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RISK-SHARING UNDER VARYING INFORMATION REGIMES:
THEORY AND MEASUREMENT IN VILLAGE ECONOMIES

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**RISK-SHARING UNDER VARYING INFORMATION REGIMES:
THEORY AND MEASUREMENT IN VILLAGE ECONOMIES**

by

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1. Introduction

This paper attempts to characterize and test the behavior of consumption in a class of private information models. My interest in this class of models is motivated by the failure of 'permanent income' models and complete markets models, two workhorses of economic theory, to adequately account for the role which individual income plays in determining consumption, both in the U.S. and more particularly in the village economies of developing countries.

Three economic regimes

Economists' models can often be classified according to what markets are present in them. In this taxonomy, there is a locus of models near Friedman's work on the permanent income hypothesis; models which have a full set of spot and credit markets, and which I will describe as belonging to the permanent income regime. This regime includes important contributions by Muth (1960), Bewley (1977) and Hall (1978). For the purposes of this research, this last contribution is of particular interest, because of Hall's seminal role in proposing to test the implications (derived from the Euler equations) of the permanent income model. Consumption in these models depends on the nature of the *individual* income processes of agents.

A second cluster of models owes its position in the taxonomy to Arrow and Debreu. These models, characterized by complete contingent claims markets, generally suppose a larger set of markets than in the permanent income models. It is an implication of these models that individuals' consumption depends only on the *aggregate* income process, not on individual income; the consumption insurance that results is reasonably called *full* insurance (cf. Diamond (1967), Wilson (1968)).

The third set of models I wish to discuss are models which belong to the private information regime. These are models which, in the presence of full information, *would* deliver the complete set of contingent claims markets promised by the Arrow-Debreu class of models. What distinguishes these models from the complete markets models, however, is that not all information is known to all agents, ruling out some contracting possibilities due to the problems of adverse selection and moral hazard. The optimal consumption allocations in such environments will fail to achieve Pareto optimality; the best attainable allocation will be second best. In such models, consumption allocations may depend on all public information in a manner which is highly sensitive to the precise production technology and information structure of the economy (Holmstrom 1979).

Consumption based tests of regimes

It is probably not the case that models belonging to a particular regime are right while the others are wrong. The question, rather, is this: if we take a particular actual economy, which regime provides the best description of that economy? Differences in technology and information structure alone are enough to suggest that different economies will be best described by different regimes.

Hall's initial contribution to the permanent income literature spawned a voluminous empirical literature devoted to testing implications of the permanent income model (variously defined), including Hansen and Singleton (1982), Hayashi (1987), Zeldes (1989), and Runkle (1991).

The literature testing the full-insurance implications of complete markets models is comparatively recent; although Leme (1984) provides some early, informal evidence that nations do not fully insure each other, Mace (1991) and Cochrane (1991) were the first to explicitly seek a test of full insurance using data on individuals in the U.S. Tests of full insurance in the villages of various developing countries have been undertaken by, most notably, Townsend (1992), Morduch (1991), and Deaton (1990). Tests of full insurance within extended families in the U.S. have been conducted by Altonji, Hayashi, and Kotlikoff (1989). Lim (1992) deserves special mention for attempting to discriminate between the insurance implications of a particular full-insurance, Arrow-Debreu model and a permanent income model.

There have been few attempts to test the implications that models of the private information regime hold for consumption. This is at least in part due to the difficulty, alluded to above, of specifying the manner in which consumption ought to depend on other observables. Because allocations in general may depend on all public information, there may be a serious specification problem for an econometrician who observes only a subset of the public information set, and who does not know what remaining information is public and what private. In the absence of detailed knowledge of the primitives of the economy under consideration, the hypothesis that private information plays a role in determining consumption may often play the role of an ill-specified alternative to some well-specified null hypothesis.

Among the tests of private information models that *have* been conducted, Phelan (1990) shows that the increase in consumption inequality in the U.S. is consistent with that predicted by a well-specified private information model, but is not able to distinguish very well between private information and permanent income regimes. Green and Oh (1991) describe some observable implications of private information models which might serve to distinguish them from permanent income models, but they do not examine any actual economies. The implications that they derive are both different from and weaker than those derived here.

The approach of the authors mentioned above might be said to belong to the mech-

anism design tradition. This tradition takes as primitives the preferences, endowments, technology and information structure of some set of agents, and derives from these an efficient set of institutions, which may then be compared to the institutions one observes in some real economy or economic relationship. The presumption is that observable differences between the real and predicted institutions are due to a mis-specification of the primitives. The potential difficulty of the mechanism design approach is that one may fail to find a set of primitives which gives rise to observed institutions.

An alternative and perhaps more common approach in the development literature takes observed institutions as given, and inquires into the optimal use of these institutions by agents. For example, Besley, Coate, and Lorry (1993) examines rotating savings and credit associations (ROSCAs), a common institution in developing countries, and show that this institution might be useful to members for financing the purchase of individual goods. However, ROSCAs seem to be a rather inefficient means of providing such financing, even in the absence of external credit markets. The formation of ROSCAs is presumably due in part to a combination of incentive problems and limited commitment; the institutional approach fails to explain why we observe ROSCAs rather than some other institution which might better suit the environment. The institutional and mechanism design approaches may certainly complement each other: Besley, Coate, and Lorry exploit this complementarity by taking something of a mechanism design approach to ROSCAs in a companion paper (Besley, Coate, and Lorry 1992).

Firmly in the institutional tradition, Stiglitz (1974) shows that sharecropping contracts may provide incentive compatible insurance in the presence of private information. Udry (1993) finds that the contingent loan contracts he observes in the semi-arid tropics of Nigeria fail to provide full insurance, attributing this failure to some sort of transactions cost. Foster and Rosenzweig (1993) use evidence on the prevalence of piece-rate and wage labor to infer the existence of adverse selection in Phillipine labor markets. All of these are imaginative applications of theory combined with a knowledge of actual institutions. Their shortcoming lies in the fact that theory suggests that alternative arrangements might well provide a better solution to the adduced economic problem than existing institutions.

This paper takes something of a hybrid approach. There is a presumption shared by the mechanism design literature that institutions may be expected to be (constrained) efficient. At the same time, the tests presented here focus on allocations rather than the institutions which deliver those allocations. A large class of environments and institutions which are efficient within those environments will be equally characterized by the tests developed here. The issue of the sensitivity of allocations to the environment is avoided by focusing on a partial characterization of efficient contracts which is insensitive to variation in information and technology. Also, I present some speculation regarding the ability of observed institutions (e.g., moneylending, sharecropping) to deliver efficient allocations.

Organization

Subject to separability in preferences between actions and consumptions, I derive a partial, but fairly general, characterization of second best consumption allocations in environments with private information. Furthermore, this characterization can be tested in the absence of further knowledge of both the information structure and production technology. Under a particular parameterization of preferences, the hypothesis that consumption allocations are indeed second best yields a restriction which can be tested against similar restrictions that provide partial characterizations of the full-insurance and permanent income regimes.

Using panel data from three villages in rural South India, I can test which regime best describes the data. The second best regime clearly wins this contest, although the results suggest that differences in technology and information may be great enough across villages that different villages are best modeled by different regimes. In particular, in Aurepalle, a village characterized by more traditional forms of subsistence farming and patronage relations (especially moneylending), consumption is closer to that required by the second best private information regime than it is to either the permanent income or complete markets regimes. Sharecropping is an important institution in Shirapur, which is also clearly best characterized by the second best, private information allocation. The third village, Kanzara, is wealthier than the other two villages, and has a less risky agriculture. Of the three villages, Kanzara seems the closest to a full-insurance regime.

In Section 2.1 I set up some notation, and specify the nature of the primitives of the model. Section 2.6 makes precise what I mean by a permanent income economy, while Section 2.7 sets up the full information problem, and provides a partial characterization of the consumption allocation in that environment. I also make clear how one might distinguish full insurance and permanent income economies on the basis of observations of consumption. In Section 2.8 I derive a restriction which characterizes a fairly large class of second best consumption allocations, and which, when contrasted with the restrictions derived in Sections 2.6 and 2.7 will allow me to judge which regime best fits the data. Section 3 discusses the data, methodology, estimation procedure, and results, in that order. Section 4 addresses some potential difficulties one might face in applying the methods developed in this paper, while Section 5 concludes.

2. Three Models

In this chapter we set out to derive distinct sets of restrictions on intertemporal consumption allocations under uncertainty. We wish to characterize three different model regimes: the permanent income regime, the full insurance regime, and the private in-

formation regime. We obtain a general set of restrictions for each regime under the maintained hypothesis that agents' von Neumann-Morgenstern preferences are additively separable in consumption and action¹.

In Section 2.1 we establish some notation and general structure common to all three models. Section 2.6 derives a partial characterization of consumption under the permanent income hypothesis, and makes some general remarks about the behavior of consumption in a permanent income world. Section 2.7 derives and discusses restrictions on consumption implied by full insurance, while Section 2.8 does the same for a broad class of models with private information. Finally, Section 2.9 emphasizes the point that no one of these regimes is a priori the "right" regime; the efficiency of each regime can only be evaluated relative to the information structure which actually prevails in the economy, and each regime is efficient relative to *some* information structure. Which characterization of the intertemporal allocation of consumption best describes consumption allocations in an actual economy is not an issue that can be decided on the basis of theory alone.

Preliminaries

The players

The environment has a principal (who we will sometimes label agent 0), and a finite set of agents indexed by $I = 1, 2, \dots, n$. Time is discrete and is indexed by $t = 0, 1, 2, \dots, T$. The space of actions, A , includes all the actions we might think of the agent taking which would affect his (or any other agent's) utility, or which might affect the public outcome $\{x_t\}$ (A might also include actions which have no such effect). The public outcome $\{x_t\}$ includes all information save (possibly) private information regarding agents' actions $\{a_{it}\}_{i \in I}$.

For notational convenience, let $c_t = \{c_{it}\}_{i=1}^n$ be the vector of consumptions of agents in period t ; $c_i^t = \{c_{it}\}_{\tau=0}^t$ be the history of consumption of agent i , and $c^t = \{c_i^t\}_{i=1}^n$ be the history of consumption of all agents. Define $w_t, w_i^t, w^t, x_t, x_i^t, x^t, a_t, a_i^t, a^t$ and so on analogously.

Preferences

Principal and agents have preferences

¹Generalizations to non-separable preferences are straightforward for the full information and permanent income regimes. For the private information regime, one must make some additional assumptions regarding the information structure of the economy, a point which is made clear in Section 2.9. Roughly, in order for it to be convenient to generalize the private information restrictions, it must be the case that each agent's marginal utility of consumption be publicly observable.