FORMAL MARKETS AND INFORMAL INSURANCE

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1. INTRODUCTION

Anthropologists have long insisted that exchange within the rural communities of developing countries differ in kind from the exchange familiar to most economists. An important aspect of this difference has to do with what Bailey (1971) calls the "multiplex" nature of relationships in the former setting. The idea is that the exchange of any particular good within what Scott (1976) calls the "moral economy of the peasant" will either incur or satisfy additional obligations, and must be understood to be but a single element of a much larger pattern of exchange and support. Indeed,

> The watershed between traditional and modern society is exactly this distinction between single-interest and multiplex relationships. The hallmark of a modern society is the specialized role and the whole apparatus of its productive prosperity rests upon the division of labour between specialized roles. (Bailey, 1971, p. 287)

Thus, to take examples from Bardhan and Rudra (1981), Bardhan and Rudra (1983) and Bell (1988), in a "traditional" society one's banker may also be one's landlord (or perhaps the landlord's brother), and labor undertaken on growing crops on the landlord's land may influence not only the expected yield, but also the terms of a loan taken years earlier.

These kinds of interlinkages seem to be observed in three Indian villages, described at length by Walker and Ryan (1990). However, theory suggests that when the kinds of credit markets characteristic of 'modern' social organization are introduced into traditional societies, these interlinkages will be undermined, and both household-level risk and expected consumption growth will increase for those households which participate in the new institutions.

Ligon (1998) uses predicted differences in the consumption process for traditional and modern households to categorize the households in

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the three villages. In this paper we use the regime assignment estimated by Ligon (1998), but try to shed some light on what *particular* kinds financial arrangements are employed by the two different categories of households, rather than simply considering outcomes, as is usual in much of the literature on risk-sharing (c.f. Townsend, 1994; Ligon, 1998). To this end, we examine the specific financial transactions engaged in by the two different sorts of households in the one village with substantial heterogeneity in regime assignment. We find that while most types of financial transactions are engaged in with roughly similar frequency by the two different sorts of households, traditional households are much the more frequent recipient of transfers of food and clothing, and much the more frequent source of transfers of crop output. This is consistent with contractual arrangements in which a principal closely controls household consumption (necessary for the dynamic interlinkages which characterize the traditional arrangements), while receiving contingent in-kind transfers of crop output at harvest time.

2. 'Modern' Credit in Formal Markets

In this paper we'll highlight insurance arrangements as an important difference between the "traditional" and "modern" communities considered by Bailey. We start by describing a stylized model of consumption smoothing in modern society.

We imagine a set of infinitely lived households, indexed by $i = 1, 2, \ldots, n$. Time is discrete, and indexed by $t = 1, 2, \ldots$. In each period each household take some action $a \in A$ and consumes some quantity $c \in C$. Each household's preferences over consumption and actions are described by a time-separable von Neumann-Morgenstern momentary utility function $U(c) - a$; for simplicity, the function U takes the constant relative risk aversion (CRRA) form

$$U(c) = \begin{cases} \frac{c^{1-\gamma}-1}{1-\gamma} & \text{for } \gamma \neq 1; \\ \log(c) & \text{for } \gamma = 1, \end{cases}$$

where $\gamma > 0$ may be interpreted as the household's coefficient of relative risk aversion (Arrow, 1965). Future utility is discounted at a rate $1/\beta - 1$.

At date t each household i produces some random output $y_{it} \in C$, drawn from a distribution which depends on the action taken by the household. This dependence is described by the cumulative distribution function $F(y|a)$. Though the household may simply choose to consume this output, as an alternative it may contract with other households

or firms. These contracts may take a wide variety of forms, including that of an employment relationship or of insurance; what we require is simply that the contract specify a transfer $w(y)$ to be made to the household which may depend on the realization of y.

Because output is drawn randomly each period and because U is a concave function, each household would prefer to smooth its consumption over both time and states. Following Fudenberg et al. (1990), we assume that the action a is private information, and that each household has access to a bank, and can save or borrow at an interest rate $R - 1$. Let the household's net savings be denoted by b. We suppose that the household's problem can be expressed as the dynamic program

$$(1) \qquad V(b) = \max_{a,c} U(c) - a + \beta \int V(R(b - c) + w(y)) dF(y|a).$$

Now, it's clear that in addition to depending on the current realization of y, one could more generally permit w to depend on past realizations of this random variable. However, from Fudenberg et al. (1990) we know that the (constrained) efficient set of contracts w will *not* feature this sort of history dependence in the present environment and that—to use their language—even long-term relationships in this modern economy won't differ in their implications for consumption from a sequence of short-term contracts.

Working with the first order and envelope conditions from this problem, we obtain the usual Euler equation

$$(2) \qquad U'(c_{it}) = \beta R \mathrm{E}_t U'(c_{it+1}),$$

where E_t denotes the expectations operator conditioning on information available to the household at time t. By connecting the consumption-savings decision at time t to the same problem at $t + 1$, the Euler equation characterizes the evolution of household i's consumption over time. To better understand this evolution, suppose that $\beta R = 1$. Then the Euler equation implies that the marginal utility of consumption follows a random walk. So long as shocks to consumption aren't perfectly correlated *across* households, this in turn implies that there will be ever-increasing inequality in the distribution of consumption across any given cohort of households, consistent with evidence presented by Deaton and Paxson (1994) for the U.S., U.K., and Thailand.

Also of interest is the trajectory of expected consumption—can we expect the average household to have have higher consumption in the future, or lower? The answer to this question turns out to depend critically on the curvature of U'. For the case of CRRA utility (or more generally for any utility function exhibiting decreasing absolute

risk aversion), U' is a convex function, so that by Jensen's inequality (2) implies that $\mathrm{E}_t c_{it+1} \geq c_{it}$. Accordingly every household pursues a savings policy which gives it a higher expected consumption next period than in the present period.

We haven't assumed anything about aggregate income for this economy increasing (indeed, our notation was chosen to suggest that it will remain constant over time). Since inequality is increasing, aggregate income is constant, and every household expects that its consumption will be increasing over time, it's clear that many households will be disappointed in their expectations.

Any insurance in this setting will be limited by the problem of moral hazard, which rules out perfect insurance of the sort envisioned by, e.g, Townsend (1994). Nonetheless, consumption smoothing may take two forms. The first simply stems from the possibility that variation in $w(y)$ may be less than variation in y; the second from the intertemporal smoothing households can achieve via credit markets.

3. 'TRADITIONAL' INFORMAL INSURANCE

We now consider a slight modification to the environment described in the previous section; however, as we shall see, this slight modification will be of great importance for the nature of the efficient contracts and the evolution of consumption over time.

What we propose to do is to imagine ourselves now in the context of Bailey's "traditional" community (or, as we'll call it, the village). As before, households take an unobserved action a which affects the distribution of output, and this has the effect of limiting insurance. However, unlike the previous case, we imagine that at present not all households can borrow or save at a common rate, though it's recognized that they may be able to do so in the future. Further, which households have access to these sort of banking services is common knowledge, as are transactions between villagers. The effect of this extra information is to make it possible for one or more parties within the village (say a moneylender) to exercise control over the evolution of household consumption; in particular, for those households without banking access there's no reason to expect the Euler equation (2) to hold.

To proceed, let us imagine for simplicity that there's one member of the village who is risk neutral; call him the principal. The principal has access to banking services at interest rate $R - 1$. This principal proposes contracts with other members of the village; these contracts exploit dynamic incentives to helping these households to smooth their consumption, despite the problem of moral hazard.

To induce households to agree to the contracts proposed by the principal, the contracts must guarantee a level of expected, discounted utility $\bar{U}_i$ greater than or equal to the level they'd expect without such an arrangement. Having committed himself to providing household i with discounted expected utility $\bar{U}_i$ the principal solves the problem of minimizing the present value of the cost of satisfying this *ex ante* utility promise, as in Atkeson and Lucas (1992).

When the principal can control the rate of consumption growth, as in this setting, a well known result (Lambert, 1983; Rogerson, 1985; Spear and Srivastava, 1987; Malcomson and Spinnewyn, 1988) gives a new characterization of the evolution of household consumption under the efficient contract:

$$(3) \qquad \frac{1}{U'(c_{it})} = \beta R \mathrm{E}_t \frac{1}{U'(c_{it+1})}.$$

Note the strong parallel with the Euler equation (2); (3) is exactly that equation, but with the *reciprocal* of marginal utility appearing where marginal utility did in (2).

This parallel gives us a simple way to contrast the effects of this sort of informal insurance with the credit arrangements described in Section 2. Once again we employ Jensen's equality. With CRRA utility and $\beta R = 1$, (3) implies that

$$c_{it}^{\gamma} = \mathrm{E}_t c_{it+1}^{\gamma}.$$

Accordingly (and unlike the case with credit markets), the trajectory of expected consumption depends on the value of γ. In particular (Rogerson, 1985), with $\gamma < 1$ expected consumption is increasing over time; with $\gamma > 1$ expected consumption is decreasing, and with $\gamma = 1$ (the case of log utility) consumption itself follows a random walk, so that expected consumption tomorrow is equal to realized consumption today. Since there seems to be general consensus that appropriate values of γ exceed one in developing countries, one can predict that in traditional societies expected consumption is decreasing, while in modern societies it is increasing, even if the two societies share exactly the same production technology.

What can we say about the evolution of inequality? With some modest additional structure on utility functions, Thomas and Worrall (1990) and Phelan (1998) show that we can expect the progressive immiserization of all the households in the village (with probabililty one). The principal uses future risk to induce households to take higher actions a, consistent with evidence presented in Kochar (1993), simultaneously reducing the level of expected future consumption relative to

the case of credit markets while providing more insurance than could be obtained in these same markets.

The principal is able to profitably improve household's consumption insurance relative to what they could obtain via credit markets only by distorting the intertemporal profile of consumption for these households. This distortion involves a sort of history-dependence which doesn't characterize the outcomes described in Section 2 since the distribution of consumption tomorrow depends on the level of consumption today, by an argument similar to that advanced by Townsend (1982) or Allen (1985). Further, by once more applying Jensen's inequality and comparing (2) and (3), we see that *if* the household had access to banking services on the same terms as the principal, the household would choose to increase its savings, so as to reduce the risk it faces tomorrow—in this sense, we can regard the household as being savings constrained (see Rogerson, 1985, for a proof of this result).

4. DATA[1]

Do the stylized models described in the previous sections bears any resemblance to arrangements in actual villages? Here we take as examples three villages in the semi-arid tropics of India. These three villages are among the six villages initially selected by the International Crops Research Institute of the Semi-arid Tropics (ICRISAT) for inclusion in ICRISAT's Village Level Studies (VLS). Numerous surveys have been conducted as a part of the VLS, but we will chiefly rely on eight years (1976–83) of panel data from about 35 households in each of these three villages.

These villages are very poor by western standards. The median annual per capita income, averaged over the three villages and expressed in 1975 dollars, is only about $50; the share of this income spent on food is in excess of 60 per cent. This income includes income from all sources save transfers, including payments made in kind. Agricultural land occupies a dominant position in the portfolio of assets held by villagers, with the share of land in total assets ranging from 63 to 80 per cent Walker and Ryan (1990). Agricultural produce accounts for over 70 per cent of all income in each of the villages while agricultural labor accounts for most of the remainder.

Though all these villages rely on agriculture for the bulk of their income, the agriculture of the three villages is varied. In the first village, Aurepalle, the chief crops are sorghum, millet, castor, and paddy. In

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[1]Portions of this section draw heavily on Ligon (1998), which in turn relies largely on Walker-Ryan (1990).

the second village, Shirapur, sorghum dominates production. Kanzara, the third village, uses a variety of intercropping techniques to grow cotton, pigeon-pea, and mung beans, and grows a hybrid sorghum as a sole crop. To some extent, these different cropping patterns may reflect differences in access to outside markets. However, to a greater extent crop choice reflects exogenously given aspects of the environment each village finds itself in. Despite the fact that all three villages are located in central India, they differ considerably by soil type, rainfall, and of course geographic location. Differing physical environments and differing choices of cropping patterns mean that different tasks must be undertaken. Some crops, particularly paddy, are particularly labor-intensive; some tasks, such as weeding, may be difficult to monitor.

These villages seem particularly suitable for testing models of insurance because households in these villages face a great deal of idiosyncratic income risk. Of 33 households in Aurepalle continuously sampled over eight years, there were 17 instances in which a households' per adult-equivalent income fell below half of the household's median income. There were also 17 such shortfalls in Shirapur, but for only 31 households; there were only eight such shortfalls for 36 households in rainfall-assured Kanzara. One might suppose that these shortfalls tended to happen in response to some aggregate shock (which would limit the scope of mutual insurance), but they are fairly spread out across years. In Aurepalle, for example, although there were six shortfalls in 1976, there were three in each of 1977 and 1982, two in 1980, 1981, and 1983, and one in 1979. In Shirapur, there were four shortfalls in 1980, three in each of 1976, 1979, and 1983, two in 1982, and one in each of 1977 and 1981. Kanzara's eight shortfalls are spread out almost uniformly over 1978–81.

More formal tests of income covariance also indicate that there is considerable idiosyncratic risk, although aggregate sources of risk are clearly non-negligible. The average of Spearman's rank correlation coefficients for household income is 0.1481 in Aurepalle, 0.0494 in Shirapur, and 0.2893 in Kanzara. Calculation of these statistics permits us to construct a nonparametric test of the hypothesis that there is no cross-sectional correlation in realized incomes Frees (1995); though this hypothesis is easily rejected at conventional levels of significance for each of the three villages, it seems that income correlations are rather small in magnitude, save perhaps for Kanzara.

If income risk creates scope for insurance mechanisms of some sort, is there evidence that such mechanisms are employed? In a first stab at answering this question, we compute the same rank correlation statistic

we used a moment ago for income, but apply it instead to consumption. The statistics for consumption are surprisingly uniform across villages; 0.4604 for Aurepalle, 0.4905 for Shirapur, and 0.5059 for Kanzara. These are, again, significantly greater than zero, and also significantly greater than the corresponding statistics for income, indicating that there is a quite considerable amount of consumption smoothing.

There are two central questions one would like to answer about this consumption smoothing. First, since the amount of smoothing we see is less than full insurance, we would like to know whether (and which) particular households seem to be involved in the kinds of long term contracts delivering informal insurance described in Section 3, and which households have consumption processes which are better characterized by a model with equal access to credit markets, as in Section 2. Ligon (1998) uses the restrictions (2) and (3) as the basis of an estimation procedure which assigns individual households to one of these two regimes.

Here we ask whether or not data on the actual, detailed financial transactions engaged in by the households in these villages is supportive of the classification described by Ligon (1998). In particular, since careful control of consumption is key to the provision of the intertemporal incentives observed in the long-term contracts of Section 3, it seems reasonable to ask whether households which seem (on the basis of their consumption profiles) to be engaged in long-term contracts also engage in a pattern of transactions which suggest that control over consumption is being exerted.

Several earlier studies have examined financial transactions using these same data. Bhende (1986) and Binswanger et al. (1985) use annual data on indebtedness to draw a picture of the supply and demand for credit in these villages while Binswanger and Rosenzweig (1986) use data on transactions to describe the sources and uses of credit. More ambitiously, Lim and Townsend (1998) carefully examine all the transactions data to see what mechanisms are employed to smooth consumption, and find that while the most important mechanisms vary across villages buffer stocks of either cash or grain play an important role for many households. One of the conclusions one can draw from these papers is that the actual financial arrangements employed in these villages are often rather complicated, and depend on a variety of contingencies. For example, an obvious contingency which features in many descriptive accounts of credit involves the possibility of default. Default is common on loans from formal sources, but there is evidence that both parties to such transactions actually expect default; though nominally loans, these transactions are actually more like transfers or subsidies from the government than they are

like credit. On the other hand, default is quite uncommon on financial transactions involving informal sources (which account for some 90 per cent of all loans received); however, loans may often be forgiven in whole or in part, or payments rescheduled. The addition of such contingencies makes these transactions look much more like bundles of contingent claims than the simple debt contracts usually called for under the permanent income hypothesis.

More evidence that actual contracts are considerably more complicated than simple debt is found in the fact that there are a variety of local names to describe different sorts of financial transactions, all of which tend to be compounded into the single category of "credit" in the data collected and described by economists. One particular sort of loan commonly seen in Aurepalle bears the local name *nagu*. A *nagu* loan is issued by a moneylender at the beginning of the cropping season, either for consumption purposes or to finance the purchase of crop inputs. The putative 'interest rates' on such loans are quite high; around 12 per cent per month, with exchange denominated in units of grain. The length of the crop season depends on the crop, and ranges from about three to about six months. The moneylender apparently does not attempt to closely monitor cropping operations during the growing season. At the end of the season, the crop is harvested, and must be threshed. At this time, the moneylender goes to the threshing floor, often in person, to claim a portion of the crop. If the crop is good, he will collect the original principal and interest; however, if the crop is poor, the moneylender may choose to either forgive the loan, or to reschedule payment. Binswanger et al. (1985) reports that most farmers are involved in a long term relation with a moneylender; at the time of their survey, the average length of relationship with the same moneylender was nearly a decade.

5. EVIDENCE

Ligon (1998) observes that when $\beta R = 1$, for a traditional household with CRRA utility (3) implies that

$$(4) \qquad \qquad E_t \left(\frac{c_{it+1}}{c_{it}} \right)^\gamma = 1,$$

while for a modern household (2) implies

$$(5) \qquad \qquad E_t \left(\frac{c_{it}}{c_{it+1}} \right)^\gamma = 1.$$

This forms the basis of a estimation procedure which permits each household to have a consumption process satisfying

$$(6) \qquad \mathrm{E}_t \left(\frac{c_{it+1}}{c_{it}} \right)^{s_i \gamma} = 1,$$

where s_i takes the value 1 or -1, thus determining the sign of the exponent household by household; when positive, the household is assigned to the traditional regime, and when negative to the modern regime.

Ligon (1998) uses a "continuously updated" (Hansen et al., 1996) GMM estimator to produce both assignments of individual households to different regimes, and estimates of the coefficient of relative risk aversion. These latter estimates are reported (corresponding to the different sets of instrumental variables shown in the first column) are given in Table 1, reproduced from Ligon (1998). The J statistics reported in this table are asymptotically distributed χ^2, and serve as tests of the overidentifying restrictions implicit in the instrument sets, conditional on a correct assignment of households to regimes.

The results of this procedure? Estimated risk aversion is near that of log utility. In Aurepalle, twelve of 33 households are assigned to the traditional regime; in Shirapur all but one household is so assigned, while in Kanzara four households are assigned to the modern regime. Thus, only in Aurepalle is there enough variation to make comparisons of financial transactions across households interesting. Perhaps surprisingly, regime assignment in Aurepalle does not seem to be associated with farm size, except perhaps for the smallest landholders, all but one of whom belong to the modern regime. Nearly equal numbers of large farmers and landless households belong to the modern regime, and there are no overwhelming differences in the conditional means for any of the variables used in the estimation.

A chief virtue of the methods used to test what regime different households belong to is that one needn't take a stand on precisely what set of contracts or other arrangements households are involved in, but rather simply looks at outcomes. Nonetheless, any consumption allocation must in fact be affected by some set of contractual arrangements, and we might wonder if there appear to be systematic differences between the arrangements employed by modern households and the arrangements of traditional households.

We have data on realized transfers of goods and money for each household in our sample, though we know little about the households' partners for these transactions, and nothing at all about how any given transaction might be related to others (we cannot, for example, identify an outflow of cash as repayment for an earlier loan). On a very narrow

	Village			
	Aurepalle	Shirapur	Kanzara	All
Instrument Vector	$\hat{\gamma}$	$\hat{\gamma}$	$\hat{\gamma}$	$\hat{\gamma}$
	$(\sigma(\hat{\gamma}))$ J	$(\sigma(\hat{\gamma}))$ J	$(\sigma(\hat{\gamma}))$ J	$(\sigma(\hat{\gamma}))$ J
—	1.36	1.39*	0.95	1.52*
	(1.69) 0	(0.43) 0	(0.58) 0	(0.33) 0.01
Income	1.56	1.43*	1.00*	1.78*
	(1.24) 0.04	(0.42) 0.00	(0.51) 0.02	(0.31) 0.08
Income, Land	1.16	1.45*	0.76	1.72*
	(0.82) 0.27	(0.45) 0.14	(0.44) 0.07	(0.32) 0.39
Family Size, Income, Land	1.07*	1.23*	0.69	1.45*
	(0.46) 0.04	(0.43) 0.18	(0.46) 0.04	(0.30) 1.42
Family Size, Income, Land,	0.97*	1.59*	0.82*	0.96*
Rain, Avg Consumption	(0.21) 0.21	(0.26) 1.72	(0.15) 0.68	(0.12) 0.95

TABLE 1. Estimates of risk aversion with heterogeneous regimes, reproduced from Ligon (1998). Starred estimates are significant at the 95% level. Standard errors are reported in parentheses. Statistics reported under the columns labelled J are scaled to have an asymptotic χ^2 distribution, and serve as a portmanteau specification test.

reading of the models, we might expect that permanent income households would use only spot markets and markets for non-contingent credit. Transactions in our data are not, however, classified so that we can examine this hypothesis. The data do, however, identify particular payments and receipts as "credit" transactions. Table 2 helps to classify these transactions for Aurepalle (as noted above, there's too little variation in regime assignment for this exercise to be interesting in the other two villages). Each transaction is classified according to whether it is a receipt or an outlay, what 'type'[2] the other party is, whether or

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[2]The table gives four possible categories for type. The data is only slightly richer. What we call "banks" is intended to include any formal credit transaction, and includes credit transactions with the government (including "fair price shops"), commercial banks, and cooperatives. What we call "moneylenders" captures informal credit transactions in which interest is (perhaps only nominally) charged. The party may be any other household, or the household's landlord (if it is a tenant), tenant (if it is a landlord), or employer or employee. The category "Friends and relatives" is used for nominally interest free transfers from friends or relatives, but in

not the transaction is in cash or in kind, and finally whether the household is classified as belonging to the permanent income or traditional regime. The numbers in the table report, first, the mean number of transactions of each sort per household (over the entire period of the survey); and second the mean value, in current rupees, of transactions of each sort (reported in parentheses). An asterisk between the the "traditional" and "modern" columns indicates a significant difference (at a 95 per cent level of confidence) between the two regimes. Thus, for example, the most common sort of credit transaction aside from 'other' was in kind receipts from moneylenders to modern households; these households averaged 19.30 such transactions over the ten year period 1975–84, significantly more than the 14.42 transactions of traditional households.

Perhaps the most striking feature of Table 2 is that the overwhelming majority of transactions in Aurepalle are informal, with partners in the "moneylender" category. Examination of the data in Table 2 shows a striking difference, in that traditional households are more likely to engage in in-kind credit transactions than are modern households, while conversely modern households make significantly greater use of cash arrangements for credit, lending more in cash to friends and relatives (both in number of transactions and magnitude), and repaying loans to moneylenders in cash with significantly greater frequency than do traditional households. A further interesting difference is that total outlays by traditional households are less than total receipts, while total outlays for modern households exceed receipts. This pattern is consistent with the idea that traditional households' credit transactions may be interlinked with, say, labor transactions, while modern households are paying interest on loans received.

Some interesting differences also emerge when we look at all financial transactions (Table 3). These are all recorded transactions that don't occur in spot markets, and chiefly comprise credit and transfers. Traditional households appear to take in significantly more receipts, both in number and magnitude. On the other side of the ledger, the traditional households have a larger number of outlays than the modern households, but of smaller magnitude. Total outlays per household average 26,320 Rs. for the traditional households, and slightly more for the permanent income households; 29,253 Rs. Transactions in Table 3 are broken down by the type of good transferred. From this breakdown, we can see that the main source of the difference in total

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which the principal is supposed to be repaid. The category "other" includes credit transactions with private shops, itinerant merchants, millers, and miscellaneous.

		Receipts				Outlays		
		Traditional		Modern	Traditional		Modern	
Cash	Banks	0.83	*	1.05	1.17	*	2.25	
		(6200.60)	*	(3265.24)	(2168.57)	*	(743.11)	
	Moneylenders	11.67		11.80	8.75	*	10.35	
		(486.32)		(780.21)	(585.62)		(787.97)	
	Friends and	0.17		0.20	0.42	*	0.25	
	Relatives	(550.00)	*	(100.00)	(373.00)	*	(1604.00)	
	Other	8.00	*	5.85	9.42	*	7.95	
		(430.66)		(364.24)	(350.55)		(332.62)	
	Total	20.67	*	18.90	19.75	*	20.80	
		(695.70)		(782.32)	(562.56)		(618.88)	
In Kind	Banks	0.08	*	0.35	0.08	*	0.40	
		(93.00)	*	(534.61)	(354.40)	*	(102.19)	
	Moneylenders	14.42	*	19.30	9.67	*	12.70	
		(76.90)		(52.35)	(441.24)		(303.90)	
	Friends and	0.33		0.25	0.17		0.10	
	Relatives	(210.00)	*	(87.01)	(1795.00)	*	(135.68)	
	Other	24.58	*	17.90	5.75	*	3.85	
		(92.32)		(94.51)	(351.65)	*	(80.55)	
	Total	39.42	*	37.80	15.67	*	17.05	
		(87.68)		(77.01)	(422.30)		(247.75)	
Total		60.08	*	56.70	41.08		41.45	
		(296.82)		(312.11)	(477.31)		(448.38)	

TABLE 2. Credit Transactions by Regime, Partner, and Type. Numbers in parentheses are the mean size of transactions, while otherwise figures indicate the average number of transactions per household in each regime. Stars indicate a significant difference between figures for traditional and modern.

transactions across regimes comes from the receipt of food and clothing. Traditional households receive 28 per cent more transactions of food and clothing than do modern households, each with an average value 19 per cent greater than the average food and clothing receipt of modern households, so that on balance traditional households receive 33 per cent more food and clothing. In contrast, outlays of food and clothing are very similar across regimes. Outlays of food and clothing are far fewer in number, but are on average more than twice as large as receipts.

	Receipts			Outlays		
	Traditional		Modern	Traditional		Modern
Cash	28.33	*	25.45	49.67	*	44.55
	(686.74)		(619.44)	(293.68)		(450.71)
Food and	39.42	*	30.80	12.83	*	11.15
Clothing	(93.39)		(78.55)	(193.47)		(186.45)
Other	10.58	*	8.25	1.67		1.70
Consumption	(333.23)		(233.04)	(436.32)	*	(1407.74)
Production	16.92	*	18.60	4.17	*	3.80
Inputs	(292.53)		(93.30)	(305.82)		(310.74)
Crop Output	0.00		0.00	16.08	*	13.35
	(—)		(—)	(450.89)		(264.27)
	95.25	*	83.10	84.42	*	74.55
Total	(331.91)		(262.84)	(311.81)		(392.49)

TABLE 3. Financial Transactions by Regime and Type. The mean size of each transaction is reported in parentheses; the average number of transactions per household is not parenthetical. Stars indicate a significant difference between figures for traditional and modern.

	Receipts			Outlays		
	Traditional		Modern	Traditional		Modern
Cash	21.00	*	19.05	20.08		20.80
	(750.53)		(784.42)	(575.96)		(618.88)
Food and	22.08	*	20.75	1.75	*	3.85
Clothing	(113.00)		(82.36)	(274.69)	*	(149.46)
Other	6.58	*	4.10	0.00		0.00
Consumption	(17.50)		(57.81)	(—)		(—)
Production	10.92	*	13.30	2.58		2.55
Inputs	(78.84)		(73.44)	(53.16)		(69.23)
Crop Output	0.00		0.00	11.75	*	10.65
	(—)		(—)	(607.24)		(326.02)
	60.58	*	57.20	36.17	*	37.85
Total	(317.45)		(312.34)	(534.20)		(451.70)

TABLE 4. Credit Transactions by Regime and Type. The mean size of each transaction is reported in parentheses; the average number of transactions per household is not parenthetical. Stars indicate a significant difference between figures for traditional and modern.

	Receipts		Outlays		
	Traditional	Modern	Traditional		Modern
Cash	6.00	6.25	29.00	*	23.30
	(586.55)	(130.74)	(100.78)		(274.28)
Food and	17.33 *	10.05	11.08	*	7.30
Clothing	(68.41)	(70.67)	(180.65)		(205.97)
Other	4.00	4.15	1.67		1.70
Consumption	(852.86)	(406.17)	(436.32)	*	(1407.74)
Production	6.00 *	5.45	1.58	*	1.25
Inputs	(681.34)	(140.44)	(718.05)		(803.44)
Crop Output	0.00	0.00	4.33	*	2.70
	(—)	(—)	(26.92)		(20.70)
	33.33 *	25.90	47.67	*	36.25
Total	(366.14)	(153.60)	(144.87)		(313.04)

TABLE 5. Transfer Transactions by Regime and Type. The mean size of each transaction is reported in parentheses; the average number of transactions per household is not parenthetical. Stars indicate a significant difference between figures for traditional and modern.

The fact that traditional households have more and larger receipts of food and clothing is tantalizing, because it is clear that implementing the traditional regime requires considerable control over consumption. Because food and clothing constitute the bulk of consumption, transfers of these goods seems to be the most direct instrument of control.

Between the two of them, credit transactions and transfer transactions account for nearly all financial transactions. Because there are no large differences in credit transactions across regimes (Table 2), the differences in total financial transactions observed in Table 3 must be accounted for principally by differences in transfers. Table 5 displays these differences.

To summarize, while most patterns of financial transactions are fairly similar across modern and traditional households in Aurepalle, there's a large difference in that traditional households receive 70 per cent more transfers of food and clothing than do modern households, though the size of the average transfer is very similar across household types. Related, though neither type of household *receives* any transfers of crop output, traditional households give 60 per cent more transfers of crop output than do modern households, with the size of the average transfer 30 per cent larger than that of modern households. This result seems

to match the description of stylized arrangements involving traditional moneylenders in Aurepalle—recall that the pattern in those arrangements called for a sequence of in-kind transfers to the household, followed by a reverse transfer of crop output at the time of harvest. Given the limits of the data available to us, this seems remarkably compelling evidence in support of the categorization of households into traditional and modern regimes.

6. Conclusion

Anthropologists and economists have had frequent occasion to note the importance of what Bailey calls the "multiplex" nature of long-term relationships in traditional villages, and contrast this with the relatively short-term relationships observed in modern economies. When one uses the tools of theory to design an optimal dynamic insurance contract in an environment with moral hazard, the nature of the efficient contract turns out to hinge critically on whether or not the household has access to credit markets. When the household does have access to credit markets, the insurer will be unable to exploit dynamic incentives to provide insurance, and whatever limited amount of consumption smoothing there is will be accomplished via the use of these credit markets (Allen, 1985; Fudenberg et al., 1990).

When households have CRRA preferences with the coefficient of relative risk aversion greater than one, and the interest rate facing the principal is equal to the rate of time preference, the principal will manipulate transfers to traditional households (those without access to banks) so as to provide insurance at the cost of a consumption profile which falls over time in expectation. If given access to credit markets on the same terms as the principal, these households would choose to save, but doing so would undermine the dynamic incentives relied upon by the principal. Conversely, modern households will expect their consumption expenditures to increase over time, but will bear more risk than do the traditional households. It's worth noting that, given otherwise identical environments, the traditional regime Pareto dominates the modern regime, in which dynamic incentives can't be used to ameliorate the problem of moral hazard.

Possible pitfalls of modernization become clear if we imagine the consequences of introducing banking services to a traditional village. Our model tells us that prior to the introduction of banking services, we might expect to see the traditional households of the village all nearly equal but poor, at the bottom of the distribution of consumption (though note that small differences in consumption for very poor

households may yield very large differences in marginal utility). Further, these poor households would expect their low consumption to decline further over time, while most of the surplus of the village was consumed by the principal (e.g., a moneylender or large landholder). The introduction of banking services would undermine the dynamic incentives provided by the principal, leading households who participated in the newly available credit markets to suddenly bear more risk, but to expect their consumption to increase over time. Inequality would subsequently increase, and the average household who participated in the new credit markets would regret the passing of the old ways.

Ligon (1998) uses data from three villages in India to assign households to either traditional or modern regimes. In two of the three villages almost all households seem to be traditional; in the third (Aurepalle) there's more heterogeneity. Here we look at actual patterns of financial transactions for these two categories of households in Aurepalle. We find that the average traditional household is more likely to engage in in-kind credit transactions, receives many more transfers of food and clothing (consistent with the need for the principal to control household consumption), and makes many more transfers of crop output. These patterns seem to support the importance of a particular "multiplex" mechanism observed in this village, wherein a large moneylender makes a sequence of in kind transfers to his traditional clients, and subequently receives a contingent share of the household's crop output at harvest.

References

Allen, F. (1985). On the fixed nature of sharecropping contracts. *The Economic Journal 95*, 30–48.

Arrow, K. J. (1965). *Aspects of the Theory of Risk Aversion.* Helsinki: Yrjö Jahnssonin säätiö.

Atkeson, A. and R. E. Lucas, Jr. (1992). On efficient distribution with private information. *The Review of Economic Studies 59*, 64–88.

Bailey, F. G. (1971). The peasant view of the bad life. In T. Shanin (Ed.), *Peasants and Peasant Societies.* Harmondsworth: Penguin Books.

Bardhan, P. and A. Rudra (1981). Terms and conditions of labour contracts in agriculture: Results of a survey in West Bengal 1979. *Oxord Bulletin of Economics and Statistics 43*(1), 89–111.

Bardhan, P. and A. Rudra (1983). Labour mobility and the boundaries of the village moral economy. Manuscript.

Bell, C. (1988). Credit markets and interlinked transactions. In H. Chenery and T. Srinivasan (Eds.), *Handbook of Development Economics, Volume I.* Elsevier Science Publishers.

Bhende, M. J. (1986). Credit markets in rural south india. *Economic and Political Weekly 21*(38–39), A119–A124.

Binswanger, H. P. et al. (1985). Credit markets in rural South India: Theoretical issues and empirical analysis. World Bank Discussion Paper Report ARU 45, World Bank.

Binswanger, H. P. and M. R. Rosenzweig (1986). Credit markets, wealth and endowments in rural south India. Presented at the 8th International Economic Association World Congress.

Deaton, A. and C. Paxson (1994). Intertemporal choice and inequality. *Journal of Political Economy 102*(3), 437–467.

Frees, E. W. (1995). Assessing cross-sectional correlation in panel data. *Journal of Econometrics 69*, 393–414.

Fudenberg, D., B. Holmström, and P. Milgrom (1990). Short-term contracts and long-term agency relationships. *Journal of Economic Theory 51*, 1–31.

Hansen, L. P., J. Heaton, and A. Yaron (1996). Finite-sample properties of some alternative GMM estimators. *Journal of Business and Economic Statistics 14*(3), 262–280.

Kochar, A. (1993). Labor market responses to idiosyncratic agricultural shocks: Empirical evidence from rural India. Manuscript.

Lambert, R. A. (1983). Long-term contracts and moral hazard. *Bell Journal of Economics 14*(2), 441–452.

Ligon, E. (1998). Risk-sharing and information in village economies. *Review of Economic Studies 65*, 847–864.

Lim, Y. and R. M. Townsend (1998). General equilibrium models of financial systems: Theory and measurement in village economies. *Review of Economic Dynamics 1*(1), 59–118.

Malcomson, J. M. and F. Spinnewyn (1988). The multiperiod principal-agent problem. *Review of Economic Studies LV*, 391–408.

Phelan, C. (1998). On the long run implications of repeated moral hazard. *Journal of Economic Theory 79*(2), 174–191.

Rogerson, W. P. (1985). Repeated moral hazard. *Econometrica 53*, 69–76.

Scott, J. C. (1976). *The Moral Economy of the Peasant.* New Haven: Yale University Press.

Spear, S. E. and S. Srivastava (1987). On repeated moral hazard with discounting. *Review of Economic Studies 54*, 599–618.

Thomas, J. and T. Worrall (1990). Income fluctuation and asymmetric information: An example of a repeated principal-agent problem.

Formal

Journal of Economic Theory 51, 367–390.

Townsend, R. M. (1982, December). Optimal multiperiod contracts and the gain from enduring relationships under private information. *Journal of Political Economy 90*, 1166–1185.

Townsend, R. M. (1994). Risk and insurance in village India. *Econometrica 62*(3), 539–591.

Townsend, R. M. (1995). Consumption insurance: An evaluation of risk-bearing systems in low-income economies. *The Journal of Economic Perspectives 9*(3), 83–102.

Walker, T. S. and J. G. Ryan (1990). *Village and Household Economies in India's Semi-arid Tropics*. John Hopkins.

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