indirect costs of migration in terms of utility for members of both the households hence increasing migration. This partial network effect is shows as a rightward shift of the migrant supply function in the figure.

The employment crowding out effect comes through a fall in the employment rate or probability of new migrants as a consequence of an increase in the

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[11]The counter intuition here arises from a careful dissection of the migration effects, notably the partial network effect.

numbers of fully employed previous migrants. The decline in the employment probability or crowding out of employment subsequently induces a decrease in the supply of new migrants which is simply a movement along the migrant supply function. The positive supply effect or partial network effect is not strong enough to counter this large negative employment crowding out effect therefore resulting in an overall fall in equilibrium level of new migration and also a decline in the employment rate of the new migrants.

The intuition behind the dominance of the crowding out effect is that while the partial network effect works only through the decrease in the direct and indirect costs of migration in terms of utility, the crowding out effect on the other hand by decreasing the employment rate for the new migrants not only increases these costs in terms of utility but also increases these directly, see the first two terms in (20).

The result obtained above underscores the importance of the assumptions made about the characteristics of the labour market in the urban sectors of developing countries. The assumption of job rationing and migrant homogeneity in terms of skills, i.e., they compete for the same job, along with the fact that ours is a general equilibrium type framework where subsequent changes in the employment rate also influence migrant supply, are the key driving force behind this seemingly counter intuitive result.

Finally, although most of the literature on network effects predicts new migration to respond positively to pre-established migrant communities at the destination, there is theoretical literature which corroborates our results in a dynamic framework of flexible wages and homogenous labour. This literature underlines the possibility of the negative effect on migration coming from a fall in the wages at the destination as a consequence of more previous migrants to dominate the positive network externalities beyond a certain threshold stock of previous migrant (see Bauer *et. al* (2002) and Graaff (2003)).

3.2   The Case of Endogenous Remittance

The above analysis was done assuming exogenous remittances, now we would analyze the effect of an increase in the number of previous migrants on equilibrium new migration level and employment probability when the fraction of remittance is also determined optimally by the extended family. Before getting into the comparative statics we would restate the optimality conditions.

Now the extended family simultaneously decides on the optimal number of migrants, M, to send to the urban area and also the optimal fraction of remittance, α, to send to the rural household. As before in making these decisions the family does not take into account the effect on the employment probability in the urban sector of its actions. Therefore maximizing the welfare function, (12), with respect to, M (as before), and, α, and assuming that the solutions are in the interior we get the following first order conditions:

$$\frac{\partial w}{\partial M} = [V_M - V_R] + V_M'[p\overline{W}(1-\alpha) - y_M] + V_R'[y_R - Y_l + \alpha p\overline{W} - C] = 0 \quad (28)$$

$$\frac{\partial w}{\partial \alpha} = V_R' - V_M' = 0 \tag{29}$$

While (28) is the migration equilibrium condition same as before, (29) gives the optimal remittance condition which states that the urban migrant household would remit a fraction, α, of its income till the marginal utilities of both the households are equalized.[12] In this, V_R', is the marginal benefit from remittance to the rural household, and, V_M', is the marginal cost to the migrant. According to this condition the fraction of remittance would increase with an increase in income of the migrants and fall with an increase in income of the family - the standard altruistic conception behind the motivations to remit.

There is a large body of empirical literature on the motivations to remit, most of which gives at least partial credence to the altruism hypothesis. For example Lucas and Stark (1985) in their analysis on Botswana concluded that there is a mixture of both altruism and insurance in the observed remittance behavior of migrants suggesting, what has been coined by Stark, a form of 'tempered altruism'. Similarly Banerjee (1981) for the case of India, Hoddinott (1994) for Kenya and Massey and Basem (1992) for Mexico came up with similar conclusions. Though most of the literature indicates that at lower levels of income of the migrant an increase in their income does increase remittances this positive effect tends to taper off at higher income levels suggesting a possible fall in risk aversion of the migrants and hence a lesser need for insurance on their part. Although, interestingly, when it came to a fall or loss in income of the origin family most of the empirical findings indicate that the migrants respond by increasing the fraction of remittance thus lending credibility to the altruism hypothesis (see Kaufmann and Lindauer (1980) and Hoddinott (1994)).

The Migrant Supply Function and The Partial Network Effect:

Now though the migrant demand function remains unchanged the migrant supply function has to be derived again using the optimal remittance condition. Therefore writing the above two conditions as functions:

$$w_1 = w_1(M, p, \overline{M}, \alpha) \tag{30}$$

$$w_4 = w_4(M, p, \overline{M}, \alpha) \tag{31}$$

Totally differentiating (30) and (31) we get:

$$dw_1 = w_{11}dM + w_{12}dp + w_{13}d\overline{M} + w_{14}d\alpha = 0 \tag{32}$$

$$dw_4 = w_{41}dM + w_{42}dp + w_{43}d\overline{M} + w_{44}d\alpha = 0 \tag{33}$$

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[12]S.O.C:

$$\frac{\partial^2 w}{\partial \alpha^2} = V_R'' \left[\frac{\overline{W}\left(\overline{M} + pM\right)}{\left(\overline{l} - M\right)} \right] + V_M'' \left[\frac{\overline{W}\left(\overline{M} + pM\right)}{M + \overline{M}} \right] < 0$$

The above two equations can be written as:

$$dM = -\frac{w_{12}}{w_{11}}dp - \frac{w_{13}}{w_{11}}d\overline{M} - \frac{w_{14}}{w_{11}}d\alpha \qquad (34)$$

$$d\alpha = -\frac{w_{41}}{w_{44}}dM - \frac{w_{42}}{w_{44}}dp - \frac{w_{43}}{w_{44}}d\overline{M} \qquad (35)$$

Before we derive the remittance augmented migrant supply function, let us first see the additional partial effects coming from endogenising the fraction of remittance in the framework. Now the additional partial effect is, $\partial M/\partial \alpha = -w_{14}/w_{11}$, which is positive, as $w_{11} < 0$, and

$$w_{14} = -V_R'' \left[\frac{\overline{W}(\overline{M} + pM)}{\overline{l} - M} \right] [v_M + v_R] > 0 \qquad (36)$$

therefore

$$\frac{\partial M}{\partial \alpha} > 0$$

The above additional partial effect shows that an increase in the remittance fraction would result in an increase in migration. The intuition behind this is straight forward. An increase in the fraction of remittances from the migrant household increases the income per capita of the rural household, which, by lowering their marginal utility of income per capita, reduces the positive costs of migration per head in terms of utility hence resulting in an increase in the number of new migrants. Thus increase in remittances by increasing rural income facilitates more migration. This positive partial effect of remittances on migration is in line with empirical literature on migration which shows that relatively better off households or those with higher remittance income have a greater ability to finance the costs of migration and hence would generally exhibit a higher propensity of sending migrants to the urban areas (see Banerjee (1981, 91), Hoddinott (1994) and Rozelle (1999)).

Now we would look at equation, (35), determining the flow of remittances. The partial effects are the following, given that $w_{44} < 0$ (SOC):

$$w_{41} = -V_R'' \left[\frac{v_R}{(\overline{l} - M)} \right] + V_M'' \left[\frac{v_M}{M + \overline{M}} \right] \gtrless 0, \qquad (37)$$

$$w_{42} = V_R'' \left[\frac{\alpha M \overline{W}}{(\overline{l} - M)} \right] - V_M'' \left[\frac{M \overline{W}}{M + \overline{M}} \right] \gtrless 0, \qquad (38)$$

$$w_{43} = V_R'' \left[\frac{\alpha \overline{W}}{(\overline{l} - M)} \right] - V_M'' \left[\frac{M \overline{W}(1 - \alpha)(1 - p)}{(M + \overline{M})^2} \right] \gtrless 0, \qquad (39)$$

therefore

$$\frac{\partial \alpha}{\partial M} \gtrless 0; \qquad \frac{\partial \alpha}{\partial p} \gtrless 0; \qquad \frac{\partial \alpha}{\partial \overline{M}} \gtrless 0$$

In (37) an increase in the number of new migrants would have an ambiguous effect on the optimal fraction of remittances. This is because marginal migration leads to a fall in income of both the rural and the migrant household, thus increasing the marginal utility of income of the members of the two households. This entails a simultaneous increase in the marginal benefit (V_R') and marginal costs of remittances (V_M') rendering the partial effect ambiguous. Also looking at (38) and (39), an increase in employment probability and the number of previous migrants raises the total remittance income of the rural household therefore reducing the marginal utility of income and hence marginal benefit of remittance. At the same time the income of the migrant household also increases which reduces their marginal utility of income and hence lowers the marginal cost of remittance. Thus a simultaneous reduction in both the marginal costs and benefits of remittance results in the apparent ambiguity in the above partial effects.

Now Substituting $d\alpha$ from (33) into (40) and simplifying we get the following modified implicit migrant supply function in a general form:

$$dM = \left[\frac{w_{14}w_{43} - w_{13}w_{44}}{w_{11}w_{44} - w_{14}w_{41}}\right] d\overline{M} + \left[\frac{w_{14}w_{42} - w_{12}w_{44}}{w_{11}w_{44} - w_{14}w_{41}}\right] dp, \qquad (40)$$

where[13]

$$\left.\frac{\partial M}{\partial p}\right|_{\alpha^*} = \left[\frac{w_{14}w_{42} - w_{12}w_{44}}{w_{11}w_{44} - w_{14}w_{41}}\right]; \qquad \left.\frac{\partial M}{\partial \overline{M}}\right|_{\alpha^*} = \left[\frac{w_{14}w_{43} - w_{13}w_{44}}{w_{11}w_{44} - w_{14}w_{41}}\right] \qquad (41)$$

Now looking at the augmented slope of the migrant supply function, $\partial M/\partial p$, the denominator of the above is positive, [14] while the numerator, $w_{14}w_{42} - w_{12}w_{44}$, simplifies to

$$V_R'' V_M'' \left[\frac{M\overline{W}^2(\overline{M} + pM)}{(\overline{l} - M)(M + \overline{M})}\right] [v_M + v_R]$$

$$- V_M' \overline{W}^2 (\overline{M} + pM) \left[\frac{V_R''}{\overline{l} - M} + \frac{V_M''}{M + \overline{M}}\right] > 0, \qquad (42)$$

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[13] With endogenous remittances these partials can also be expressed as:

$$\left.\frac{\partial M}{\partial \overline{M}}\right|_{\alpha^*} = \frac{\left.\frac{\partial M}{\partial \overline{M}}\right|_{d\alpha=0} + \frac{\partial M}{\partial \alpha}\frac{\partial \alpha}{\partial \overline{M}}}{1 - \frac{\partial M}{\partial \alpha}\frac{\partial \alpha}{\partial M}}$$

$$\left.\frac{\partial M}{\partial p}\right|_{\alpha^*} = \frac{\left.\frac{\partial M}{\partial p}\right|_{d\alpha=0} + \frac{\partial M}{\partial \alpha}\frac{\partial \alpha}{\partial p}}{1 - \frac{\partial M}{\partial \alpha}\frac{\partial \alpha}{\partial M}}$$

[14] From the concavity of the welfare function it follows that:

$$w_{11}w_{44} - w_{14}w_{41} = \nabla$$

$$\nabla = V_R'' V_M'' \left[\frac{\overline{W}(\overline{M} + pM)}{(\overline{l} - M)(M + \overline{M})}\right] [v_M + v_R]^2 > 0$$

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thus

$$\left.\frac{\partial M}{\partial p}\right|_{\alpha^*} = \frac{w_{14}w_{42} - w_{12}w_{44}}{\nabla} > 0$$

In the partial network effect with endogenous remittances, $\partial M/\partial \overline{M}$, the numerator, $w_{14}w_{43} - w_{13}w_{44}$, simplifies to

$$V_R'' V_M'' \left[\frac{\overline{W}(\overline{M} + pM)}{(\overline{l} - M)}\right] \left[\frac{\overline{W} - y_M}{M + \overline{M}}\right] [v_M + v_R] > 0, \tag{43}$$

therefore

$$\left.\frac{\partial M}{\partial \overline{M}}\right|_{\alpha^*} = \frac{w_{14}w_{43} - w_{13}w_{44}}{\nabla} > 0$$

Hence, although the additional effect from endogenising remittances are ambiguous, i.e., $(\partial M/\partial \alpha)\left(\partial \alpha/\partial \overline{M}\right) \gtrless 0$ and $(\partial M/\partial \alpha)\left(\partial \alpha/\partial p\right) \gtrless 0$, the total effect of both, an increase in employment probability and the number of previous migrants on the supply of new migrants, the 'partial network' effect, is found to be positive.

3.2.1 Comparative Statics

Now we can look at the comparative static results given the function for the employment rate which is the same as before

$$dp = (\frac{\partial p}{\partial \overline{M}})d\overline{M} + (\frac{\partial p}{\partial M})dM \tag{44}$$

Assuming a solution (p^*, M^*) exists and hence solving (40) and (44) simultaneously we get

$$\left.\frac{dM^*}{d\overline{M}}\right|_{\alpha^*} = \frac{\left.\frac{\partial M}{\partial \overline{M}}\right|_{\alpha^*} + \left.\frac{\partial M}{\partial p}\right|_{\alpha^*}\frac{\partial p}{\partial \overline{M}}}{|J|} \tag{45}$$

Given the above partials, $|J| > 0$, and the numerator in (45) simplifies to the following expression:

$$\frac{1}{\nabla} \left\{ \begin{array}{c} -V_R'' V_M'' \left[\frac{\overline{W}(\overline{M}+pM)y_M}{(\overline{l}-M)(M+\overline{M})}\right] [v_M + v_R] \\ +\frac{V_M'\overline{W}^2(\overline{M}+pM)}{M}\left[\frac{V_R''}{\overline{l}-M} + \frac{V_M''}{M+\overline{M}}\right] \end{array} \right\} < 0 \tag{46}$$

Therefore we get

$$\left.\frac{dM^*}{d\overline{M}}\right|_{\alpha^*} < 0$$

and from (44)

$$\left.\frac{dp^*}{d\overline{M}}\right|_{\alpha^*} \leq 0$$

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Proposition 2 *When the amount of remittance, α, is chosen optimally by the family an increase in the number of previous migrants would reduce both the equilibrium probability of employment and the number of new migrants in the urban sector unambiguously.*

In the above analysis no particular assumption was made about the preferences of the members of the extended family, implicit assumption being that members of one household have the same preferences. Now we would see whether the results obtained above change qualitatively or not if we assume the same or homogenous preferences of members of both the rural and the migrant household under endogenous remittances.

3.2.2 Homogenous Preferences

When the preferences of both the household members are identical, than looking at the optimal remittance condition which states that in equilibrium the marginal utility of income of both the households should be the same, (29), it is clear that with homogenous preferences this implies that the migrant household would remit to the rural household till the income per capita of both the households are the same, i.e., $y_M = y_R$. Therefore substituting (29) into (28) and putting $y_M = y_R$ into the migration equilibrium we see that the marginal benefit of migration would go to zero and so would the net marginal costs of migration, yielding the following simplified migration equilibrium condition:

$$\frac{\partial w}{\partial M} = p\overline{W} - Y_l - C = 0 \tag{47}$$

The above condition is similar to the Harris-Todaro type migration equilibrium condition indicating that the extended family would keep on sending new migrants till the expected wage in the urban sector is equal to the marginal product in the rural sector plus the direct costs of migration. The similarity here comes from the fact that in this model with endogenous remittances and homogenous preferences the extended family becomes one large identical group with the same income per capita and preferences which corresponds to the rural household or labor force in the H-T model thus giving the same first order conditions.[15] In the H-T model no distinction is made between migrant and non-migrant groups and hence in their equilibrium the population proportion in both sectors as well as equilibrium unemployment is determined and not the number of employed and unemployed migrants explicitly.

Now we would see the effect of an increase in the number of previous migrants on equilibrium probability of employment and migration level in the urban sector

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[15] It is worthwhile to note that in their seminal paper, as Harris and Todaro (1970) did not distinguish between the urban born labour and the migrant labour, they assume that

"the typical migrant retains his ties to the rural sector and, therefore, the income that he earns as an urban worker will be considered , from the standpoint of sectoral welfare, as accruing to the rural sector" (Harris and Todaro (1970), page 127)).

The authors justify this assumption by highlighting the observed phenomenon of migration leading to the emergence of extended family systems with remittances flowing between the migrant and the origin.

respectively by solving explicitly for the equilibrium number of new migrants. From the above first order condition as $\overline{W}$, Y_l and C are constants we can solve for M by substituting the equation for the employment probability:

$$p = \frac{\widetilde{L}(\overline{W}) - \overline{M}}{M}$$

into the first order condition of migration (47) to yield:

$$M^* = \left[\frac{\widetilde{L}(\overline{W}) - \overline{M}}{Y_l + C} \right] \overline{W}$$

From the above we get

$$\frac{dM^*}{d\overline{M}} = -\frac{\overline{W}}{Y_l + C} = -\frac{1}{p} < 0.$$

Now as $\overline{W}$, Y_l and C are constants, in equilibrium the employment rate remains unchanged,

$$\left. \frac{dp^*}{d\overline{M}} \right|_{\alpha^*} = 0$$

Proposition 3 *If the preferences of the migrant and the rural household are the same and remittances are endogenously determined than an increase in the numbers of previous migrants would not effect equilibrium employment probability of new migrants but would unambiguously reduce the number of new migrants in the urban sector.*

With homogenous preferences and a constant marginal product, Y_l, in the rural sector, the migrant supply function with respect to employment probability becomes perfectly elastic and the partial network effect of migration, i.e., shift in the migrant supply function due to change in the number of previous migrants is absent, see (47) and the figure above. Therefore, as the supply side effects are non-existent the change in equilibrium migration level comes only from change in their employment rate, the negative crowding out effect on the employment prospects of new migrants. This leads to a fall in equilibrium number of migrants exactly equal to this crowding out effect with the employment probability of migrants unaffected in equilibrium. Hence the net effect on new migration as a consequence of an increase in the population size of previous migrants under this particular scenario is unambiguously greater than when remittances are exogenous in the framework.

The results obtained above were rather strong mainly because of the assumption of full employment in the previous migrant group. This assumption led to a very strong negative crowding out effect which dominated the positive partial network effect on new migration. In the following section we would carry out a similar exercise but with the assumption of unemployment in both the migrant groups (the new and the previous). This particular assumption brings
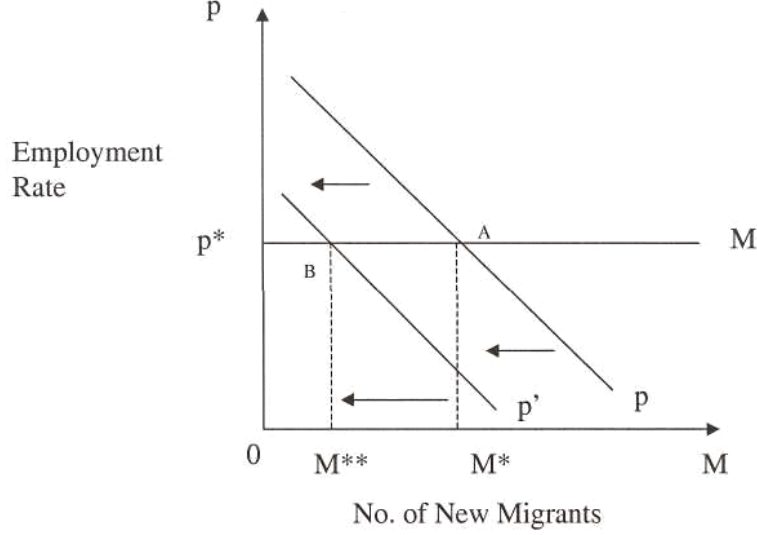
Figure 4: The Full Crowding Out Effect

our model closer to the standard Harris-Todaro analysis in which all members of the urban labour force face the same employment probability given by the urban employment rate. Therefore the objective here is to see whether this particular change in the assumption regarding the employment characteristics of the migrant groups in the urban sector causes any qualitative differences in the results obtained earlier.

4 An Extension

All the main assumptions and equations from (1) to (5) of the model specified in Section 2 apply here except now we assume unemployment in both the migrant labour groups, the previous and the new. Therefore the employment probability, p, for the new migrants is simply given by the urban employment rate :

$$p = \frac{\widetilde{L}}{\overline{M} + M} \tag{48}$$

where

$$0 < p < 1$$

Now using (48) the income per capita of the urban migrant household, y_M, and the rural household y_R is:

$$y_M = p\overline{W}(1 - \alpha) \tag{49}$$

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$$y_R = \left(\frac{Y(\bar{l} - M) + \alpha p \overline{W}(M + \overline{M}) - CM}{\bar{l} - M} \right) \tag{50}$$

Where α as we know is the fraction of income the migrant household remits to the rural, and, C, is the direct cost of migration of a family member which is borne by the rural household, hence CM is the total cost of migration. As in the previous model the per capita utility levels of the members of the migrant household and the rural household are given by their indirect utility functions:[16]

$$V_M = V_M(y_M) \quad and \quad V_R = V_R(y_R), \tag{51}$$

which exhibit positive and diminishing marginal utilities:

$$V_M' > 0; V_R' > 0 \quad and \quad V_M'' < 0; V_R'' < 0 \tag{52}$$

The decision of migration is made at the level of the extended family, the rural and the migrant household and as done before we assume that the family size is large, hence, appealing to the strong law of large numbers we assume away the existence of any aggregate uncertainty for the family.

Therefore maximizing the same utilitarian family welfare function, see (12), with respect to the number of migrants M and taking the probability of employment as given we get the following first order condition assuming that the solutions are in the interior:[17]

$$\frac{\partial w}{\partial M} = [V_M - V_R] + V_R'[y_R - Y_l + \alpha p \overline{W} - C] = 0 \tag{53}$$

The above migration equilibrium condition can be rewritten as:

$$V_M - V_R = V_R'[v_R], \tag{54}$$

where

$$v_R = -y_R + Y_l - \alpha p \overline{W} + C$$

As before, v_R, is the marginal cost of migration per member of the rural household including both the direct and indirect costs of migration. This is identical to the marginal cost to the rural household in the previous model and is assumed to be positive hence ensuring gains from individual migration, $V_M - V_R > 0$. Thus in equilibrium the utility differential for the migrants $V_M - V_R$ or the marginal benefit of migration is equal to the marginal cost of migration to the rural household given that this cost is shared equally between the rural household members. The difference between the above first order condition and that derived for the previous model is that in this case there are no marginal costs of migration to the urban household and therefore the total marginal costs of migration in this framework are less than in the previous model.

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[16] Similar to the case in the previous model if we assume different preferences of the new and previous migrants the comparative static results obtained are not qualitatively different and in this particular case the first order condition of migration would also remain unchanged.

[17] S.O.C:

$$\frac{\partial^2 w}{\partial M^2} = \frac{V_R''(-v_R)^2}{(\bar{l} - M)} < 0$$

5 Network Effects and Equilibrium Migration

Now as done in the case of the first model we would analyze the effect of an increase in the number of previous migrants on equilibrium migration and employment probability first with exogenous remittances and than with endogenous remittances to see whether there are any major qualitative differences in results. As in this model there is unemployment in both the migrant groups, the function for the employment rate would have to be restated and the migrant supply function re-derived because of the different first order condition of migration.

5.1 The Case of Exogenous Remittances

The Function for the Employment Rate

From (5) the first order condition of profit maximization we get the fixed demand for labour by firms in the urban sector given by

$$\widetilde{L} = \widetilde{L}(\overline{W}) \tag{55}$$

Substituting (55) into (48) we get the following function of the probability of employment p

$$p = \frac{\widetilde{L}(\overline{W})}{M + \overline{\overline{M}}} \tag{56}$$

where

$$\frac{\partial p}{\partial M} = -\frac{p}{(\overline{M} + M)} < 0$$

The above partials indicate that given a fixed wage in the urban sector and hence a fixed employment level an increase in the number of new migrants would lead to a fall in the probability of getting a job or the employment rate in the urban sector, so as to maintain the number of employed, $\widetilde{L}$, constant.

The Crowding Out Effect:

$$\frac{\partial p}{\partial \overline{M}} = -\frac{p}{(\overline{M} + M)} < 0$$

As was the case in the previous model an increase in the number of previous migrants would necessarily lead to a decrease in the employment rate or probability of getting a job for the new migrants. It has to be noted here that the increase in the stock of previous migrants would have a lesser impact on the employment rate than was the case before as in this particular instance a portion of these would go into the unemployment pool therefore diminishing the previously large employment crowding out effect. We can look at this dampened crowding effect by comparing the above partial effect to that in the previous model:

$$\left[\frac{\partial p}{\partial \overline{M}} \bigg|_{\widetilde{L}=p(M+\overline{M})} = \left| -\frac{p}{(M+\overline{M})} \right| \right] < \left[\frac{\partial p}{\partial \overline{M}} \bigg|_{\widetilde{L}=pM+\overline{M}} = \left| -\frac{1}{M} \right| \right]$$

.

The Migrant Supply Function:

As the migration equilibrium condition is now slightly different we would have to re-derive the implicit migrant supply function. The method of derivation is identical to the previous case but the partial derivatives with respect to the first order condition of migration (53) would be different. Therefore we would restate the resulting implicit migrant supply function in its general form again assuming remittance to be exogenous:

$$dM = -\frac{w_{12}}{w_{11}}dp - \frac{w_{13}}{w_{11}}d\overline{M}, \tag{57}$$

where

$$\left.\frac{\partial M}{\partial p}\right|_{d\alpha=0} = -\frac{w_{12}}{w_{11}}$$

Now in the above, $w_{11} < 0$, and

$$w_{12} = V_M'[\overline{W}(1-\alpha)] + V_R'[\alpha\overline{W}] - V_R''\left[\frac{\alpha\overline{W}(M+\overline{M})}{\overline{\bar{l}} - M}\right][v_R] > 0 \tag{58}$$

therefore

$$\left.\frac{\partial M}{\partial p}\right|_{d\alpha=0} > 0$$

The migrant supply function, (58), is increasing in employment probability, $w_{12} > 0$ as an increase in the employment probability not only increases the income per capita and hence utility of the migrant household (increase in the marginal benefit of migration), first term in (58), but also reduces the marginal costs of migration directly for the rural household, second term, and by increasing the expected income through remittances reduces the costs of migration in terms of utility for the rural household, last term, resulting in an increase in migration.

The Partial Network Effect:

$$\left.\frac{\partial M}{\partial \overline{M}}\right|_{d\alpha=0} = -\frac{w_{13}}{w_{11}}$$

where

$$w_{13} = -V_R''\left[\frac{\alpha p\overline{W}}{\overline{\bar{l}} - M}\right][v_R] > 0 \tag{59}$$

Given, $w_{11} < 0$, we get

$$\left.\frac{\partial M}{\partial \overline{M}}\right|_{d\alpha=0} > 0$$

The above partial network effect is similar to that in the last model, an increase in the stock of previous migrants results in an increase in the amount of remittances flowing to the rural household. This increase in the rural income per-capita reduces their positive direct and indirect costs of migration (v_R) in

terms of utility hence enabling the extended family to send more migrants to the urban sector.

The difference between the partial network effect above and that in the previous model is that here there are no marginal costs of migration to the migrant household, $v_M = 0$, hence the additional cost reducing effect to the migrant household from an increase in previous migrants is non-existent. Also, in this particular model in the absence of remittances from the framework ($\alpha = 0$) the partial network effect, see (59), would be simply zero:

$$\left.\frac{\partial M}{\partial \overline{M}}\right|_{\alpha=0} = 0$$

As mentioned before the link between the migrant and the rural household is through remittances and if we put $\alpha = 0$ than an increase in the number of previous migrants has no effect on rural income, therefore as the rural incomes remain unaffected the partial network effect in this case is simply zero. This is in contrast to the last model where even with zero remittances the partial network effect was positive because of the presence of positive marginal costs of migration ($v_M > 0$) facing the migrant household, see (22). Hence with a non-existent supply side network effect the only impact on new migration from an increase in past migrants would be the negative employment crowding out effect. Therefore in this particular case with no remittances we would obtain an overall unambiguously larger negative comparative static result of an increase in the stock of previous migrants on equilibrium new migration level.

5.1.1 The Equilibrium and Comparative Statics

Now assuming that an equilibrium solution (p^*, M^*) exists we can write (56) and (57) as

$$dp = \frac{\partial p}{\partial M}dM + \frac{\partial p}{\partial \overline{M}}d\overline{M} \tag{60}$$

$$dM = \frac{\partial M}{\partial p}dp + \frac{\partial M}{\partial \overline{M}}d\overline{M} \tag{61}$$

We can now determine the effect of an increase in the number of previous migrants on equilibrium migration and employment probability with exogenous remittances by solving (60) and (61) simultaneously to obtain:

$$\left.\frac{dM^*}{d\overline{M}}\right|_{d\alpha=0} = \frac{\left.\frac{\partial M}{\partial \overline{M}}\right|_{d\alpha=0} + \left.\frac{\partial M}{\partial p}\right|_{d\alpha=0}\frac{\partial p}{\partial \overline{M}}}{|J|}, \tag{62}$$

where from the above partials $|J| > 0$.

Now the numerator in the above expression capturing both the partial network effect and the employment crowding out effect simplifies to:

$$\frac{1}{w_{11}}\left\{V_M'\left[\overline{W}(1-\alpha)\right] + V_R'\left[\alpha\overline{W}\right]\right\} < 0 \tag{63}$$

therefore

$$\left.\frac{dM^*}{d\overline{M}}\right|_{d\alpha=0} < 0$$

and

$$\left.\frac{dp^*}{d\overline{M}}\right|_{d\alpha=0} < 0,$$

Proposition 4 *With unemployment amongst both the migrant groups and with exogenous remittances an increase in the number of pervious migrants would reduce equilibrium number of new migrants in the urban sector unambiguously.*

Also in this particular case we have seen that if the fraction of remittance is zero than the partial network effect is absent, hence the only effect on equilibrium new migration comes from the negative employment crowding out effect, that is:

$$\left.\frac{dM^*}{d\overline{M}}\right|_{\alpha=0} = \frac{\left.\frac{\partial M}{\partial p}\right|_{\alpha=0} \frac{\partial p}{\partial \overline{M}}}{|J|} < 0 \tag{64}$$

Therefore we can state the following additional proposition:

Proposition 5 *With unemployment in both the migrant groups if the fraction of remmittance from the migrants to the rural members is zero than this would lead to a complete absence of the partial network effect thus leading to a greater fall in equilibrium number of new migrants as a consequence of an increase in past migrants.*

The Figure below captures the total effect with zero remittances:

5.2   The Case of Endogenous Remittances

The Migrant Supply Function and The Partial Network Effect:
As done in the previous section we would first show a general result under endogenous remittances and than look at the case of homogenous preferences of the extended family members. Now with endogenous remittances the migrant supply function has to be re-derived using the first order condition of migration and the optimal remittance condition. The first order condition of migration is specified in (53), and, the optimal remittance condition for this modified model is the same as the one derived in the last model, see (29), which states that the migrant household in the urban sector would remit a fraction α of its income to the rural household till the marginal utility of the members of both the households are equalized. Before deriving the implicit migrant supply function using both the first order conditions of migration and remittances, we shall look at the partial effects coming from these two conditions. As done previously we take the total differential of the first order conditions and write these as functions:

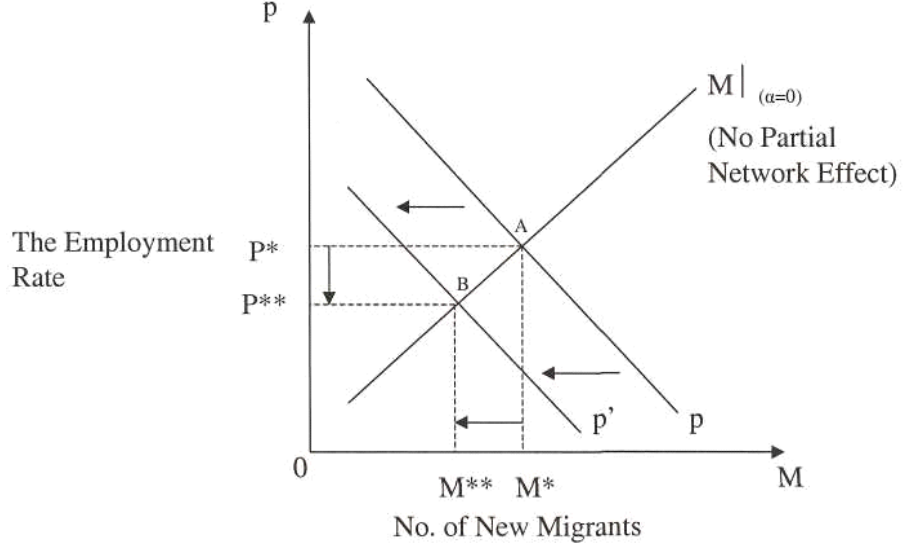$$dM = -\frac{w_{12}}{w_{11}}dp - \frac{w_{13}}{w_{11}}d\overline{M} - \frac{w_{14}}{w_{11}}d\alpha \tag{65}$$

Figure 5: The Net Effect $(\alpha = 0)$: *The Crowding Out Effect*

$$da = -\frac{w_{41}}{w_{44}}dM - \frac{w_{42}}{w_{44}}dp - \frac{w_{43}}{w_{44}}d\overline{M} \tag{66}$$

Now as before with endogenous remittances the additional partial effect on migration is positive as:

$$w_{14} = -V_R'' \left[\frac{p\overline{W}(\overline{M} + M)}{\overline{l} - M} \right] [v_R] > 0, \tag{67}$$

therefore

$$\frac{\partial M}{\partial \alpha} > 0$$

Again an increase in the fraction of remittances would raise rural income per capita and hence reduce the positive marginal costs of migration in terms of utility resulting in an increase in migration.

Now we would see the indirect effect coming from endogenising remittances by looking at the following partials derived from (66).

Given $w_{44} < 0$ (SOC),

$$w_{41} = -V_R'' \left[\frac{v_R}{\overline{l} - M} \right] > 0, \tag{68}$$

$$w_{42} = V_R'' \left[\frac{\alpha\overline{W}(\overline{M} + M)}{\overline{l} - M} \right] - V_M'' \left[\overline{W}(1 - \alpha) \right] \lessgtr 0, \tag{69}$$

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$$w_{43} = V_R'' \left[\frac{\alpha p \overline{W}}{\overline{l} - M} \right] < 0 \qquad (70)$$

Therefore we have

$$\frac{\partial \alpha}{\partial M} > 0; \qquad \frac{\partial \alpha}{\partial p} \lessgtr 0; \qquad \frac{\partial \alpha}{\partial \overline{M}} < 0$$

In the partial, see (68), as marginal migration decreases the per-capita income of the rural household, $v_R > 0$, it leads to an increase in the rural marginal utility of income which entails that the marginal benefit of remittance would rise thus resulting in an increase in the remittance fraction. With respect to employment probability, see (69), as both rural and migrant income increase the net effect on remittances would be ambiguous.

However the effect on remittances from an increase in previous migrants is unambiguously negative, see (70). The intuition here is that a greater stock of previous migrants in this case would only increase the income of the rural members through higher remittance decreasing therefore their marginal utility of income and hence the marginal benefit of remittance which thus entails a fall in the optimal fraction remitted. Thus when remittances are endogenous in the framework an increase in the stock of previous migrants would by increasing the total remittance to the rural household improve its economic standing and hence reduce its need for more remittances. As mentioned earlier most of the empirical literature on remittance does support this hypothesis, remittances from migrants are shown to increase (decrease) in response to a negative (positive) fluctuation in the income of the origin household (see Kaufman and Lindauer (1986) and Hoddinott (1994)).

Now from (67), (69) and (70) the additional effect on migration from endogenising remittances is ambiguous with respect to the employment rate, $(\partial M/\partial \alpha)(\partial \alpha/p) \lessgtr 0$. While the additional partial network effect is negative, $(\partial M/\partial \alpha)(\partial \alpha/\overline{M}) < 0$, therefore dampening the direct partial network effect. As done in the previous section from (65) and (66) we derive the following augmented migrant supply function, that is, with endogenous remittances:

$$dM = \left[\frac{w_{14}w_{43} - w_{13}w_{44}}{\nabla} \right] d\overline{M} + \left[\frac{w_{14}w_{42} - w_{12}w_{44}}{\nabla} \right] dp, \qquad (71)$$

where

$$\left. \frac{\partial M}{\partial p} \right|_{\alpha^*} = \left(\frac{w_{14}w_{42} - w_{12}w_{44}}{\nabla} \right); \qquad \left. \frac{\partial M}{\partial \overline{M}} \right|_{\alpha^*} = \left(\frac{w_{14}w_{43} - w_{13}w_{44}}{\nabla} \right)$$

Where from the concavity of the welfare function the denominator in $\partial M/\partial p$

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is positive,[18] while the numerator is:

$$V_R'' V_M'' \left[\frac{p\overline{W}^2(\overline{M}+M)}{(\overline{l}-M)} \right] [v_R] - V_M' p\overline{W}^2 \left[\frac{V_R''(M+\overline{M}) + V_M''(\overline{l}-M)}{(\overline{l}-M)} \right] > 0 \quad (72)$$

Also the numerator in $\partial M/\partial \overline{M}$ simplifies to the following expression:

$$V_R'' V_M'' \left[\frac{\alpha \left(p\overline{W} \right)^2}{(\overline{l}-M)} \right] [v_R] > 0 \quad (73)$$

Therefore

$$\left. \frac{\partial M}{\partial p} \right|_{\alpha^*} > 0; \qquad \left. \frac{\partial M}{\partial \overline{M}} \right|_{\alpha^*} > 0$$

Hence the remittance augmented migrant supply function is increasing in employment probability. Also, the partial network effect with endogenous remittances is positive although the additional effect from endogenising remittances was negative.

Comparative Statics:

Therefore now we can simultaneously solve the migrant demand function (56) and the migrant supply function (71) to get the comparative static results, assuming as before that an equilibrium (p^*, M^*) exists. From (45), as $|J| > 0$, and in the numerator the entire expression capturing the partial network and crowding out effect in is negative:

$$\frac{1}{\nabla} \left\{ \begin{array}{c} -(\overline{M}+M) V_R'' V_M'' \left[\frac{p(\overline{W})^2}{(\overline{l}-M)} \right] [v_R][1-\alpha] \\ +V_M' p\overline{W}^2 \left[\frac{V_R''(M+\overline{M}) + V_M''(\overline{l}-M)}{(\overline{l}-M)} \right] \end{array} \right\} < 0,$$

therefore

$$\left. \frac{dM^*}{d\overline{M}} \right|_{\alpha^*} < 0$$

and from (44)

$$\left. \frac{dp^*}{d\overline{M}} \right|_{\alpha^*} \leq 0$$

Proposition 6 *With unemployment in both the migrants groups and with endogenous remittances an increase in the stock of previous migrants would unambiguously decrease the equilibrium level of new migrants and the employment rate in the urban sector.*

Hence with unemployment in both the migrant groups and with endogenous remittances we also get a negative effect on equilibrium migration. Now we would look at the special case of homogenous preferences of the extended family members.

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[18]

$$\nabla = \frac{V_R'' V_M'' \left[p\overline{W}(-v_R)^2 \right]}{\left(\overline{l} - M \right)} > 0$$

5.2.1 Homogenous Preferences

With homogenous preferences of the urban migrant and the rural household, given the optimal remittance condition (29), which states that the marginal utility of income of members of both households should be the same in equilibrium, we would necessarily have an equality of income per capita of both households. Therefore substituting, $y_M = y_R$, in the migration equilibrium condition, (53), we get the following reduced first order condition of migration:

$$\frac{\partial w}{\partial M} = p\overline{W} - Y_l - C = 0 \tag{74}$$

The above migration equilibrium is the same as the one derived in the previous model with unemployment in the migrant group only. So the family keeps on sending migrants to the urban sector till the expected wage equals the rural marginal product plus the direct cost of migration. We would therefore expect the results to be similar to the ones obtained for the previous model. Now given the function for the employment rate:

$$p = \frac{\widetilde{L}(\overline{W})}{M + \overline{M}}$$

Substituting the above into (74) we can solve for the number of new migrants explicitly:

$$M^* = \frac{\widetilde{L}\,\overline{W}}{Y_l + C} - \overline{M}$$

from the above we get

$$\left.\frac{dM^*}{d\overline{M}}\right|_{\alpha^*} = -1 < 0$$

and

$$\left.\frac{dp^*}{d\overline{M}}\right|_{\alpha^*} = 0$$

Proposition 7 *With endogenous remittances when the preferences of the migrant and the rural household are the same than an increase in the number of previous migrants would not effect the equilibrium employment probability in the urban sector but would reduce the number of new migrants in equilibrium.*

Therefore with homogenous preferences the migrant supply function becomes perfectly elastic and an increase in the number of previous migrants has no effect on migrant supply, see (74). In the absence of a positive supply side network effect the only effect which comes through is the employment crowding out effect which by lowering the employment prospects of the new migrants induces a fall in equilibrium number of new migrants in the urban sector.

6   Conclusion

In this paper we developed an extended family framework of migration within a Harris-Todaro type urban setting in order to determine the so called network effect on equilibrium new migration levels in the urban sector. We constructed a model in which initially the supply of migrants came from the extended family jointly maximizing a welfare function with respect to the number of migrants only. Subsequently the migrant supply function was augmented by endogenising the fraction of remittances. The employment rate of the migrants was derived from the first order condition of profit maximization of firms. In this simple framework with fixed minimum wages in the urban sector the function for the probability or rate of employment and the migrant supply could be solved simultaneously for the equilibrium level of migrants and also the employment rate in the urban sector.

The results obtained in Section 3 and 5 of the paper seem initially counter intuitive and against the conventional ideas on network effects. In most of the theoretical and empirical literature on network effects the central benefit of having friends or relatives in the urban sector is through the transmission of positive information about job availability, the help in job search activity pre and post migration and the initial support extended to the new migrants from relatives in cities. Hence in the theoretical models the network effect is either captured by making the utility of the prospective migrants a positive function of the stock of previous migrants or by making the employment prospects of migrants and the costs of migration endogenous and dependent on the incumbents.[19]

In our model the positive partial network effect came primarily through the change in incomes and hence the direct and indirect costs of migration in terms of utility of both the migrant and the rural household members on account of changes in the stock of previous migrants. The positive effect on rural incomes was brought about by the increase in the amount remitted as a direct consequence of a greater number of previous migrants. This increase in rural income facilitated the family at the origin to finance the positive costs of migration hence resulting in the extended family sending more of its members to join the urban migrant household. Thus the modelling of migration in terms of the extended family allowed us to characterize the partial network effect in the analysis.

Now as the urban sector was modelled on the lines of the standard H-T type framework, i.e., fixed wage, homogenous labour in terms of skill and urban unemployment, the two migrant groups, the previous and the new, essentially competed for the same job due to migrant labour rationing. Thus the presence of greater numbers of previous migrants resulted in the crowding out of the employment prospects of new migrants, that is, a fall in their employment probability. This decline in employment probability therefore led to the negative effect on new migration which was found to be greater than the positive partial network effect leading to an overall fall in the equilibrium number of

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[19]See Carrington, *et al* (1996), Winters, *et al* (1999), Bauer *et. al* (2002) and Graaff (2003).

new migrants. This result was consistent under both the case of unemployment only in the previous migrant group and with unemployment in both the new and previous migrants.

In line with the results of this paper there is literature on network effects which highlights the possibility of the negative effect on migration, coming from a fall in the urban wage rates as a consequence of more previous migrants, to dominate the positive network externalities beyond a certain threshold level of previous migrant stock, (see Bauer *et. al* (2002) and Graaff (2003)). Moreover, there is a large body of work on both the network effects and the welfare implications of migration on the destination or host country which focuses on more migration leading to employment crowding out or fall in wages of previous or incumbent migrants and the indigenous labour force (see Heitmuller (2003), and Frieber and Hunt (1995)).

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