

Migration, Integration and Development

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Abstract

We re-examine the Lewis undermigration hypothesis by studying a two-sector model in which there is a trade-off between higher productivity in the modern sector and better information in the traditional sector. The consequent presence of well-functioning local insurance markets in the traditional sector and their absence in the modern sector leads to the possibility of inefficient undermigration: total social surplus would be increased if migration were larger than its laissez-faire level; whether this occurs depends in part on the distribution of wealth. In a dynamic version of the model, modernization of the economy may be too slow, and it is possible that the economy gets stuck in an undermigration trap (never fully modernizes). The migratory dynamics also lead to well-defined dynamic relations between average income and inequality. We find that although the Kuznets inverted-U curve may arise, it is equally likely that the relation of inequality and income follows other patterns, including an upright U.

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1 Introduction

In the fifties and the sixties migration was central to economists' understanding of the development process. This was consistent with their overall view that most underdeveloped economies were dominated by a backward traditional sector where the rational forces of the market-place had not yet penetrated. Migration was then not only an engine of, but also a metaphor for the many processes which lead to the integration of the traditional sector with modern sector.

Perhaps the most influential study of the actual process of modernization was by Kuznets [12]. He studied a number of then-developed countries and concluded that there was a common pattern in the process of modernization of these countries. Initially the impact of modernization was to increase inequality but over time as the economy approached full modernization inequality decreases again. This prediction for the pattern of evolution of inequality is what is known as the Kuznets inverted U-hypothesis.

Kuznets suggested a simple explanation of why one might observe such a pattern. Assuming that the productivity level in the traditional sector was below that in the modern sector, he argued that the first impact of modernization would be to increase inequality, as some of the workers who used to work in the low productivity traditional sector will now earn higher wages in the modern sector. Eventually however everyone will earn high wages in the modern sector and equality will be restored.

This theory takes as exogenous one key ingredient of the migration process — the rate of migration. The problem is to explain why despite the difference in wages the integration takes so long. As it turned out, at about the same time when Kuznets was doing this work Arthur Lewis was developing his very influential work on the determinants of migration [13]. Lewis was concerned with the possibility that the rate of migration under *laissez-faire* may be lower than optimal because of the nature of certain institutions in the traditional sector.¹ One such institution is the family farm; Lewis assumed that on the family farm all family members earned an equal share of the output as long as

¹This view actually goes back further. Similar arguments were made in the Soviet Union in the early years of communist rule by Preobrazensky and others in the context of the debates about what to do with the Kulaks.

they worked there but did not earn anything if they left to work in the modern sector.² The private opportunity cost of labor from the farm is therefore its average product, typically much higher than the social opportunity cost which is the marginal product. Therefore there will be under-migration.

The Kuznets-Lewis view of the development process and its various extensions had an immense impact on development thinking till the 70s.³ Since then, however, it has increasingly come under heavy attack and is now largely ignored at least by academic economists. The attacks were both about the micro-foundations of the view and its macro implications. Lewis' theory of the family farm requires that the farm is organized in an inefficient way. All family members could be better off if they changed the allocation rule so that the family member who goes away does not lose his share. Empirical evidence suggests that this is exactly what families do; migration is very much a family decision and optimization does take place.[5]

On the more macro level, the experience of most countries that have gone through the development process since Kuznets's paper does not suggest that the U-curve is in any way universal.⁴ Studying data from other countries people have identified inverted J-curves and even non-inverted U-curves.

More broadly the trend in development economics is to take a skeptical view of whether there is such a thing as a traditional sector in the above-mentioned sense: indeed, a large body of theoretical and empirical work has helped to establish that phenomena which were viewed as evidence of systematic irrationality in the rural sector are in fact rational. If this premise is granted, the question of integration and modernization would be irrelevant and migration would be only an issue in urban economics.

Yet it seems almost undeniable, as many social scientists have emphasized, that there are important institutional differences between the traditional and modern sectors, and that nature of the articulation among these institutions is important for understanding the development process. The position we take in this paper is an intermediate one which accommodates the latter view and allows us to try to make some sense of it. We grant that agents and institutions in the traditional sector are rational in the sense that they optimize given market prices. We do however maintain that there is a

²For an important early study of the model of the family farm within the context of this view see [14]

³Other seminal contributions to this line of research include Fei and Ranis [7] and Harris and Todaro [10].

⁴See Adelman and Robinson [1] and Fields [8], [9] for surveys of the evidence.

difference between the sectors. The difference is two-fold; the modern sector is indeed more productive, but the traditional sector has institutions which are in some ways more efficient.

The idea that there may be efficient institutions which are special to the traditional sector is now becoming increasingly widely accepted. It has been widely observed that the extended family and neighbors act as a nexus for the provision of credit and insurance [16], [17]. More recently,⁵ it has also become clear from the remarkable repayment rates in Grameen banks and other collective credit institutions in the rural areas of developing countries, that this nexus may, under the right conditions, extend beyond family and immediate neighbors [15], [18]. Even the village money-lender, long viewed as the classic example of an exploitative institution, is being appreciated for his contribution to channeling credit to those who would not get it otherwise.

The reason why these institutions may not be transplanted in the modern sector is that they depend heavily on how life is organized in the traditional sector. What is important for these institutions to function is that those who participate in them have better information and a greater ability to inflict punishment on each other than do outsiders; this derives from the fact that in the traditional sector people live and work together for generations and longer.

The purpose of this paper is to investigate the implications for patterns of migration and income distribution of this simple trade-off between higher productivity in the modern sector and more efficient institutions in the traditional sector. We model the traditional sector institution as a local consumption loan market which acts a kind of insurance for its participants. The reason this institution can thrive in the traditional sector is that agents there have good information about each other and can therefore enforce higher repayment rates than can their less informed, modern-sector counterparts.

The first result is a direct consequence of this; since those who have less initial wealth typically need to borrow more, relatively poorer people may choose to remain in the less productive traditional sector. This is true despite the fact that if everybody was forcibly moved to the modern sector output — indeed total social surplus — would be larger. In this sense it is the very efficiency of the rural credit institution that generates inefficient migration.⁶

⁵In terms of academic interest — the actual evidence on the success of credit cooperatives in the traditional sector dates back to the German cooperatives of the late 19th century [3].

⁶See [6] for some direct evidence that informal credit and insurance arrangements in

We go on to try to characterize the set of economies where this kind of under-migration is likely to emerge. What we show is that under-migration is less likely both in very poor and very inegalitarian economies and in very rich economies. It is the intermediate class of economies where under-migration is possible.

In the last section we look at the dynamics of the economy. The picture that emerges complements the results just described; more generally, patterns of the inequality dynamics and of modernization do depend somewhat sensitively on parametric specification, suggesting that Kuznets curves and full modernization should not be expected to be universal phenomena. It is possible to find conditions under which there is a tendency toward full transition to a modern economy, although the pace of modernization will be too slow. Such economies will display the full Kuznets phenomenon, defined as full modernization combined with the inverted U pattern of evolution of inequality. On the other hand, rural economies which are opened to already populated urban sectors give rise to the possibility of abortive or partial modernization, and exogenous shocks may have a role in determining whether or not modernization takes place. Finally, we can provide theoretical justification for the empirical ambiguity of the Kuznets hypothesis, by making small changes to the basic model. Simply by changing the timing of agents' location decisions — specifically, by allowing them to relocate *after* learning their productivity rather than before — one can, through selection effects, generate economies in which the evolution of inequality follows an upright U: inequality decreases, then increases during the modernization process, in effect turning Kuznets on his head.

2 The Model

To make these ideas precise we consider a simple model with just two possible locations — a single village representing the traditional sector and a single city representing modernity. The economy has a single storable consumption good which may also be as capital. The biography of a typical individual goes as follows. At the beginning of his life, an individual receives an inheritance from his parent, who bequeaths a portion β of his income. With this initial wealth a in hand, the child makes his location choice, which has no direct

rural areas — and their absence in cities — contribute to undermigration problems in India.

cost — labor is freely mobile. In his youth, before entering his productive phase, the individual has a chance p of suffering a utility loss s which may be offset by consuming $m < s$ units of the good (think of illness and cure); without the loss, extra consumption at this phase of life yields no utility. Finally, in adulthood, the individual earns his income from labor, which he supplies inelastically. The von Neumann-Morgenstern preferences have the form $y - pl$, (so the agent is risk-neutral in income y), and l denotes the utility loss from illness, which is either s if m is not consumed, or 0 if it is.

The first crucial assumption is that productivity is higher in the city than in the village. We model this by assuming that an individual who can earn w in his village could earn λw in the city, where $\lambda > 1$. In a first-best world, where information was not at issue, everyone could borrow and lend at the market gross interest rate r (the only reason to borrow would be to finance the medicine). Thus every individual would move to the city, purchase the medicine at a price r , enjoy a utility of $\lambda w + (a - pm)r$,⁷ and the economy would operate efficiently.

But this is not a first-best world, and this fact affects the workings of the market for consumption loans. We assume that capital is freely mobile between the two locations. What is not mobile is information and enforcement powers. The consumption loan/insurance market is distinguished by the possibility that a borrower might renege on a debt.⁸ To abstract from bankruptcy issues, assume for the moment that labor income is high enough to insure that borrowers can afford repayment. Suppose an agent puts up all of his wealth a (the maximum he can provide) as collateral and borrows an amount L . When it comes time to repay the loan, he may attempt to avoid his obligations by fleeing from the purview of the lender and disappearing into the urban crowds, albeit at the cost of lost collateral ar . The borrower succeeds in escaping attempts at recovering the loan with probability π , in which case he enjoys a net income of y , having avoided paying Lr ; with probability $1 - \pi$ he is caught before he has a chance to dispose of his income and a maximal punishment is imposed which holds his lifetime income to zero. Reneging therefore yields a payoff of πy , while repaying yields $y - Lr + ar$;

⁷Since illness only occurs with probability p , this expression can be interpreted as saying either that with probability p , the agent buys m , or that he pays pm before he knows his health, receiving m only if he is sick. Below, these interpretations will not be equivalent, and we shall prefer the latter.

⁸This model of an imperfect loan market is very similar to that studied by Kehoe-Levine [11] and Banerjee-Newman [4].

the borrower will renege whenever $(1 - \pi)y + ar < Lr$. Knowing this, lenders will only make loans that satisfy $(1 - \pi)y + ar \geq Lr$. All loans made in equilibrium will satisfy this constraint, and the borrower will never renege.

Since the agent needs exactly m to recover from illness and pm to cover an insurance premium that will cover this need, his initial wealth must satisfy $a \geq pm - (1 - \pi)y/r$ if he is to borrow at all; if his wealth is below this threshold value, he will be unable to pay for the medication. Observe that this threshold value of wealth is increasing in the interest rate, decreasing in income, and increasing in the escape probability π , so that this model provides a simple if perhaps extreme model of an imperfect loan market which accords in its conclusions with those of other agency models.

We now use this model to distinguish the informational advantage of the village over the city. Specifically, we make the extreme assumption that escape is impossible if one is born and remains in the village: $\pi = 0$ there, so that the threshold wealth is $pm - w/r \equiv a_V(w, r)$: as long as the individual's wage in the village exceeds pmr , she can borrow and insure against illness. If however, one locates in the city (either by choice or by birth), π is large in the sense that $\lambda(1 - \pi) < 1$; thus, $a_C(w, r) \equiv pm - (1 - \pi)\lambda w/r > a_V(w, r)$ for all w and r .

This market imperfection is the source of the possibility of undermigration: an individual whose wealth lies between the threshold values $a_C(w, r)$ and $a_V(w, r)$ would indeed gain a higher wage by migrating, but would be giving up the possibility of insuring himself. (Note that it is never socially or individually optimal for someone born in the city to move to the country, because he faces the same value of π but earns a lower income.) It remains to see whether this possibility is compatible with competitive equilibrium.

3 Static Equilibrium

Normalize the population of adults in the world in any period to be of Lebesgue measure 1. Denote by $\mathcal{R}(a)$ the measure of people born in the village with wealth less than a at the beginning of the period. Denote by $U(a)$ the corresponding measure in the city.

Let us now consider the choice problem faced by the those who grew up in the rural sector. Given an interest rate r , an agent with $a \geq a_C(w, r)$ has a payoff of $w - pmr + ar$ if he stays in the village and $\lambda w - pmr + ar$ if he moves to the city, so he clearly will migrate. If his wealth is less than $a_V(w, r)$, he

will also migrate because he doesn't get insurance in either location and so takes the higher urban wage. An agent with wealth between $a_C(w, r)$ and $a_V(w, r)$ however, will migrate only if $w - pmr + ar \leq \lambda w - ps + ar$, i.e. if $r \geq \frac{s}{m} - \frac{(\lambda - 1)w}{pm} \equiv \hat{r}(w)$. What this tells us then, is that migration will tend to be carried out by the relatively wealthy and by those for whom the market interest rate exceeds $\hat{r}(w)$; since this is a decreasing function of w , it is those with the highest incomes (e.g. the most skilled) who will migrate. Finally, very poor low-skilled people may also migrate — this requires that their skill levels are low enough to make $a_V(w, r)$ positive; if not, even agents with zero wealth will be able to borrow for insurance and will remain in the village.

To summarize, we have

Proposition 1 *An agent born in the village with wealth a and who earns w there migrates to the city when the interest rate is r only if (a) $a \geq a_C(w, r)$ or (b) $r \geq \hat{r}(w)$ or (c) $a < a_V(w, r)$.*

As we have already noted, those who grew up in the urban sector never have reason to migrate to the village. See Figure 1 ($\hat{w}(r)$ is the inverse of $\hat{r}(w)$, i.e. the income level at which an agent is indifferent between staying in the village with insurance and moving to the city without it).

Given this proposition, the supply and demand for loans can be characterized very simply. For the remainder of this section we assume that everyone earns the same income (equivalently, we may assume that no one learns his income, which is independent of initial wealth, until after he has made his location decision, while the opportunity to renege occurs after locating but before income is earned — this will be the preferred interpretation in the next section), so that agents only differ in initial wealth; thus we might as well write $a_C(r)$ and $a_V(r)$ for $a_C(w, r)$ and $a_V(w, r)$ evaluated at this common value of w , and \hat{r} for $\hat{r}(w)$. All of those with wealth above $a_C(r)$ demand loans, as do those with wealth less than $a_C(r)$ who remain in the village. If the interest rate is greater than \hat{r} , everyone migrates, so the demand for loans is $pm[1 - R(a_C(r) - U(a_C(r)))]$, which is decreasing (at $r = \frac{s}{m}$, the demand is the interval $[0, pm[1 - R(a_C(\frac{s}{m}) - U(a_C(\frac{s}{m}))]]$). At \hat{r} , those villagers with wealth below $a_C(\hat{r})$ but above $a_V(\hat{r})$ are indifferent between the two locations, so the demand becomes an interval $[pm[1 - R(a_C(\hat{r})) - U(a_C(\hat{r}))], pm[1 - R(a_V(\hat{r})) - U(a_C(\hat{r}))]]$; as r declines

further demand becomes $pm[1 - R(a_V(r)) - U(a_C(r))]$, eventually reaching its maximum value of pm . Supply is simply the aggregate wealth \bar{a} . Thus equilibrium, if it exists, is generically unique.⁹ It is straightforward to check that the maximum equilibrium gross interest rate is s/m , while because the good is storable, the minimum is 1.

Figure 2 illustrates the situation. Also shown are the demand functions which would result in the first-best case without information problems (this is also the demand function for a pure village economy in which there was no urban sector to migrate to), and the demand from a pure urban economy (say one in which everyone was forced to move to the city).

We can now check whether the equilibrium level of migration is efficient in the sense of making full use of the existing supply of resources. In particular we shall ask whether social surplus could be increased relative to its equilibrium level by forcing agents to choose locations in some way other than the one which occurs in equilibrium. Thus we shall not be concerned here with the possibility of increases in social surplus which might be obtained from interventions in the loan market or from tax and transfer schemes more generally. We should also note at this point that, as is often the case in economies in which incentives and wealth effects play a role, the potential surplus increases under discussion cannot typically be transformed into Pareto improvements.

On the face of it, we should expect that any situation where some agents remain in the rural sector is a candidate for inefficiency. To see this, note that labor in the rural sector is being used inefficiently. If a small number of people were moved to the urban sector, more income would be generated. This reduces the demand for loans however, but if the interest rate is able to fall, the capital that is no longer being used in the rural sector can flow to the city, clearing the market at a lower interest rate, as shown in Figure 2.¹⁰

The next step is to determine whether and under what conditions an inefficient equilibrium actually exists. Figure 3 illustrates the level of mi-

⁹Existence is guaranteed if $R(\cdot)$ and $U(\cdot)$ are continuous. With such distribution functions, the only case of nonuniqueness occurs when $\bar{a} = pm$, in which case we focus on the equilibrium in which $r = 1$, which is the one that maximizes the level of migration and social surplus.

¹⁰This does not say that the optimal allocation has everyone moving to the urban sector, since if the interest rate cannot fall enough, some of the wealth would be consumed rather than used for insurance. This will be clarified below.

gration as a function of the equilibrium interest rate. Clearly a necessary condition for inefficiency is that the equilibrium r be no higher than \hat{r} . Since 1 is the lowest equilibrium value of r , a necessary condition for the existence of inefficient undermigration is

$$p(s - m) \geq (\lambda - 1)w. \quad (1)$$

This condition is quite plausible. If the productivity differential between village and city is large (λ is large), then the attraction of the city is enough to swamp the possible lack of insurance, and everyone migrates. By the same token, if the value of insurance is small (s is close to m), undermigration is unlikely, since poor people have little to lose by leaving their village.

As is evident from Figure 2, the existence of inefficient undermigration depends in part on the mean level of wealth. But it also it depends on the higher moments of the wealth distribution. A complete characterization for continuous distributions of wealth is offered in the following

Proposition 2 *Suppose condition (1) holds and $R(\cdot)$ and $U(\cdot)$ are continuous. Then the level of migration is inefficient if and only if (a) $1 - R(a_V(1)) - U(a_C(1)) > \frac{\bar{a}}{pm}$ and (b) $\frac{\bar{a}}{pm} > [1 - R(a_C(\hat{r})) - U(a_C(\hat{r}))]$.*

Proof. First, suppose that conditions (a) and (b) hold. Condition (a) ensures that the equilibrium interest rate r^* is greater than one, while Condition (b) implies that at least some agents remain in the rural sector. There are now two cases. If $\frac{\bar{a}}{pm} \leq 1 - R(a_C(1)) - U(a_C(1))$, then moving all people to the urban sector raises output (because they are more productive) without changing the surplus from insurance, because the loan market will now clear at a new interest rate lower than r^* . Thus, surplus increases, and the original level of migration was inefficient. If instead $\frac{\bar{a}}{pm} > 1 - R(a_C(1)) - U(a_C(1))$, one can increase surplus by requiring $\frac{\bar{a}}{pm} - [1 - R(a_C(1)) - U(a_C(1))]$ agents with wealth less than $a_C(1)$ (this quantity is less than $R(a_C(1)) - R(a_V(1))$) by Condition (a) to stay in the village and sending everyone else to the city; this clears the insurance market at $r = 1$ and increases output by increasing the number of people in the city.

Conversely, suppose that (a) fails to hold, i.e. that $r^* = 1$. Then moving anyone from the village to the city increases output, but they will now be

unable to get a loan since the interest rate cannot fall (their wealth must be less than $a_C(1)$ or they already would have moved); by (1) this entails a net loss of surplus. If (b) fails, then as we have seen, everyone migrates, so equilibrium is efficient. ■

This proposition is the central result of this section. It helps to shed light on exactly what the rural institution is doing. Clearly, since in the initial equilibrium there are people who choose to remain in the traditional sector, they are paying less in interest in the traditional sector than they would in the modern sector (more precisely, they are getting loans there that they would not get in the modern sector). In other words, the rural credit institution does facilitate borrowing. On the other hand if they were moved to the modern sector the wealth they were using would not lay fallow. Somebody will end up using it and now it will be used in the more productive modern sector. The interest rate will fall to make this possible; in other words the rural credit institution creates inefficiency by allowing the interest rate to be set too high relative to its second-best level (it will typically be too *low* relative to its first-best level).

One special case deserves to be underscored. If the economy is wealthy in the sense that $\bar{a} \geq pm$, migration is always efficient (condition (a) is violated in this case). Since, as we have said, poor economies will tend to have efficient migration as well (although this is not necessary), it is the middling economies, where the villagers have something to lose but wealth is not yet so plentiful as to render the urban agency problems nugatory, that are the best candidates for inefficient undermigration.

Observe that the falling interest rate which results from a policy of forced migration will hurt net lenders (which may include very poor agents as well as the very wealthy); the beneficiaries would tend to be those at the middling wealth levels. We are currently investigating whether suitably designed taxes and transfers can turn the surplus increase into a Pareto improvement.

One possibility which we have not so far discussed is that of *overmigration*, an evident problem in many countries today. In the present model, overmigration exists when the aggregate wealth \bar{a} is less than pm , but the loan market fails to clear, i.e. even at an interest rate of unity there is more wealth than is demanded for use as insurance. Now, while this won't be possible under laissez-faire (if $r = 1$, anyone who moved to the city who doesn't have a loan there would be better off staying in his village; the capital would flow to him there, and condition (1) implies he would be better off), it is possible that catastrophes such as the Bengal famine in the 1940's would

have the effect of forcing sudden movement to the city with concomitant dissolution of the rural information networks. Suppose that the condition $\frac{\bar{a}}{pm} > 1 - R(a_C(1)) - U(a_C(1))$ mentioned in the proof of Proposition 2 holds. Then we would have a situation in which everyone (say) was in the city, but a fair amount of them (more than is necessary given the amount of wealth in the economy) were uninsured, so that much of the economy's wealth would be "idle," i.e., consumed rather than used for insurance. Thus, while forced migration might have desirable consequences if there are not too many villagers who are poor (have wealth less than $a_C(1)$), the opposite may be true if there are too many of them; an optimum would then involve keeping some of those people in the rural sector.¹¹

To summarize, if the urban sector is suddenly opened to a very poor economy, there should be full migration (the interest rate is likely to be higher than \hat{r}). Only if the rural economy has a sufficiently high aggregate wealth is undermigration likely to be a problem. The degree of undermigration will depend not only on the aggregate level of wealth but also on its distribution. For instance, if the distribution is fairly inegalitarian while the mean is reasonably high, $R(a_C(\hat{r}))$ is likely to be large, so that it is quite easy for undermigration to occur. The general point to note here is that the wealth distribution in the two sectors is the state variable which tells us, among other things, how many people migrate. Thus if we can generate an account of the dynamics of the wealth distribution, we will also have generated the rate of migration endogenously.

4 Some Rudimentary Dynamics

Our main interest is in the transitional dynamics of an economy. Specifically, starting with a pure rural economy, we wish to examine the level of migration and the distribution of labor earnings over time after the urban sector is opened. A full analysis of the global dynamics of the model is beyond the scope of this paper (this is partly for technical reasons — see [4]), so we limit ourselves to a few special cases which nevertheless illustrate how the migration dynamics can lead to a variety of patterns of the evolution of

¹¹The optimal allocations of people across sectors are the ones used in the proof of Proposition 2. Of course, all of this discussion presupposes that interventions in the loan market or direct redistributions of wealth are not possible.

inequality.

In order to study the dynamics in the simplest possible way, we need to elaborate a bit on the timing and preferences used in the previous sections. Suppose that during an agent's life (that is in the course of one period) there are five dates. At date 0, the agent inherits his wealth; at date 1 he chooses his location and engages in the insurance contract; uncertainty about the utility loss is resolved at date 2; agents earn twice in their lifetimes, at dates 3 and 4, and also consume at those dates.

The agent consumes for the first time after earning a wage and repaying any loans (below we shall make assumptions to guarantee that repayments can be made out of a single date's earnings). He then earns the (same level) wage again and splits this income between consumption and a bequest to his child. Utility is

$$c_3 - pl + \alpha c_4^{1-\beta} b^\beta,$$

where c_3 and c_4 are the consumption levels at dates 3 and 4; b is the bequest; $l = 0$ if the insurance is purchased, and s if it is not; and $\alpha < 1$. If the agent earns y at each date, then this yields the indirect utility $(1 + \delta)y + ar - pmr$ (or $(1 + \delta)y + ar - ps$ if he doesn't obtain the insurance loan) where $\delta \equiv \alpha\beta^\beta(1 - \beta)^{1-\beta} < 1$.

Notice that with these preferences, consumption at the date 3 has greater utility than consumption at date 4. This introduces the possible need for a second consumption-loan market, distinct from the insurance-loan market: agents have an incentive to borrow against fourth-date earnings in order to consume at the third date. Equilibrium in this consumption-loan market would entail that the gross interest rate there be equal to $1/\delta$. One equilibrium allocation — the one we shall focus on exclusively — has each agent consuming date-3 earnings net of insurance repayments at date 3, and splitting date-4 earnings between date-4 consumption and the bequest; in particular, there is no borrowing and lending between dates. This is the unique symmetric allocation and the only one that would be compatible with even a slight imperfection in the consumption loan market.

Under these assumptions, the bequest, which is identical to the offspring's initial wealth, is equal to βy , provided that y is large enough to cover any loan repayments. This specification of preferences, earnings levels and the consumption loan market yields exactly the same one-period behavior that we saw in the previous sections, assuming that agents who are caught after renegeing on loans are subject only to having their date-3 income confiscated,

while their date-4 income is inappropriable.¹² Moreover, it greatly simplifies the analysis of the dynamics; in particular, the information contained in the distribution of wealth in each location is summarized by the single number R denoting the fraction of the population in the rural sector. Since our purpose is to illustrate the variety of possible dynamic behavior generated by migration (as distinct from wealth accumulation, which has been studied by many authors), rather than to make strong predictions, we feel justified in imposing this structure.

Finally, for what follows we need to distinguish between two alternative assumptions about when an agent's skill becomes known (to himself and the public alike). In one case, this information is not learned until date 3; in the second it is learned between dates 0 and 1.

4.1 Full Modernization and the Kuznets curve

Suppose first that agents learn their skill level *after* choosing a location (to be precise, at date 3), so that their decisions correspond to the one-wage case alluded to in Section 3. Let that the distribution of skills (corresponding to village labor earnings) be $F(w)$, which is supported on a nondegenerate interval $[\underline{w}, \bar{w}]$ with density $f(w)$, mean \bar{w} , and variance σ^2 . The distribution of earnings among those in the city is then $F(\frac{w}{\lambda})$.

In order to guarantee that agents repay loans out of date-3 earnings alone, we need to assume that $\underline{w} \geq ps$ (ps is the largest possible value of pmr , since $r \leq s/m$.) Notice that this implies that the fraction of villagers born with wealth less than $a_V(r)$ is always zero (the largest value of $a_V(\cdot)$ is $pm - \frac{\bar{w}}{s/m} \leq pm - \frac{\bar{w}}{s/m} \leq pm - \frac{ps}{s/m} = 0$): villagers can always insure. We are only interested in case in which average wealth \bar{a} is less than pm , since in the other case modernization is instantaneous. Thus we assume that β is small enough that $\beta\bar{w} < pm$.

For ease of computation, we use the coefficient of variation as an inequality measure. Suppose that in period t the population of the rural sector at the beginning of the period (i.e. *before* the location decisions) is R_t ; then the urban population is $1 - R_t$. This will serve as the state variable; we don't need to consider any higher dimensional objects such as the wealth distribution:

¹²If one assumes instead that *lifetime* income can be held to zero, the expressions for $a_C(r)$ and $a_V(r)$ become $pm - (1 + \delta)(1 - \pi)\lambda w/r$ and $pm - (1 + \delta)w/r$; this is essentially inconsequential for the analysis but requires some cumbersome modification of notation.

since an agent whose income realization is w and who remains in the village in period $t-1$ bequeaths βw to his child, the fraction of the rural population at the beginning of period t with wealth less than x is given by $R_t F(\frac{x}{\beta})$; the urban wealth distribution is just $(1 - R_t) F(\frac{x}{\lambda\beta})$.

The distribution of wages in the economy in period t is then given by $R_{t+1} F(w) + (1 - R_{t+1}) F(\frac{w}{\lambda})$ (by our notational convention, R_{t+1} is the rural population after people choose their locations and so represents the relevant population for computing the distribution of incomes). One can readily check that inequality is equal to $\frac{\sigma}{\bar{w}}$ when $R = 0$ or 1 , is increasing at 0 , decreasing at 1 , and has a (unique) maximum at $R = \frac{\lambda}{\lambda+1}$.¹³ Since mean income $R\bar{w} + (1 - R)\lambda\bar{w}$ is decreasing in R , if we can show that R_t decreases monotonically from 1 to 0 , assuming at least one interior value along the way, we will have shown that the economy follows the inverted-U curve as it develops.¹⁴

We note first that the level of migration (i.e. $R_t - R_{t+1}$), as shown in Figure 3, is nonnegative — no one ever migrates from the city to the village. Thus R_t does indeed follow a monotonic path. But in order to guarantee that the inverted-U relation is generated by the economy's dynamics, we must also show that (a) the economy fully modernizes (that is, R_t converges to 0), and (b) it does so in more than one period (otherwise inequality remains at $\frac{\sigma}{\bar{w}}$ for all time).

From Figure 3, a lower bound for the level of migration is given by $R(\infty) - R(a_C(\hat{r}))$; this in turn is bounded below by $R_t(1 - F(\frac{a_C(\hat{r})}{\beta} + pm\hat{r}))$. Thus, if $\bar{w} > \frac{a_C(\hat{r})}{\beta} + pm\hat{r}$, there is a uniform positive lower bound on the fraction of the rural population that will migrate each period, and it follows that R_t converges to zero.

Next, we need to ensure that the economy does not modernize instantly. Note (again refer to Figure 3) that if the interest rate is \hat{r} upon opening the urban sector, then not everyone migrates in the first period, except in the singular case in which $pm[1 - R(a_C(\hat{r}))] = \beta\bar{w}$. This is equivalent to the

¹³These properties can be established using the expression for the coefficient of variation, which is

$$\sqrt{\frac{[R + (1 - R)\lambda^2](\sigma^2 + \bar{w}^2)}{[R + (1 - R)\lambda]^2\bar{w}^2}} - 1,$$

where $R \in [0, 1]$.

¹⁴Apparently, the idea that a monotonic increase in the urban population leads to this inverted-U relation between income and the coefficient of variation is known (see [8]), although there the rate of migration is left unexplained.

condition that $\frac{\beta\bar{w}}{pm} > 1 - F(\frac{ac(\hat{r})}{\beta})$.¹⁵ Thus we have

Proposition 3 *If $\bar{w} > \frac{ac(\hat{r})}{\beta}$, $\underline{w} > ps$, and $\frac{\beta\bar{w}}{pm} > 1 - F(\frac{ac(\hat{r})}{\beta})$, then as $t \rightarrow \infty$, $R_t \rightarrow 0$ (the economy fully modernizes) and the path of inequality and income follows an inverted-U curve.*

Notice that although the economy fully modernizes, it does so too slowly — even if full modernization takes only finite time,¹⁶ any discounted sum of single-period social surpluses would be increased if modernization were to occur immediately as the modern sector opens.

The modernization process in this model operates at two levels. When full modernization occurs, it is because some positive fraction of rural agents are always successful enough to pass on a large bequest to their children, who can then afford to insure themselves in the modern sector. This is an individual level effect which depends on primitive assumptions about the distribution of earnings. But there is also a “trickle-down” effect which operates at a more aggregate level: as people move to the city, they earn more, aggregate wealth increases, while demand for insurance typically does not increase. This leads to a decrease in the interest rate, thereby lowering everyone’s cost of insurance. In particular borrowing in the city becomes easier at the lowered interest rate, which in turn make the modern sector more attractive. A related trickle-down mechanism is discussed in [2]

In a parallel way, increasing wealth in the modern sector mollifies the effects of poor information there. For an individual, having a lot of wealth improves his borrowing prospects. And as the whole economy becomes wealthy, falling interest rates lower the agency costs of borrowing for everybody. Thus, there is a dual sense in which a wealthy economy can to a certain extent afford to do without good information.

¹⁵It is not hard to find distributions which satisfy this condition. Start with a mean wage $\bar{w} > ps$ and the Dirac distribution there. Choose β large enough to render $\frac{ac(\hat{r})}{\beta} > \bar{w}$ and $\beta\bar{w} < pm$. Now spread the Dirac distribution in a mean-preserving way to keep its support in $[ps, \frac{ac(\hat{r})}{\beta}]$. Now, through mean-preserving spreads, generate a continuous distribution $G(w)$ with support equal to $[ps, \frac{ac(\hat{r})}{\beta}]$. Since $G(\frac{ac(\hat{r})}{\beta}) = 1$, $\frac{\beta\bar{w}}{pm} > 1 - G(\frac{ac(\hat{r})}{\beta})$. Now let F be a mean-preserving spread of G which puts (a small) positive weight above $\frac{ac(\hat{r})}{\beta}$, preserving the condition.

¹⁶For instance, if λ is large enough, mean wealth may exceed pm in finite time, which as we have seen, then leads immediately to full modernization.

4.2 Undermigration in the Long Run

What if the conditions of Proposition 3 are not satisfied? Is it possible that a long-run version of undermigration can occur, i.e. that the economy could settle into a steady state in which some people inefficiently remain in the rural sector?

If the economy is to get stuck in an undermigration trap, both the individual and trickle-down effects have to be mitigated. We first begin by dispensing with the assumption that $\bar{w} > \frac{ac(\hat{r})}{\beta}$, which weakens the first effect, and is necessary if there is not to be full modernization; thus $\bar{w} \leq \frac{ac(\hat{r})}{\beta}$ and $F(\frac{ac(\hat{r})}{\beta}) = 1$. We continue to assume that $\beta\bar{w} < pm$, as this is also a necessary condition for undermigration, as discussed above.

We shall be interested in deriving the recursion function for the state variable R_t , the rural population at the beginning of the period t . Denoting the current interest rate by r_t , the rural population evolves according to:

$$R_{t+1} = G(R_t) = \begin{cases} R_t F(\frac{ac(r_t)}{\beta}), & r_t < \hat{r} \\ \frac{\beta\bar{w}}{pm} [R_t + (1 - R_t)\lambda] - (1 - R_t)(1 - F(\frac{ac(r_t)}{\lambda\beta})), & r_t = \hat{r} \\ 0, & r_t > \hat{r} \end{cases} \quad (2)$$

Of course, this is not yet a proper characterization of dynamics, because r_t itself depends on R_t through the insurance market equilibrium. The insurance loan market equilibrium can be characterized very simply, however. The supply of loans each period is $\beta\bar{w}[R_t + (1 - R_t)\lambda]$. Demand is

$$\begin{cases} pm[1 - (1 - R_t)F(\frac{ac(r_t)}{\lambda\beta})], & r_t < \hat{r} \\ [pm(1 - R_t)\{1 - F(\frac{ac(r_t)}{\lambda\beta})\}, pm\{1 - (1 - R_t)F(\frac{ac(r_t)}{\lambda\beta})\}] & r_t = \hat{r} \\ pm(1 - R_t)[1 - F(\frac{ac(r_t)}{\lambda\beta})], & r_t > \hat{r} \end{cases}$$

From these expressions, one can verify that r is increasing in R when $r_t < \hat{r}$.

Now observe that for all $R \in [0, 1]$, $G(R) \leq R$, since migration never goes from city to village. Since $G(R) \geq 0$ by definition, we conclude that $G(0) = 0$.

We now need to establish the existence of fixed points of $G(\cdot)$ other than zero. Suppose that R^* is such a fixed point. Then from (2) the associated interest rate r^* must satisfy $F(\frac{ac(r^*)}{\beta}) = 1$ and $r^* \leq \hat{r}$. Suppose there is a fixed point (call it \bar{R}) associated with the interest rate \hat{r} . As this is a stationary

point, there can be no migration at when $R = \bar{R}$. Therefore we must have supply exactly equated to the highest level of demand generated by \hat{r} (refer back to Figures 2 and 3). Hence,

$$\beta\bar{w}[\bar{R} + (1 - \bar{R})\lambda] = pm[1 - (1 - \bar{R})F(\frac{a_C(\hat{r})}{\lambda\beta})]. \quad (3)$$

Now choose R^* below \bar{R} . The corresponding equilibrium interest rate r^* must also lie below \hat{r} (supply increases while demand decreases). So long as $F(\frac{a_C(r^*)}{\lambda\beta}) = 1$, R^* is also a fixed point of $G(\cdot)$. Indeed, there will be an interval (possibly degenerate) of fixed points $[\underline{R}, \bar{R}]$, where the interest rate r associated with \underline{R} satisfies $a_C(r) = \beta\bar{w}$. Thus we need only establish the existence of a solution to (3) in order to guarantee that $G(\cdot)$ has stationary points bounded away from zero.¹⁷

Solving (3) for \bar{R} yields

$$\bar{R} = \frac{\frac{\lambda\beta\bar{w}}{pm} + F(\frac{a_C(\hat{r})}{\lambda\beta}) - 1}{\frac{(\lambda-1)\beta\bar{w}}{pm} + F(\frac{a_C(\hat{r})}{\lambda\beta})};$$

this expression lies in the allowable range if and only if $\frac{\lambda\beta\bar{w}}{pm} + F(\frac{a_C(\hat{r})}{\lambda\beta}) - 1 > 0$. It is not hard to find parameter values for which this condition holds. Thus we have

Proposition 4 *Suppose that $\frac{\lambda\beta\bar{w}}{pm} + F(\frac{a_C(\hat{r})}{\lambda\beta}) - 1 > 0$. Then there exists an interval $[\underline{R}, \bar{R}]$ of rural population levels which remain constant over time once the economy arrives there.*

Since $\bar{R} > 0$, at least some of these levels are positive: full modernization does not occur. We therefore refer to the interval $[\underline{R}, \bar{R}]$ as the “undermigration trap.”

How might the economy actually arrive in an undermigration trap? We could start by returning to our original question and asking whether long-run undermigration is possible starting from a pure rural economy. Figure 4

¹⁷For $R > \bar{R}$, the interest rate remains at \hat{r} . Raising R decreases supply and raises the upper bound of demand at \hat{r} , so the interest rate cannot fall. On the other hand, if r rises, it must satisfy

$$pm(1 - R)[1 - F(\frac{a_C(r)}{\lambda\beta})] = \beta\bar{w}[R + (1 - R)\lambda];$$

solutions to this equation are decreasing in R , a contradiction.

illustrates possible shapes that $G(\mathcal{R})$ might assume, given that the undermigration trap exists. As noted in footnote 17 above, when $\mathcal{R} \geq \bar{\mathcal{R}}$, the interest rate is \hat{r} . Thus, $G(\mathcal{R})$ is linear there and can have either slope, depending on the sign of $\frac{\beta\bar{w}}{pm}(1 - \lambda) + 1 - F(\frac{ac(\hat{r})}{\lambda\beta})$. If the slope is positive (Figure 4(a)), then an economy starting at $\mathcal{R} = 1$ will converge to $\bar{\mathcal{R}}$; income inequality will increase over time, perhaps decreasing a small amount toward the end (the so-called inverted J-curve).

But for most parameter values the slope will be negative (see Figure 4(b)). Thus the only way a pure rural economy would fall into the undermigration trap is if $G(1) = \frac{\beta\bar{w}}{pm} \geq \underline{\mathcal{R}}$: as shown in Figure 4(b), when this condition is satisfied, the economy jumps to the undermigration trap as soon as the urban sector opens. If this condition fails, the economy jumps past the undermigration trap when the urban sector opens and then eventually fully modernizes (Figure 4(c)). In these cases, trickle-down remains strong enough to eventually modernize the economy.

We have been asking whether long run undermigration is possible assuming that the economy starts out a purely rural. This is a useful thought experiment, but is not necessarily the only relevant case. Many instances of modernization and development, especially in modern times, correspond to opening an already large urban sector to the rural sector. Thus initial conditions with $\mathcal{R} < 1$ are also of interest. As indicated in Figure 4(c), the basin of attraction of the undermigration trap is considerably larger than the trap itself, so a failure to modernize is reasonably likely: if the economy begins with the size of the rural sector in the interval $[\underline{\mathcal{R}}, \bar{\mathcal{R}}]$, it falls into the trap. We therefore have a dynamic analogue to the conditions leading to undermigration in the static case discussed in the previous section. Opening a moderate-sized city to the village may not effect further development of the economy, at least if one relies on the laissez-faire migration mechanism.

4.3 Other Dynamics with Self-Selection

As we stated at the outset, there has been considerable controversy surrounding the validity of the Kuznets hypothesis. We have seen that it is possible for the migratory dynamics generated by the trade-off between high modern sector productivity and efficient traditional sector institutions to yield an inverted-U curve. What we show now, is that even if we maintain the same basic “engine” of modernization that Kuznets and Lewis described, it

is possible under plausible specifications to generate rather different patterns for the evolution of inequality. In particular, the way individuals *select* for migration will be crucial for the pattern of the evolution of inequality.

Suppose that agents learn the level of their earnings between dates 0 and 1, *before* they make their location decision. Assume this information is public. Then each period, migration follows the pattern described by Proposition 1 and Figure 1. In particular, note that low-skill agents migrate while medium-skill agents remain in the rural sector. Imagine that the low-skilled in the city actually end up earning close to what the medium-skilled are earning back in the village. Then, assuming the fraction of very high-skill agents (those who migrate even though they could get insurance in the rural sector) is small, the possibility arises that opening the urban sector could actually *decrease* the level of inequality; subsequently, as the rural sector empties out, inequality increases again. The result is an “upright” U, rather than Kuznets’s inverted U.

To see how this mechanism operates, suppose that there are just two skill levels, w and λw (these are the earnings of an agent in the village; in the city he would earn λw and $\lambda^2 w$). An agent’s chance of having the high skill is q , assumed independent of the wealth he inherits. Make the following parametric assumptions:

$$(\lambda + \beta)w > ps - (\lambda - 1)\lambda w \quad (4)$$

$$p(s - m) > (\lambda - 1)\lambda w \quad (5)$$

$$\beta w > pm - \frac{\lambda w pm}{ps - (\lambda - 1)\lambda w} \quad (6)$$

$$pm - w > \lambda \beta w \quad (7)$$

Assumption (4) ensures that high-skill agents in the rural sector can repay loans at date 3 when the interest rate is $\hat{r}(\lambda w)$; (5) is the analog of (1) and ensures that inefficient undermigration is possible; (6) implies that the high-skill agents always have enough wealth to obtain insurance (i.e., their wealth, which is at least βw , exceeds $a_V(\lambda w, \hat{r})$), while (7) ensures that the low-skill agents are below $a_V(w, 1)$ and therefore always migrate.¹⁸ Under these assumptions, there will be just two wealth levels before the urban sector opens, *viz.*, βw and $\beta \lambda w$. Figure 5, which is just Figure 1 specialized

¹⁸It is not difficult to find parameters satisfying (4)-(7). For instance, $\lambda = 2$, $w = 1$, $p = 0.5$, $m = 3$, $s = 8$, $\beta = 0.2$.

to the current example, depicts the possible wealth-wage combinations that can occur in as the economy evolves. Before the modern sector opens, wages are either w or λw , and wealth always lies somewhere below $\beta\lambda w$ (so wealth-wage pairs lie on the heavy segments).¹⁹ Note that by choosing π_C sufficiently close to 1, one can guarantee that the high-skill agents born in the village will be unable to obtain insurance in the city (i.e., their wealth will lie below $a_C(\lambda w, r)$ for all r).

Assumption (7) ensures that as long some of the population remains in the rural sector, a positive fraction q of their children will be born poor and low-skilled enough to migrate. Eventually, therefore, the economy fully modernizes. Observe that in this example, in contrast to those considered in the previous subsections, it is the low types who migrate; modernization comes from below rather than above (more generally, as we have pointed out, it tends to come from the tails of the distribution, not the middle).

In any period, only two wages are earned: either w and λw or λw and $\lambda^2 w$. Thus, if ρ is the fraction of the population earning the higher wage, the coefficient of variation is $\frac{\sqrt{\rho(1-\rho)(\lambda-1)}}{\rho\lambda+1-\rho}$, which achieves a unique maximum at $\rho = \frac{1}{\lambda+1}$. The initial distribution of wages has q at λw and $1 - q$ at w ; since there is full modernization, eventually the distribution approaches q at $\lambda^2 w$ and $1 - q$ at λw . Thus, inequality is the same at the start and end of the development process.

Now consider the periods in between. As the urban sector opens, the low-skill agents migrate to the city, where they earn λw . They pass on bequests of $\beta\lambda w$; their children will earn either λw or $\lambda^2 w$, bequeathing $\beta\lambda w$ and $\beta\lambda^2 w$. Meanwhile, the children of the high-skilled agents who remain in the village inherit wealth $\beta\lambda w$ and skill w or λw . From these considerations, there are five possible wealth-wage pairs that can occur once the modern sector is opened (but before location choices are made); these are denoted by the X 's in Figure 5.

For certain levels of q ,²⁰ market clearing entails that $r = \hat{r}(\lambda w)$ and that

¹⁹Without actually calculating any particular distribution of wealth —such as a steady state — for the pure rural economy (unlike in sections 4.1 and 4.2, this computation is complicated by the fact that under the parametric assumptions (4)-(7), at interest rates larger than $\hat{r}(\lambda w)$, loans cannot necessarily be repaid out of date-3 earnings alone), it is not hard to verify that an upper bound for any agent's wealth is $\beta\lambda w$, since from what we said at the beginning of the section, λw is the most that an agent would have at date 4 from which to produce a bequest.

²⁰Specifically, maximum demand at $\hat{r}(\lambda w)$, $q\gamma m$, must exceed supply $[q\lambda + 1 - q]\beta w$;

some (call the fraction τ) of the high-skill agents also migrate (the demand and supply functions for this case are shown in Figure 6).²¹ Suppose that $q = \frac{1}{\lambda+1}$; after the urban sector opens we have $q\tau$ at λ^2w and $1 - q\tau$ at λw . Since $q = \frac{1}{\lambda+1}$ yields the maximum level of inequality, we find that in this case that *the initial impact of the development process is to decrease inequality.*

As before, let R_t denote the beginning-of-period- t rural population. As t increases, R_t decreases monotonically to zero; the supply of wealth is therefore increasing. Demand, meanwhile, cannot increase above its maximum initial level qpm , since only high-skill agents (whether rural or urban) can exceed the respective threshold wealth levels. Therefore, interest rates cannot increase over time. If the interest rate in some period t is less than $\hat{r}(\lambda w)$, the fraction of the population earning the high wage is $q(1 - R_t)$, which increases with time. With $q = \frac{1}{\lambda+1}$, this implies that inequality must increase over time as well.²² In the limit as the economy evolves toward full modernization, inequality returns to its initial level: *the path of inequality follows an upright U*, contrary to Kuznets's hypothesis.

Essentially the same conclusion holds if initially market clearing occurs at $r = 1$ (i.e., when q fails to satisfy condition (8)), in which case none of the high-skill migrate in the first period. Then everyone earns λw : there is perfect equality ($\rho = 0$) as soon as the modern sector opens. Then a similar argument gives us a monotonic increase of ρ back to its initial level. Inequality then traces out an upright U, at least if $\lambda\beta < 1$.²³

using (7), this is equivalent to

$$q > \frac{\beta w}{pm - (\lambda - 1)\beta w}. \quad (8)$$

²¹The figure is drawn supposing that there are just two wealth levels at the time the city opens; the key point is that a finite number is typical. Readers may be bothered by the discontinuity in the demand which results from the atoms in the wage distribution. If instead the distribution was atomless and supported on two small intervals centered about w and λw , then demand would be continuous and the interest rates would always assume values very close to \hat{r} , r_1 , and r_2 depicted in the diagram. The present example can be thought of as an approximation to that case. (Of course, by (7) r_1 and r_2 are less than 1, so equilibrium always exists in the first period after the city opens; but the approximation is valid more generally.)

²²In case r remains at $\hat{r}(\lambda w)$, the fraction of high wage earners is still increasing over time, but the argument is slightly more complicated, and we omit it.

²³If not, then if $q > \frac{1}{\lambda+1}$, inequality will overshoot its final (and original) level before declining back to it, thereby following a "slanting S."

For other values of q , however, the initial impact of opening the modern sector *can* lead to an increase in inequality, à la Kuznets. To take an extreme example, suppose that q is nearly equal to 1 (so there is nearly perfect equality to begin with). Then the interest rate following the opening of the modern sector will be $\hat{r}(\lambda w)$. A large fraction of the rural population migrates and earns the high wage $\lambda^2 w$: inequality has increased.²⁴ Eventually, of course, everyone will end up in the city, so inequality will have to decline to its original level, yielding the inverted U.

5 Conclusion

The implications of the dynamic examples studied in section 4.3 may be summarized by saying that characteristics of those who choose to migrate have important implications for the evolution of inequality in developing economies. Moreover, the dynamics of inequality, as the example there shows, can depend delicately on parameters of the distribution of these characteristics. We conclude that there is no theoretical reason — even if we adhere to the migration-as-engine-of-development story — to believe in the inverted U.

More generally, the conclusion of this study is that the intuitions from the older literature on migration and development may still be relevant as long as we view them through the lens of the appropriate model. The empirical failures of the Lewis and Kuznets models were at least as much a result of naive modelling as they were of the failure of the basic stories.

We should like to point out that our model is open to somewhat broader interpretation. It has been noted that in many developing countries (as well to some extent among immigrant communities in developed countries), that migrants to cities often reproduce the social networks formerly held in their original villages. However, this does not invalidate the model. On the contrary, an agent's membership in a traditional social network is costly. Indeed, full engagement in the modern sector may require participation in a different network, or mobility (often cited as one of the reasons for the higher productivity of the modern sector) which makes maintenance of close social ties impossible. Thus close spatial proximity of the traditional and

²⁴With q close to 1, the fraction of the population which migrates and receives $\lambda^2 w$ upon the opening of the modern sector is close to $1 - \lambda \frac{\beta w}{pm}$; using (7), this exceeds $\frac{1}{1+\lambda}$. Noting that inequality is decreasing on $[\frac{1}{1+\lambda}, 1]$ proves the claim.

modern sectors (say, in the city) does not necessarily imply that agents can adequately participate in both. The result is that the patterns of income and inequality generated by our model are still valid, although they need not manifest themselves in the pattern of migration: even if everyone does move from village to city, the economy will still be slow to modernize.

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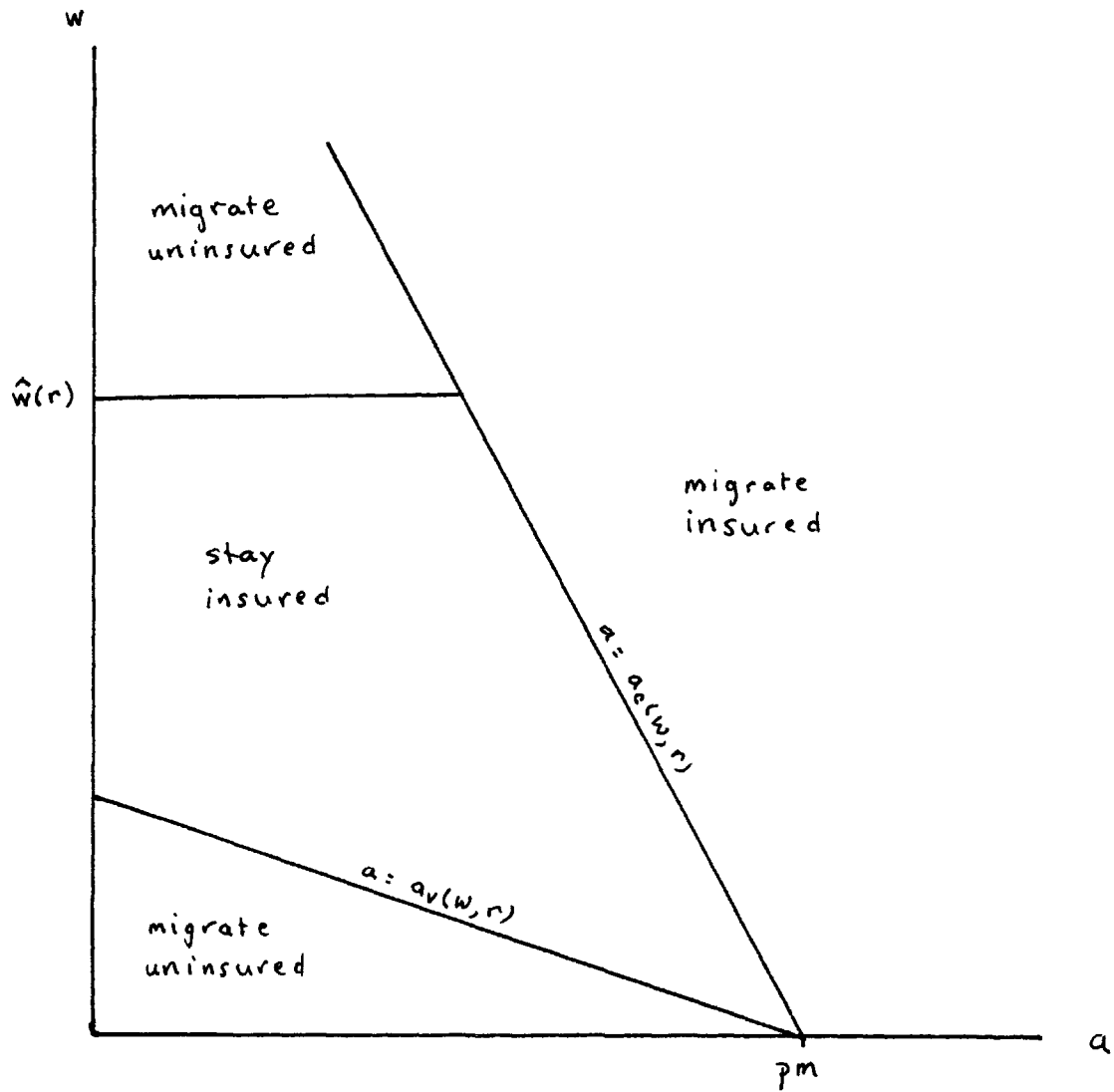


Figure 1

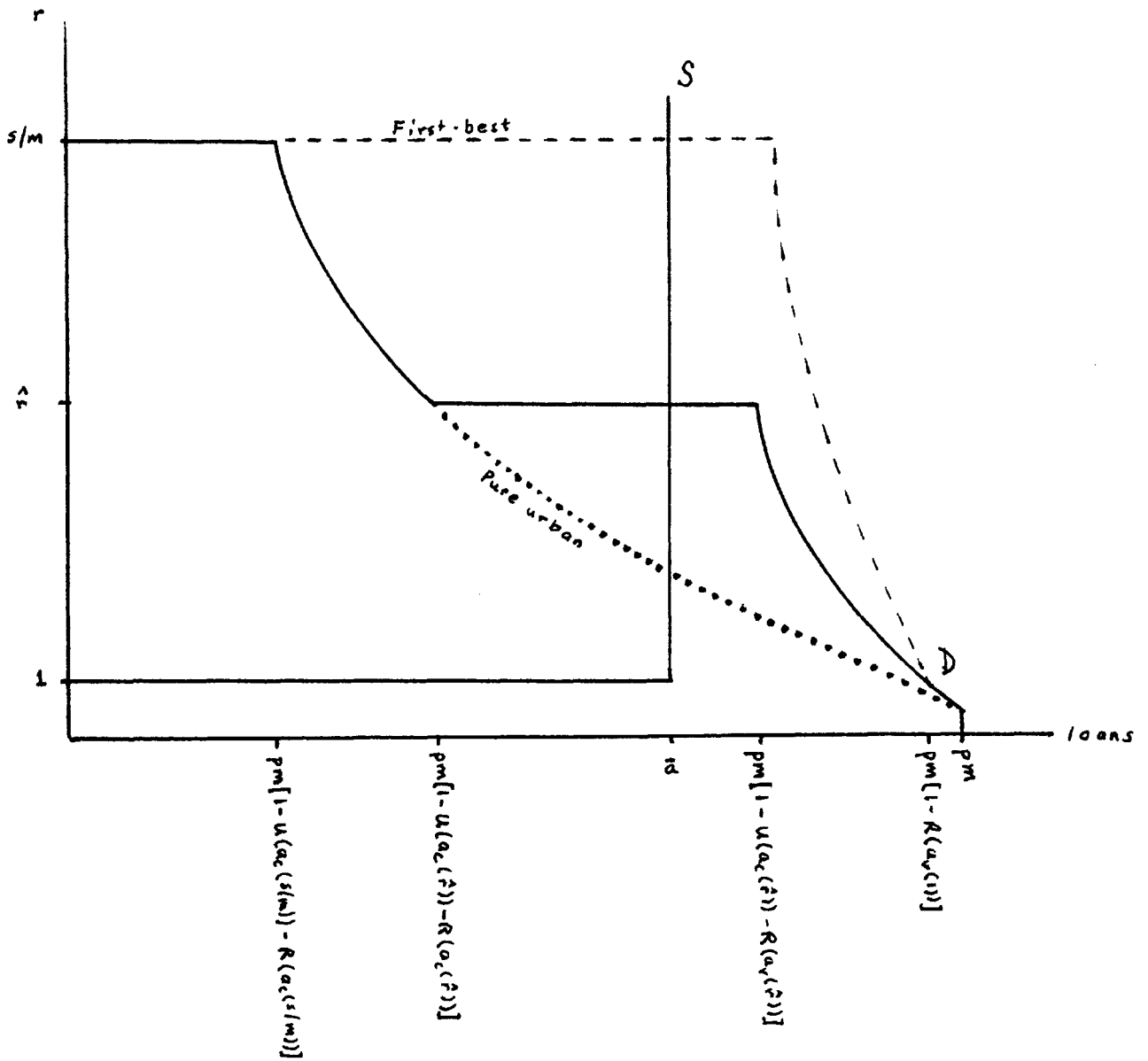


Figure 2

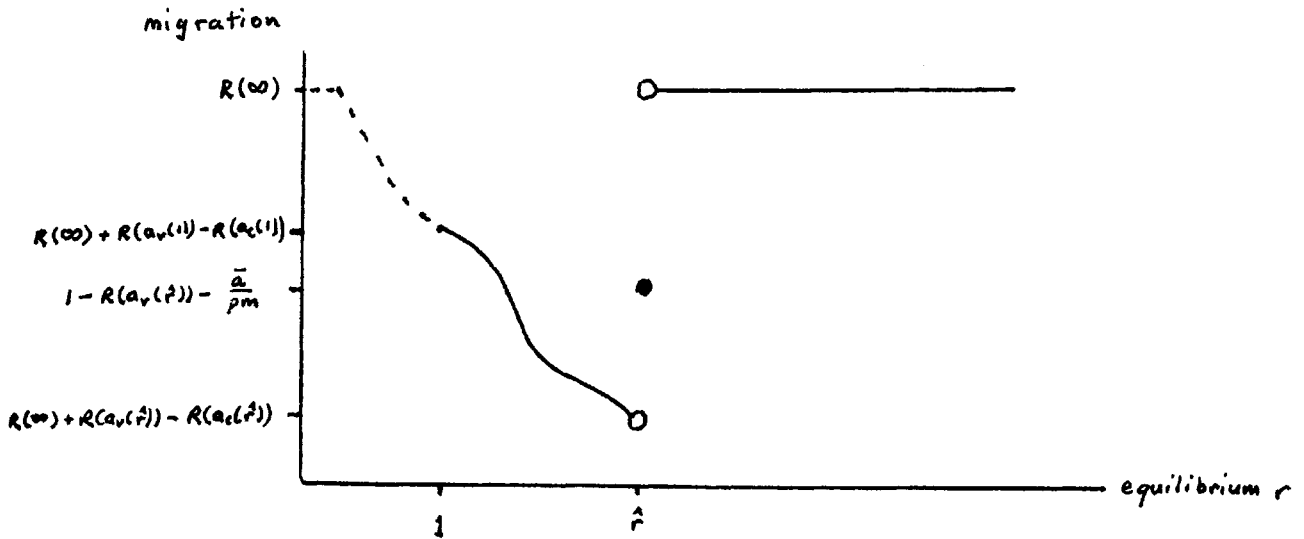
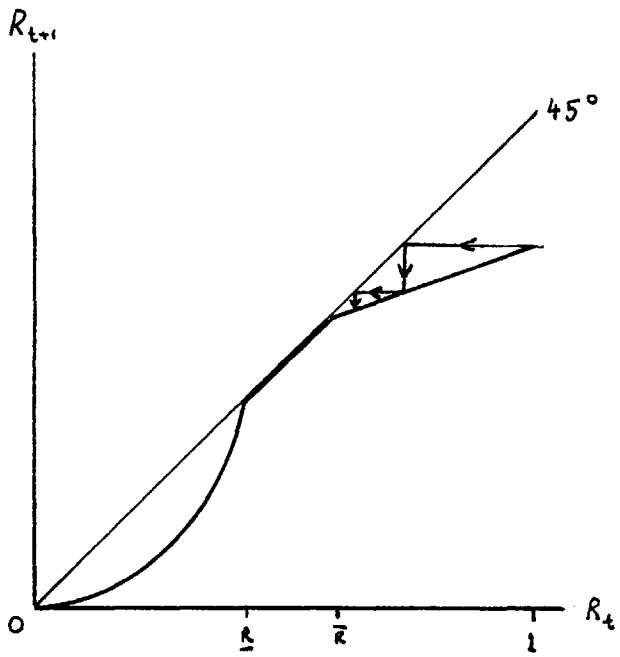
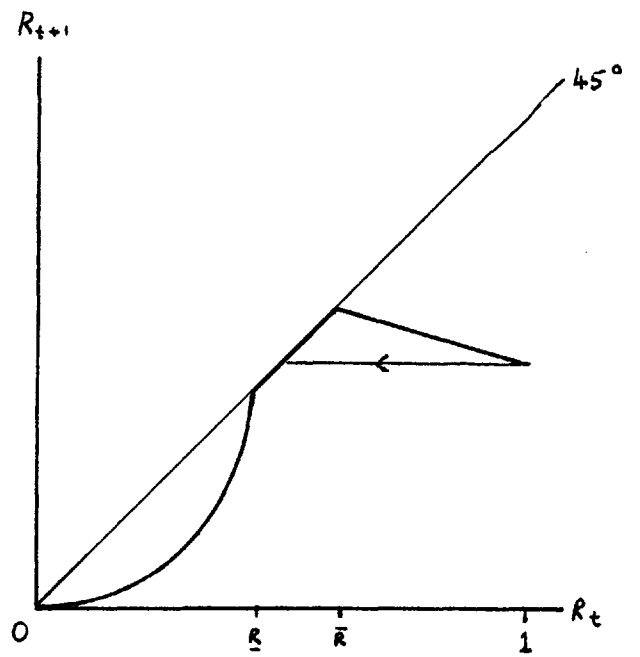


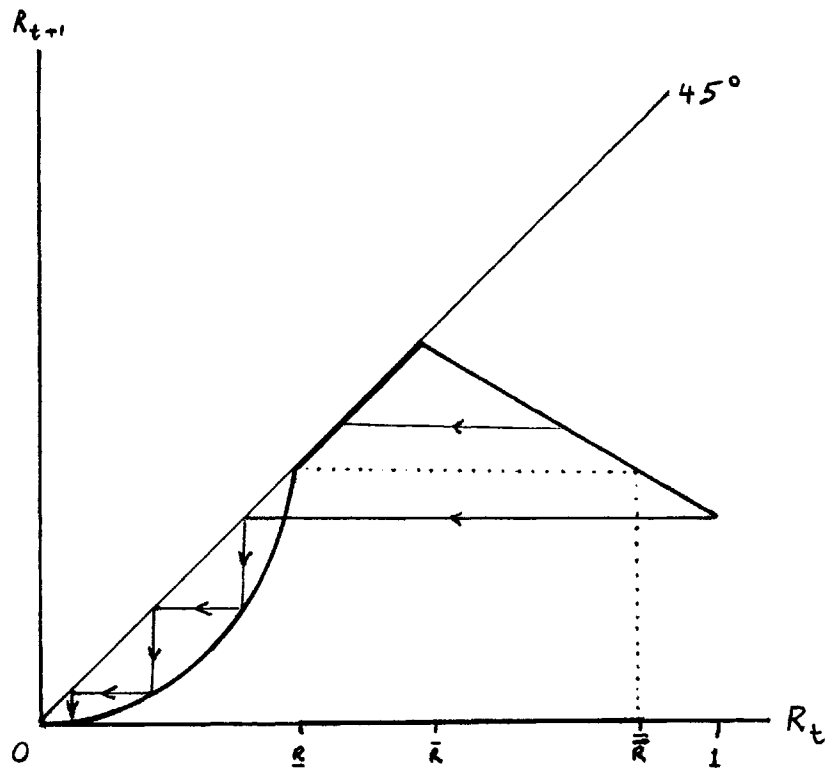
Figure 3



(a)



(b)



(c)

Figure 4

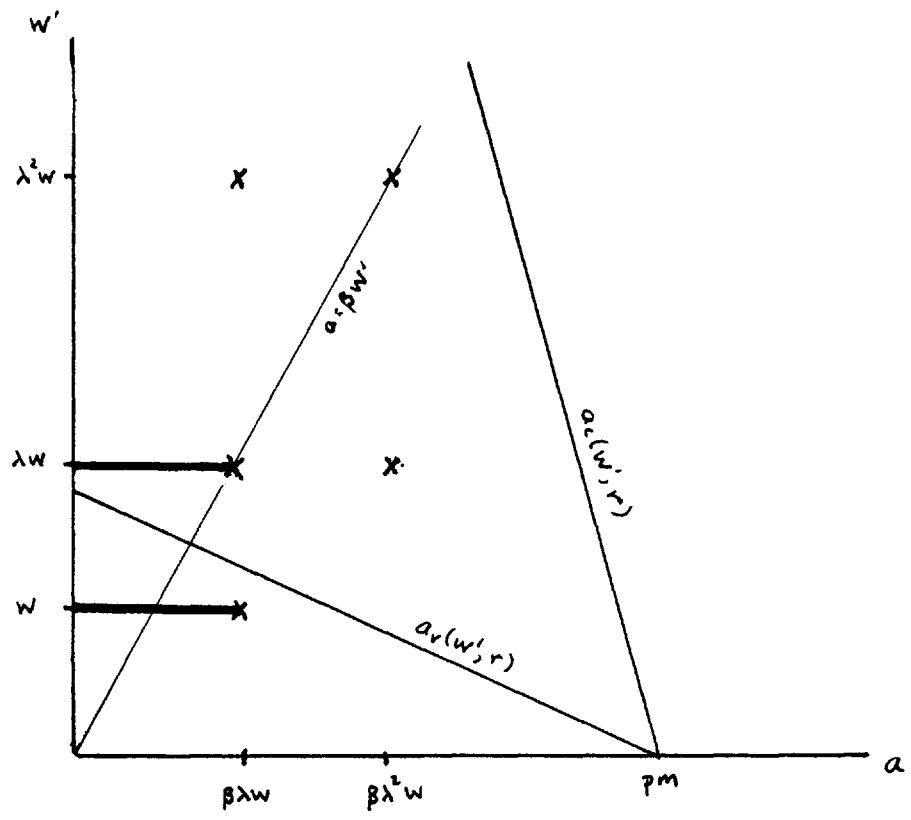


Figure 5

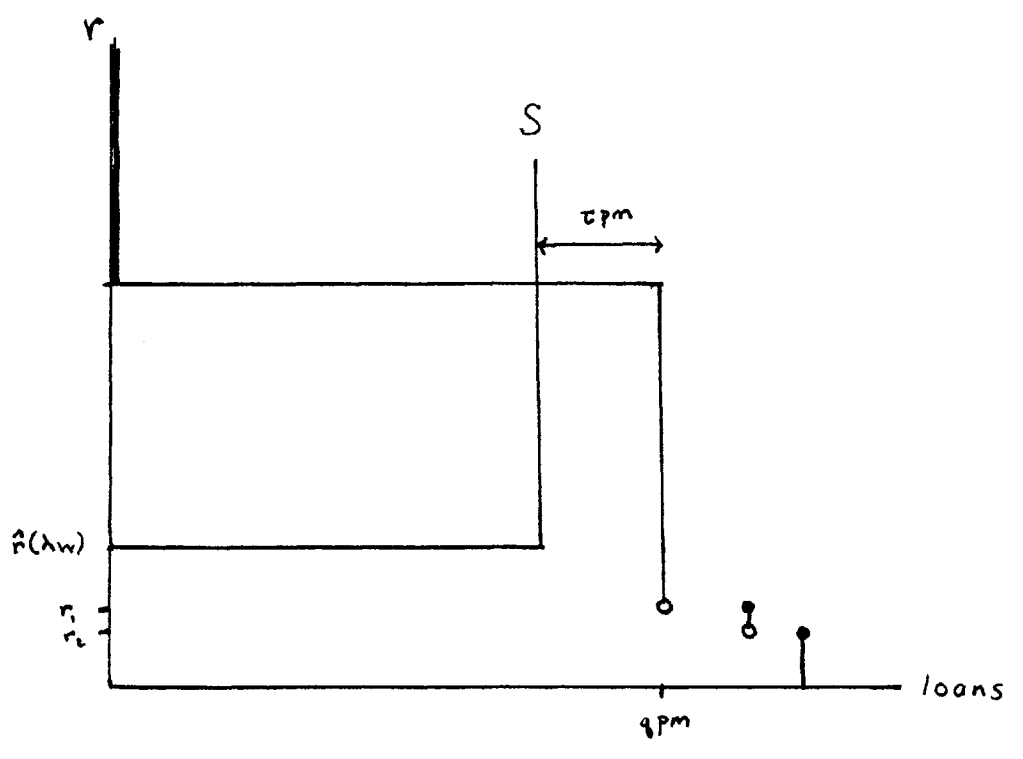


Figure 6