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Self-Production, Friction, and Risk Sharing against Disasters: Evidence from a Developing Country

YASUYUKI SAWADA [a], HIROYUKI NAKATA [b] and TOMOAKI KOTERA [c,*]

[a] *University of Tokyo, Japan*
[b] *University of Leicester, UK*
[c] *University of Wisconsin-Madison, USA*

Summary. — This paper uses a unique household data set collected in Vietnam to empirically test the necessary conditions for an extended version of the consumption risk-sharing hypothesis. The test explicitly incorporates self-production and uses natural disasters such as avian influenza, droughts, and floods to identify the effectiveness of market and non-market risk-sharing mechanisms. With these additional treatments, full risk sharing within each commune cannot be rejected, which suggests the presence of omitted variable and endogeneity biases in existing studies that reject full risk sharing. We also find that credit constraints have a significant impact, although limited commitment is not necessarily serious.

Key words — consumption risk sharing, self-production, credit constraints, limited commitments

1. INTRODUCTION

In the past three decades, there has been a remarkable progress in formulating and testing the full consumption risk-sharing hypothesis (Townsend, 1987; Mace, 1991; Cochrane, 1991; Townsend, 1994; Udry, 1994; Hayashi, Altonji, & Kotlikoff, 1996; Ligon, 1998; Dercon & Krishnan, 2000; Ogaki & Zhang, 2001; Murgai, Winters, Sadoulet, & de Janvry, 2002; Fafchamps & Lund, 2003; Morduch, 2003; Dubois, Jullien, & Magnac, 2008; Ligon, 2008; Angelucci & De Giorgi, 2009; Kinnan, 2010; Attanasio & Pavoni, 2011; Mazzocco & Saini, 2012; Ambrus, Mobius, & Szeidl, 2014; Laczó, 2015). According to the canonical model of consumption risk sharing, idiosyncratic changes in household income should be absorbed by all other members within the same risk-sharing network when the market is complete. Thus, when aggregate shocks are controlled for, idiosyncratic income shocks should not affect consumption when risk sharing is efficient. Existing studies on the full risk-sharing hypothesis typically use changes in household income, employment status, and health status from multipurpose household panel survey data as a proxy for idiosyncratic shocks.

Because tests of the full risk-sharing hypothesis using data from developing countries tend to reject it, researchers have elaborated on models incorporating various sources of friction to account for the partial risk sharing (Ligon, 2008). Such friction includes limited commitment constraints and moral hazard arising from information asymmetry. Ligon (1998) uses panel data from India to test a moral hazard–constrained insurance model against the canonical full insurance and permanent income models. Dubois *et al.* (2008) use Pakistani household panel data to develop and test a model with limited commitment and incomplete formal contracts. Using panel data from rural Thailand to construct models of limited commitment, moral hazard, and hidden income to explain the incomplete nature of informal insurance, Kinnan (2010) finds that the predictions of the hidden income model are supported by the data. Using data from the UK, Attanasio and Pavoni (2011) obtain supportive evidence of risk sharing under a moral hazard problem with hidden saving.

An alternative strategy for explaining the lack of full consumption risk sharing is to mitigate estimation biases arising from various econometric problems (Ravallion & Chaudhuri, 1997; Ogaki & Zhang, 2001).[1] By relaxing assumptions on the functional form of utility, Ogaki and Zhang (2001) find evidence in support of the full risk-sharing hypothesis at the village level. However, they replicate the results of the previous research, that is, the full risk-sharing hypothesis is rejected with a constant relative risk aversion utility, a functional form that is widely used in the literature. Their results suggest that errors due to econometric specification are not negligible.

In the present paper, we use a unique data set collected in Vietnam to make three main contributions to the literature. First, we mitigate a possibly important source of specification errors: the lack of distinction between purchased goods consumption and self-produced goods consumption. More specifically, we apply Lewis's (1996) framework, which investigates international risk sharing with non-tradable goods, in the context of a village economy. Based on this framework, the canonical test of consumption risk sharing is likely to suffer from an omitted variable bias, and the direction of the bias is positive if income changes and changes in self-produced goods consumption are positively correlated. Indeed, the bias arising from the lack of distinction between self-produced and purchased goods consumption may be serious, since self-produced goods consumption is usually substantial in (rural) village economies in the developing countries.[2] Although

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de Janvry and Sadoulet (2011) point out the importance of home production for consumption as a means to cope with negative shocks especially among the poor, such a role of self-production has been otherwise largely neglected in the existing literature. To implement our framework empirically, we use a unique data set from Vietnam that explicitly distinguishes purchased goods consumption from self-produced goods consumption.

Second, we use information about natural disasters as sources of exogenous variations to test the consumption risk-sharing hypothesis. Existing studies on risk sharing typically use income changes as the idiosyncratic shock variables to test the full consumption risk-sharing hypothesis.[3] However, these variables are not necessarily exogenous to households, resulting in possible estimation biases arising from endogeneity, measurement error, and/or problems with private information (Ravallion & Chaudhuri, 1997; Ligon, 1998, 2008). Natural disasters provide an exceptionally clean experimental situation for at least three reasons. First, occurrence of natural disasters is intrinsically exogenous and cannot be manipulated by households (Kahn, 2005). Second, natural disasters can cause large enough losses that the noise-to-signal ratios in the disaster-related shock variables are significantly small and the data are less susceptible to attenuation biases arising from measurement errors. Third, whereas the shock variables in existing studies are likely to be private information (e.g., income), losses caused by natural disasters are typically large enough to be visible and easily verifiable. Hence, the assumption of perfect information is less problematic. Because Vietnam has experienced a variety of natural disasters and epidemics, such as avian influenza, typhoons, floods, and droughts, it provides ample data related to natural disasters that can be used in empirical analyses.[4]

Finally, in order to explore the reasons behind the acceptance of the full consumption risk-sharing hypothesis, we incorporate two sources of friction, that is, limited credit access and limited commitment. Unlike existing studies such as Kinnan (2010) and Laczó (2015), our strategy is to use direct information on commitment constraints as well as credit constraints.

With an explicit consideration of self-production and the use of natural disaster shocks as instrumental variables for income changes, we find that the full consumption risk-sharing hypothesis cannot be rejected. Our results suggest that the results of the previous studies, which have tended to reject the full risk-sharing hypothesis, involve omitted variable bias arising from the lack of distinction between self-produced goods and purchased goods consumption.

This paper is organized as follows. In Section 2, we present the theoretical and econometric framework for our analysis. In Section 3, we explain the survey data, and in Section 4, we present the empirical results. In Section 5, we present the results based on empirical models with limited credit access or limited commitment. This is followed by concluding remarks in Section 6.

2. THE THEORETICAL AND ECONOMETRIC FRAMEWORKS

In this section, we explain the theoretical and econometric frameworks that are used to test the full risk-sharing hypothesis in this paper. We first explain the theoretical framework, followed by the econometric framework.

In the standard framework, full consumption risk sharing can be characterized as the solution to a benevolent social planner's problem that maximizes the weighted sum of people's lifetime utilities given social resource constraints (Mace, 1991; Cochrane, 1991; Townsend, 1994). Lewis (1996), additionally, incorporates the consumption of non-tradable goods in testing the international consumption risk-sharing hypothesis.[5] We apply this framework in the village economy set-up by distinguishing between purchased goods consumption and self-produced goods consumption. Such a distinction is crucial in a village economy, because consumption of self-produced goods accounts for a substantial portion of the total consumption. As will be explained below, ignoring the consumption of self-produced goods (or non-traded goods) may lead to an omitted variable bias.

Consider an economy, which can be a village or a district, that is composed of J infinitely lived households, each facing serially independent income draws. We let $\mathbf{J} = \{1, 2, \ldots, J\}$ denote the set of households within the economy, with j being the typical element of $\mathbf{J}$. Assume also that no storage of the goods is possible, which rules out the possibility of self-insurance over time. We set up a social planner's problem for the economy with consumption of self-produced goods so as to describe the conditions for full consumption risk sharing as follows, although we relegate the justification for the formulation in the Appendix 1:

$$\begin{aligned} \max_{\left\{c_j^T(s_t), c_j^N(s_t)\right\}_{j,s_t}} \quad & \sum_{j\in\mathbf{J}} \lambda_j \sum_{t=0}^{\infty} \left(\tfrac{1}{1+\delta}\right)^t \sum_{s_t} \pi(s_t) u\left[c_j^T(s_t), c_j^N(s_t)\right] \\ s.t. \quad & \sum_{j\in\mathbf{J}} c_j^T(s_t) \leqslant \sum_{j\in\mathbf{J}} y_j^T(s_t), \forall s_t, \\ & c_j^N(s_t) \leqslant y_j^N(s_t), \forall j \in \mathbf{J}, s_t, \end{aligned} \tag{1}$$

where λ_j is the Pareto-Negishi weight attached to household j; t denotes time; $\pi(s_t)$ is the probability of state s_t in time t; δ is a subjective discount rate; u is a representative household's utility function; $c_j^T(s_t)$ and $c_j^N(s_t)$ are j's purchased goods consumption (or *tradables*) and consumption of self-produced goods (or *non-tradables*) in state s_t, respectively; $y_j^T(s_t)$ is j's tradable portion of the initial endowment; and $y_j^N(s_t)$ is j's self-produced or non-tradable portion of the initial endowment.

The first-order conditions of this problem with respect to purchased goods consumption are as follows:

$$\left(\frac{1}{1+\delta}\right)^t \lambda_j \pi(s_t) \frac{\partial u\left[c_j^T(s_t), c_j^N(s_t)\right]}{\partial c_j^T(s_t)} = \mu^{\mathbf{J}}(s_t), \quad \forall s_t,$$

where $\mu^{\mathbf{J}}(s_t)$ is the Lagrangian multiplier associated with the purchased goods consumption constraint for state s_t in problem (1). Following Baxter and Jermann (1999) and Lewis (1996), a log-linearization of these first-order conditions gives the following testable equation: for every $j \in \mathbf{J}$,

$$\Delta \ln c_{jt}^T = \alpha^{\mathbf{J}} + \beta_1^{\mathbf{J}} \Delta \ln c_{jt}^N + \beta_Z^{\mathbf{J}} \Delta \ln y_{jt} + u_{jt}^{\mathbf{J}}, \tag{2}$$

where Δ denotes the first-order difference, e.g., $\Delta \ln c_{jt}^T = \ln c_{jt}^T - \ln c_{jt-1}^T$, $\alpha^{\mathbf{J}}$ corresponds to the Lagrange multiplier $\mu^{\mathbf{J}}(s_t)$ where it is a function of the network $\mathbf{J}$, the state-contingent variables are replaced by observed variables or realized values by defining $c_{jt}^T = c_j^T(s_t)$, $c_{jt}^N = c_j^N(s_t)$, and $y_{jt} = y_j^N(s_t) + y_j^T(s_t)$ for all s_t, and $u_{jt}^{\mathbf{J}}$ is a well-behaved error term. This formulation assumes that the income changes $\Delta \ln y_{jt}$ are idiosyncratic, which is a typical assumption made in the existing studies on consumption risk sharing. Note that the consumption risk-sharing hypothesis is supported when $\beta_Z^{\mathbf{J}} = 0$ is satisfied. In Eqn. (2), $\alpha^{\mathbf{J}}$ represents the *average* growth rate