WORKING PAPERS IN ECONOMICS

No. 01/07

S. QUAMRUL AHSAN

TEMPORARY MIGRATION, LABOUR SUPPLY AND WELFARE

Department of Economics
UNIVERSITY OF BERGEN

Temporary Migration, Labour Supply and Welfare[1]

S. Quamrul Ahsan

Department of Economics
University of Bergen

e-mail: quamrul.ahsan@econ.uib.no

[1]This paper was written while the author was visiting *Institüt für Finanzwissenschaft* at *Universität Freiburg* during September-October, 2006. The author will like to thank Professor Dr. Bernd Raffelhüschen at Freiburg for his kind invitation and generous hospitality. A travel grant from the *Meltzerfondet* at the University of Bergen is gratefully acknowledged.

Abstract:

This essay addresses the incidence of temporary migration in poor rural economies. The methodological view taken here is that temporary or seasonal migration is a strategy of self-insurance, used largely by peasant households in order to cope with the risk of unemployment and income loss during agricultural *slack seasons*. Households typically implement the insurance strategy by sending away some of its working members to seek urban jobs during slack seasons while the remaining members pursue rural employment. This allows for diversification of household slack season income risks to the extent that the incomes from rural and urban sources are not fully correlated. The analytical focus of this paper is on exploring how household behaviour, especially with respect to labour supply, is affected by participation in seasonal migration. The market and income distributional outcomes of seasonal migration are also analysed in relation to the corresponding outcomes in the counterfactual state of no migration. The following results are obtained.

In the event that the participation in slack season migration is utility/welfare improving, the participating households are likely to supply more labour during the post-migration peak season, compared to the counterfactual state. The intuition is simple. In an intertemporal (i.e., a two season) setting, participation in welfare improving migration in the slack season will allow households to allocate more resources for consumption in the peak season. Higher consumption leads to higher effort supply via the consumption-effort relationship. In terms of the aggregate/market outcomes of migration, the land-owning (employer) households and the peasant households with migrants will experience welfare gains while non-participating peasant households will suffer a welfare loss relative to the counterfactual state.

Key words: Development, poverty, seasonal rural-to-urban migration, rural labour markets, risk coping strategies

JEL classification: C31, D1, D81, J43, J61, O1, Q12, R23

1.1. Introduction

This paper focuses on the role of *seasonal migration* as a provider of income insurance for the rural poor. The concept of insurance motivated (rural-to-urban) migration, in the context of rural economies, has been widely studied both theoretically and empirically, (see, among others, Cox and Jimenez (1992), Hoddinott (1994), Levhari and Stark (1982), Lucas and Stark (1985, 1988)) and Chen *et al*. (2003)[2]. The standard problem discussed in this literature is that of income risks and consumption smoothing over time. Income from agricultural activities is typically subject to vagaries of nature and therefore inherently risky. In the absence of standard insurance markets, a means of coping with the income risk for a farm family would be to self-insure. A simple mechanism for self-insurance is to accumulate savings during good years and run these down during lean years. Such inter-temporal risk pooling however may not provide adequate/sufficient insurance as harvests over time tend to be serially correlated. An alternative would be a scheme of mutual insurance between two (or more) family members, whereby some family members seek employment in urban areas (or in foreign countries) and the remaining members tend the home farm. Migration of this type creates potential for risk-spreading/diversification since *spatial separation* between the home village and the urban centre(s), as well as the structural differences between the village and the urban economies imply that earnings from these (alternative) sources are *not subject* to same/common shocks and are therefore largely uncorrelated.

In this paper, the insurance approach is adopted to study a *special case* of the more general migration phenomenon discussed above – namely, the incidence of *seasonal* or *temporary rural-to-urban migration*. The motivation for studying seasonal migration lies in our underlying interest in understanding the broader issue of incidence and consequences of rural poverty[3]. Below, we draw attention to a number of key issues.

- Seasonal migration remains a major demographic phenomenon that occurs with unerring regularity during the lean agricultural season in rural societies in most of South Asia. The incidence of seasonal migration is the highest among peasant

[2] Chen *et al.* model international migration in a non-rural context. We contend that the work by Chen *et al.* remains relevant in the present context as there are strong similarities between the motives for rural-to-urban migration as we perceive it and that for international migration as modelled in Chen *et al*.

[3] The geographic area of interest here is South Asia in general and the Indian subcontinent in particular.

households who also make up the bulk the acute poor, (see for example Rogaly (2002)).

- Seasonal migration, as we argue below, is a *qualitatively* distinct phenomenon and different from the standard notion of migration as modelled by Stark *et al*. (*op. cit*). In particular, we argue that seasonal migration is a key coping strategy open to peasant households faced with the risk of *seasonal unemployment*. The notion of (insurance motivated) migration *à la* Stark *et al*., on the other hand, is thought to be a response to *production risks* in agriculture. We argue that *employment risks may exist independent of production risks*, (see section 1.2. for further details).

We believe that this distinct nature of seasonal migration has strong implications for understanding the nature of rural poverty as well as for designing poverty policies in the context of south Asia. Indeed, demographers have long held that seasonal migration is singularly important as a poverty coping instrument in peasant communities, see Rogaly (2002) and the references therein. Unfortunately, there is little evidence that the special nature of seasonal migration is duly analyzed in the literature. This paper is an effort to fill this alleged gap (in the literature). Before we embark on modelling, we present the notion of seasonal migration in its appropriate context.

1.2. The Context

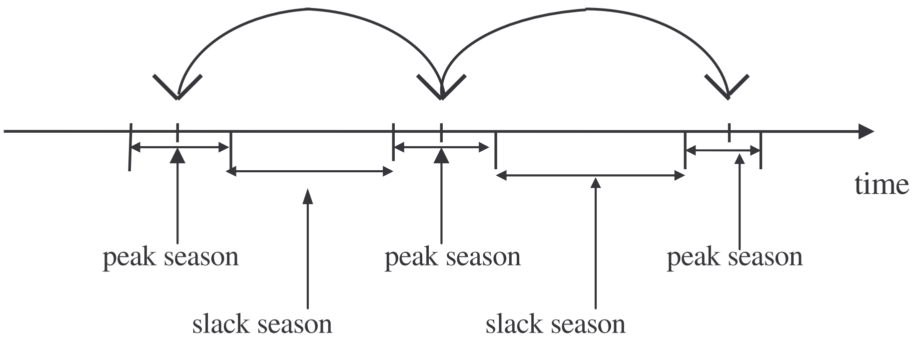
We begin by stating some facts about agricultural labour markets. The production cycle (or the growing season) in traditional agriculture is characterized by a short spell of brisk labour intensive activities, (the *peak season*), during which labour market is *tight*, followed by a period of relative inactivity, (the *slack season*), see Figure 1. While there are generally little or no employment uncertainties in the peak season, many peasant (landless) households are typically unable to secure agricultural employment in the *low/slack* season as labour demand tends to be low as well as uncertain[4]. *Seasonal migration* takes the form of

[4] The onset of peak season coincides with the beginning of harvesting. This is followed by threshing and other harvest related activities, and often soil preparation and replanting, all of which are peak season activities. We define the mid-point of this season *the harvest point*. Further, the slack season is thought to be a period when there is standing crop in the field with little demand for labour effort. It is implicit in Figure 1 that the harvesting of a crop is immediately followed by replanting, but in reality there is often a period of *fallow* between harvesting and replanting. In our analysis, the fallow period will also be considered a part of slack/low season.

unemployed agricultural workers migrating to urban centres during the slack season to seek unskilled/informal jobs, and returning home before the peak season labour market opens up.

Figure 1

The large arrowheads ( ) indicate harvest points



Peasant households and risk coping

Our focus is on the rural households which own virtually *no productive assets* other than their labour power and survive by selling labour services in a seasonal labour market with fluctuating employment opportunities. The problem these households face is the income risk stemming form *employment uncertainty*, especially in the *low/slack season*. Note the qualitative difference between the income risk (*a*) faced by peasants due to *employment uncertainty*, and (*b*) that faced by a farmer due to *fluctuation* in the *size of harvest*. The inter-temporal structure of the *two risks* is different for the following reason: While employment opportunities vary from one season to the next *within a production cycle*, output fluctuation can only occur *across harvest points*, (i.e., from one cycle to the next), (see also Figure 1)[5]. The focus in the analytical literature (e.g., Stark *et al*.) has been on the *production risk*. *We will focus exclusively on the employment risk.* For peasant families, the need for insurance arises as the savings from peak season income typically are inadequate to stabilize slack season consumption. For these households, participation in *slack season migration* is a means of diversifying slack season income risks.

[5] Note that employment risks may exist independent of production risks. A peasant worker may not find slack season employment, for example, in *weeding* (at the expected time) simply because the weeding season is postponed due to a random weather event, (for example, an unexpected/untimely flooding of crop fields). Note further that while an event like this causes workers extreme hardship, it need not affect the size of harvest.

Operationalizing seasonal migration

Consider a peasant household with several working members. Given that the individual members face high probabilities of full/partial unemployment in slack seasons, a choice open to the household is to allocate part of its labour power to the urban labour market, i.e., send some members to the city during the low season to seek unskilled jobs, with the option of returning home during the peak season when employment opportunities improve.

The role of strategic resources

Successful undertaking of migration involves costs. In addition to transportation costs, a potential migrant incurs diverse other costs both at *destination* (e.g., an urban centre) and the *place of origin* (village home). Costs at destination include job search costs, costs of supporting oneself while in job search, emotional costs due to separation from family, and so forth. Further, when an adult male migrates, the family as well as the properties/assets left behind are deprived of certain amount of care and protection, which clearly has imputed costs. The latter costs can be substantial in societies where property rights are poorly defined and/or enforced. The point is that migration costs may vary a great deal across households depending on households' access to certain *strategic resources*, also known as *social capital*. A prime example of this is the membership in a family/kinship network. Below, we give examples of how the size and *tightness* of a network affects costs of migration. The care and protection for the family left behind by a migrating adult will be provided by other family members at a minimal cost if the migrant belongs to a large/extended family. Further, job search costs at destination are significantly lower for a migrant who has family members/kin already working in the same urban destination, compared to a migrant who has no urban connections. Clearly, unequal access to social capital may explain why households, that are otherwise similar, may show different incidence of seasonal migration.

Our goal in this paper is to develop a framework for analyzing seasonal rural-to-urban migration that draws on the stylized facts/attributes (of migration) summarized above. To this end, we propose an inter-temporal, *albeit*, a two-period model of labour allocation decision of a peasant household, where the two periods are the two seasons in the crop cycle. The peak season allocation of labour is assumed to be trivial: the entire family works in the home/village labour market. The key decision problem is how to allocate family labour in the *slack period* between home-based (rural) activities and migration (i.e., urban activities), so as maximize the household inter-temporal utility. The main novelty of this work is in the results it yields. Two of the main results are as follows:

- For an individual household, undertaking seasonal migration may be worthwhile even if the *expected slack season urban income* is lower than the *expected slack season rural income*. This will obtain if the migration-induced *benefit from income diversification* outweighs the (negative) urban-rural wage differential.

- Participation in seasonal migration yields potential utility/welfare gains both *directly* and *indirectly*. First, a household with migrant members may be better off because it enjoys higher (*risk adjusted*) income in the slack season relative to *that* of a comparable rural household without migrants. This we call the *direct effect* of migration. Additionally, participation in (slack season) migration may yield inter-temporal spill-over benefits on the family welfare. It is shown below that participating households may in fact supply more labour in the peak season (relative to comparable non-participating households) yielding higher household income and utility. The mechanism is as follows. Note first that the slack season for peasant households is typically a period of *deficit*, in that income falls short of desired consumption. The expected deficit is generally met by savings from the (preceding) peak season. To the extent that slack season migration leads to a rise in the *risk-adjusted* (or *certainty equivalent*) income, the corresponding expected deficit (and savings requirement) is reduced. This allows the household to increase its peak season nutritional intake and potentially supply more labour, thereby generating additional earnings and utility. The latter is defined the *indirect effect* of seasonal migration. The possibility of similar spill-over effects of migration has been alluded to in the literature, (see for example, Regmi and Tisdell (2002)), although this has not been modelled. Note that the assumption that is key in generating the positive labour supply response to migration is the positive relationship that exists (among the extreme poor) between one's *nutritional intake* and one's *capacity f or physical work*.

The paper also takes up the issue of the possible *market* and *distributional* consequences of seasonal migration in the source region for migrants, i.e., the rural economy. There indeed exists a large literature on this issue, and interestingly, the opinion in the literature is highly divided. Lipton (1980) and Barham and Boucher (1998), among others, argue that migration is likely to worsen income distribution in the source area. Stark *et al*. (1986) and Stark and Taylor (1991), among others, draw largely the opposite conclusion. There is however consensus that the divergence in opinion can be attributed to the differences in methodologies used, as well as the nature of the questions asked. The method used in this paper is inspired by the work of Barham and Boucher (*op. cit*.). Using econometric techniques on data from Nicaragua, Barham and Boucher compare income distribution in the presence of migration with the counterfactual of no-migration. We construct here a similar counterfactual experiment, *albeit* using a simple simulation model. For tractability, we divide up the rural population in three groups: households with migrants, households without migrants and land-owning households. The simulation exercise yields the following results. Migration depresses the peak season market wage (for rural labour). A lower wage has following consequences. The land-owning and migrant households are better off and the non-migrant households are worse-off, compared with the counterfactual of no migration.

The rest of the paper is organized as follows. The analytical model of household decision making is presented in section two along with the discussions of the results. Section three contains discussions of the numerical/simulation results on the income distributional outcomes of seasonal migration. The policy implications of the analyses and the conclusions and caveats are taken up in section four.

2.1. The Model

We consider a rural economy over a crop cycle, with two seasons: a *high/peak* season (period 1) with a tight labour market, followed by a *slack/low* season (period 2) with low as well as uncertain labour demand. There are two types of rural households: large land-owning households and landless peasant or worker households. Large households employ hired labour to produce certain staple. These households are not modelled explicitly. Our focus is on the labour supply behaviour of the peasant households. In the peak season (which is the harvesting period), a competitive labour market prevails, and all job seekers could potentially find employment at a given market wage. Below, we make two *foundational assumptions* about the *peak season labour market*.

- Following Dasgupta (1993) and others, we assume that an individual's productivity (or the supply of *effective effort*) in the peak season is a function of his/her nutritional intake in that season, (see figure 2). That is, one's *nutritional status* or *innate strength* is not a factor in determining one's productivity in peak season activities. Note that the assumption is only relevant for individual job-seekers who are assetless and rely entirely on labour income for sustenance. Note further that this individual level relationship is assumed to be also valid at the family level.
- The market operates on a piece rate basis, that is, wages are based on productivity.

While the validity of the first of these assumptions (in similar contexts) has been criticized in the literature, we provide the following justification for their inclusion. Sukhatme and Margen (1982), Payne (1992), Srinivasan (1994) and others argue that a person's physical efficiency adjusts over time to alterations in nutritional intake. That is, there is no *unique* relationship between calorie-intake and productivity. Empirical evidence from rural India however show that a *strong* (i.e., statistically significant) nutrition-productivity relationship *does* exist for *certain key agricultural activities*, such as *harvesting*, which requires sustained energy expenditure. For other activities, such as ploughing which requires innate strength, the relationship is a weaker one; see among others, Behrman and Deolalikar (1988) and Strauss (1986), for details. We point out that harvesting is the main peak season activity and is largely performed by casual workers. Further, as argued by Dasgupta (1993), Dasgupta and Ray (1986) and others, this assumption guarantees that the concept of *poverty* indeed has a functional role in the analysis.

The plausibility of the second assumption – that piece wages *can be* (and *are*) implemented in spot markets – depends on whether an individual worker's productivity is *observable*. Note that while labour productivity may not be observable without monitoring in certain activities, e.g., ploughing, it is certainly observable in harvesting. This largely concurs with the empirical observation that the peak season market is dominated by casual workers where piece rates are common, see among others, Behrman and Deolalikar (1988). This concludes our defence as to why the two assumptions above should indeed be part of this model.

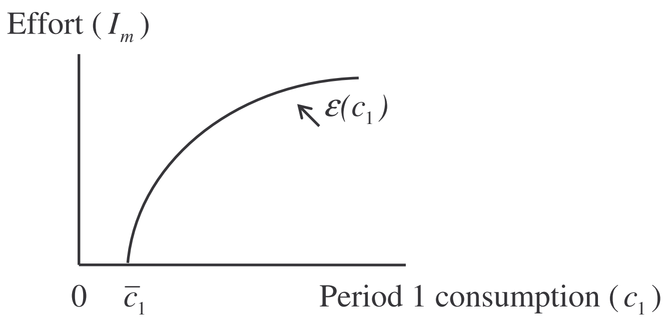
The *slack season* (which follows the peak season) is a period of relative inactivity. The agricultural labour market does not operate in the standard sense. We assume that job opportunities (of fixed duration and fixed remuneration) crop up only sporadically and job-matching takes place randomly[6]. The consumption-effort relation is assumed not to play any role in the slack period labour allocation. The reason is that since a given amount of work (or a given *number of tasks*) are allocated randomly among potential workers, individual workers/households can not affect their own probabilities of getting a job (or the amount of effort to be supplied if they get a job) by varying the level of consumption. That is, the slack season household income in the absence of migration is *exogenous random variable*, and is assumed to be given by a two parameter (mean-variance) distribution. The average slack season family income is also typically less than the household's *subsistence requirement*. If migration possibilities open up, the households will be free to allocate its labour resources between two markets in the slack season. The income stream from urban employment is also assumed to be uncertain and is described by a given mean-variance distribution, similar to the slack season rural income. The act of migration involves certain expenditures (as discussed earlier). These expenditures/costs are family specific and are assumed to have a fixed and a variable component. The fixed component includes, for example, costs of information gathering about urban job market (-a part of search cost). The variable component, (e.g., travel costs, urban living expenses, etc.), is assumed to be a linear function of the proportion of family members that migrates.

[6] Workers, in addition, have access to some non-market opportunities (e.g., self-employment) in the slack season, which yield very small returns.

The main assumptions of the model are presented in the following table.

High/peak season (period 1)	**Low season (period 2)**
No uncertainty.	Employment income in the rural sector (y_R) is uncertain.
There exists a given piece rate wage, *w*.	$\tilde{y}_R : N(\bar{y}_R, \sigma_R^2)$, σ_R^2: variance of rural income
Household income is $y_1 = w.I_m$, where I_m: productive effort.	Employment income (y_u) in the urban informal sector (in the case of migration) is given by, $\tilde{y}_u : N(\bar{y}_u, \sigma_u^2)$. σ_u^2 : variance of urban income.
Effort supply (I_m) is a function consumption, $I_m = \begin{cases} 0, & c_1 < \bar{c}_1, \\ \varepsilon(c_1), & c_1 \geq \bar{c}_1. \end{cases}$ Figure 2 below[7].	Migration costs (household *i*): $\theta_{1i} + \theta_{2i}\alpha$. α : Proportion of family labour allocated to the urban market. θ_{1i} and θ_{2i} are, respectively, fixed and marginal cost of migration. Subscript *i* indicates *i*th household. That is, θs vary across households.

Figure 2



According to Figure 2, the household does not produce any effective effort up to consumption level $\bar{c}_1$. $\bar{c}_1$ is often defined as the *Resting Metabolic Rate* (see Dasgupta (1993)). Effort is a concave function of consumption thereafter.

[7] This representation of consumption-effort function is due to Dasgupta (1993).

2.2. The decision problem of a representative household

The representative household is assumed to maximize expected utility defined as a function of consumption and effort supply, over a two period decision horizon. The household operates as a single decision making unit. That is, possible conflict between individual well-being and group welfare is assumed away[8]. We assume further that migration takes place only in the slack season, and that, migrants always return home to the rural labour market in the peak season[9]. For a household to contemplate migration, it must hold that the expected utility from undertaking migration is at least as large as the expected utility in the absence of migration. In order to obtain the "marginal conditions" under which migration is welfare improving, we need to incorporate in the model the *optimal expected utility in the absence of migration* as a constraint. The modelling is therefore done in two stages. First, we model family labour allocation in the absence of migration. This is followed by the full model.

Allocation in the absence of Migration

The maximization problem (in the absence of migration) is defined as follows:

Maximize $\{EU(c_1, \tilde{c}_2, I_m) = U^1(c_1,\ I_m) + \delta EU^2(\tilde{c}_2)\}$, subject to $I_m \leq \varepsilon(c_1)$,

where U^1 and EU^2 are utility for period 1 and expected utility for period 2 respectively,

c_1: consumption in period 1,

$\tilde{c}_2$: consumption (stochastic) in period 2 = $\tilde{y}_R + (y_1 - c_1) = \tilde{y}_R + (wI_m - c_1)$, and

δ is the subjective discount rate.

In the beginning of period 1, households make simultaneous decision on how much effort to supply (I_m) and how much to consume in period 1 (c_1). Period 2 effort supply, as explained earlier, is not a decision variable. For the purpose of illustration we assume the following negative exponential utility[10]:

[8] The assumption that households in developing countries operate as a unit in making migration decisions has been made by Chen *et al*. (2003).

[9] The latter assumption clearly lacks realism. That is, return migration cannot be an optimal strategy if the household stands to be better off by having some members staying permanently in the city. However, we do not attempt to model the coexistence of seasonal and more permanent form of migration in order to keep matters simple. We leave this as a topic for future research.

[10] Chen *et al*. (2003) assume similar utility specification in their model of household migration decisions.

$U^1(c_1, I_m) = -e^{-A(c_1-\gamma I_m)}$, and

$U^2(\tilde{c}_2) = -e^{-A\tilde{c}_2}, \Rightarrow EU^2(\tilde{c}_2) = -e^{-A\left[\bar{c}_2 - (\frac{1}{2})A\sigma_R^2\right]} = -e^{-Ac_2^{CE}}$,

where A (- the measure for *absolute risk aversion* -) is a constant,

$c_2^{CE} \equiv \left[\bar{c}_2 - (\frac{1}{2})A\sigma_R^2\right]$: certainty equivalent consumption for the slack season[11],

$\bar{c}_2 \equiv \bar{y}_R + (wI_m - c_1)$: mean slack season consumption, and

variance($\tilde{c}_2$) $\equiv$ variance($\tilde{y}_R$) $\equiv \sigma_R^2$.

The utility specification for period 1 follows that of Eswaran and Kotwal (1985). In a single period context, this specification implies, assuming consumption equals income, (i.e., $c_1 = wI_m$),

$$I_m = \begin{cases} Max., & if\ w > \gamma \\ 0, & if\ w < \gamma \\ 0 \le I_m \le Max., & if\ w = \gamma \end{cases},$$

where "*Max.*" stands for maximum possible effort supply, and γ has the interpreted of the "reservation wage".

In the present context, maximum effort supply is attained where effort supply constraint binds. We indeed assume that effort supply constraint always binds. This we argue is reasonable given that the "reservation wage" (γ) for the very poor is expected to be always smaller than the prevailing market wage, (i.e., the very poor will not be voluntarily unemployed).

Rewriting the maximization problem as a Lagrange function:

$$Max.L = \underset{\{c_1, I_m, \lambda\}}{Max}\left[\{U^1(c_1,\ I_m) + \delta U^2(c_2^{CE})\} + \lambda\{\varepsilon(c_1) - I_m\}\right]$$

The first order conditions, (given that the effort supply constraint binds, i.e., $\lambda > 0$), are:

$$c_1: \qquad \frac{\partial L}{\partial c_1} = U^1_{c_1} - \delta U^{2'}(c_2^{CE}) + \lambda\varepsilon'(c_1) = 0,$$

[11] This follows derivation in Laffont (1993), chapter 2, pages 19-22.

$$\text{or,}\qquad U^1_{c_1} + \lambda\varepsilon'(c_1) = \delta U^{2'}(c_2^{CE}) \tag{1}$$

$$I_m:\qquad \frac{\partial L}{\partial I_m} = 0 \Rightarrow U^1_{I_m} + \delta U^{2'}(c_2^{CE})w = \lambda \tag{2}$$

$$\lambda:\qquad \frac{\partial L}{\partial \lambda} = 0 \Rightarrow \varepsilon(c_1) = I_m \tag{3}$$

First, by substituting (2) into (1), and then using (3) and the definition of the utility functions (i.e., negative exponential utilities), we can reduce the first order conditions to a single equation[12]:

$$U^1_{c_1}(c_1, I_m)[1-\gamma\varepsilon'(c_1)] - \delta U^{2'}(c_2^{CE})[1-w\varepsilon'(c_1)] = 0$$

$$\text{or,} U^1_{c_1}(c_1, I_m)[1-\gamma\varepsilon'(c_1)] = \delta U^{2'}(c_2^{CE})[1-w\varepsilon'(c_1)] \tag{4.1}$$

Equation (4.1) gives the condition for the optimal allocation of consumption between the two periods. That is, at the optimum no possible reallocation of consumption between periods will yield utility gains. This can also be expressed as the marginal rate of substitution in consumption between the two periods, (with the second period consumption expressed in terms of *certainty equivalent*)[13]:

$$\frac{U^1_{c_1}(c_1, I_m)}{U^{2'}(c_2^{CE})} = \delta.\frac{[1-w\varepsilon'(c_1)]}{[1-\gamma\varepsilon'(c_1)]}\ (<1) \tag{4.2}$$

Equation (4.2) has the following interpretation. The optimal allocation of consumption between the two periods is *uneven* - a higher consumption is preferred in the peak/first period. This is so for two reasons: First, agents are impatience, so they prefer higher consumption in the first period – (note that the discount factor, δ<1, can be interpreted as the rate of impatience). Second, higher period 1 consumption is preferred, (independent of the impatience factor (δ)), because it increases one's productivity in that period. The second period consumption has no such productivity enhancing effect. This follows from

[12] Given that the effort supply constraint always binds, the optimization problem reduces to a problem with only one unknown, c_1. That is, the optimal level of c_1 uniquely determines the levels of effort supply, I_m, and period 2 consumption.

[13] Note that the term 'second period consumption' or 'slack season consumption' will, from here-onward, refer to the 'certainty equivalent consumption' in that period/season.

$\frac{[1-w\varepsilon'(c_1)]}{[1-\gamma\varepsilon'(c_1)]}$ <1, since $w > \gamma$ (by assumption)[14]. Below we give a numerical example of the solution to the household allocation problem.

Numerical Example 1

We rewrite first (4.2):

$$\frac{U^1_{c_1}(c_1, I_m)}{U^{2'}(c_2^{CE})} = \delta . \frac{[1-w\varepsilon'(c_1)]}{[1-\gamma\varepsilon'(c_1)]} .$$

The utility functions for periods 1 and 2, as define earlier, are:

$$U^1(c_1, I_m) = -e^{-A(c_1 - \gamma I_m)},$$

$$EU^2(\tilde{c}_2) = U^2(c_2^{CE}) = -e^{-Ac_2^{CE}} ; \quad c_2^{CE} = \bar{y}_R + (wI_m - c_1) - \frac{1}{2}\sigma_R^2 .$$

It follows that $U^1_{c_1}(c_1, I_m) = A\, e^{-A(c_1 - \gamma I_m)}$, and $U^{2'}(c_2^{CE}) = A\, e^{-Ac_2^{CE}}$.

We choose, in addition, the following functional form for the consumption-effort relationship:

$$\varepsilon(c_1) = I_m = \begin{cases} 0, & \text{for } c_1 \le \frac{b+1}{a}, \ \frac{b+1}{a} > 0 \\ \ln(ac_1 - b), & \text{for } c_1 > \frac{b+1}{a}. \end{cases}$$

The inverse of $\varepsilon(c_1) : c_1 = \phi(I_m) = \frac{e^{I_m} + b}{a}$, I_m>0.

The function $\phi(I_m)$ is often referred to as the *food/consumption requirement function*, (see for example, Stiglitz (1976)). Given the choice of functional forms, an analytical solution for consumption allocation does not exist. We therefore look for a numerical solution. The following parameter values are chosen:

---

[14] Note that the term $w\varepsilon'(c_1)$ represents the *value* of increased work capacity/productivity due to a marginal increase in period 1 consumption, evaluated at the market wage. The term $\gamma\varepsilon'(c_1)$, (with a negative sign in front), represents (a measure of) disutility from a marginal increase in effort supply. Further, note that both $[1-\gamma\varepsilon'(c_1)]$ and $[1-w\varepsilon'(c_1)]$ are positive. These are in fact "weights" assigned to marginal utilities in order to find *net change in utility* due to incremental consumption. A negative weight would mean *net marginal utility* is negative from incremental consumption, which is not compatible with optimality conditions for utility maximization.

$A=1,\ \ \bar{y}_R=15,\ \ w=8,\ \ \gamma=2,\ \ \sigma_R^2=20,\ \ \delta=\dfrac{1}{1.5},\ \ a=4$ and $b=3$.

Substituting these values in (4.2), the following is obtained:

$$\frac{e^{-(c_1-2\ln(4c_1-3))}}{e^{-(15+(8(\ln(4c_1-3))-c_1)-5)}}=\frac{1}{1.5}\times\frac{\left[1-8(\frac{4}{4c_1-3})\right]}{\left[1-2(\frac{4}{4c_1-3})\right]}$$

This yields the following solution[15]:

Period 1 consumption, c_1^* =25.91

Period 1 effort supply, $\varepsilon(c_1^*)=I_m^*=\ln(4c_1^*-3)$ =4.6115

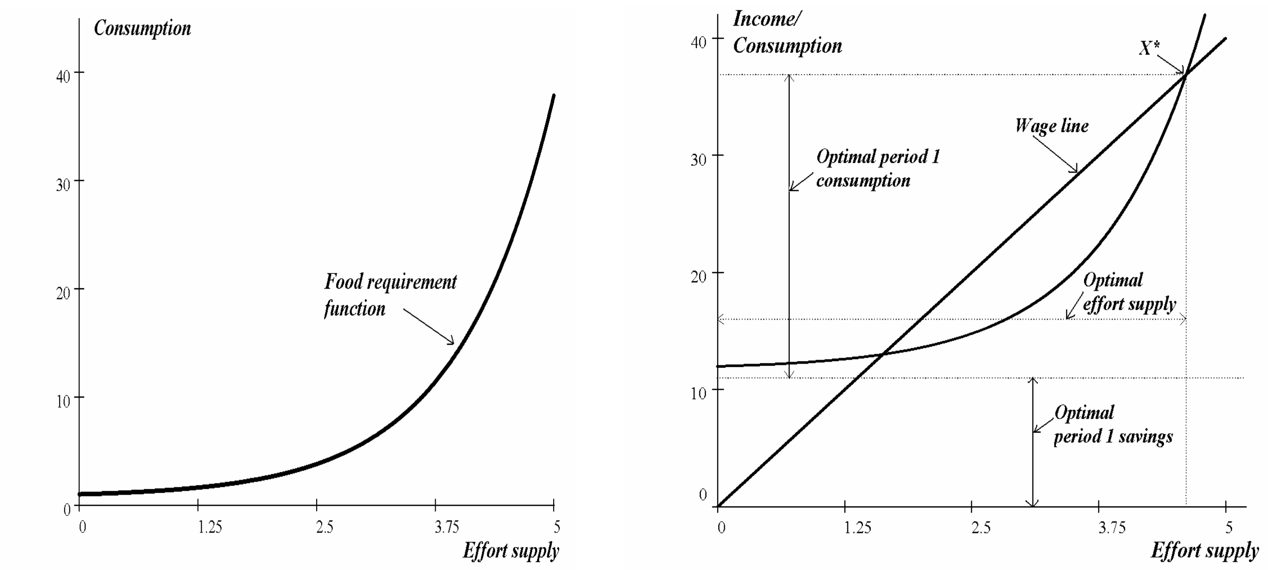
Period 1 savings, $wI_m^*-c_1^*=8(4.6115)-25.91=10.982$

Period 2 consumption ("certainty equivalent"), $c_2^{CE*}=\bar{y}_R+(wI_m^*-c_1^*)-\frac{1}{2}\sigma_R^2$

= 15+(10.982) −10=15.982.

The above solution is presented graphically in Figure 3 below[16].

Figure 3



Food Requirement Function

Panel I (Figure 3)

Allocation in Pre-migration State

Panel II (Figure 3)

[15] The numerical solution routine in *Scientific Workplace 5.0* (MacKichan Software Inc. USA) is used in all computations below.

[16] This and all subsequent figures are generated by *Scientific Workplace 5.0*.

Panel I of Figure 3 shows the food requirement function, $c_1 = \phi(I_m) = \frac{e^{I_m} + 3}{4}$. In Panel II, this function is redrawn but now added onto a horizontal line with the height equalling the optimal savings from period 1 income, $wI_m^* - c_1^*$. The optimal household effort supply is given at *X**, where effort supply constraint binds and the wage income is maximized.

Comparative Statics[17]:

Here, we look at the effect of a change in (i) the exogenous wage rate (w) and (ii) the variance of slack season income (σ_R^2) on the optimal intertemporal consumption and savings allocation. The above two (comparative statics) are representative of all possible comparative statics that can be meaningfully defined for the present problem.

(i) An increase in period 1 wage rate will unambiguously increase period 1 consumption, c_1, and labour supply, I_m; $\frac{dc_1^*}{dw} > 0$ and $\frac{dI_m^*}{dw} > 0$. The intuition is simple. Suppose that an increase in wage (w) *does not* lead to a corresponding change in period 1 consumption. That must imply that the entire increase in income is saved and spent on period 2 consumption. This causes the right-hand side of the first order condition in (4.1) to drop with no corresponding change on the left-hand side, violating (4.1). In other words, there are utility gains to be had by reallocating consumption from period 2 to period 1. That is, the supposition above does not hold. Therefore, period 1 consumption must rise, (and along with it, period 1 labour supply (I_m^*)).

The effect of wage on the period 1 savings (and therefore, on period two consumption) is however ambiguous:

$$\frac{d}{dw}(wI_m^* - c_1^*) \gtreqless 0 .$$

The intuition here is as follows. Once again, the first order condition implies that higher period 1 income should *generally* lead to higher consumption in both periods. However,

[17] The derivation of the comparative static results is presented in the Appendix. Below, we present the intuition behind the results.

there is a special case. It is conceivable that if the productivity gains from higher consumption (in period 1) are *very large*, then it may turn out to be worthwhile to *lower* period 1 savings in order to raise period 1 consumption to a level that will generate maximum productivity gains. Lower period 1 savings imply lower period 2 consumption.

(ii) A decline in σ_R^2 raises the certainty equivalent income for period 2. Optimality requires that this raise consumption in both periods. This can be easily demonstrated using similar argument as in (i) above. Further, an increase in period 1 consumption, in the present case, can only come about through lower period 1 savings. That is:

$$\frac{d}{d\sigma_R^2}(wI_m^* - c_1^*) < 0 \text{ and } \frac{dc_1^*}{d\sigma_R^2} > 0,$$

where ($wI_m^* - c_1^*$) is the optimal period 1 savings.

Below, we extend the household decision making problem to allow for *slack season migration*.

2.3. Allocation under migration

For a household to contemplate migration, it must hold that the expected utility from undertaking migration is at least as large as the expected utility in the absence of migration. In order to obtain the "minimum requirements/conditions" under which migration is welfare improving, we consider first the household decision problem in which the expected pre-migration utility enters as a constraint. The key decision here is how to optimally allocate family labour between the two labour markets in the slack season.

Maximize $\{EU(c_1, \tilde{c}_2) = U^1(c_1,\ I_m) + \delta EU^2(\tilde{c}_2) = U^1(c_1,\ I_m) + \delta U^2(c_2^{CE})\}$,

subject to

(i) $I_m \le \varepsilon(c_1)$,

(ii) $U^1(c_1,\ I_m) + \delta U^2(c_2^{CE}) \ge EU^B$ where,

$$c_2^{CE} = \bar{c}_2 - \frac{1}{2} A\sigma^2,$$

$$\bar{c}_2 = \alpha\bar{y}_u + (1-\alpha)\bar{y}_R + (wI_m - c_1) - (\theta_1 + \theta_2\alpha)$$

$$\sigma^2 = \alpha^2\sigma_u^2 + (1-\alpha)^2\sigma_R^2 + 2.\alpha(1-\alpha)\sigma_{uR}$$

α : the proportion of total family labour allocated to the urban labour market.

The appropriate Lagrange function is given by:

$$Max.L = \underset{\{c_1, I_m, \lambda_1\} \atop \lambda_2, \alpha}{Max} \left[\begin{array}{l} \{U^1(c_1,\ I_m) + \delta U^2(c_2^{CE})\} + \lambda_1\{\varepsilon(c_1) - I_m\} \\ + \lambda_2\left\{U^1(c_1,\ I_m) + \delta U^2(c_2^{CE}) - EU^B\right\} \end{array} \right]$$

The first order conditions are given by:

$$c_1: \qquad U^1_{c_1} - \delta U^{2'}(c_2^{CE}) + \lambda_1\varepsilon'(c_1) + \lambda_2\left(U^1_{c_1} - \delta U^{2'}(c_2^{CE})\right) = 0 \tag{6}$$

$$I_m: \qquad U^1_{I_m} + \delta U^{2'}(c_2^{CE})w - \lambda_1 + \lambda_2(U^1_{I_m} + \delta U^{2'}(c_2^{CE}).w) = 0 \tag{7}$$

$$\lambda_1: \qquad I_m = \varepsilon(c_1) \tag{8}$$

$$\lambda_2: \qquad U^1(c_1,\ I_m) + \delta U^2(c_2^{CE}) = EU^B \tag{9}$$

$$\alpha: \qquad \alpha = \frac{(\bar{y}_u - \bar{y}_R) - \theta_2 + A(\sigma_R^2 - \sigma_{uR})}{A(\sigma_u^2 + \sigma_R^2 - 2\sigma_{uR})} \tag{10}$$

Substituting for λ_1 from (7) into (6), one obtains upon some simple manipulation:

$$\frac{U^1_{c_1}(c_1, I_m)}{U^{2'}(c_2^{CE})} = \frac{\delta[1 - w\varepsilon'(c_1)]}{[1 - \gamma\varepsilon'(c_1)]} \tag{11}$$

Note that the marginal rate of substitution in consumption between the two periods given in (11) is identical with that in (4.2). This implies that if the household pre-migration expected utility is equal to the post migration expected utility, then the *ex ante* consumption allocation between the two periods will also be identical in the pre- and post migration regimes. That is,

$$c_1^{(pre)} = c_1^{(post)} \tag{12a}$$

and $$c_2^{CE(pre)} = c_2^{CE(post)} \tag{12b}$$

pre: pre-migration, *post*: post migration.

According to (12a), period 1 (peak period) consumption is identical in the pre- and post migration states. This further implies that the household peak season labour supply will also be identical in the two states. (12b) yields the following:

$$c_2^{CE(pre)} = \bar{c}_2^{(pre)} - \tfrac{1}{2} A\sigma_R^2 = \bar{c}_2^{(post)} - \tfrac{1}{2} A\sigma^2 = c_2^{CE(post)}.$$

It follows that if $\sigma_R^2 \geq \sigma^2$ *then* $\bar{c}_2^{(pre)} \geq \bar{c}_2^{(post)}$.

That is, given that migration results in some diversification of risk, the *expected* second/slack period consumption will be lower in the state with migration than without. With the above as a backdrop, we address the following questions:

(i) What is the *minimum required urban income* that will induce households to participate in migration?

(ii) How would the peak season household labour supply respond to a (welfare improving) participation in migration?

The minimum required urban income

We begin with the following relationship from above:

$$\bar{c}_2^{(pre)} - \tfrac{1}{2} A\sigma_R^2 = \bar{c}_2^{(post)} - \tfrac{1}{2} A\sigma^2$$

$$\Rightarrow \bar{y}_R + (wI_m - c_1) - \tfrac{1}{2} A\sigma_R^2 = \alpha\bar{y}_u + (1-\alpha)\bar{y}_R + (wI_m - c_1) - (\theta_1 + \theta_2\alpha) - \tfrac{1}{2} A\sigma^2$$

$$\Rightarrow \bar{y}_u^* = \bar{y}_R + (\frac{\theta_1}{\alpha} + \theta_2) - \frac{A}{2\alpha}(\sigma_R^2 - \sigma^2) \tag{12}$$

$\bar{y}_u^*$ is the required (average) minimum urban income. That is, for any $\bar{y}_u > \bar{y}_u^*$, migration will be welfare improving. Note further that $\bar{y}_u^* < \bar{y}_R$, if $\frac{A}{2\alpha}(\sigma_R^2 - \sigma^2) > (\frac{\theta_1}{\alpha} + \theta_2)$. That is, if the benefits from risk reduction, $(\sigma_R^2 - \sigma^2)$, are sufficiently large, then one can show that migration may be desirable even if the income of the urban migrants falls short of comparable rural income. An example of this is given below, (see numerical example 2). Similar results were also obtained by Levhari and Stark (1982) and Chen *et al*. (2003).

Labour supply response to participation in migration

It follows from above that peasant households will be indifferent between participation (in migration) and no-participation at $\bar{y}_u = \bar{y}_u^*$, where $\bar{y}_u^*$ is defined in (12). Consider now a household that participate in migration at $\bar{y}_u = \bar{y}_u^*$. How would the household respond (in terms of the allocation of consumption and effort) to a marginal increase in $\bar{y}_u$ from the level $\bar{y}_u^*$, with everything else the same? We answer this first intuitively, followed by an analytical demonstration.

The effect of a higher $\bar{y}_u$ is in fact analogous to that of a decline in σ_R^2 as discussed above under comparative static exercises. The discussion is briefly repeated. Assume for the time being that the household does not adjust α as a response to a change in $\bar{y}_u$ - this will be relaxed later. Consider first the slack/low season. An increase in $\bar{y}_u$ raises the slack season *certainly equivalent income*. Optimality requires that this lead to higher consumption in both periods. Note however that higher consumption in period 1 can only be achieved through lower savings (in that period). Higher peak season (or period 1) consumption, in turn, enables the household to supply more labour and therefore earn more and potentially consume more in both periods in equilibrium. Let us now relax the assumption of a constant α. Given that α affects utility/allocation only via its impact on the slack season income, a rational household will adjust α from its initial equilibrium value (following an increase in $\bar{y}_u$) only if this raises the slack season income even further. Therefore, an increase in $\bar{y}_u$ will unambiguously increase the household peak season labour supply. In order to verify this analytically, the following steps are necessary. First, we need to solve the household allocation problem without imposing the pre-migration utility constraint. We then evaluate $\frac{dI_m}{d\bar{y}_u}$ via comparative-static exercise on the new solution. It follows trivially that the equations (6), (7), (8) and (10) are the relevant first order conditions for the *unconstrained* problem, (with equation (9) omitted). Note that equation (11) is valid for the unconstrained problem, (but not equation (12)).

The evaluation of $\frac{dI_m}{d\bar{y}_u}$ follows similarly as the earlier comparative statics:

$$\frac{dI_m}{d\bar{y}_u} = \frac{d\varepsilon(c_1)}{d\bar{y}_u} = \varepsilon'(c_1)\frac{dc_1}{d\bar{y}_u} > 0, \text{ where}$$

$$\frac{dc_1}{d\bar{y}_u} = \frac{\alpha * \delta * \overbrace{U''(c_2^{CE})}^{(-)} * \overbrace{(1 - w\varepsilon'(c_1)}^{(+)}}{\underbrace{U^1_{c_1c_1}}_{(-)} * \underbrace{(1 - \gamma\varepsilon'(c_1))^2}_{(+)} + \delta * \underbrace{U^{2''}(c_2^{CE})}_{(-)} * \underbrace{(1 - w\varepsilon'(c_1))}_{(+)} + \underbrace{\varepsilon''(c_1)}_{(-)} * \underbrace{(\delta w U^{2'}(c_2^{CE}) - \gamma U^1_{c_1})}_{(+)}} > 0$$

Below, we give numerical illustration of the above two results by extending Numerical Example 1.

Numerical Example 2.

(i) First, we numerically evaluate the "minimum required urban income" for a given set of parameter values.

We begin with relationship (12):

$$\bar{y}_u^* = \bar{y}_R + (\frac{\theta_1}{\alpha} + \theta_2) - \frac{A}{2\alpha}(\sigma_R^2 - \sigma^2),$$

Where

$$\sigma^2 = \alpha^2 \sigma_u^2 + (1-\alpha)^2 \sigma_R^2 + 2.\alpha(1-\alpha)\sigma_{uR}, \text{ and}$$

$$\alpha = \frac{(\bar{y}_u - \bar{y}_R) - \theta_2 + A(\sigma_R^2 - \sigma_{uR})}{A(\sigma_u^2 + \sigma_R^2 - 2\sigma_{uR})}.$$

We keep the parameter values from the pre-migration model, (Numerical Example 1), unchanged. We assume the following values for the additional parameters that belong only to the post migration model:

$$\theta_1 = 1.8,\ \theta_2 = 2,\ \sigma_u^2 = 20 \text{ and } \sigma_{uR}^2 = 0.$$

Solving (12) numerically with the above parameter values gives $\bar{y}_u^* = 9$. That is, an average slack period urban earning, $\bar{y}_u$ >9, will induce participation in migration. Note that the corresponding value for slack season rural income, $\bar{y}_R$ = 15 > 9 $(= \bar{y}_u)$. This demonstrates that an urban earnings prospect that is substantially inferior to comparable rural prospect can still induce rural-to-urban migration.

(ii) It is shown below that an exogenous increase in the slack season mean urban earning ($\bar{y}_u$) will cause household consumption to increase in both peak and slack periods. This, following the *consumption-productivity relationship*, induces households to supply more labour in the peak season. Note that given the values of parameters as in (i) above and $\bar{y}_u$ =9, the optimal allocation of consumption (c_1 and c_2^{CE}) and period 1 labour supply (I_m) in both pre- and post migration scenarios are identical. We show numerically how the optimal allocation changes as a response to an increase in $\bar{y}_u$ from 9 to 14.

By substituting the parameter values in the first order condition for the household post migration allocation problem, (equation (11)), we get:

$$\frac{e^{-(c_1 - 2\ln(4c_1 - 3))}}{e^{-((\frac{17}{40}*14+\frac{23}{40}*15)+(8(\ln(4c_1-3))-c_1)-(1.8+2*\frac{17}{40})-(10*(\frac{17}{40})^2+10*(\frac{23}{40})^2))}} = \frac{1}{1.5}\times\frac{\left[1-8(\frac{4}{4c_1-3})\right]}{\left[1-2(\frac{4}{4c_1-3})\right]}$$

The above yields the following solution:

Period 1 consumption, c_1^*=27.026

Period 1 effort supply, $\varepsilon(c_1^*) = I_m^* = \ln(4c_1^* - 3)$ =4.655

Period 1 savings, $wI_m^* - c_1^* = 8(4.6651) - 27.293 = 10.214$

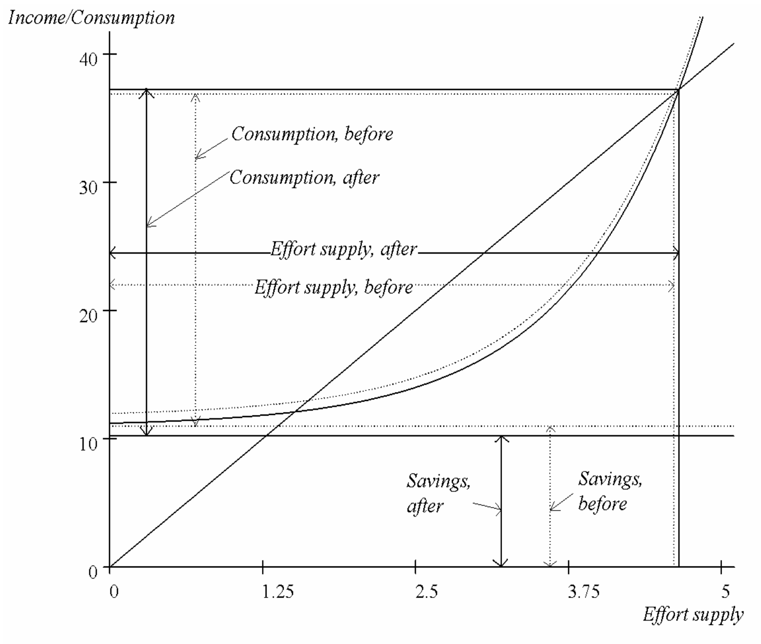
Period 2 consumption ("certainty equivalent"),

$$c_2^{CE} = ((\frac{17}{40}*14+\frac{23}{40}*15)+(8(\ln(4*27.026-3))-27.026)-(1.8+2*\frac{17}{40})-(10*(\frac{17}{40})^2+10*(\frac{23}{40})^2))$$

=17.026.

Figure 4 depicts two separate migration equilibria: one with $\bar{y}_u$ =9 ("*before*") and the other with $\bar{y}_u$ =14 ("*after*") – all other parameters are held constant.

Figure 4



The vertical *line segment* labelled "*savings, after*" shows the optimal savings with $\bar{y}_u$ =14. Note that this is lower than the optimal savings with $\bar{y}_u$ =9, shown by the line segment "*savings, before*", (which is same as the pre-migration savings in example 1). The figure also shows both optimal consumption and labour supply for the two values of $\bar{y}_u$. In particular, it shows that the peak season labour supply increases as a response to an expected increase in the slack season urban income.

To summarize the main results, we show that if a household finds itself better-off as a result of participating in seasonal migration compared to the initial state of no-migration, then household consumption in both periods must increase in the post migration equilibrium. Increased period 1 consumption also yields, via the consumption-productivity function, higher period 1 labour supply. This does not necessarily require that urban income opportunities are better that the rural ones. In fact, the diversification benefits alone may make migration worthwhile even if urban income opportunities are *inferior* to rural opportunities.

3. Market analysis

The analysis thus far has been *partial equilibrium* in nature. It is, at this juncture, natural to raise the following question:

What are the economy-wide of effects seasonal migration, both in terms of labour market and distributional outcomes?

In order to address this, we construct a simple model of the rural labour market by extending the household model, and then perform numerical simulations of the following type. We assume that the rural economy initially is at a pre-migration equilibrium (- the counterfactual state -) and then trace out how the equilibrium market outcomes, (e.g., market wage), are affected by the introduction of migration possibilities via a *positive* exogenous shock, e.g., an increase in $\bar{y}_u$ or σ_R^2 or decline in σ_u^2. We also perform *welfare comparisons* of the two alternative market equilibria: one in the presence of migration and one without. We should emphasize that we look for welfare effects of migration that comes about exclusively through the labour market, i.e., changes in wage. That is, we abstract from all other possible price/output effects (of migration).

First, we discuss the set-up and workings of the simulation model and the intuition behind the results it produces. Recall our earlier assumption that there are predominantly two types of rural households: Large land-owning (non-worker) households and landless peasant/worker households. Only the peasant households contemplate migration. Further, it is assumed that only those owning *strategic resources* among the peasant households are able to successfully participate in migration. Let us now assume that each of the two groups of peasant households, (those with strategic resources and those without), is homogeneous (within the group). It follows from the partial equilibrium analysis above that with the pre-migration equilibrium as a starting point, the act of migration by one *group* of households, induced by (say) an exogenous rise in expected urban income, will cause the aggregate peak season labour supply of this group to increase. The labour supply of the other group - (that without strategic resources) - remains unchanged. This leads to an increase in the aggregate labour supply. This will depress the equilibrium peak season wage. How would this affect the well-being of the representative households from the three different groups in the post migration equilibrium? Consider first the *land-owners*[18]. Assume that landlords maximize (utility of) profits from production (of a staple) using pleasant labour, land and other inputs. Everything else the same, a lower wage means that the landlords will hire more labour and enjoy higher profit/returns and therefore will be

[18] The following conclusion about the land-owning households is ad-hoc. Note that these households are not formally modeled in this paper.

unambiguously better-off. What about the *peasant households without migrants*? These households are unambiguously worse-off as a decline in the peak season wage will lead to lower effort supply and lower income in the peak season. The utility loss for these households can be easily demonstrated by using the comparative-static results in section 2.2. The *peasant households with migrants*, on the other hand, will be better-off despite a fall in wage. The intuition is as follows. Suppose first to the contrary, i.e., household utility declines as the equilibrium peak wage drops. This supposition, we argue, cannot hold if we allow the households to be "dynamically rational", meaning that the households recognize their worsening well-being to be a consequence of their own action, (namely, supplying more labour). All that the households need to do to avoid being worse off is to consume all income gains from migration in the second period. This leaves period one consumption and labour supply unaffected, but household utility increases due to higher period two consumption. One can then conclude that should the equilibrium wage fall, this must also accompany utility gains for these households. The above utility comparisons of peasant households are demonstrated below via a numerical example.

Numerical Example 3: A model of the rural sector

Recall that the rural economy has three population groups: Landlords, peasant households with (potential) migrants and peasant households without migrants.

Aggregate demand for labour

(Inverse) demand for labour aggregated over all landlords is assumed to be given by:

$$\textit{Wage } (w) = 44.\,892 - (\textit{Aggregate labour effort})/50$$

Migration costs

It is further assumed that there are 400 peasant households; 200 in each of the two groups. Peasant households have the following migration cost function:

$$\textit{Migration costs} = \theta_1 + \theta_2\alpha = \begin{cases} (i)\ \ 1.8 + 2\alpha \text{ (for households with strategic resources)} \\ (ii)\ 4.1{+}2\alpha \ \text{ (for households without strategic resources)} \end{cases}$$

The two groups of peasant households only differ in terms of *fixed cost* of migration. All households are otherwise endowed with the same utility- and consumption-effort function as defined in the numerical examples 1 or 2.

Derivation of aggregate effort supply

Pre-migration period:

We derive first the pre-migration effort supply. The market data, (i.e., the parameters and the exogenous variables) are as follows:

$$\bar{y}_R = 15,\ \bar{y}_u = 9,\quad \sigma_R^2 = 20,\ \sigma_R^2 = 20 \text{ and } \sigma_{uR} = 0 .$$

The definition of pre-migration period in the present context is as follows. Given the above parameters, no household will find it worthwhile participating in migration[19]. All households will allocate consumption and effort according to the following rule, (- same as equation (4.2) with the parameter values substituted in):

$$\frac{e^{-(c_1 - 2*\ln(4c_1 - 3))}}{e^{-(15+(w*(\ln(4c_1-3))-c_1)-5)}} = \frac{1}{1.5} \times \frac{\left[1 - w*(\frac{4}{4c_1 - 3})\right]}{\left[1 - 2(\frac{4}{4c_1 - 3})\right]},$$

where c_1: period 1 consumption

Period 1 effort supply: $I_m = \ln(4c_1 - 3)$

w: prevailing market wage in period 1

For a given value of wage, the above equation generates optimal values for consumption and effort supply. We generate household effort supply (i.e., points on the supply curve) for different possible wages between 4 and 10 with intervals of 0.5. Each of these values is multiplied by 400 to obtain an aggregate supply for the rural economy. This is drawn in Figure 5.

Post migration period:

We introduce now the following (positive) exogenous shock: The expected slack period urban income rises to 14. Note that this is still smaller than the comparable rural income, $\bar{y}_R = 15$. This leads to participation in migration among only the low (migration) cost households. The high (migration) cost households will still not find participation worthwhile. We generate effort supply for both household types for the same range of wage (4, 10) with intervals of 0.5. Household effort supply for each group is multiplied by

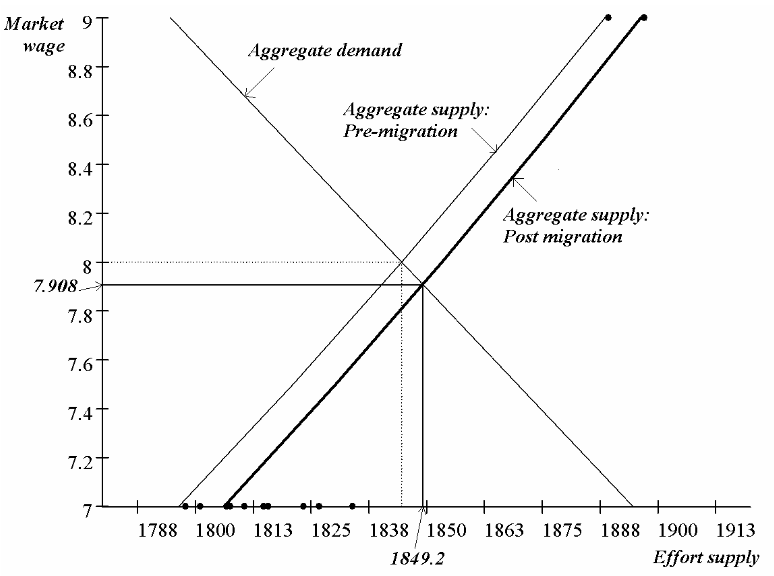
[19] In fact, the household group with lower fixed cost of migration will be indifferent between participation in migration and no-participation. However, this is of no consequence since their consumption and effort supply remain unchanged whether they participate or not.

200 and added up to obtain the aggregate/market supply of effort in the presence of migration. This is also drawn in Figure 5. The market equilibrium is as follows:

Pre-migration equilibrium: $w = 8$ and effort supply = 1844.6

Post migration equilibrium $w = 7.9085$ and effort supply = 1849.2

Figure 5



Post migration market outcome

The household intertemporal consumption and utility levels in the two equilibria are as follows:

Pre-migration equilibrium ($w = 8, \bar{y}_R = 15$)

Household consumption (All peasant households)		**Utility** $(U^1(c_1, I_m) + \delta EU^2(\tilde{c}_2) = -e^{-A(c_1-\gamma I_m)} - \delta.e^{-Ac_2^{CE}})$
Period 1 (c_1)	*Period* 2 (c_2^{CE})	
25.91	15.982	-1.3298×10^{-7}

Post migration equilibrium ($w = 7.9085,\ \bar{y}_R = 15,\ \bar{y}_u = 14$)

	Household consumption	**Utility** $(U^1(c_1,\ I_m) + \delta EU^2(\tilde{c}_2) = -e^{-A(c_1-\gamma I_m)} - \delta.e^{-Ac_2^{CE}})$
***Period* 1** (c_1)	***Period 2*** (c_2^{CE})	
Peasant households with low migration costs:		
26.762	16.784	-6.0059×10^{-8}
Peasant households with high migration costs:		
25.647	15.74	-1.6939×10^{-7}

The utility figures show that the households with migrants are better-off ($-6.0059 \times 10^{-8} > -1.3298 \times 10^{-7}$) and the households without migrants are worse-off ($-1.6939 \times 10^{-7} < -1.3298 \times 10^{-7}$) respectively in the post migration equilibrium relative to the pre-migration equilibrium[20].

4. Conclusions

This paper develops a theoretical framework – *albeit*, one that is largely illustrative - for studying seasonal migration in poor rural economies. While the methodological approach adopted is micro-theoretic, the framework also allows for simple analyses at the aggregate/market level. At the micro-level, the model derives a number of results regarding how household behaviour is intertemporally affected due to participation in seasonal migration. In particular, the model shows that participation in *slack season* migration may encourage poor households to supply more labour in the *peak season*. As to the market/macro effects of migration, the results show that while the land-owning households and the peasant households with migrants are better off, the non-participating peasant households, (or, in the present context, those lacking access to *strategic resources*), are

[20] We do not try to derive any exact measure of income inequality in order to do a before and after comparison, (for example, through formally defining some *inequality index*) for that will require that the model is given additional structure, but more importantly, it is unclear how informative such an exercise would be given the level of abstraction of the model. This should also be borne in mind while considering policy options below.

worse off in the post migration equilibrium. In other words, the poorest and the most disadvantaged of the rural households are also the ones that bear the *negative* consequences of migration[21].

Recall that the point of departure for this essay has been the query as to how rural poor may use seasonal migration as an effective tool for risk-coping. The conclusions drawn above suggest that some of the poor ("the non-participating households") are doubly cursed: they remain exposed to the slack season income risks as they lack the means to participate in migration, and further, they experience a fall in potential wage income in the peak season as the market wage drops due participation in migration by others.

As to the issue of policy, the discussion above naturally leads us to the following conclusion: The acute poor need to be provided with alternative means of coping income risks. That is, there appears to be a clear role for public intervention. In fact, there are a number of public poverty alleviation measures, currently being practiced world-wide (see Ravallion (2006) for details), that can adequately serve as a means of risk-coping. Some examples are given below.

- Public transfer programs
- Work-fare programs (e.g., *food-for-work* projects)
- Micro-credit programs

Recall again how participation in migration, according to our model, potentially improves household welfare: It raises the slack season certainly equivalent income. This, in turn, has spill-over effects on household *peak period consumption* and *labour supply*. All *public transfers* are comparable to an increase in slack season certainly equivalent income. One of the difficulties with transfers however is reaching the target group, i.e., the *targeting problem*. The problem of identifying the target group and keeping the non-poor from abusing the program remains a problematic issue, see Ravallion (1990, 2006).

[21] We should here add the caveat that in evaluating the welfare effects of migration, we consider only the effect of the equilibrium change in wage. A declining wage is likely to affect the output of staple positively leading to a change in staple/food prices. If the price of staple declines, this will affect all households positively. A *before* and *after* welfare comparison with price and output effects is however beyond the scope of the present framework.

Slack season *work-fare programs* in rural areas directed towards unemployed peasants have clear risk-coping functions. Public works programs are also popular among policy makers as these possess a number of *desirable* properties: While designed as poverty measures, works programs also contribute by creating rural infrastructure investments. Additionally, works programs, if properly designed, can be *self-targeting*. By self-targeting one refers to a program design that leads to the poor *self-selecting* (into the program) while the non-poor staying away. Such a design could be, for example, to keep wages/remuneration for participants sufficiently low, (i.e., lower than the *reservation wage* of the non-poor, if that is known).

Access to credit via micro-credit institutions can also function as a means of risk coping by allowing poor to engage in self-employment activities during the slack season. There is however evidence that the acute poor are not always the most efficient utilizers of credit, and that they may still have to rely on *complementary public policies*, e.g., public transfers of one kind or another, in order to protect themselves from income risks, (see, for example Morduch (2000) and Zaman (1999)).

While the above antipoverty measures have been practiced worldwide and have gone through much scrutiny as to their effectiveness, the arguments articulated above nonetheless provide additional reasons for their desirability.

Appendix

Derivation of comparative static results:

1. To show that $\frac{dc_1^*}{dw} > 0$ and $\frac{d}{dw}(wI_m^* - c_1^*) \underset{<}{\overset{>}{=}} 0$.

We start with the first order condition for utility maximazation given in (4.2):

$$U_{c_1}^1(c_1, I_m).[1-\gamma\varepsilon'(c_1)] = \delta U^{2'}(c_2^{CE}).[1-w\varepsilon'(c_1)]$$

By taking total derivative of this and observing that only the peak-period wage (w) undergoes change, the following is obtained:

$$\{U_{c_1c_1}^1 * \frac{dc_1}{dw} + U_{c_1I_m}^1 * \frac{dI_m}{dw}\}\{1-\gamma\varepsilon'(c_1)\} - U_{c_1}^1\gamma\varepsilon''(c_1)\frac{dc_1}{dw}$$
$$= \{\delta U^{2''}(c_2^{CE})\} * \{w\varepsilon'(c_1)\frac{dc_1}{dw} - \frac{dc_1}{dw} + I_m\}\{1-w\varepsilon'(c_1)\} - \delta U^{2'}(c_2^{CE})\left[w\varepsilon''(c_1)\frac{dc_1}{dw} + \varepsilon'(c_1)\right]$$

Noting that $U_{c_1I_m}^1 * \frac{dI_m}{dw} = -\gamma U_{c_1c_1}^1 * \varepsilon'(c_1)\frac{dc_1}{dw}$, and collecting terms in the above, we get the following:

$$\frac{dc_1^*}{dw} = \frac{\delta\left[\overbrace{U^{2''}(c_2^{CE})}^{(-)} * I_m * \overbrace{(1-w\varepsilon'(c_1))}^{(+)} - \overbrace{U^{2'}(c_2^{CE})}^{(+)} * \overbrace{\varepsilon'(c_1)}^{(+)}\right]}{\underbrace{U_{c_1c_1}^1}_{(-)} * \underbrace{\{1-\gamma\varepsilon'(c_1)\}^2}_{(+)} + \underbrace{\delta U^{2''}(c_2^{CE})}_{(-)} * \underbrace{\{1-\gamma\varepsilon'(c_1)\}^2}_{(+)} + \underbrace{\varepsilon''(c_1)}_{(-)} * \underbrace{\{\delta U^{2'}(c_2^{CE})w - \gamma U_{c_1}^1\}}_{(+)}} > 0$$

To show that $\frac{d}{dw}(wI_m^* - c_1^*) \underset{<}{\overset{>}{=}} 0$.

First, we evaluate the left-hand side derivative:

$$\frac{d}{dw}(wI_m^* - c_1^*) = w.\varepsilon'(c_1^*).\frac{dc_1^*}{dw} + I_m^* - \frac{dc_1^*}{dw} = I_m^* - \frac{dc_1^*}{dw}(1-w.\varepsilon'(c_1^*)).$$

It follows that $I_m^* - \frac{dc_1^*}{dw}(1-w\varepsilon'(c_1^*) \underset{<}{\overset{>}{=}} 0$, if $I_m^* \underset{<}{\overset{>}{=}} \frac{dc_1^*}{dw}(1-w\varepsilon'(c_1^*)$,

where $I_m^* = \varepsilon(c_1^*) > 0$, and we have from before, $\frac{dc_1^*}{dw} > 0$ and $(1-w\varepsilon'(c_1^*) > 0$.

This establishes the claim made above.

2. To show that $\frac{dc_1^*}{d\sigma_R^2} > 0$ and $\frac{d}{d\sigma_R^2}(wI_m^* - c_1^*) < 0$.

First, we evaluate $\frac{dc_1^*}{d\sigma_R^2}$. We start as before by taking total derivative of the first order condition (4.2):

$$\{U^1_{c_1c_1} * \frac{dc_1}{d\sigma_R^2} + U^1_{c_1I_m} * \frac{dI_m}{d\sigma_R^2}\}\{1-\gamma\varepsilon'(c_1)\} - U^1_{c_1}\gamma\varepsilon''(c_1)\frac{dc_1}{d\sigma_R^2}$$
$$= \{\delta U^{2''}(c_2^{CE})\} * \{w\varepsilon'(c_1)\frac{dc_1}{d\sigma_R^2} - \frac{dc_1}{d\sigma_R^2} - \frac{1}{2}\}\{1 - w\varepsilon'(c_1)\} - \delta U^{2'}(c_2^{CE}).\, w\varepsilon''(c_1).\frac{dc_1}{d\sigma_R^2}$$

Noting that $U^1_{c_1I_m} * \frac{dI_m}{d\sigma_R^2} = -\gamma U^1_{c_1c_1} * \varepsilon'(c_1)\frac{dc_1}{d\sigma_R^2}$, and collecting terms in the above, we get the following:

$$\frac{dc_1^*}{d\sigma_R^2} = \frac{-\frac{1}{2}\delta * \overbrace{U^{2''}(c_2^{CE})}^{(-)}\overbrace{(1-w\varepsilon'(c_1)}^{(+)}}{\underbrace{U^1_{c_1c_1}}_{(-)} * \underbrace{\{1-\gamma\varepsilon'(c_1)\}^2}_{(+)} + \delta * \underbrace{U^{2''}(c_2^{CE})}_{(-)}\underbrace{\{1-\gamma\varepsilon'(c_1)\}^2}_{(+)} + \underbrace{\varepsilon''(c_1)}_{(-)} * \underbrace{\{\delta U^{2'}(c_2^{CE})w - \gamma U^1_{c_1}\}}_{(+)}} < 0.$$

To show that $\frac{d}{d\sigma_R^2}(wI_m^* - c_1^*) > 0$.

Taking the left-hand side derivative, we get

$$\frac{d}{d\sigma_R^2}(wI_m^* - c_1^*) = w\varepsilon'(c_1^*)\frac{dc_1^*}{d\sigma_R^2} - \frac{dc_1^*}{d\sigma_R^2} = -\underbrace{(1-w\varepsilon'(c_1^*)}_{+} * \underbrace{\frac{dc_1^*}{d\sigma_R^2}}_{-} > 0.$$

This establishes the claim.

References

Ahsan, Q. (1998), "Insurance Motives for Rural-to-urban Migration", Discussion Paper #0698, Department of Economics, University of Bergen.

Barham, B. and Boucher, S. (1998), "Migration, Remittances, and Inequality: Estimating the Net Effects of Migration on Income Distribution", *Journal of Development Economics*, Vol. 55.

Behrman, J. R. and Deolalikar, A. B. (1988), "Health and Nutrition" in Handbook of Development Economics. Vol.1. Eds.: Hollis Chenery and T. N. Srinivasan. Amsterdam: North-Holland.

Chen, K-P, Chiang, S-H and Leung, S.F. (2003), "Migration, Family, and Risk Diversification", *Journal of Labour Economics*, 21.

Cox, D . and Jimenez, E. (1992), "Social Security and Private Transfers in a Developing Country: The Case of Peru", *The World Bank Economic Review*, 6.

Dasgupta, P. (1993), *An Inquiry into Well-being and Destitution.* Oxford, Clarendon Press.

Dasgupta, P. and Ray D. (1986), "Inequality as a Determinant of Malnutrition and Unemployment: Theory", *Economic Journal*, 96

Eswaran, M. and Kotwal, A. (1985), "A Theory of Two-tier Labour Markets in Agrarian Economies", *American Economic Review*, 75.

Hoddinott, J. (1994) "A Model of Migration and Remittances applied to Western Kenya" *Oxford Economic Paper*, 46.

Katz, E. and Stark, O. (1986), " Labor Migration and Risk-Aversion in Less Developed Countries" *Journal of Labor Economics,* 4.

Laffont, Jean-Jacque. (1993), *The Economics of Uncertainty and Information.* The MIT Press.

Levhari, D. and Stark, O. (1982), "On Migration and Risk in LDCs" *Economic Development and Cultural Change*, 31.

Lucas, R.E.B. and Stark, O. (1985), "Motivation to Remit: Evidence form Botswana" *Journal of Political Economy*, 93.

Lucas, R.E.B. and Stark, O. (1988), "Migration, Remittances and the Family", *Economic Development and Cultural Change*, 36.

Morduch, J. (2000), "The Microfinance Schism", *World Development*, 28.

Pitt, M. and Khandker, S. (1998), "Credit Programs for the Poor and Seasonality in Rural Bangladesh", Discussion Paper, Brown University.

Payne, P. (1992), “Assessing Undernutrition: The Need for Reconceptualization” in *Nutrition and Poverty*. Eds.: S. R. Osmani. Oxford University Press.

Ravallion, M. (1990), “On the Coverage of Public Employment Schemes for Poverty Alleviation”, *Journal of Development Economics*, 34.

________, M. (2006), “Evaluating Anti-Poverty Programs” in *Handbook of Development Economics Volume 4*, edited by Robert E. Evenson and T. Paul Schultz, Amsterdam: North-Holland, forthcoming.

Regmi, G. and Tisdell, C. (2002), “Remitting behaviour of Nepalese rural-to-urban migrants: implications for theory and policy”, *Journal of Development Studies,* 38.

Rogaly, B. (2002), “Seasonal Migration and Welfare/illfare in Eastern India: A Social Analysis”, *Journal of Development Studies*, 38.

Rosenzweig, M. (1988), “Risk, Implicit Contracts and Family in Rural Areas of Low Income Countries”, *Economic Journal,* 98.

Srinivasan, T. (1994), “Destitution: A Discourse”, *Journal of Economic Literature*, 32.

Stark, O. (1978), *Economic and Demographic Interaction in the Course of Agricultural Development: The Case of Rural-to-Urban Migration.* Rome: UN Food and Agricultural Organization.

Stiglitz, J. (1976), “The Efficiency Wage Hypothesis, Surplus Labour and the Distribution of Income in L.D.C.’s”, *Oxford Economic Papers*, 28.

Strauss, J. (1986), “Does Better Nutrition Raise Farm Productivity?”, *Journal of Political Economy*, 94.

Sukhatme P. and Manger, S. (1982), “Autoregulatory Homeostatic Nature of Energy Balance”, *American Journal of Clinical Nutrition* , 35.

Zaman, H (1999), “Assessing the poverty and vulnerability impact of microcredit in Bangladesh: a case study of BRAC”, Policy Research Working Paper Series 2145, The World Bank.

Department of Economics
University of Bergen
Fosswinckels gate 6
N-5007 Bergen, Norway
Phone: +47 55 58 92 00
Telefax: +47 55 58 92 10
http://www.svf.uib.no/econ