European University Institute

Department of Economics

Essays on Risk-Sharing and Development

Patrick Hoang-Vu Eozenou

Thesis submitted for assessment with a view to obtaining the degree of
Doctor of Economics of the European University Institute

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Dedication

A mon père.

Aknowledgement

My sincere appreciation and gratitude go first to my supervisor Morten O. Ravn for offering me outstanding guidance and invaluable support during my years at the EUI.

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General Introduction

Individuals living in developing economies are subject to a wide variety of risks. Moreover, since private and public formal institutions designed to help individuals coping with risks tend to be weaker and narrower than in rich countries, these risks very often bear a heavy burden on welfare. If the preferences of agents can be characterized by concave utility functions, these agents will want to spread risk across time and among themselves. We focus here on mechanisms allowing agents to share risk among themselves, and we look more particularly at environments where formal insurance options are incomplete or absent. This thesis offers three chapters which goal is to analyze the extent to which risk sharing is affected by imperfections in the insurance or in the credit markets. In the first two chapters, we take a microeconomic perspective and we examine how rural farmers cope with income shocks in village economies characterized by the absence of formal insurance markets. In the last chapter, we adopt a macroeconomic perspective and we look at the role of the domestic financial sector development in fostering risk sharing through financial integration between countries.

At the microeconomic level, households have relied on informal ways to minimize their exposure to risk and to mitigate the influence of shocks on their welfare when domestic financial institutions are not sufficiently developed to deliver efficient pooling of risks. One way through which risk can be pooled in these environment is through informal tranfers or reciprocated gifts. This channel has been investigated in the anthropological literature by Cashdan (1985) in Northern Botswana, and in development economics with the studies of Foster and Rosenzweig (2001) and Cox (2002). In chapter 1, we build on this work to examine whether inter-household private

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transfers play an insurance role in rural Vietnam. We look at household survey data collected in 1993 and in 1998 to analyze transfer flows, focusing particularly on the relationship between transfer partners and their geographical location. We find that transfer flows do respond to both income and life-cycle shocks at the household level, but this informal insurance occurs essentially within the family network. Moreover, these transfer patterns are consistent with a simple risk-sharing model where contracts cannot be enforced, and where altruism helps increasing the scope for insurance possibilities.

Informal transfers are however not the only possible mechanism on which rural households can rely to cope with realized income shocks. Following the work of Townsend (1994) and of Deaton (1997) in developing countries, we adopt another approach which consists in looking at the outcome of informal risk sharing in terms of consumption instead of focusing on the specific channels throught which this pooling of risks is achieved. In chapter 2, using the same data, we assess the effectiveness of informal risk sharing arrangements in protecting household consumption from idiosyncratic income shocks. We find that households consumption allocations are consistent with optimal risk sharing taking place at the commune level under limited contract enforceability.

At the macroeconomic level, international financial integration should also in theory allow countries to pool idiosyncratic risks. However, a series of financial crises taking place during the 1990's has shown that financial integration is not without risk for the stability of aggregate consumption. In chapter 3 we focus on the influence of domestic financial development in the relationship between financial integration and macroeconomic volatility. Looking at a panel of 90 countries over the period 1960-2000, we find that consumption growth volatility increases with the degree of financial integration in countries with low level of financial development and it decreases in countries with high level of financial development.

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CHAPTER 1

Transfers and Insurance Among Vietnamese Families

1.1. Introduction

In a country like Vietnam, rural households are exposed to a wide range of risks, most of which directly affect their main income generating activity. If these households are risk averse, they will want to insure themselves against income fluctuations one way or another. As in many other developing economies though, formal insurance against these risks, whether private or public-based, is often lacking or incomplete. If formal insurance mechanisms are absent, there exists nonetheless a variety of informal strategies allowing households to either reduce their exposure to risks or to cope with shocks once they have occured (see Alderman and Paxson (1992), Morduch (1999), or Fafchamps (2003) for reviews of this literature).

One possible way by which risk sharing could take place is through informal transfer arrangements in which risk-averse agents agree ex-ante to deliver ex-post a state contingent payment when hit by different idiosyncratic shocks. When contracts are not enforceable ex-post however, the scope for risk sharing diminishes and full insurance is often not achievable. Cox (2002) analyzes the patterns of inter-household transfers in Vietnam during the 1990's and concludes that these transfers are frequent and important. We extend this descriptive analysis by asking whether these transfers serve as a vehicle for risk sharing in rural Vietnam.

The standard conceptual framework in the literature related to transfers has distinguished three major possible determinants of transfers: altruism, pure exchange motives and risk sharing motives (see for example Becker (1974), Cox (1987), Cox et al. (2004), Kazianga (2006)). Another

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approach initiated by Foster and Rosenzweig (2001) analyzes transfer behavior by explicitly accounting for limited commitment issues inherent to informal risk sharing arrangements. Using panel data from rural India and rural Pakistan, they analyze how the degree of altruism affects the shape of risk sharing arrangements when contracts are not perfectly enforceable. To do so, they introduce altruistic agents in the model of risk sharing under limited commitment of Thomas and Worrall (1997). If altruism has no obvious role to play in determining risk sharing arrangements when contracts are perfectly enforceable, the situation is different when the incentives to deviate from an agreement exist. In that case, the scope for risk sharing between selfish agents should decrease substantially, but altruism could in principle increase the possibility of risk sharing within kins.

In this paper, we follow this approach and we use household survey data from Vietnam conducted in 1993 and 1998 to study the determinants of private transfers between rural households. Transfers are large and widespread among Vietnamese families during this period and, most importantly, they often take place within the family circle (see figures 8 and 9). This is why we believe that altruism is an important motive for transfers in rural Vietnam. We ask whether inter-household private transfers play an insurance role for Vietnamese families and, if it does, to what extent are these arrangements influenced by limited commitment problems.

The paper is organized as follows. Following Foster and Rosenzweig (2001), section 2 presents a conceptual framework for private transfers between altruistic agents in an environment where contracts are not perfectly enforceable. The empirical approach and the data are described in sections 3 and 4, and the results are presented in sections 5 and 6. Sections 7 and 8 discuss the results and conclude.

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1.2. Transfers, Altruism and Limited Commitment

The model has two agents $i = 1, 2$ who care about each other in the sense that their single-period utility function depends positively on the other agent's utility:

$$U_1 = u(c_1) + \gamma v(c_2), \tag{1.1}$$

$$V_2 = v(c_2) + \gamma u(c_1). \tag{1.2}$$

The two agents receive a stochastic endowment $y_i(s_t)$ in each period, where s_t denotes the state of nature at date t. States of nature follow a Markov process with probability of transition π_{sr} from state s to state r. There is no possibility of saving across periods. Both $u()$ and $v()$ are increasing and concave and the degree of altruism is captured by the parameter γ, with $\gamma \in (0, 1)$.

Risk-averse agents will be better-off sharing the idiosyncratic shocks on their endowment. One way to model risk sharing possibilities here is to allow agents to send transfers to each other conditional on the realized state of the world and on the past history of events. In this model, contracts are not legally enforceable, so the agents compare at every period t the benefits of sticking to their informal agreements made in the previous periods to the benefits of deviating from it. We assume that the cost of deviating once from an informal arrangement is to revert to a sequence of static Nash equilibria. The nature of this Nash equilibrium depends on the degree of altruism between the partners: for low levels of altruism both agents operate under autarchy, but at higher levels, partial risk sharing is still possible. As such, altruism influences risk-sharing arrangements in an ambiguous way: on one hand, since an agent's utility depends positively on the other agent's utility, altruism directly increases the likelihood of transfers when agents are hit by different shocks; on the other hand, because it

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also reduces the credibility of the reversion to autarchy, it diminishes the ability to sanction deviations from the agreements.

In that environment, the set of feasible contracts can be characterized by a transfer function $\tau(h_t)$ that specifies a transfer flow from agent 1 to agent 2 in period t after history h_t where $h_t = \{s_1, s_2, ..., s_t\}$. If agent 1 receives a transfer, this amount is negative.

First, the transfer function for the static Nash equilibrium given state s_t can be characterized as follows:

- If agent 1 is better-off than agent 2 to the point that his marginal utility of consumption is lower than the weighted marginal utility of his partner (where the weight is the altruism parameter γ), i.e.

$$u'(y_1(s_t)) < \gamma v'(y_2(s_t)),$$

then agent 1 will transfer a positive amount TR^N to agent 2 (out of pure altruism, $\gamma > 0$) so that after transfers, agent 1's marginal utility is equal to the weighted marginal utility of his partner.

$$u'\left(y_1(s_t) - TR^N(s_t)\right) = \gamma v'\left(y_2(s_t) + TR^N(s_t)\right). \tag{1.3}$$

- Conversely, if agent 1 is worse-off than agent 2 to the point that his weighted marginal utility (from the perspective of agent 2) is higher than his partner's marginal utility, i.e.

$$v'(y_2(s_t)) < \gamma u'(y_1(s_t)),$$

then agent 1 will transfer a negative amount TR^N to agent 2 so that marginal utilities adjusted for the altruism parameter are equalized after transfers

$$v'\left(y_2(s_t) + TR^N(s_t)\right) = \gamma u'\left(y_1(s_t) - TR^N(s_t)\right). \tag{1.4}$$

- $TR^N = 0$ otherwise, i.e. no transfer takes place.

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Now we can define for agent 1 the expected discounted utility gain from the risk-sharing arrangement with respect to the sequence of static Nash equilibria defined above as:

$$\begin{aligned} U(h_t) &= \left[u\left(y_1(s_t) - TR_t(h_t)\right) + \gamma v\left(y_2(s_t) + TR_t(h_t)\right)\right] \\ &- \left[u\left(y_1(s_t) - TR^N(s_t)\right) + \gamma v\left(y_2(s_t) + TR^N(s_t)\right)\right] \\ &+ E\sum_{j=t+1}^{\infty} \beta^{j-t}\{\left[u\left(y_1(s_j) - TR_j(h_j)\right) + \gamma v\left(y_2(s_j) + TR_j(h_j)\right)\right] \\ &- \left[u\left(y_1(s_j) - TR^N(s_t)\right) + \gamma v\left(y_2(s_j) + TR^N(s_t)\right)\right]\} \end{aligned} \tag{1.5}$$

where β is the time discount factor. This is just the present value difference between the expected utility of enforcing the contract and the expected utility of deviating from it. The first two lines represent the immediate gain from the contract while the last two lines describe the continuation gain of participating in the arrangement. We can write a similar expression $V(h_t)$ for agent 2.

In this environment, since contracts are not legally enforceable, any feasible contract has to satisfy the following implementability constraints:

$$U(h_t) \geq 0$$

and

$$V(h_t) \geq 0$$

for each history h_t. In other words, the informal risk sharing arrangements are enforced only inasmuch as the expected utility of maintaining the arrangement is higher, given history h_t, than the expected utility of deviating from it. These conditions define a set of sustainable contracts, among which lies the set of constrained-efficient contracts.

Next, $V_s(U_s)$ can be defined as the Pareto frontier which maximizes

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household 2's expected discounted utility for the realized state of nature s at date t, given that household 1 enjoys at least $U(s_t)$. The Markov assumption implies that the problem is recursive. Moreover, since any efficient contract must have an efficient continuation contract, the implementability constraints outlined above depend only on the current state of nature. Therefore, the Pareto frontier too depends only on the current state s and not on the past history[1]. The Pareto frontier $V_s(U_s)$ can thus be defined as:

$$V_s(U_s) = \max_{TR_s,(U_r)_{r=1}^S} \left\{ [v(y_2(s)+TR_s)+\gamma u(y_1(s)-TR_s)] + \beta \sum_{r=1}^{S} \pi_{sr} V_r(u_r) \right\}$$

such that:

$$\begin{aligned}
\lambda &: [u(y_1(s)-TR_s)+\gamma v(y_2(s)+TR_s)] \\
&\quad -\left[u\left(y_1(s)-TR_s^N\right)+\gamma v\left(y_2(s)+TR_s^N\right)\right] + \beta \sum_{r=1}^{S} \pi_{sr} U_r \geq 0 \\
\beta\pi_{sr}\phi_r &: U_r \geq 0 \\
\beta\pi_{sr}\mu_r &: V_r(U_r) \geq 0 \\
\psi_1 &: y_1(s)-TR_s \geq 0 \\
\psi_2 &: y_2(s)+TR_s \geq 0.
\end{aligned}$$

The first order conditions and the envelope condition for this problem are:

$$\begin{aligned}
\frac{v'(y_2(s)+TR_s)+\gamma u'(y_1(s)-TR_s)}{u'(y_1(s)-TR_s)+\gamma v'(y_2(s)+TR_s)} &= \lambda + \frac{\psi_1-\psi_2}{u'(y_1(s)-TR_s)+\gamma v'(y_2(s)+TR_s)} \\
-V_r'(U_r) &= \frac{\lambda+\phi_r}{1+\mu_r} \\
\lambda &= -V_s'(U_s) \qquad (1.6)
\end{aligned}$$

The slope of the Pareto frontier for which both agents equalize their marginal utility is given by $-\lambda$. More specifically, for each state s there is

[1]See Thomas and Worrall (1988) and Thomas and Worrall (1997).

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a history independent interval $\left[\underline{\lambda_s};\overline{\lambda_s}\right]$ such that the dynamics of $\lambda(h_t)$ can be described by:

$$\lambda(h_{t+1}) = \left\{ \begin{array}{cc} \underline{\lambda_s} & \text{if } \lambda(h_t) < \underline{\lambda_s} \\ \lambda(h_t) & \text{if } \lambda(h_t) \in \left[\underline{\lambda_s};\overline{\lambda_s}\right] \\ \overline{\lambda_s} & \text{if } \lambda(h_t) > \overline{\lambda_s} \end{array} \right\} \tag{1.7}$$

The dynamics of the optimal implementable contract can be described as follows. The agents first agree on a distribution of current and future resources given the current state of the world. This allocation corresponds to a point on the Pareto frontier $V_s(U)$. The negative of the slope of the Pareto frontier at this point defines a ratio of single period marginal utilities λ_0 that the agents are willing to maintain in the next period. When the next period unfolds, and as long as the implementability constraints are satisfied for both agents, transfers take place in order to maintain marginal utilities at λ_0. When an implementability constraint binds, however, i.e when the better-off agent would prefer to deviate and revert to the sequence of static Nash equilibria, the current resource allocation is adjusted together with the continuation payoff just as much as to satisfy the implementability constraints for both agents. A new ratio of marginal utilities λ_1 is thus defined and maintained until another implementability constraint binds again.

In comparison to this, the first-best contract is a stationary contract and is defined such that $\lambda = 1$ at all points in time. When contracts are perfectly enforceable, then the agents can just pool their endowment together and divide it equally amongst them at every period. If contracts are not enforced ex-post, however, the better-off household can sometimes prefer to walk away from the arrangement made in the previous period, keep his high endowment for himself and remain in the static Nash equilibrium for the following periods. In these cases, what the optimal implementable contract does is to change the repartition rule in favor of the better-off agent just enough as to prevent him of deviating from the risk-sharing arrangement.

Foster and Rosenzweig (2001) resort to numerical simulations to derive qualitative implications for the shape of the optimal contract by varying the degree of altruism, imperfect commitment and also income covariance. A key prediction of this model is that when contracts are not enforceable ex-post, current transfers should depend on past transfers. When limited commitment is not an issue, however, full risk sharing is possible, and the implementability constraints never bind. In this case, current transfers are not history dependent.

Assuming that altruism is greater among family members, the above model has interesting implications for the determination of transfers within and between families. If limited commitment matters in the design of informal insurance contracts, then, holding the level of income correlation between transfer partners constant, families are expected to play a more important role in the provision of insurance.

1.3. Estimation Strategy

An exact representation of the relationship between current shocks, past history and current transfers would require information that is usually not available in typical survey data (such as the joint distribution of income for the two agents). An alternative and simpler approach suggested by Foster and Rosenzweig (2001) starts with a linear approximation of the transfer function. They use simulated data from the model to carry regression analysis and to derive specific predictions on the coefficients of the linearized transfer function. These estimates are compared with those obtained from survey data using the same specification and estimation procedure. We follow the same approach here.

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Equation (1.6) can be solved for TR and then linearized. A measure of transfer history is obtained by using the sum of past transfers as a proxy for $\lambda(h_t)$:

$$T_{it} = \sum_{t=0}^{t-1} TR_{it}. \tag{1.8}$$

The linear approximation of the transfer function can then be written as

$$TR_{it} = \alpha_0 + \alpha_1 T_{it} + \alpha_2 y_{it} + \alpha_3 y_{-it}, \tag{1.9}$$

where y_{-it} is the income of the transfer partner and TR_{it} is the net transfer amount received by agent i from its partners. Usually, however, the income of the transfer partner y_{-it} and the complete history of transfers up to time t are not observed. One way to address this issue is to assume first that income can be decomposed into a fixed anticipated part and an unanticipated i.i.d part: $y_{it} = \overline{y}_i + \epsilon_{it}$. Then, we need also to assume that the correlation between the transfer partners error term ρ can be written such that $\epsilon_{-it} = \rho\epsilon_{it} + u_{-it}$. Finally, by substituting these terms and taking the first difference of equation (1.9), we have the following reduced form

$$\triangle TR_{it} = \alpha_1 TR_{it} + \alpha_4 \triangle \epsilon_{it} + \alpha_3 \triangle u_{-it}, \tag{1.10}$$

where $\triangle$ is a (forward) first difference operator and $\alpha_4 = \alpha_2 + \rho\alpha_3$. Observations for at least 2 periods are now needed to estimate (1.10). In the case of symmetric transfer arrangements ($\alpha_3 = -\alpha_2$), if partners income are not perfectly correlated ($\rho < 1$), then $sgn(\alpha_4) = sgn(\alpha_3)$.

Note that these reduced form estimates will suffer from a potential endogeneity bias. First, lagged transfers appear both in the dependent variable $\triangle TR_{it}$ and on the right hand side of (1.10). Second, endogeneity could arise because of measurement error in agent i's income, and finally,

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because the unobserved partner's income shock u_{-it} is likely to be correlated with the current transfer level of i. To address endogeneity issues we use instruments for all the potentially endogenous right hand side variables. More specifically, we include inherited land holdings, interacted with past natural disaster shocks in our set of instruments. We assume that these are orthogonal to u_{-it}. A history of natural disaster shocks in the five year preceding the first survey round was recorded at the commune level. Besides, we take that inherited land holdings (dry and irrigated) reflect the initial asset position of rural households. The interaction of inherited land holdings with a five year history of natural disasters shocks should thus be a relevant predictor for the transfer asset stock at the begining of the survey period. Moreover, inherited land holdings interacted with natural disaster shocks between 1993 and 1997 should form reasonable instruments for income shocks experienced between the two survey rounds.

Using simulated data from their model and the above estimation framework, Foster and Rosenzweig (2001) derive a set of testable predictions for the patterns of private transfers between altruistically related agents in an environment where commitment is limited. We will compare the shape of private transfers in Vietnam against the following predictions:

- [P1] If risk sharing is a motive driving inter-household private transfers, then positive income shocks should be associated with a reduction in received transfers, so $\alpha_4 < 0$.
- [P2] Even in the presence of high degree of altruism between partners, risk-sharing arrangements can be restricted because of commitment problems. This restriction will be translated in the data through a certain degree of negative history dependence in current transfers. Holding income correlation between partners constant, individuals who received assistance in the past are less likely to receive transfers in the current period compared to individuals who

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did not receive assistance in the past. This means that when commitment constraints are binding, $\alpha_1 < 0$.

- [P3] Both for family and non-family partners, transfers should be more sensitive to income shocks the lower the degree of income correlation between partners.
- [P4] For similar degrees of income correlation between partners, transfers should be more responsive to shock and less history dependent when altruism is higher.
- [P5] When the degree of altruism between partners is sufficiently high, history dependence is higher when income correlation is higher.

Because it contains relatively detailed and disaggregated information on the origin of transfers received and on the destination of transfers sent, the panel dataset from the Vietnam Living Standard Survey (VLSS) conducted in 1993 and in 1998 allows us to test the main predictions of the Foster and Rosenzweig (2001) model. In their paper, Foster and Rosenzweig showed that the main predictions of the model are supported by the ICRISAT Village Level Studies (VLS) from India. Our work is complementary to theirs to the extent that we use a dataset that differs substantially in dimension to the Indian data: the ICRISAT data covers 6 villages and 207 households over up to 10 years while the VLSS covers 156 communes and 4305 households over 2 time periods.

1.4. Transfers in the Vietnam Living Standard Survey

This section presents the dataset and the variables of interest, together with a descriptive overview of the patterns of transfers in Vietnam between 1993 and 1998.

1.4.1. The Vietnam Living Standard Survey. The VLSS was designed to provide nationally representative data on household living standards to be used in policy design, monitoring of living standards and evalu-

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ation of policies and programs. The basic sample frame was obtained from the 1989 Population Census from which 4,799 households were sampled in 1993. This sample was chosen to be representative of the whole population and self-weighting. In 1998, over 1,500 households were added to the initial sample and a total of 4,305 households were re-surveyed, providing a relatively large sample but with a short time dimension. Information was collected both at the commune and household level, covering areas such as health, education, employment activities, agricultural production, non-farm business, asset ownership and transfers.

We focus here on households interviewed in the two survey rounds and living in rural areas because commune level information was collected in rural areas only. This constitutes a panel of 3465 households interviewed both in 1993 and in 1998. Table 1, 2a and 2b present some summary characteristics for our sample. Households in our sample are distributed across 120 communes and in 7 administrative regions[2].

The VLSS does not provide direct calculations of household income, but detailed information on the sources of income is available and allows us to estimate household real income for the whole sample in both years. Nominal income is corrected in both years for monthly and regional price variations. Moreover we express income from 1993 in 1998 terms[3]. From the survey information, total income can be disaggregated into 5 components: (1) income from land payments, (2) income from agricultural activities, (3) non-farm self-employment income, (4) wage income, and (5) other income (including public and private transfers). The details concerning these broad income components are given in Appendix 1.

Income estimates obtained by aggregating these various components are in line with the estimated total consumption expenditures given by the

[2]Communes are the basic local level administrative unit, and each commune has a number of villages from which households were sampled (on average 2 villages were selected in every commune).

[3]In 1998, the exchange rate between VND and USD was approximately 13,900 VND for 1 USD.

survey (table 1). We focus more specifically on pre-transfer income, which is total income plus transfers sent to other households minus transfers received from other households. Between 1993 and 1998, pre-transfer income grew at an annual rate of 9% while total consumption per capita grew at an annual rate of 8%.

The structure of income for our sample of rural households is represented in figures 2 and 3. The main component of rural households' income is derived from agricultural activities. Figure 1 and table 2 show the regional repartition of income in 1993 and 1998. Southern regions grew more rapidly than northern regions[4].

1.4.2. Inter-Household Transfers in 1993 and in 1998. Our focus is on transfers defined as any amount of money or the real value of goods received (sent) from (to) individuals who are not members of the household but who resided in Vietnam during the past 12 months preceding the interview.

A noticeable feature of transfer patterns in rural Vietnam is that despite rapid economic growth between 1993 and 1998, transfers remained relatively important. The percentage of rural households participating in transfer activities (receiving transfers, sending transfers or both) is relatively high in both years, and it actually increased from 24% in 1993 to 33% in 1998 (table 3). This increase in the transfer participation rate was also noted by Cox (2002) who looked at the whole VLSS sample and reported and increase in the participation rate from 35% in 1993 to 39% in 1998. Not only participation in transfer activities increased between 1993 and 1998, but so did the magnitude of transfers, both in absolute and in relative terms (table 4). The amounts of transfers received were already relatively important in proportion to receivers pre-transfer income in 1993 (16.3%), and in the second round of the survey this ratio was close to 20%.

[4]In the figures and in the tables, regions from left to right correspond to regions from North to South.

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We notice a similar trend for transfers out. These represented 5% of net senders pre-transfer income in 1993 and 8% in 1998.

Furthermore, transfers in rural Vietnam seem to flow from richer to poorer households (table 5). In both rounds of the survey, net senders income before transfers was close to twice the level of income for net receivers, and this difference is statistically significant at a 99% confidence level. Moreover, comparing the age distribution of household heads according to their transfer status, we observe that net senders are predominantly in the active age range while net receivers are not. The age distribution of household heads for net receivers is clearly bimodal in both years of the survey, with a mode at the early stage of active life and the other mode at retirement age (see figure 4). This suggests that among the many potential motives underlying transfer flows in rural Vietnam, redistribution is an important one, both from the richest to the poorest and from the economically active to the non-active.

An interesting characteristic of the VLSS data on transfers is that some information about the transfer partners is available (such as their relationship and their geographical location at the province level[5]. This allows us to look at the geography of transfer flows in rural Vietnam. A non-negligible amount of inter-household transfers occurs outside the local vicinity. While 63-65% of the transfers take place within the same province in 1998, the percentage of transfers involving partners located in different regions is around 51-54% (table 6). Looking now at the relationship between transfer partners, we note that a large majority of transfer flows involves family members, most of which are close family members. Between 1993 and 1998, the proportion of transfers taking place outside the family circle remains more or less the same (3-5%) while the proportion of transfers involving extended family members increase from about 20% to about 30% (figures 8 and 9).

[5]Unfortunately, this information is not available at the village nor at the commune level.

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Overall, the VLSS dataset appears particularly suited to serve as a basis to analyze risk sharing through inter-household transfers. Transfers are frequent and important, and they involve partners experiencing different degrees of income correlation. Moreover, if risk sharing takes place through transfers, the information relative to the relationship of the transfer partners will allow us to investigate the role of altruism in determining the shape of the risk sharing arrangements.

1.5. Empirical Analysis

Having the model presented in section 2 in mind, we use the information available in the VLSS to assess whether transfers provide some insurance against income shocks in rural Vietnam. Then, we examine whether risk sharing through transfers is somehow constrained by limited commitment. Finally, we also attempt to determine whether altruism plays a role in shaping informal risk sharing arrangements.

The empirical tests are based on equation (1.9). Using a fixed-effects IV regression and treating the transfer partner's income y_{-it} as an unobserved variable (together with the additional assumptions that $y_{it} = \overline{y}_i + \epsilon_{it}$ and that $\epsilon_{-it} = \rho\epsilon_{it} + u_{-it}$) yields the reduced form equation (1.10). Three asset stock variables are also introduced in equation (1.9) to account for the fact that some households in rural Vietnam have access to some form of saving technology: the real value of livestock holdings, the real value of savings and the real value of owned capital equipment. While the real value of livestock holdings and of savings remained almost the same between 1993 and 1998, the value of capital equipment owned increased by 33% between the two survey rounds (table 7).

Table 2 and figure 1 show us that the Central Highlands region experienced a larger income growth compared to the other regions. This is due to the fact that this region is specialized in the production of coffee (84%

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of the farmers in this region) and to the fact that world coffee prices increased dramatically between 1993 and 1998. Since most of the farmers in the Central Highlands were net senders, we checked the robustness of our findings by dropping the coffe producers from the sample. This did not change our results[6].

Finally, we also control for insurance transfers received from the government. The proportion of households receiving government transfers (social insurance funds and social subsidies) is stable around 20% in both rounds of the survey (table 1).

1.5.1. Instrumental Variables. Since income shocks ϵ_{it} are likely to be measured with error, we treat income shocks as endogenous in (1.10). Inherited land holdings (irrigated and non-irrigated) at the household level, and their interaction with natural disasters at the commune level are used as instruments for income shocks. Moreover, because the transfer stock at the beginning of the period is determined simultaneously with the dependent variable, we also use inherited land holdings interacted with the history of natural disasters as instruments for the stock of transfers. The average surface of owned non-irrigated land in rural Vietnam remains more or less the same between 1993 and 1998 (0.43 Ha and 0.44 Ha). The average surface of irrigated land, however, grows from 0.32 Ha in 1993 to 0.37 Ha in 1998 (table 8). Natural disasters include droughts, pests, floods, typhoons and any other weather related events that lead to a reduction in production of 10% or more at the commune level. The occurrence of such events was recorded at the commune level between 1993 and 1998, and also in the past 5 years preceding the first round of the survey (see figure 10). Between 1988 and 1993, the number of natural disasters reported varied between 0 and 15, and in 1993 alone, half of the sampled communes reported at least one such natural disaster in the 12 months preceding the interview. We assume

[6]The results are not reported here, but are available on request.

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here that the initial state variables represented by land holdings and their interaction with past natural disasters are good predictors for TR_{it}, but are otherwise unrelated to $\triangle TR_{it}$.

Moreover, the value of savings, of livestock and of capital equipment are also treated as endogenous and we use their level at the begining of the period as an instrument for the change between 1993 and 1998.

Our instrumental variables must satisfy two requirements: they must be relevant (correlated with the endogenous regressors) and valid (orthogonal to the error term). The consequence of relying on weak instruments is that the resulting IV estimates can be even more biased than simple OLS estimates (Staiger and Stock (1997)). In order to assess whether our instruments are sufficiently relevant, we look at $F-statistics$ and at the partial R^2 measure from the first stage regressions (Shea (1997)). Moreover, we also run underidentification and weak instruments tests[7]. The results of these tests are reported in table 9 and in table 10. These suggest that our regression model is not underidentified and that our instruments are sufficiently correlated with the endogenous regressors. Finally, table 10 also reports the results from overidentification tests which suggest that the model is correctly specified and that the orthogonality conditions are valid.

A last issue of concern regarding our IV estimation strategy is the potential influence of heteroskedasticity on our estimates. If heteroskedasticity is present, standard IV estimates are still consistent but standard errors are inconsistently estimated and this is problematic to conduct inference. Most importantly, the identification tests mentioned before are going to be invalid in the presence of heteroskedasticity[8]. The usual approach when facing heteroskedasticity of unknown form is to resort to the Generalized

[7]We used the routines `ivreg2` in `STATA` (Baum et al. (2007))

[8]While the identification tests based on Cragg and Donald (1993) depend on the validity of the *i.i.d* assumption, the analog tests proposed by Kleibergen and Paap (2006) are robust to heteroskedasticity, autocorrelation and clustering. Since heteroskedasticity was detected in some cases (table 11), the identification tests reported on table 10 are derived from Kleibergen and Paap (2006).

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Method of Moments (GMM) introduced by Hansen (1982). In the context of IV estimation, the moment conditions are derived from the exogeneity assumption imposed on the instrument set.

In addition to potential heteroskedasticity of unknown form, within-group correlation of errors is likely to be an issue in the context of commune level data. The consequences of having clustered errors are similar to those of heteroskedasticity: GMM estimates will still be consistent, but not efficient. To address these issues we follow White (1980) and Arellano (1987) who suggest estimation methods for the variance-covariance matrix of the GMM estimator which are robust to both arbitrary heteroskedasticity and intragroup correlation.

The Breusch-Pagan/Godfrey/Cook-Weisberg test is a standard procedure to assess the presence of heteroskedasticity in a regression (Breusch and Pagan (1979), Godfrey (1978), and Cook and Weisberg (1983)). This test relies heavily on two important assumptions: (1) normally distributed errors and, for the IV case, (2) homoskedasticity in the first stage equations (relating the endogenous regressors to the instruments). Koenker (1981)'s test statistic relaxes the first assumption and Pagan and Hall (1983) proposed a test which relaxes the second assumption. The results for these tests are resented in table 11. Depending on the distribution assumption imposed on the errors, these tests provide conflicting conclusions. Assuming that the errors are normally distributed the tests always reject the null hypothesis of homoskedasticity, but relaxing this assumption almost always results in failure to reject the null. Given that the heteroskedasticity tests give an ambiguous conclusion, and given that we want to allow for intragroup correlation at the commune level, we choose to estimate our model using 2-step efficient GMM estimation with cluster-robust standard errors.

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1.6. Results

Fixed effects estimates are obtained with OLS after taking the first difference of equation (1.9). We examine first a simple version of the model where we only control for household characteristics, past transfer history and income shocks. Then, in order to account for the fact that rural households also have the possibility to transfer part of their consumption good from one period to another, we augment the base model with asset stock variables. We also include a dummy variable indicating whether the household received some form of formal insurance through public transfers (for pension, disability, war veterans and other types of social subsidies).

The regressions are conducted with and without the instrumental variables and the results are presented in table 12 for the whole sample. Two important results emerge here which correspond to predictions P1 and P2 (see section 1.3). First, net received transfers respond negatively to own income shocks which is consistent with transfer flows playing an insurance role for rural households. Second, transfers received today do depend negatively on transfers received in the past which suggests that informal transfer arrangements are shaped like credit relations where past debt influences current borrowings, everything else equal. This pattern also suggests that if insurance takes place through transfers, the scope for risk sharing is limited by binding commitment constraints. Full insurance is thus rejected by the data because this would imply no history dependence for current transfers.

If received transfers respond positively to negative transitory income shocks, they also seem to respond to longer term shocks such as changes in the household demographic structure. Households with a higher proportion of dependent members (youngsters and elderly) are more likely to receive assistance. Contrasting the baseline model with the augmented model (1c and 1d in table 12), we note that the magnitude and the direction of the

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coefficients for the variables of interest are preserved. In general, transfers do not seem to depend much on the value of assets held by rural households. The only exception to this is savings which influence positively the amount of transfers received. Looking also at formal transfers, it seems that public subsidies are indeed substitutes to informal transfers. However, the coefficient for this variable is not significantly different from zero.

The model considered in section 1.2 implies that transfer flows should vary according to the degree of altruism and to the degree of income correlation between partners. We cannot directly observe these parameters from our data, but we can use the fact that we have some information concerning the geographical location and the relationship of the transfer partners to confront the model's predictions to the data. For that, we need to make two additional assumptions. First, we assume that the degree of altruism is higher among close-family members than among non-family members or among extended-family members[9]. Second, we take that income correlation is higher within provinces than across provinces. This allows us to look at the role of altruism and of income correlation in shaping informal transfers. When splitting the transfers according to location or relation between partners, we include only the lagged transfer stock for each specific kind of transfers[10].

Columns (2) and (3) of table 13 present estimation results distinguishing between family and non-family transfers respectively. While transfer flows provide some insurance among family members, these transfers do not respond to transitory income shocks when we look at transfers taking place outside the family circle. This is consistent with the model outlined

[9]As suggested by figures 8 and 9, most transfers in rural Vietnam take place among close-family members and few transfers occur among non-relatives. To avoid having too much unbalance in our subsamples, we regroup both non-relatives and extended family members in the category "non-family".

[10]Initially, we included also lagged values of the other transfer types. Joint significance of the cross-transfer variables was however rejected at conventional significance level, so we excluded these cross-terms from our specification.

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in section 1.2, in which the scope for risk sharing under limited commitment is higher for high degrees of altruism between partners. Despite the fact that risk sharing with non-kins could be potentially beneficial because income correlation among non-family members is likely to be lower than among family members, these benefits do not appear to be strong enough compared to the costs imposed by commitment issues. Likewise, insurance against life-cycle shocks at the household level also takes place only at the family level. The coefficient of the age dependency ratio in the non-family transfer function is not statistically different from zero. Rural Vietnamese families thus seem to use transfers to share risks of different nature. While the type of income shocks we are looking at is more transitory and unanticipated, life-cycle shocks at the household level are certainly less transitory and more predictable. Informal insurance in rural Vietnam seems to take place primarily within the close-family network.

Current transfers, however, are still influenced negatively by past transfers both for family-based transfers and for non-family transfers. Thus, even when altruism is high, commitment issues are still limiting the scope for risk sharing. This could reflect the fact that if on one hand altruism allows more risk sharing to take place because partners care about each other, on the other hand, altruism also introduces a deterrent effect for risk sharing by reducing the credibility of the punishment threat after one agent deviates from the informal arrangement.

History dependence of informal transfers seems lower for family transfers than for non-family transfers, suggesting that the effects of limited commitment are less binding among close family members. This could be due to the fact that altruism is more important among close family members, but it could also be resulting from the fact that information relative to past transfer history is better shared among close-family members. One way to distinguish between these two possibilities is to look at family transfers within and across localities. To the extent that information sharing concerning past violations of arrangements should also be higher at the local level (even for non-family members), comparing the history dependence effects for family members and for non-family members located in the same province should reflect the role of altruism only.

In colum (4) and (5) of table 13, the transfer function is estimated separately for flows remaining within the provinces and for inter-provincial flows. The underlying assumption here is that transfer partners located within the same province are likely to have higher income correlation compared to transfer partners located in different provinces. Transfers do respond to shocks both within and between provinces. History dependence is higher for transfers taking place at the local level, and the response of transfers to income shocks seems also to be stronger at the provincial level. This last result would seem to contradict prediction P3 outlined in section 1.3, but since we do not control here for the level of altruism between partners, it is hard to distinguish the role of income correlation from that of altruism. As suggested by the model presented above, when commitment is limited, risk sharing is facilitated both by lower income correlation and by higher degree of altruism between partners.

We now estimate the transfer function by splitting our sample according to the relation and to the location of partners, but now we consider both dimensions simultaneously. This allows us to look at the effects of altruism by controlling for income correlation and vice versa. Foster and Rosenzweig (2001)'s model suggests that when the degree of altruism is sufficiently high, history dependence is positively associated with income correlation. Moreover, holding the degree of income correlation constant, transfers should be more responsive to income shocks and less history dependent for a higher degree of altruism. Both predictions seem to be supported by the data when we look at table 14. Focusing on family transfers, the coefficient on past transfers is more negative for transfers taking place within the provincial level (P4). Comparing family transfers (column (6)) to non-family transfers (column (8)) within provinces, we can see that higher degrees of altruism are indeed associated with slightly lower history dependence and with a stronger response of transfers to income shocks (P5). Given that we are looking at transfers taking place at the local level, where information regarding past transfer history is assumed to be better shared, we interpret this last result as reflecting the fact that it is altruism per se, more than improved information sharing within the family circle, that alleviates the limited commitment constraints on risk sharing. The fact that the coefficient on income shocks is close to zero for non-family members suggests that transfers are not driven by risk sharing motives outside the close family circle.

1.7. Discussion

Even in the absence of well established markets or formal mechanisms to properly insure against risks, households still have the possibility to either manage their exposure to risks or cope with the consequences of adverse shocks once they have occured. The current analysis focused on one mechanism out of a broad portfolio of strategies available.

We compared the patterns of inter-household transfer flows in rural Vietnam to the predictions of a model of risk sharing with limited commitment and altruistically related agents. Since two key parameters of the model are not directly observable in the data (the degree of altruism and the degree of income correlation between transfer partners) we had to distinguish between family-based transfers and non-family transfers, and also between transfers taking place at the local province level and those flowing across provinces. Although this is certainly not the ideal way to control for altruism and for income correlation, it gives a first idea of how commitment issues interact with altruism to shape insurance transfers in a country like Vietnam.

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Inter-household transfers are important in Vietnam, both in frequency and in magnitude, especially at the family level. These transfers did not diminish between 1993 and 1998, which is a period where Vietnam experienced high and sustained growth levels. Moreover, public transfers do not seem to be crowding out informal insurance arrangements at the family level.

One possible explanation behind these trends is the Confucian nature of Vietnamese culture which places filial loyalty to parents at the center stage of social relations. In that case, it would be difficult to extend these results to other environments where social institutions are built on different cultural background. The way altruism and commitment issues interact to shape informal transfers should thus be empirically documented in different contexts to see whether these transfers are an effective vehicle for insurance and whether informal transfers are complements or substitutes to formal insurance. Albarran and Attanasio (2003) for example found evidence that public transfers are substitutes to private transfers in Mexico. This crowding out effect is shown however to be larger in communities where the variance of income is smaller.

1.8. Conclusion

We have looked at household data collected in rural Vietnam in the 1990's to ask whether informal transfers serve as a vehicle for insurance in an environment where insurance markets are absent and where contracts are not enforceable ex-post. In this kind of environment, Foster and Rosenzweig (2001) have shown that altruism helps alleviating commitment problems and could thus enlarge the scope for potential risk sharing between agents. By distinguishing transfers along two observable dimensions, the location and the relation between transfer partners, we were able to confirm the findings of Foster and Rosenzweig (2001) using a different dataset.

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Transfers in rural Vietnam provide some insurance by responding to income shocks and to life-cycle shocks within close-family networks only. For non-family members, altruism is too low and commitment issues too high for risk sharing to take place. A higher degree of altruism at the family level, together perhaps with better information sharing, allow for higher risk sharing through informal transfers. Nevertheless, even if partial insurance is provided, lack of commitment constraints are still binding and prevent full risk sharing to take place.

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Appendix

Appendix: Income calculation details.

(1) Land payments:
  (a) payments received from rent (+)
  (b) payments made to use owned land (-)
  (c) payments made to use rented land (-)
(2) Agricultural income:
  (a) Crop
  (b) By-products
  (c) Home-production
  (d) Livestock
  (e) Water product
  (f) Lease of farming equipment
(3) Non-farm self-employment (income from family business)
(4) Wage income
(5) Other income
  (a) Private transfers
  (b) Scolarship
  (c) Pensions
  (d) Subsidies
  (e) Interest on savings, loans
  (f) Gifts
  (g) Inheritance
  (h) Lottery gains
  (i) Lease of building
  (j) Lease of machines

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Tables

Table 1: Summary Characteristics of Households in Sample.

N = 3465	1993		1998	
	Mean (sd)	Median	Mean (sd)	Median
Household size	5.08 *(2.1)*	5	4.84 *(1.95)*	5
Age of head	45.2 *(14.7)*	42	47.86 *(13.9)*	45
Age dependency ratio	.422 *(.23)*	.5	.398 *(.25)*	0.43
Consumption per capita*	1614.6 *(943.7)*	1294.3	2218.5 *(1361.1)*	1897.8
Total income per capita*	1725.3 *(2398.5)*	1409.5	2753.2 *(2743.5)*	2081.5
Pre-transfer income*	1695.7 *(2420.1)*	1383.4	2716.9 *(2889.4)*	2047.3
Total land surface^{+a}	3804.1 *(5044.9)*	2628	3670.8 *(5692.0)*	2379
Irrigated land surface^{+a}	1947.5 *(3549.3)*	1099	2629.7 *(4602.8)*	1620
# disasters in past 5 years	3.96 *(3.17)*	3	6.19 *(6.44)*	5
Value of livestock^{*a}	1917.1 *(3921.9)*	1024.8	1856.6 *(2602.5)*	915.6
Value of equipment^{*a}	751.3 *(3321.7)*	62.9	1226.6 *(4659.8)*	152.2
% participating in transfers	24.1 *(42.8)*	.	33.4 *(47.2)*	.
% sending transfers	11.9 *(32.4)*	.	16.9 *(37.5)*	.
% receiving transfers	14.1 *(34.8)*	.	20.6 *(40.4)*	.
Amount sent (senders)^{*b}	552.4 *(1381.8)*	236.6	1449.0 *(3675.9)*	448.4
Amount received (receivers)^{*b}	892.5 *(1612.3)*	460.1	1566.9 *(3198.8)*	646.7
% Receiving public transfers*	19.6 *(39.7)*	.	21.2 *(40.9)*	.

Notes: (*) Thousand VND in real 1998 value ; (+) Square meters.

(^{a}) Unconditional estimates. (^{b}) Conditional estimates.

The average ages reported in table 1 for 1993 and 1998 do not account for (a) heads who moved, (b) heads who died and (c) heads who changed. The reported average age difference is less than 5 because the new heads in 1998 were usually younger than previous heads in 1993.

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Table 2a: Summary Characteristics of Households in Sample [By Regions, in 1993]

	North Mountains	Red River Delta	North Central Coast	South Central Coast	Central Highlands	Southeast	Mekong River Delta
N	606	817	550	374	115	296	707
Household size	5.28 *(1.9)*	4.30 *(1.6)*	4.91 *(1.95)*	5.22 *(2.64)*	6.02 *(2.43)*	5.36 *(2.25)*	5.63 *(2.24)*
Age of head	41.1 *(13.8)*	44.2 *(14.3)*	45.3 *(15.2)*	48.2 *(15.5)*	45.4 *(14.7)*	46.4 *(14.0)*	47.4 *(14.5)*
Age dependency ratio	.441 *(.22)*	.399 *(.25)*	.453 *(.23)*	.425 *(.23)*	.478 *(.20)*	.394 *(.22)*	.410 *(.228)*
Consumption*	1350.8 *(613.6)*	1557.0 *(715.9)*	1416.8 *(634.8)*	1651.2 *(918.7)*	1399.6 *(712.0)*	2056.7 *(1376.5)*	1883.4 *(1250.0)*
Total income*	1338.5 *(856.1)*	1765.2 *(1659.9)*	1407.8 *(2079.6)*	1360.5 *(1179.8)*	1426.4 *(1199.7)*	2233.9 *(2334.9)*	2269.6 *(4126.9)*
Pre-transfer income*	1323.0 *(1002.2)*	1724.6 *(1691.1)*	1367.5 *(2091.1)*	1326.6 *(1194.4)*	1429.5 *(1202.5)*	2206.7 *(2350.6)*	2245.7 *(4136.1)*
Total land surface+	3396.6 *(3875.0)*	2481.4 *(1445.3)*	2955.8 *(2321.2)*	2719.4 *(2813.9)*	2174.6 *(3794.9)*	4176.8 *(5537.2)*	7060.67 *(8489.7)*
Irrigated land surface+	1356.02 *(1494.5)*	2084.3 *(1259.6)*	1504.3 *(1630.3)*	1534.7 *(2289.7)*	100.0 *(327.6)*	1428.9 *(3581.7)*	3348.6 *(6684.7)*
# disasters in past 5 years	2.82 *(2.10)*	3.19 *(2.90)*	7.44 *(3.68)*	4.48 *(4.31)*	4.93 *(3.81)*	2.63 *(2.15)*	3.24 *(1.95)*
Value of livestock*	2590.5 *(2209.7)*	1399.0 *(1462.9)*	2556.0 *(7714.8)*	2291.8 *(2871.1)*	1371.8 *(2108.3)*	2042.4 *(4363.4)*	1326.7 *(2849.3)*
Value of equipment*	283.6 *(667.1)*	238.4 *(438.4)*	272.4 *(635.4)*	299.1 *(896.3)*	1645.3 *(4564.3)*	1405.4 *(5056.8)*	1938.9 *(6021.1)*
% participating in transfers	24.1 *(42.7)*	30.8 *(46.2)*	28.5 *(45.2)*	17.6 *(38.2)*	11.3 *(31.8)*	19.2 *(39.5)*	20.5 *(40.4)*
% sending transfers	15.2 *(35.9)*	15.0 *(35.7)*	11.6 *(32.1)*	6.7 *(25.0)*	11.3 *(31.8)*	9.8 *(29.8)*	9.75 *(29.7)*
% receiving transfers	11.6 *(32.0)*	18.9 *(39.2)*	18.7 *(39.0)*	11.5 *(31.9)*	0.1 *(9.3)*	10.1 *(30.2)*	11.9 *(32.4)*
Amount sent*	601.7 *(1233.8)*	649.5 *(2105.6)*	318.8 *(353.0)*	537.9 *(1094.8)*	317.1 *(265.6)*	773.1 *(947.4)*	483.9 *(657.6)*
Amount received*	1064.1 *(2924.8)*	856.3 *(1438.7)*	850.1 *(1170.9)*	765.4 *(958.8)*	112.9 (.)	1188.6 *(1686.9)*	845.1 *(1123.4)*
% public transfers	23.3 *(42.3)*	26.9 *(44.4)*	27.1 *(44.4)*	13.6 *(34.4)*	7.8 *(26.9)*	6.7 *(25.1)*	12.6 *(33.2)*

Standard deviation in parentheses.

(*) Thousand VND in 1998 real value ; (+) Square meters.

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Table 2b: Summary Characteristics of Households in Sample [By Regions, in 1998]

	North Mountains	Red River Delta	North Central Coast	South Central Coast	Central Highlands	Southeast	Mekong River Delta
N	606	817	550	374	115	296	707
Household size	5.15 *(1.71)*	4.00 *(1.54)*	4.76 *(1.91)*	4.89 *(2.10)*	6.14 *(2.50)*	5.23 *(2.14)*	5.19 *(2.00)*
Age of head	44.36 *(13.1)*	47.5 *(13.7)*	48.6 *(14.4)*	50.5 *(14.3)*	44.7 (13.2)	49.5 *(13.5)*	49.0 *(13.5)*
Age dependency ratio	.417 *(.233)*	.385 *(.277)*	.440 *(.266)*	.404 *(.265)*	.469 *(.214)*	.368 *(.225)*	.363 *(.231)*
Consumption*	1791.8 *(1028.3)*	2371.8 *(1320.5)*	2006.9 *(1193.5)*	2207.9 *(1306.4)*	2155.2 *(1304.0)*	3303.2 *(2253.3)*	2133.5 *(1021.1)*
Total income*	2252.0 *(1992.7)*	2597.1 *(2044.9)*	2103.6 *(1561.1)*	2554.2 *(2659.1)*	4248.3 *(4511.0)*	3856.8 *(4467.6)*	3268.7 *(3115.2)*
Pre-transfer income*	2218.3 *(2050.1)*	2586.9 *(2149.8)*	2018.5 *(1755.1)*	2507.5 *(2706.9)*	4263.8 *(4563.3)*	3816.1 *(4621.8)*	3236.6 *(3414.8)*
Total land surface+	3708.7 *(3981.2)*	2066.7 *(1190.9)*	2684.6 *(5460.9)*	3125.8 *(2766.3)*	3090.3 *(4535.0)*	4510.9 *(4510.9)*	6290.4 *(8714.6)*
Irrigated land surface+	1749.0 *(1575.8)*	1942.9 *(1150.0)*	1518.3 *(1518.1)*	1536.5 *(1807.9)*	1864.0 *(3532.6)*	3212.2 *(6559.7)*	5501.6 *(8091.6)*
# disasters in past 5 years	6.51 *(4.32)*	8.0 *(9.23)*	7.57 *(5.50)*	4.48 *(4.31)*	7.55 *(4.02)*	3.09 *(2.73)*	4.73 *(6.04)*
Value of livestock*	3103.0 *(2607.3)*	1440.7 *(1604.2)*	2246.4 *(2706.6)*	2289.8 *(3450.8)*	867.8 *(1457.5)*	2017.5 *(3774.4)*	829.9 *(1780.5)*
Value of equipment*	597.8 *(1679.6)*	428.9 *(843.6)*	606.6 *(1193.3)*	476.6 *(2036.4)*	5515.9 *(11157.9)*	2451.2 *(9381.6)*	2356.0 *(6045.0)*
% participating in transfers	27.1 *(44.5)*	31.3 *(46.4)*	51.8 *(50.0)*	28.9 *(45.4)*	15.6 *(36.5)*	40.9 *(49.2)*	28.9 *(45.4)*
% sending transfers	14.2 *(34.9)*	15.7 *(36.4)*	28.4 *(45.1)*	10.9 *(31.3)*	9.6 *(29.5)*	24.3 *(42.9)*	13.0 *(33.6)*
% receiving transfers	14.5 *(35.2)*	19.9 *(39.9)*	31.3 *(46.4)*	20.3 *(40.3)*	6.9 *(25.5)*	20.9 *(40.7)*	20.5 *(40.4)*
Amount sent*	1290.6 *(1721.9)*	1723.1 *(3797.8)*	924.8 *(1957.0)*	940.7 *(1957.0)*	1991.5 *(4109.1)*	2075.3 *(6390.0)*	1776.3 *(3777.6)*
Amount received*	1872.9 *(2953.4)*	1339.6 *(1550.2)*	1714.2 *(4044.0)*	872.7 *(987.2)*	781.0 *(372.3)*	2366.0 *(4287.5)*	1527.6 *(3776.4)*
% public transfers	19.9 *(40.1)*	27.8 *(44.8)*	28.9 *(45.4)*	18.9 *(39.3)*	5.22 *(22.3)*	5.1 *(21.9)*	19.1 *(39.3)*

Standard deviation in parentheses.

(*) Thousand VND in 1998 real value ; (+) Square meters.

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Table 3: Transfer frequencies.

Percentage of households involved in transfers			
$N = 3465$	***1993***	***1998***	***93/98***
Transfers in Country	24.1	33.4	44.0
Transfers in Province	7.3	23.4	27.1
Transfers in Family	25.8	31.2	42.6

Percentage of households involved in transfers		
$N = 3465$	**Transfers to Family**	**Transfers to Non-Fam.**
Transfers in Province	25.7	2.8
Transfers out of Province	19.1	3.1

Table 4: Magnitude of Transfers in % of Pre-Transfer Income (conditional on participation).

	1993	***1998***
Average Amount Received	10.6	11.9
Average Amount Sent	6.5	11.1
In % of Receivers/Senders Income		
	1993	***1998***
Average Amount Received	16.3	19.7
Average Amount Sent	4.9	7.8

Table 5: Net Senders and Net Receivers Pre-Transfer Income (conditional means).

Pre-Transfer Income in Thousand VND	***1993***	***1998***
Net Receivers	1192.8	1796.4
Net Senders	2383.9	4154.7
$\|$***t-statistic***$\|$ (H_0 :**equality**)	9.1	10.5

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Table 6: Origin and Destination of transfers.

(in % of total transfers received/sent in the country)		***1993***	***1998***
Received Transfers	**From Same Province**	25.3	65.1
	From Same Region	55.9	75.3
Sent Transfers	**From Same Province**	27.4	63.4
	From Same Region	58.2	72.9

Table 7: Asset Value (conditional means and medians, in thousand 1998 VND).

	1993		**1998**	
	mean	**median**	**mean**	**median**
Livestock	2201.1	1330.2	2298.4	1442.9
Savings	2906.9	855.4	3118.8	722.9
Equipment	1329.5	328.3	1776.2	447.5

Table 8: Land Holdings (conditional means and percentiles, in m^2).

	1993			
	Mean	**25%*tile***	**Median**	**75%*tile***
Total Land	4306.2	1874	3000	4920
Irrigated Land	3252.2	1500	2381	3533
	1998			
	Mean	**25%*tile***	**Median**	**75%*tile***
Total Land	4469.3	1850	2875	4680
Irrigated Land	3742.1	1500	2342	3693

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Table 9: First Stage IV Regressions.

Summary Results (*Heteroskedasticity-robust F-Statistics*)		$F\,(13, 3449)$	$p - value$	Shea Partial R^2
Net transfers out in 1993 [*(1)* to *(9)*]:				
(1)	*Overall*	12.7	0.00	0.136
(2)	*Family*	15.6	0.00	0.163
(3)	*Non Family*	11.3	0.00	0.117
(4)	*In Province*	13.8	0.00	0.124
(5)	*Out of Province*	9.8	0.00	0.101
(6)	*Family In Province*	14.2	0.00	0.151
(7)	*Family Out of Province*	13.0	0.00	0.143
(8)	*Non-Family In Province*	11.5	0.00	0.135
(9)	*Non-Family Out of Province*	9.6	0.00	0.098
Income Shock		12.1	0.00	0.125
Value of Livestock		414.3	0.00	0.448
Savings		340.4	0.00	0.353
Equipment Value		37.7	0.00	0.255
Public Assistance		15.6	0.00	0.192

The instrument set includes: Initial values of asset variables (livestock, savings, equipment), irrigated and non-irrigated (inherited) land holdings in 1993, together with their interaction with natural disaster shocks (1988-1998).

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Table 10a: Identification Tests

	Whole Sample	*Family*	*Non-Family*	*In Province*	*Out of Prov.*
	(1)	*(2)*	*(3)*	*(4)*	*(5)*
Underidentification Test (H_0: The model is underidentified) [$p-values$ in parentheses]					
Kleibergen-Paap (LM$\sim \chi^2_{(7)}$)	15.51 *(0.030)*	15.47 *(0.031)*	20.36 *(0.005)*	15.07 *(0.035)*	19.39 *(0.007)*
Kleibergen-Paap (Wald$\sim \chi^2_{(7)}$)	20.14 *(0.005)*	14.84 *(0.038)*	21.53 *(0.003)*	14.87 *(0.038)*	18.04 *(0.012)*
Weak Identification Test (H_0: The model is weakly identified) [Critical value is 10.52*]					
Kleibergen-Paap (Wald F-Stat)	15.4	18.1	18.8	23.7	10.7
Overidentification Test (H_0: The overidentification restrictions are valid) [$p-values$ in parentheses]					
Stock-Wright S (LM$\sim \chi^2_{(13)}$)**	11.16 *(0.597)*	8.06 *(0.839)*	9.91 *(0.701)*	17.56 *(0.175)*	17.31 *(0.186)*
Hansen J$\sim \chi^2_{(6)}$	3.85 *(0.696)*	3.42 *(0.754)*	2.16 *(0.904)*	2.99 *(0.809)*	7.126 *(0.309)*

All identification tests are heteroskedasticity-robust.

*Critical value based on Stock and Yogo (2005) for 10% maximal IV bias (relative to OLS) at 95% confidence level.

**The Stock and Wright (2000) test is robust to the presence of weak instruments.

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Table 10b: Identification Tests

	Family In Prov.	***Family Out of Prov.***	***Non-family In Prov.***	***Non-fam. Out of Prov.***
	(6)	***(7)***	***(8)***	***(9)***
Underidentification Test (H_0: The model is underidentified) [$p-values$ in parentheses]				
Kleibergen-Paap (LM$\sim \chi^2_{(7)}$)	15.35 *(0.032)*	16.23 *(0.023)*	13.76 *(0.055)*	19.97 *(0.006)*
Kleibergen-Paap (Wald$\sim \chi^2_{(7)}$)	15.25 *(0.033)*	19.43 *(0.007)*	13.99 *(0.051)*	20.33 *(0.005)*
Weak Identification Test (H_0: The model is weakly identified) [Critical value is 10.52*]				
Kleibergen-Paap (Wald F-Stat)	29.2	25.3	17.6	13.2
Overidentification Test (H_0: The overidentification restrictions are valid) [$p-values$ in parentheses]				
Stock-Wright S (LM$\sim \chi^2_{(13)}$)**	16.49 *(0.224)*	15.22 *(0.294)*	14.6 *(0.333)*	9.67 *(0.723)*
Hansen J$\sim \chi^2_{(6)}$	2.72 *(0.844)*	5.60 *(0.469)*	8.039 *(0.235)*	2.163 *(0.904)*

All identification tests are heteroskedasticity-robust.

*Critical value based on Stock and Yogo (2005) for 10% maximal IV bias (relative to OLS) at 95% confidence level.

**The Stock and Wright (2000) test is robust to the presence of weak instruments.

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Table 11a: Heteroskedasticity Tests

H_0: ***Disturbances of the main equation are homoskedastic***					
(Statistics are distributed as $\chi^2_{(15)}$)	**Overall**	**Family**	**Non-Fam**	**In Prov.**	**Out of P.**
($p - values$ in parentheses)	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
Breush Pagan/Godfrey/Cook-Weisberg	1279.5	1549.4	9421.8	3274.6	1265.8
(normally distributed errors and homoskedasticity elsewhere)	*(0.000)*	*(0.000)*	*(0.000)*	*(0.000)*	*(0.000)*
White/Koenker nR^2	13.91	17.8	7.73	25.7	6.45
(homoskedasticity elsewhere in the system)	*(0.532)*	*(0.272)*	*(0.934)*	*(0.041)*	*(0.0971)*
Pagan-Hall	888.9	1046.7	6198.7	2131.7	1020.4
(normally distributed errors)	*(0.000)*	*(0.000)*	*(0.000)*	*(0.000)*	*(0.000)*
Pagan-Hall	12.34	17.5	7.84	27.1	6.59
(robust to non-normality and to heteroskedasticity elsewhere)	*(0.652)*	*(0.289)*	*(0.929)*	*(0.028)*	*(0.967)*

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Table 11b: Heteroskedasticity Tests

H_0: ***Disturbances of the main equation are homoskedastic***				
Statistics are distributed as $\chi^2_{(15)}$	**Family**		**Non-family**	
($p-values$ **in parentheses)**	**In (6)**	**Out (7)**	**In (8)**	**Out (9)**
Breush Pagan/Godfrey/Cook-Weisberg	2576.1	686.6	364.4	784.7
(normally distributed errors and homoskedasticity elsewhere)	*(0.000)*	*(0.000)*	*(0.000)*	*(0.000)*
White/Koenker nR^2	27.71	3.42	139.7	7.450
(homoskedasticity elsewhere in the system)	*(0.02)*	*(0.999)*	*(0.000)*	*(0.944)*
Pagan-Hall	1448.8	330.9	396.8	4414.6
(normally distributed errors)	*(0.003)*	*(0.000)*	*(0.000)*	*(0.000)*
Pagan-Hall	22.22	3.51	*34.4*	*7.89*
(robust to non-normality and to heteroskedasticity elsewhere)	*(0.102)*	*(0.999)*	*(0.002)*	*(0.928)*

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Table 12: Transfer Function Estimates: Whole Sample

Dependent = Net Transfers Received	OLS		IV-GMM	
(1)	**(1a)**	**(1b)**	**(1c)**	**(1d)**
Past Transfers	-.69 *(.109)******	-.69 *(.107)******	-.48 *(.148)******	-.52 *(.148)******
Income Shock	-.13 *(.044)******	-.14 *(.047)******	-.18 *(.049)******	-.19 *(.051)******
Age Dependency Ratio	772.5 *(219.6)******	772.5 *(214.4)******	660.4 *(245.7)******	635.9 *(248.4)******
Household Size	-27.2 *(43.2.0)*	-23.8 *(42.1)*	-22.4 *(30.4)*	-28.9 *(31.2)*
Livestock		-.032 *(.024)*		.003 *(.020)*
Savings		.033 *(.015)****		.014 *(.006)****
Equipment		-.031 *(.015)****		-.015 *(.031)*
Public Assistance Received		-284.0 *(115.3)****		-473.1 *(288.4)*
R^2	0.153	0.168	0.139	0.149

2-step GMM estimates are reported for (1c) and (1d). All regressions include communexyear interaction dummies (not reported).

The instrument set includes: Initial values of asset variables (livestock, savings, equipment),

inherited irrigated and non-irrigated land holdings in 1993, together with their interaction with natural disaster shocks.

Reported standard errors in parentheses allow for arbitrary form of heteroskedasticity and intracorrelation at the commune level.

(*), (**) and (***) denote coefficients significantly different from zero at the 90%, 95% and 99% confidence level respectively.

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Table 13: Transfer Function Estimates : Subsamples

Dependent = Net Transfers Received	IV-GMM		IV-GMM	
	Family (2)	Non-Family (3)	In Province (4)	Out of Prov. (5)
Past Transfers	-.84 *(.147)******	-.98 *(.32)******	-1.15 *(.427)******	-.84 *(.107)******
Income Shock	-.16 *(.031)******	-.017 *(.011)*	-.10 *(.025)******	-.07 *(.022)******
Age Dependency Ratio	594.1 *(150.8)******	34.7 *(52.9)*	543.6 *(122.9)******	112.5 *(107.3)*
Household Size	-76.0 *(19.0)******	5.71 *(6.59)*	-76.9 *(15.1)*	6.24 *(13.7)*
Livestock	.012 *(.012)*	.0029 *(.004)*	.016 *(.010)*	-.0005 *(.009)*
Savings	.015 *(.004)******	.0024 *(.0013)*	.019 *(.003)******	-.001 *(.003)*
Equipment	.0007 *(.018)*	.0003 *(.006)*	-.003 *(.015)*	.005 *(.013)*
Public Assistance Received	57.3 *(175.2)*	-41.19 *(61.03)*	69.8 *(144.9)*	-27.2 *(126.3)*
R^2	0.223	0.079	0.154	0.241

2-step GMM estimates are reported for (1c) and (1d). All regressions include commune**x**year interaction dummies (not reported).

The instrument set includes: Initial values of asset variables (livestock, savings, equipment),

inherited irrigated and non-irrigated land holdings in 1993, together with their interaction with natural disaster shocks.

Reported standard errors in parentheses allow for arbitrary form of heteroskedasticity and intracorrelation at the commune level.

(*), (**) and (***) denote coefficients significantly different from zero at the 90%, 95% and 99% confidence level respectively.

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Table 14: Transfer Function Estimates : Subsamples

Dependent = Net Transfers Received	IV-GMM		IV-GMM	
	To Family		To Non-Family	
	In Province (6)	Out of Prov. (7)	In Province (8)	Out of Prov. (9)
Past Transfers	-.93 *(.444)***	-.82 *(.097)***	-.98 *(.179)***	-1.00 *(.343)***
Income Shock	-.06 *(.019)****	-.10 *(.025)****	-.006 *(.002)***	-.011 *(.010)*
Age Dependency Ratio	542.1 *(123.1)****	60.9 *(95.2)*	-10.3 *(11.7)*	44.2 *(51.6)*
Household Size	-76.8 *(15.0)****	0.97 *(12.1)*	-.006 *(1.48)*	5.74 *(6.45)*
Livestock	.015 *(.010)*	-.003 *(.008)*	.001 *(.001)*	.002 *(.004)*
Savings	.017 *(.003)****	-.002 *(.002)*	.002 *(.0003)****	.0006 *(.001)*
Equipment	-.002 *(.015)*	-.003 *(.012)*	-.001 *(.001)*	.001 *(.006)*
Public Assistance Received	52.7 *(144.9)*	18.6 *(111.8)*	3.09 *(13.7)*	-44.2 *(59.7)*
R^2	0.157	0.153	0.1859	0.156

2-step GMM estimates are reported for (1c) and (1d). All regressions include communexyear interaction dummies (not reported).

The instrument set includes: Initial values of asset variables (livestock, savings, equipment),

inherited irrigated and non-irrigated land holdings in 1993, together with their interaction with natural disaster shocks.

Reported standard errors in parentheses allow for arbitrary form of heteroskedasticity and intracorrelation at the commune level.

(*), (**) and (***) denote coefficients significantly different from zero at the 90%, 95% and 99% confidence level respectively.

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Figures

Figure 1: Regional Distribution of Income.

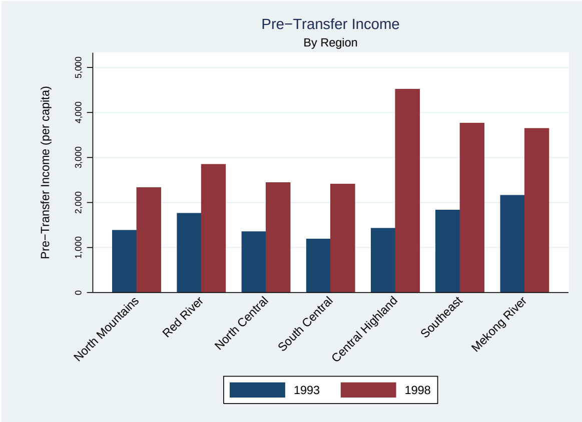

Figure 2: Income Structure.

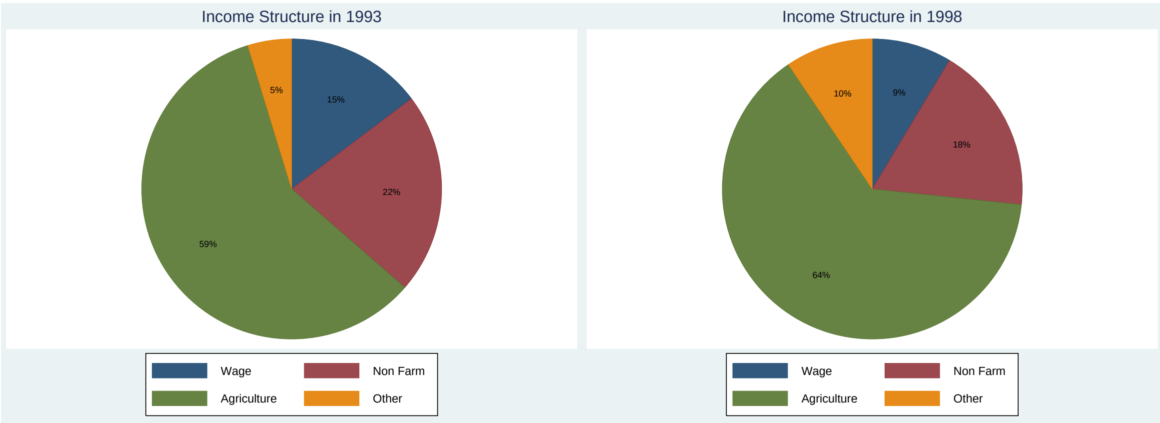

Figure 3: Income Structure by Regions.

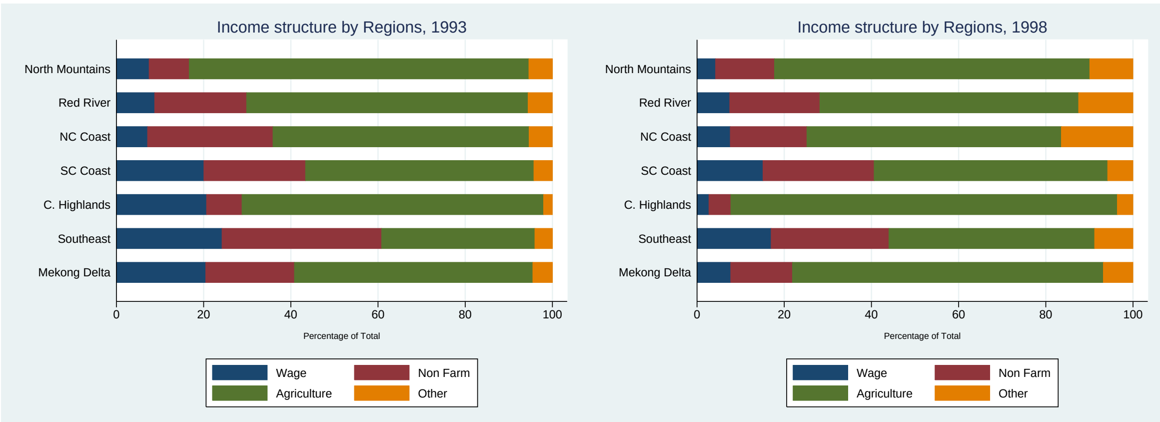

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Figure 4: Age Distribution by Transfer Status.

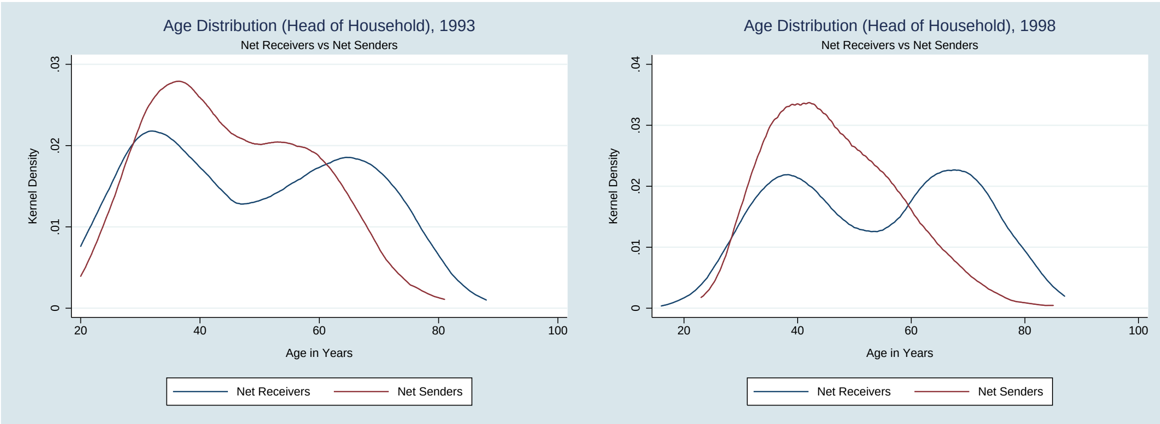

Figure 5: Average Gross Transfer Amounts.

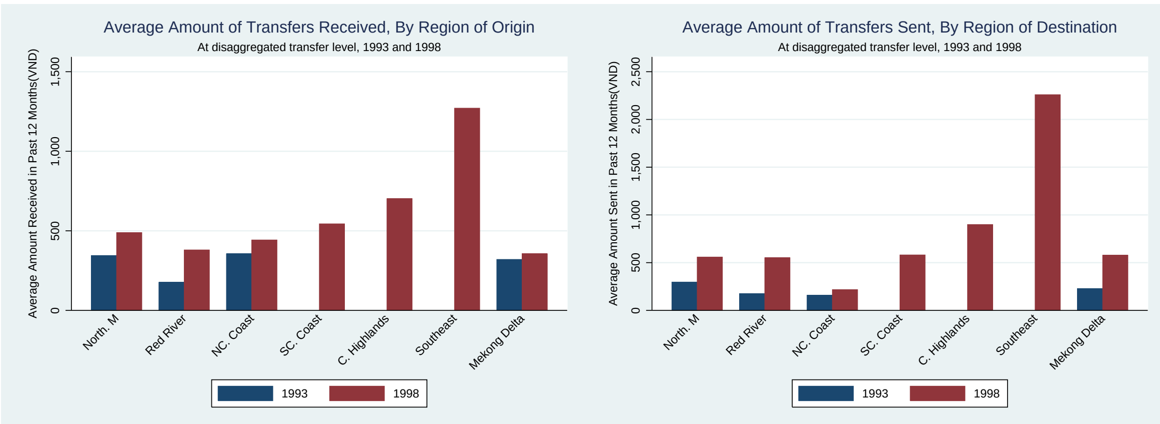

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Figure 6: Gross Received Transfers Composition (Location of Origin).

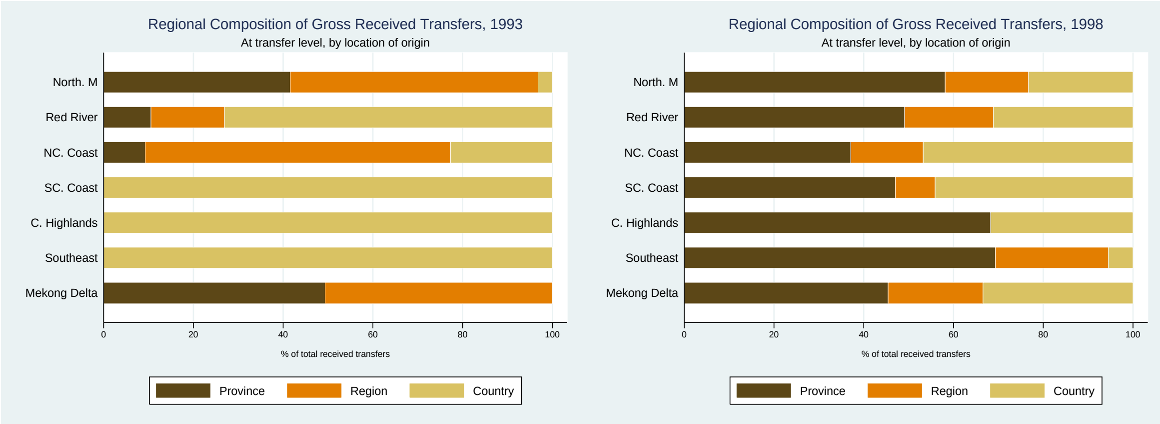

Figure 7: Gross Sent Transfers Composition (Location of Destination).

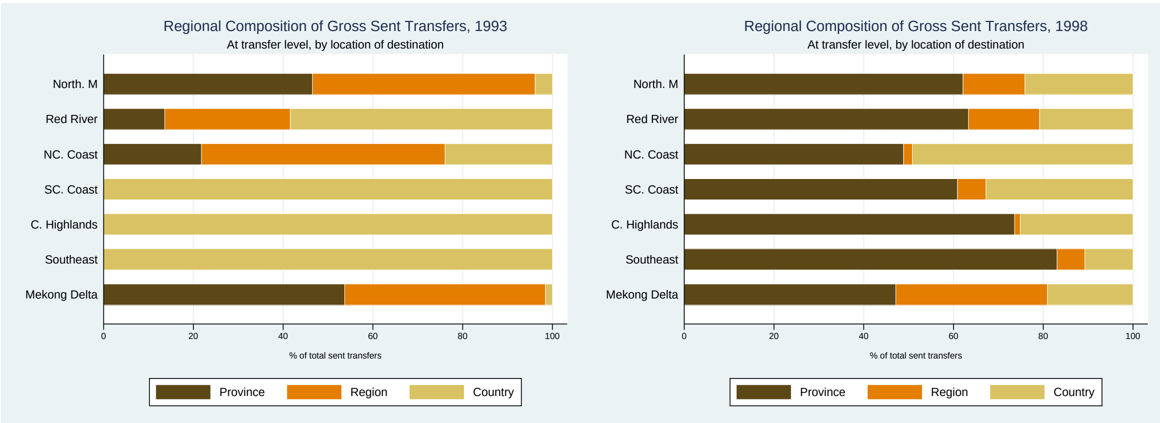

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Figure 8: Gross Received Transfers Composition (Relation with Sender).

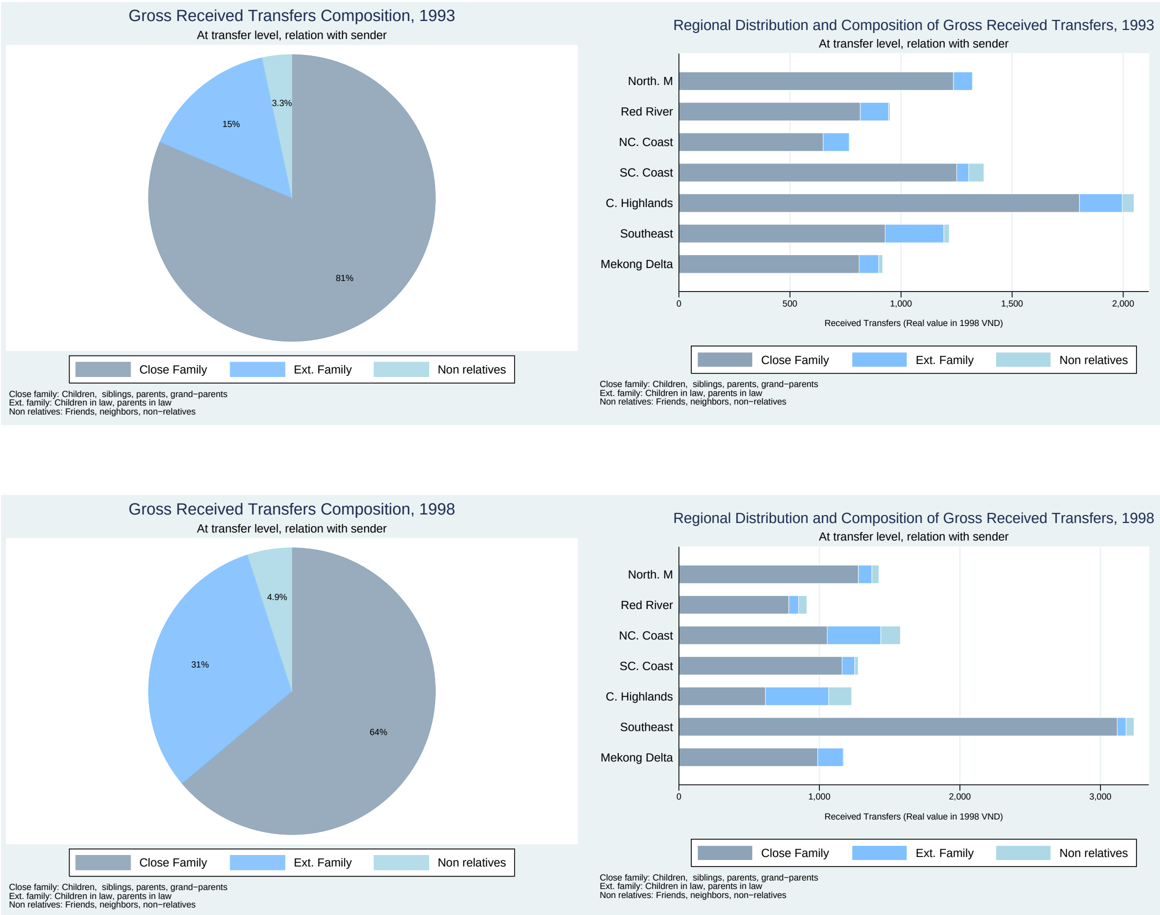

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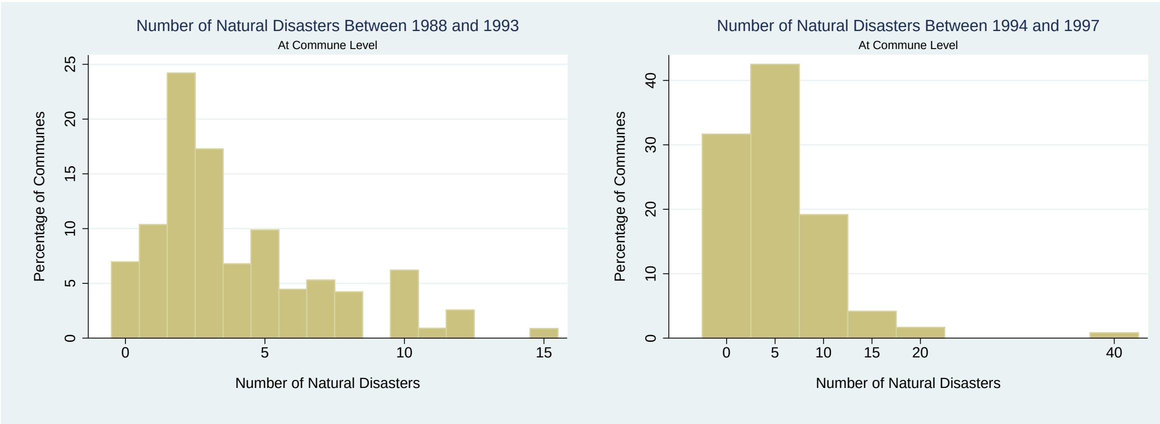
Figure 9: Gross Sent Transfers Composition (Relation with Recipient).

Figure 10: Natural Disasters at Commune Level.



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CHAPTER 2

Optimal Risk Sharing Under Limited Commitment: Evidence From Rural Vietnam

2.1. Introduction

Risk in rural developing economies is pervasive and has major influence on welfare. In these economies, agriculture is often the main source of income and it is very sensitive to the realization of natural shocks. Besides, formal institutions and insurance mechanisms designed to cope with risks are often weak or nonexistent. Absent formal insurance markets, informal insurance mechanisms allow households to mitigate the influence of risks on welfare. In this paper we study the effectiveness of informal arrangements in protecting farmers' consumption from income shocks in a village economy.

Alderman and Paxson (1992) and Fafchamps (2003) provide a comprehensive review of the various risk coping mechanisms in which households can engage. A large literature have followed the work initiated by Cochrane (1991) and Mace (1991) for the US and by Townsend (1994) in rural India to test a central implication of the full insurance model: if markets are complete, idiosyncratic shocks to income should leave consumption unaffected. Most of these studies were based on testing the null hypothesis of full insurance against an unspecified alternative model. The consensus that emerged from these studies is that even though in some cases observed consumption comes close to the full insurance allocation, perfect risk sharing is always rejected by the data. This has led researchers to work on models that provide a better account of the data. Two main hypotheses were advanced to help reconciling the theory and the data: information asymmetries and incentive problems.

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Examples of theoretical work on the role of asymmetric information in shaping the optimal allocation can be found in Thomas and Worrall (1990), Wang (1994), Cole and Kocherlakota (2001) and Doepke and Townsend (2006). We assume here instead complete information and we focus on contract enforcement constraints. Some important theoretical and empirical contributions in this literature include Thomas and Worrall (1988), Kocherlakota (1996), Ligon et al. (2002), and Dubois et al. (2008).

Thomas and Worrall (1988) characterize the efficient allocation in a setting where a risk neutral firm and a risk averse worker trade labour without being able to commit to their contract. They show that limited commitment introduces some persistence into the efficient allocation. Intuitively, if some shocks can only be partially smoothed across states because of binding commitment contraints, it is then optimal to also smooth part of these shocks across time.

Kocherlakota (1996) argues that a positive correlation between individual consumption and both current and past realizations of income can emerge in models with complete information and limited commitment. However, this property is also a feature of models with asymmetric information and without contract enforcement problems. His work shows that the way history matters in efficient allocations is different between these two environments. In the limited commitment case, the ratio of marginal utilities between agents is a sufficient statistic to predict future consumption while it is not so in models of asymmetric information.

Ligon et al. (2002) and Dubois et al. (2008) build on the theoretical insight provided by Thomas and Worrall (1988) and Kocherlakota (1996), and they offer interesting empirical applications[1].

[1] Foster and Rosenzweig (2001), which provides the analytical framework for our previous chapter on transfers, also builds on Thomas and Worrall (1988) and on Ligon et al. (2002) to derive empirically testable predictions for informal transfer flows in environments where commitment is limited.

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Ligon et al. (2002) study efficient insurance when information is complete but commitment is limited. Their constrained efficient contract can be characterized by a simple updating rule based on a ratio of marginal utilities, and which is similar to a debt contract with occasional forgiveness. They compare the full risk-pooling model with the limited commitment model by focusing on the dynamic behavior of consumption and income. Using ICRISAT data collected in three Indian villages between 1975 and 1984, they conclude that the limited commitment hypothesis is better able to fit observed consumption dynamics and their correlation with income changes.

Dubois et al. (2008), derived implications from a model with no enforcement and where formal contracts coexist with voluntary transfers to spread income risk across states. Their analysis focus on the interaction between contracts and informal arrangements. In this environment, they show that formal contracts act as a form of collateral by relaxing commitment constraints, and thus by increasing the set of incentive compatible allocations.

A common feature in the work of Ligon et al. (2002) and Dubois et al. (2008) is that they rely on the dynamic aspect of the model's predictions to derive testable implications. This strategy is particularly well suited to bring the limited commitment model to panel data with a sufficiently large time dimension. Our work is complementary to theirs in the sense that we use instead a cross-sectional implication of a limited commitment model to propose a simple test of informal insurance when contracts are not perfectly enforceable. This allows us to confront the model to a different dataset which is shorter in its time dimension, but larger in the cross section.

In this paper, we use household survey data from Vietnam to study the effectiveness of risk sharing arrangements in insuring consumption among farmers. We focus on idiosyncratic shocks to agricultural revenues. Our main finding is that, although the full insurance model is rejected by the data, the relation between idiosyncratic shocks and consumption is consistent with a simple model of risk sharing with lack of commitment. Under limited commitment, villagers can choose to renege on previous arrangements if the cost of honoring their contract is higher than the cost of default. In this environment, second-best risk sharing contracts can still be passed such that consumption is stabilized in case of unfavorable shocks. At the same time, villagers can enjoy higher consumption in proportion to realized shocks in case of more favorable events.

2.2. Analytical Framework

We consider a model of risk sharing in a village economy where one agent only (the moneylender) can commit to honor a contract whilst the others (the villagers) can't . This way of modelling originates from Green (1987) and it is the approach adopted by Thomas and Worrall (1988), and Dubois et al. (2008). We follow the model exposition given in Ljungqvist and Sargent (2004).

2.2.1. Basic Setup.

2.2.1.1. *The Villagers.* Villagers are ex-ante identical and have standard preferences characterized by

$$E\sum_{t=0}^{\infty}\beta^{t}u\left(c_{t}\right) \tag{2.11}$$

where $u^{'}(.)>0$, $u^{''}(.)<0$ and $\beta\in(0,1)$. At every period t, agents receive a stochastic endowment $\{\varepsilon_t\}_{t=0}^{\infty}$ which is identically and independently distributed across time and across agents with probability $Prob\left(\varepsilon_t=\varepsilon_s\right)=\Pi_s$, where states of nature are drawn from a finite set $s\in\{1,2,...,S\}$ and can be ordered as $\varepsilon_s>\varepsilon_{s+1}$. There is no storage possibility and no financial market, and at every period $t\geq 1$, the villager has a history of endowments $h_t=(\varepsilon_t,\varepsilon_{t-1},...,\varepsilon_0)$.

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Since the villagers are risk averse, if markets were complete, they would trade date and history-contingent claims ex-ante in order to fully insure themselves against idiosyncratic variations in income. Because all agents share the same preferences, they would then all consume the average per capita endowment $\bar{\varepsilon}_s$ in every period and they would enjoy lifetime utility

$$v_{pool} = \sum_{t=0}^{\infty} \beta^t u \left(\sum_{s=1}^{S} \Pi_s \bar{\varepsilon}_s \right) = \frac{1}{1-\beta} u \left(\sum_{s=1}^{S} \Pi_s \bar{\varepsilon}_s \right). \tag{2.12}$$

2.2.1.2. *The Moneylender.* There is a moneylender (or a planner) in this economy who can trade with the rest of the world and with the villagers, while the villagers cannot trade among themselves. The moneylender is assumed to be committed to his promises. Villagers on the other hand cannot commit and are free to deviate from any previously made arrangement at any time. The consequence of such deviation is to remain in autarchy forever. Kocherlakota (1996) shows that in these settings, autarchy is the worst possible punishment for an agent who deviates. Knowing this, the objective of the moneylender is thus to design a contract which is self-enforcing in the sense that villagers choose not to renege on the arrangement.

The contract is such that at every period the villagers give away their period-t endowment ε_t to the moneylender who then redistributes c_t back to the villagers, as was promised during the preceding period. The contract specifies history-dependent streams of consumption $c_t = f_t(h_t)$. The moneylender expects to earn

$$P = E \sum_{t=0}^{\infty} \beta^t (\varepsilon_t - c_t). \tag{2.13}$$

If a villager reneges on the contract he remains in autarchy forever, consuming his endowment only. In this case, the ex-ante expected utility of the villager in present terms is given by

$$v_{aut} = E \sum_{t=0}^{\infty} \beta^t u(\varepsilon_t) = \frac{1}{1-\beta} \sum_{s=1}^{S} \Pi_s u(\bar{\varepsilon}_s). \tag{2.14}$$

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In period t, after the realization of the state of nature s, the present value of the villager's utility is simply

$$u(\varepsilon_t) + \beta v_{aut}.$$

The moneylender must therefore design a contract that offers at least the ex-post present value of autarchy to the villagers:

$$u[f_t(h_t)] + \beta E_t \sum_{j=1}^{\infty} \beta^{j-1} u[f_{t+j}(h_{t+j})] \geq u(\varepsilon_t) + \beta v_{aut}. \tag{2.15}$$

Such a contract is said to be sustainable as it will induce the expected utility maximizing villager to participate in the arrangement.

An efficient contract is a sustainable contract which maximizes (2.13). Any such contract must, after any history h_t, include an efficient continuation contract which also satisfies the participation constraints (2.15). This promised expected discounted future value of utility is forward looking in nature, but it embeds all accumulated history. One can write it as

$$v_t = E_{t-1} \sum_{j=0}^{\infty} \beta^j u(f_{t+j}(h_{t+j})).$$

It is possible to reformulate this kind of problem in a recursive way, having in each period the moneylender delivering c_t after observing ε_t (in accordance with the promise made in the preceding period v_t), and promising a continuation value for the future v_{t+1}.

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The constrained-efficient contract offered by the moneylender must therefore solve the following problem:

$$P(v) = \max_{[c_s, w_s]} \sum_{s=1}^{S} \Pi_s \left[\bar{\varepsilon}_s - c_s\right] + \beta P(w_s) \tag{2.16}$$

$$s.t. \ \textstyle\sum_{s=1}^{S} \Pi_s \left[u(c_s) + \beta w_s\right] \geq v \tag{2.17}$$

$$u(c_s) + \beta w_s \geq u(\varepsilon_s) + \beta v_{aut}, \ \forall s \tag{2.18}$$

$$c_s \in \left[c_{min}, c_{max}\right] \tag{2.19}$$

$$w_s \in \left[v_{aut}, \bar{v}\right], \tag{2.20}$$

where (2.16) is a functional Bellman equation and w_s is the continuation value promised to the villager for the next period. Equation (2.17) states that the moneylender must deliver a value at least equal to what was promised to honor the contract, and (2.18) is the participation constraint for the villagers.

2.2.2. Constrained-Efficient Contract. We can form a Lagrangian from the problem defined above:

$$\begin{aligned} L = & \sum_{s=1}^{S} \Pi_s \left[\bar{\varepsilon}_s - c_s\right] + \beta P(w_s) \\ & + \mu \left\{ \sum_{s=1}^{S} \Pi_s \left[u(c_s) + \beta w_s\right] \right\} \\ & + \sum_{s=1}^{S} \lambda_s \left\{ u(c_s) + \beta w_s - u(\varepsilon_s) + \beta v_{aut} \right\}, \end{aligned} \tag{2.21}$$

This yields the following first order conditions

$$(\lambda_s + \mu \Pi_s) u'(c_s) = \Pi_s \tag{2.22}$$

$$\lambda_s + \mu \Pi_s = -\Pi_s P'(w_s) \tag{2.23}$$

and the envelope condition

$$P'(v) = -\mu. \tag{2.24}$$

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Since (2.23) holds true for all t, we can write

$$P^{'}(w_s) = P^{'}(v) - \frac{\lambda_s}{\Pi_s}. \tag{2.25}$$

The way the current promised value w_s depends on the promised value from the preceding period v is a function of the realized state of nature. More specifically, it depends on whether the participation constraint (2.18) binds ($\lambda_s > 0$) or not ($\lambda_s = 0$).

For realized states of nature yielding low endowment values ε_s (unfavorable shocks), the participation constraint (2.18) holds as a strict inequality $u(c_s) + \beta w_s > u(\varepsilon_s) + \beta v_{aut}$ so that $\lambda_s = 0$. Condition (2.25) implies that the promised continuation value for the next period remains the same, $w_s = v$, and thus $u^{'}(c_s) = -P^{'}(v)$. Consumption depends on the continuation value v, but not on the realized state of nature ε_s. Ljungqvist and Sargent (2004) show that the solution can be writen as

$$c_s = \underline{g}(v) \tag{2.26}$$

$$w_s = v. \tag{2.27}$$

As realized states of nature become more favorable to the villager, there exists a threshold level of endowment, say θ, for which the household is indifferent between participating in the arrangement and remaining in autarchy forever after. When the participation constraint binds, then $\lambda_s > 0 \Rightarrow P^{'}(w_s) < P^{'}(v) \Rightarrow w_s > v$ because $P^{''}(.) < 0$ by concavity. This means that the moneylender must offer the villager a higher continuation value w_s compared to the promise made in the previous period v. Moreover, if $w_s > v$, the binding participation constraint $u(c_s) + \beta w_s = u(\varepsilon_s) + \beta v_{aut}$, together with condition (2.20), implies that $c_s < \varepsilon_s$. So in exchange for an increased continuation value, the villager must accept to give away part of his received endowment to the moneylender. Current consumption c_s and

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promised continuation value w_s are determined by solving

$$u(c_s) + \beta w_s = u(\varepsilon_s) + \beta v_{aut} \tag{2.28}$$

$$u^{'}(c_s) = -P^{'}(w_s), \tag{2.29}$$

where (2.29) is obtained by combining (2.22) and (2.23). These two equations depend only on the realized income state ε_s and not on the past promise v. The solution in that case can be writen as

$$c_s = \overline{g}(\varepsilon_s) \tag{2.30}$$

$$w_s = \bar{l}(\varepsilon_s), \tag{2.31}$$

where $\overline{g}(.)$ is increasing in its argument.

The threshold level θ at which the participation constraint binds, and for which the regime for the constrained-efficient contract changes, can be determined by first solving for c_s in the low endowment regime

$$u^{'}\left[\underline{g}(v)\right] = -P^{'}(v)^{-1},$$

and then substituting this value into (2.18) at equality

$$u[\theta(v)] + \beta v = u[\underline{g}(v)] + \beta v_{aut}.$$

Combining these two exclusive regimes where $\lambda_s > 0$ and $\lambda_s = 0$, we characterize the constrained efficient contract as:

$$c = \max\left\{\underline{g}(v), \overline{g}(\varepsilon)\right\} \tag{2.32}$$

$$w = \max\left\{v, \bar{l}(\varepsilon)\right\}. \tag{2.33}$$

This contract is represented graphically in figure 1. For values of $\varepsilon_s < \theta(v)$, the moneylender guarantees a consumption level of $\underline{g}(v)$ to the household, independently of the realized endowment ε, and the continuation value is kept unchanged. When the endowment shocks become more fa-

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vorable, though, $(\varepsilon_s > \theta(v))$, the moneylender must allow the household to consume part of his endowment $(c_s = g_1(\varepsilon_s) < \varepsilon_s)$, and the remaining part $\varepsilon_s - c_s$ is taken by the moneylender in exchange for an increase in the promised future utility w_s. In this case, consumption should depend positively on the realized endowment.

We use this feature of the constrained-efficient contract to test the limited commitment model against the complete market model. If contract enforcement and limited commitment constraints were not relevant, then observed consumption should not depend on realized income shocks whatever their level. If these constraints matter, however, an implication of the limited commitment model described above is that consumption should remain independent of realized income shocks only for unfavorable shocks. For more favorable realizations, consumption should depend positively on income shocks.

2.3. Empirical model

Much of the previous applied work related to risk sharing tests in village economies is based on testing the null hypothesis of full insurance against an unspecified alternative hypothesis. Based on the same benchmark test equation, we use the model outlined in the previous section to specify an alternative hypothesis test of risk sharing under limited commitment.

2.3.1. Reduced Form Equation. If risk is perfectly insured at the village level, all idiosyncratic income shocks should be irrelevant for individual consumption. This result is the basis of the following benchmark risk sharing test equation (see Cochrane (1991), Mace (1991) and Townsend (1994)):

$$c_t^j = \alpha + \beta_1 C_t^A + \beta_2 X_t^j + \beta_3 \varepsilon_t^j + \eta^j + v_t^j, \tag{2.34}$$

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where c_t^j is a measure of household j's consumption and C_t^A is average consumption at the commune level, which captures the influence of aggregate shocks on individual consumption. X_t^j is a vector of household characteristics which is meant to capture observed heterogeneity in taste due to differences in household demographic composition, for example, and η^j is a household fixed effects introduced to capture unobserved time-invariant heterogeneity in household consumption. Finaly, ε_t^j is our measure of idiosyncratic shock to income and v_t^j is a random disturbance term which is assumed to have mean zero and to be identically distributed across households. We further assume that these errors are independently distributed across communes but not necessarily across households within the same commune.

Equation (2.34) can be derived from the first order conditions of a social planner's problem where the planner seeks to maximize a sum of weighted CARA utilities under a commune level aggregate resource constraint[2]. Based on this specification and under the null hypothesis of full insurance, we should observe $\beta_1 = 1$ and $\beta_3 = 0$. Since the household fixed effects η^j are not observable, and if at least two periods are available, then applying a first difference operator on equation (2.34) removes the fixed effects and the parameters β can be consistently estimated by OLS.

As pointed out in Morduch (2002), while the inability to reject the null hypothesis of full insurance is informative, rejecting the benchmark model when several alternatives are possible is less so. In this paper we will work with shock variables that are continuously distributed and can take positive and negative values. This allows us to distinguish the effects of favorable shocks from unfavorable ones, and by doing so we can compare the complete market case to an alternative scenario derived from the limited commitment model examined in the previous section.

[2]Assuming CRRA utility functions instead yields a similar specification with variables expressed in logs rather than in level: $\log c_t^j = \alpha + \beta_1 \log C_t^A + \beta_2 X_t^j + \beta_3 \varepsilon_t^j + \eta^j + v_t^j$.

If commitment constraints are binding, we should observe that

$$\beta_3 = 0 \text{ for unfavorable shocks } \varepsilon_t^j,\ \varepsilon_t^j \leq \theta, \text{ and} \tag{2.35}$$

$$\beta_3 > 0 \text{ for favorable shocks } \varepsilon_t^j,\ \varepsilon_t^j \leq \theta, \tag{2.36}$$

where θ is the threshold level of income shock below which consumption is partially insured, and above which households must be partially compensated to remain in the informal insurance agreement. Before turning to the empirical tests, we now give a description of the Vietnamese household data.

2.4. The Vietnam Living Standard Survey

2.4.1. Survey Design. The Vietnam Living Standard Surveys (VLSS) are two household surveys conducted in 1992/93 and 1997/98 by the General Statistical Office (GSO) of Vietnam[3]. The questionnaires were designed to cover a wide range of areas related to living standards and economic activity, with a particular emphasis on consumption and agricultural production. Both surveys provide comparable and representative data at the national level. In both years, the survey is a stratified random sampling conducted in three stages. The sample size is 4800 households in 1992/93 and 5999 households in 1997/98. In total, 4305 households were interviewed in both rounds. The overall sample was stratified into two groups, urban (20% of the population) and rural, and sampling was carried out separately in each strata. In these two groups, 150 communes were randomly selected in order to represent all provinces of Vietnam (first stage). Out of these 150 communes, 120 were from rural areas. Finaly, in each commune, 2 villages were randomly chosen (second stage), and in each village about 20 households were randomly chosen for interviews (third stage).

[3]These surveys were part of the Living Standard Measurement Study (LSMS) surveys taking place in many developing countries with technical assistance from the World Bank.

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In this paper, we focus on rural households for which agriculture is the main activity and who were interviewed in both waves. This constitutes a panel of 2863 observations over 2 time periods[4].

2.4.2. Consumption Data. Information on consumption expenditures is available at a fair level of disaggregation. Consumption data include food expenditures and non food expenditures. Food expenditures are collected over 45 food items by a variable-recall procedure: for each item, household members are asked about quantity and value of purchases, the number of months during the year in which items were bought, and the frequency of purchases during these months. In addition to annual market purchases, the value of home production consumed during the year is also computed. Non-food expenditures include daily expenses, annual expenditures, expenditures on consumer durables, expenditures from utilities (water, electricity, etc.) and housing expenses.

For the purpose of this paper we focus on two consumption aggregates to study consumption risk sharing: total consumption expenditures and food expenditures. Variables are all expressed in 1998 prices with adjustments for monthly and regional price variations.

2.4.3. Shocks to Farm Revenues. We construct a measures of idiosyncratic shocks to income based on the residual from an estimated agricultural production function. Farmers in our sample engage in perennial cropping, livestock raising and water-culture activities. The dataset contains detailed information on cultivated surfaces, hours worked on farm and various inputs used for production in the two survey rounds, so we can estimate (2.34) using panel fixed effects regression.

Since we want to use the residuals of an estimated production function as a measure of exogenous random shocks to agricultural revenues, we want to control for as many factors as we can which are not purely random or

[4]We narrow our focus on rural households for which agriculture is the main activity because we rely on estimated shocks to farm revenues as a measure of income shocks.

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exogenous to the farmers. These include, observed inputs and production factors, but they also include any form of observed or unobserved farm level heterogeneity. Unobservable farm specific factors could well result in differences in total factor productivity and in factor specific efficiency. In order to control for variations across households in total factor productivity, we choose to estimate a stochastic production frontier model. The production frontier approach defines global technical inefficiency as a distance between observed production levels and a common potential maximal level of production. Since the deviations from the production frontier might not be entirely under the control of the farmers, because of some exogenous random shocks for example, Aigner et al. (1977) propose a stochastic frontier formulation in which the reference level of potential production is allowed to vary across farms for reasons exogenous to the production model. In addition to heterogeneity in total factor productivity, we allow for factor specific variations in technology useage across households. In order to do this, we estimate the stochastic frontier model under a random parameter specification. The production model we consider can be writen as:

$$y_{it} = \zeta_i^T X_{it} + \lambda_{ct}^T \delta_{ct} + \epsilon_{it} - u_{it} \tag{2.37}$$

$$\epsilon_{it} \sim N\left(0, \sigma_\epsilon^2\right), \;\; u_{it} \sim \left|N\left(0, \sigma_u^2\right)\right| \text{and } \epsilon_{it} \perp u_{it} \tag{2.38}$$

$$\zeta_i = \zeta + \Gamma v_i \tag{2.39}$$

$$E\left[\zeta_i\right] = \zeta \text{ and } Var\left[\zeta_i\right] = \Sigma, \tag{2.40}$$

where y_{it} is the (log of) real value of total revenues from agriculture activities. X_{it} contains observable factors of production such as total owned land surface, hired labor expenditures, hours worked on farm, capital value and total input expenditures (all in logs) and observable farm specific characteristics (household size, number of crops grown, primary and secondary education indicators for household heads). δ_{ct} is a set of commune-year

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dummy variables which is introduced to capture commune specific characteristics such as aggregate shocks or soil conditions. The technical inefficiency parameter u_{it} is random, follows a truncated normal distribution, and is assumed to be orthogonal to the error term ϵ_{it}. The coefficients ζ_i are also varying randomly around a mean ζ, with variance Σ. The parameters of the model are estimated using Maximum Simulated Likelihood (see Train (2002), Econometric Software (2007) and Greene (2001, 2005) for details).

The results of the stochastic frontier production model estimation are reported in table 1a and 1b. We first pool the data and estimate the model by OLS (columns (1) and (2)). We then estimate the random parameter specification. Based on a likelihood ratio test (columns (3) and (4)), we reject the hypothesis of coefficient homogeneity in favor of the random parameter specification[5]. The average production efficiency is estimated to be at 70% of the frontier level in our sample, with farm level efficiency varying between 3% and 94%. The estimated production function exhibits decreasing returns to scale, with land and input expenditures (in seeds, fertilizers, insecticides and services) contributing the most to agricultural revenues.

Figure 3 and 4, together with table 2 present the distribution of these estimated shocks to agricultural revenues. This distribution is relatively stable between 1993 and 1998 and the estimated shocks are about -2% on average in our sample.

2.5. Results

2.5.1. Threshold Estimation. Expressions (2.35) and (2.36) define a threshold for the response of consumption to income shocks. We estimate this parameter using threshold regression methods developed by Hansen (1999, 2000).

[5]The test statistics is $\chi^2_{(2)} = 2(4099.3 - 3979.4) = 239.8$

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By splitting the support of ε_t^j in two, we can rewrite equation (2.34) as

$$c_t^j = \alpha + \beta_1 C_t^A + \beta_2 X_t^j + \beta_4 \varepsilon_t^j \mathbb{I}(\varepsilon_t^j \leq \theta) + \beta_5 \varepsilon_t^j \mathbb{I}(\varepsilon_t^j > \theta) + \eta^j + v_t^j, \quad (2.41)$$

where $\mathbb{I}(.)$ is the indicator function. Consumption per capita is measured at the household level with c_t^j, and an aggregate consumption variable is formed at the commune level to capture common movements in consumption[6]. Hansen (2000, 1999) shows how to estimate this type of nonlinear models by OLS. The presence of a threshold effect can be assessed by testing the linear constraint

$$H_0 : \beta_4 = \beta_5.$$

If $\widehat{\theta}$ exists, it can be consistently estimated and Hansen (1996) shows how to derive asymptotically valid standard errors using bootstrap methods. Confidence intervals can then be constructed around $\widehat{\theta}$ to conduct inference[7].

The results for the threshold model estimation are reported in tables 3 and 4. We first test the existence of a threshold effect for total consumption and for food consumption. Both tests reject the null hypothesis of homogenous coefficients at the 99% confidence level. We then estimate the threshold point above and below which the impact of income shocks on consumption differs. For total consumption, this threshold is estimated at 7.3%, and this value lies within the interval [-3.5%; 18.2%] with a 95% confidence level. The results for food consumption are similar, with a point estimate at 5.8% and a 95% confidence interval of [-3.4%; 14.9%]. These intervals can be represented by a plot of the concentrated likelihood function against the 95% critical value above which no threshold effect is detected (see figure 1).

[6]We compute the village level mean for every individual j by leaving out the own consumption of j.

[7]The estimation procedure consists in sorting the ε_t^j, and for every value taken by the threshold variable, estimate (2.41) by OLS with variables expressed in deviation from their mean. The estimated threshold is then chosen to be the value that minimises the concentrated sum of square errors from these within regressions.

If we look at the parameter estimates of table 4 we notice first that the idiosyncratic component of shocks to farmers revenues matter for consumption. Full insurance is clearly rejected by the data, and this is true both for total consumption (1a) and for food consumption (2a). Now if we distinguish the shocks to revenues above and below the estimated thresholds, we see that the coefficient on the shock variable is positive and significantly different from zero for favourable shocks and not different from zero for unfavourable shocks. This is again true for both total consumption and for food consumption[8].

These results indicate that consumption is insured only for unfavourable shocks. Even if the observed consumption allocations suggest that full insurance is not achieved, we can see that shocks to revenues are partially insured. This pattern is consistent with a model of risk sharing with limited commitment as outlined in section 2.2.

Since shocks to farmers revenues are constructed as a residual of a production function, it is possible that the shock variable contains some measurement error. In order to assess whether our results are robust to endogeneity bias due to some measurement error on the estimated shock variable, we use instruments for our measure of shocks to revenues. We take advangtage of the information collected at the commune level on the occurence of natural disasters[9] to construct our instruments. More specifically, we use inherited land surface owned at the begining of the survey period, together with their interaction with natural disasters as instruments for shocks to agricultural revenues. We assume here that natural disasters interacted with initial land holdings are correlated with income shocks between 1993 and 1998, but are exogenous to consumption. Figure 5 displays some characteristics of land use in 1993 and of natural disasters between

[8]

[9]Natural disasters were defined during the survey as any unfavourable event causing a crop loss of 10% or more at the commune level.

1993 and 1998. The northern regions have a relatively higher share of irrigated land in 1993 compared to the South, but inherited land surfaces are higher in the South. The average share of rural communes experiencing 1 disaster or more in the year is relatively stable, between 20%-30%, over the survey period.

2.5.2. Panel Results. Since the estimation method proposed by Hansen (1999) does not accomodate instrumental variables in a panel context we use the estimated threshold $\hat{\theta}$ to split the support of ε_t^j and we test (2.35) and (2.36) using standard instrumental variable fixed-effects regressions. For comparison we report first-difference estimates with and without instruments for shocks to revenues.

The results from the fixed effect panel tests[10] are given in table 5. We find again that both total and food consumption are affected by shocks to agricultural revenues (3a and 4a). This result also holds when we use inherited land surfaces together with their interactions with natural disasters as instruments for the estimated shocks to revenues (3c and 4c). The null hypothesis of full insurance is again rejected for the two consumption aggregates[11].

Looking now at the results from the alternative specification (2.41), we confirm that while favorable shocks still have a positive impact on both total consumption and on food consumption, unfavorable shocks seem to be insured for the two consumption aggregates (3b and 4b). Again, using instruments for the estimated shocks do not alter our results, although food consumption seems to increase with favorable shocks only at the 90% confidence level (3d and 4d).

Considering the impact of shocks to agricultural revenues on consumption in rural Vietnam, our tests reject the hypothesis of full insurance at

[10]Haussman tests reject the random effect specification in favor of the fixed effects.

[11]We ran the same regressions with commune-year dummy variables instead of average consumption at the commune level to capture all aggregate variation at the commune-level, and we obtained very similar results.

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the commune level in favor of an alternative hypothesis of partial risk sharing under binding commitment constraints. This result holds for total consumption and for food consumption, and it is robust to potential measurement error on the shock variable.

2.6. Discussion

In an environment with complete information, no storage possibility and where agents cannot commit to honor their contracts, partial risk sharing still Pareto dominates the autarkic allocation but full insurance is not feasible. The planner needs to design a self-enforcing contract which internalizes the participation constraints of the villagers. A noticeable feature of this constrained-efficient contract is that at any point in time, consumption does not depend on realized income for households hit by unfavorable shocks. Households who experience more favorable realizations, however, see their current consumption level increase with income. This nonlinearity in the response of consumption to income shocks provides the basis of a simple test to assess the plausibility of limited commitment in explaining the documented absence of full insurance in village economies.

Our findings are similar to those of Ligon et al. (2002) and Foster and Rosenzweig (2001) in the sense that they tend to support the limited commitment hypothesis against the extreme alternatives of autarchy or full risk pooling. The work of Dubois et al. (2008) brings nuances to these conslusions however. Their results from an application with Pakistanese data suggest that both formal and informal arrangements coexist at the village level and interact to provide efficient insurance to rural households.

An important question posed by limited commitment models for policy design is the net welfare effect of public insurance schemes. Addressing this issue, Attanasio and Rios-Rull (2000) show that the net welfare effect of introducing compulsory mutual insurance programs is ambiguous a priori.

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The reason being that when informal arrangements already exist, introducing formal public insurance augments the scope for risk sharing, but it also reduces the punishment value of deviating from the informal contract, which in turn limits risk sharing possibilities further. Therefore, the potential for crowding out effects needs to be carefully assessed when evaluating the social impact of conditional cash transfers (or of larger public insurance schemes) in rural environment.

2.7. Conclusion

Looking at panel data from rural Vietnam collected during the 1990's, we have tested whether estimated shock to agricultural revenues had some relevance in explaining the cross sectional distribution of consumption. Our results reject the full insurance hypothesis, except for food consumption with respect to harvest shocks. In general, the observed consumption allocations seem more consistent with a model of risk sharing where agents cannot commit to honor their contract. In such a setting, the planner needs to design a self-enforcing contract which rewards households for whom the participation constraint is binding. The reward consists in increasing both the level of current consumption and the promised value of future utility just enough as to keep the household indifferent between reneging and remaining in the arrangement. In exchange for an increase in promised future utility, the household has to abandon part of his endowment to the planner. As a result, consumption should not depend on income when households are hit by unfavorable shocks, but there should be a positive correlation between consumption and income for households experiencing more favorable shocks.

We estimated the threshold level of income shock above which the participation contraints bind at about 5%-7%. Consistently with the model's predictions, we found that consumption is unrelated to income shocks below this threshold and that a positive association exists above this threshold.

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Tables

Table 1a: Stochastic Frontier Production Function

$N = 2863$	Pooled SFM		Random Parameter Model			
$T = 2$	Base Model (1)	Full Model (2)	Base Model (3)		Full Model (4)	
	Fixed Parameters		Mean Parameters	Scale Parameters	Mean Parameters	Scale Parameters
Technology Parameters						
Constant	3.81 *(.086)******	3.94 *(.086)******	3.65 *(.061)******	-	3.81 *(.062)******	-
Land Surface	.32 *(.009)******	.26 *(.010)******	[.33] *(.006)******	[.03] *(.001)******	[.28] *(.007)******	[.01] *(.001)******
Hired Labor Exp.	.03 *(.003)******	.03 *(.003)******	[.03] *(.003)******	[.01] *(.002)******	[.03] *(.003)******	[.02] *(.002)******
Hours on Farm	.08 *(.007)******	.07 *(.007)******	[.09] *(.004)******	[.01] *(.001)******	[.06] *(.005)******	[.03] *(.001)******
Capital Value	.05 *(.002)******	.04 *(.002)******	[.05] *(.002)******	[.00] *(.001)*	[.04] *(.002)******	[.00] *(.001)*
Input Exp.	.25 *(.006)******	.24 *(.006)******	[.25] *(.003)******	[.00] *(.001)*	[.25] *(.003)******	[.00] *(.001)*
Heterogeneity Parameters						
HH. Size	-	.03 *(.004)******	-		[.04] *(.003)******	[.00] *(.001)*
Nb. of crops	-	.02 *(.002)******	-		[.02] *(.001)******	[.00] *(.001)*
Primary Education	-	.02 *(.023)*	-		[.04] *(.018)*****	[.01] *(.006)*****
Secondary Education	-	.10 *(.020)******	-		[.11] *(.018)******	[.01] *(.016)*

Commune-year dummy variables are included but not reported.The random parameter model is estimated by simulated maximum likelihood using 1000 Halton draws.

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Table 1b: Stochastic Frontier Production Function (Continued)

$N = 2863$	**Pooled SFM**		**Random Parameter Model**	
$T = 2$	**Base Model (1)**	**Full Model (2)**	**Base Model (3)**	**Full Model (4)**
Scale Parameters				
$\lambda = \frac{\sigma_u}{\sigma_\epsilon}$	1.18	1.15	1.49	1.54
σ	.65	.63	.59	.57
σ_u	.49	.47	.49	.48
σ_ϵ	.42	.41	.33	.31
Estimated Efficiency, $\exp(-\hat{u})$				
Mean	.69	.70	.69	.70
SD	.11	.10	.11	.11
Min	.15	.16	.03	.03
Max	.93	.93	.94	.94
Estimated Shocks in % [$(\epsilon * 100)\log y$**]**				
Mean	-0.04	-0.04	-1.65	-1.9
SD	34.8	34.6	34.7	35.0
Min	-98.6	-93.9	-78.0	-76.8
Max	108.8	105.7	100.9	100.2
Information Criteria				
Log Likelihood	-4228.7	-4099.3	-4128.5	-3979.4
Akaike IC	1.50	1.46	1.46	1.45
Finite Sample AIC	1.50	1.46	1.46	1.45
Bayesian IC	1.53	1.49	1.50	1.48

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Table 2: Estimated Shocks to Revenues

(in %)	Ag. Rev. Shocks 1993	Ag. Rev. Shocks 1998
N	***2863***	***2863***
[Min; Max]	[-77; +99.7]	[-76.8; +100.2]
Mean	-2.0	-1.9
Median	-3.5	-4.1
St. Dev	29.4	32.5
Percentile Intervals		
[1%; 99%]	[-67.6; +75.0]	[-68.8; +81.2]
[5%; 95%]	[-47.4; +50.9]	[-53.2; +57.0]
[10%; 90%]	[-37.9; +36.0]	[-43.8; +41.3]

Table 3: Test For Single Threshold Effect

H_0 : **No threshold effect**	**Total Consumption**	**Food Consumption**
LR statistic	68.7	57.3
P-value	0.00	0.00
(10%, 5%, 1% crtitical values)	9.10, 11.8, 14.2	9.10, 10.0, 15.3

Statistics and critical values are calculated using bootstrap methods with 300 replications.

Table 4: Threshold Regression Estimates

	θ **Estimates**	**95% CI**
Total Consumption	7.35	[-3.47; 18.2]
Food Consumption	5.77	[-3.36; 14.9]

Statistics and critical values are calculated using bootstrap methods with 300 replications.

		Total Consumption ($\hat{\theta} = 7.35$)		**Food Consumption** ($\hat{\theta} = 5.77$)	
		(1a)	**(1b)**	**(2a)**	**(2b)**
Shocks to Revenues	$\beta_3(\hat{\theta})$	1.58 *(0.30)***		1.36 *(0.29)****	
Favorable Shocks	$\beta_4(\hat{\theta})$		2.07 *(0.46)****		1.77 *(0.45)****
Unfavorable Shocks	$\beta_5(\hat{\theta})$		0.90 *(0.57)*		0.79 *(0.56)*
Commune. Cons	$\beta_1(\hat{\theta})$	0.92 *(0.02)****	0.92 *(0.02)****	0.90 *(0.02)****	0.90 *(0.02)****
R^2		0.34	0.34	0.28	0.28
$H_0 : \beta_1 = 1$ ***(p-value)***		19.57 *(0.00)*	20.03 *(0.00)*	26.94 *(0.00)*	27.46 *(0.00)*
$H_0 : \beta_1 = 1$ **and** $\beta_3 = 0$		20.64 *(0.00)*		28.87 *(0.00)*	

Age dependency ratio is included but not reported.

Standard errors are calculated using bootstrap methods with 300 replications.

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Table 5: Risk Sharing Tests, Fixed Effects Panel Results

		Dependent: Total Consumption Per Capita				Dependent: Food Consumption			
$N = 2863$		First Difference		First Difference IV		First Difference		First Difference IV	
		(3a)	(3b)	(3c)	(3d)	(4a)	(4b)	(4c)	(4d)
Shocks to Revenues	β_3	2.65 *(0.61)******	-	6.87 *(0.95)******	-	1.72 *(0.41)******	-	4.43 *(0.68)******	-
Favorable Shocks	β_4	-	3.01 *(1.02)******	-	10.69 *(1.91)******	-	2.01 *(0.88)****	-	4.80 *(2.79)**
Unfavorable Shocks	β_5	-	1.71 *(1.15)*	-	2.98 *(1.97)*	-	1.30 *(0.91)*	-	1.26 *(0.87)*
Commune. Cons	β_1	.94 *(0.03)******	.93 *(0.03)******	.85 *(0.04)******	.85 (.04)***	.83 *(0.05)******	.86 *(0.07)******	.83 *(0.05)******	.83 *(0.08)******
R^2 **(within)**		.33	.33	-	-	.11	.11	-	-
Haussman *(p-value)*		37.8 *(0.00)*	40.7 *(0.00)*	50.2 *(0.00)*	52.3 *(0.00)*	19.47 *(0.00)*	16.92 *(0.00*	17.23 *(0.00)*	15.82 *(0.00)*
$H_0 : \beta_1 = 1$ ***(p-value)***		3.61 *(0.05)*	3.57 *(0.06)*	11.54 *(0.00)*	11.49 *(0.00)*	4.07 *(0.04)*	4.03 *(0.04)*	11.03 *(0.00)*	11.38 *(0.00)*
$H_0 : \beta_1 = 1$ **and** $\beta_3 = 0$		52.59 *(0.00)*		32.55 *(0.00)*		30.04 *(0.00)*		21.25 *(0.00)*	
F/Wald test on Z		-	-	12.55 *(0.00)*	8.74 *(0.00)*	-	-	12.10 *(0.00)*	8.34 *(0.00)*
Hansen J *(p-value)*		-	-	6.49 *(0.69)*	7.12 *(0.52)*	-	-	8.36 *(0.50)*	10.4 *(0.24)*

Estimated $\widehat{\theta}$ is 7.3% for total consumption and 5.8% for food consumption. Age dependency ratio is included in regressions, but coefficients are not reported.

Cluster-robust standard errors allowing for error correlation within communes.

The set of instruments includes dry and irrigated land surfaces owned at the begining of the period, together with their interaction with natural disasters.

(***), (**) and (*) denote coefficients significantly different from zero at 99%, 95% and 90% confidence level repectively.

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Figures

Figure 1: Optimal Contract Under Limited Commitment.

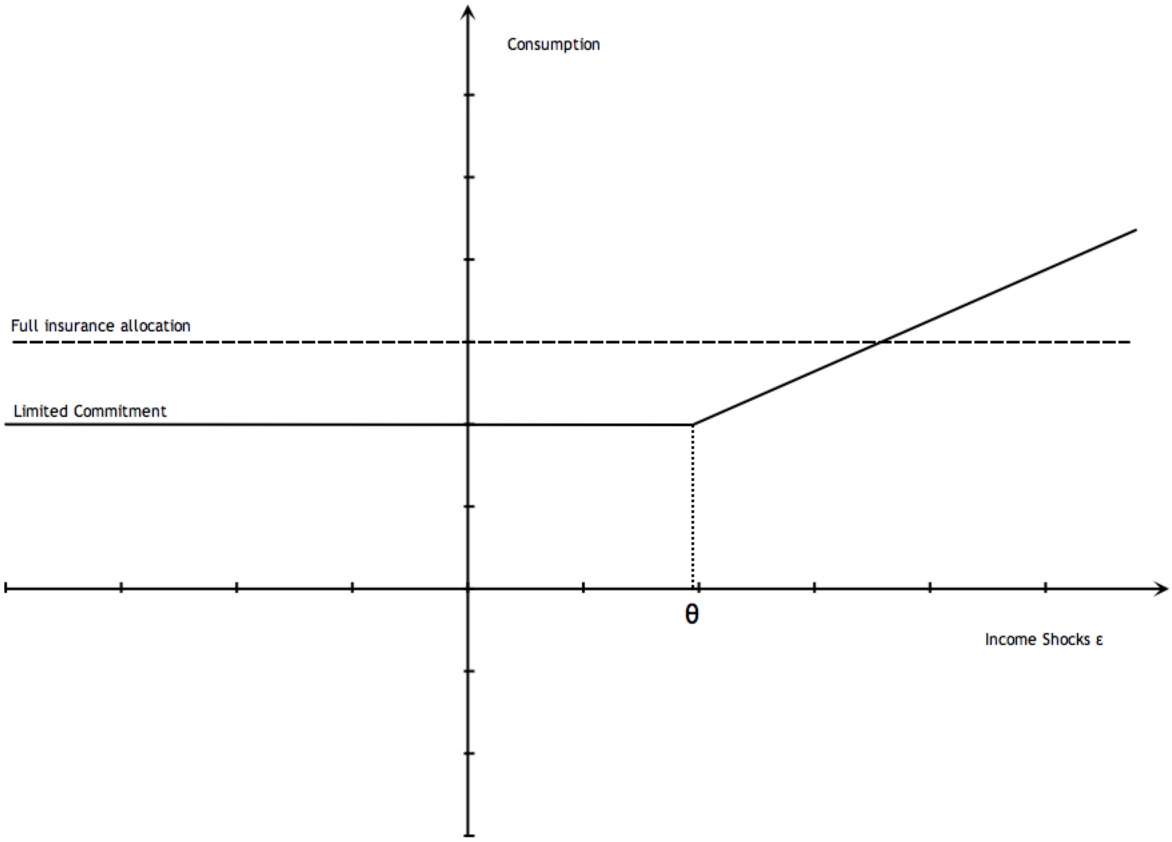

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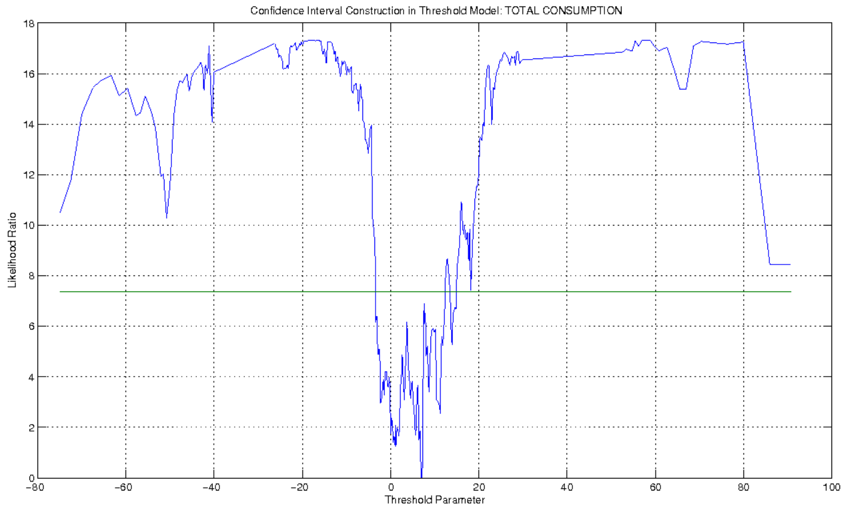
Figure 2: Threshold Estimation, Likelihoo Ratios Plots.

Total Consumption



Food Consumption

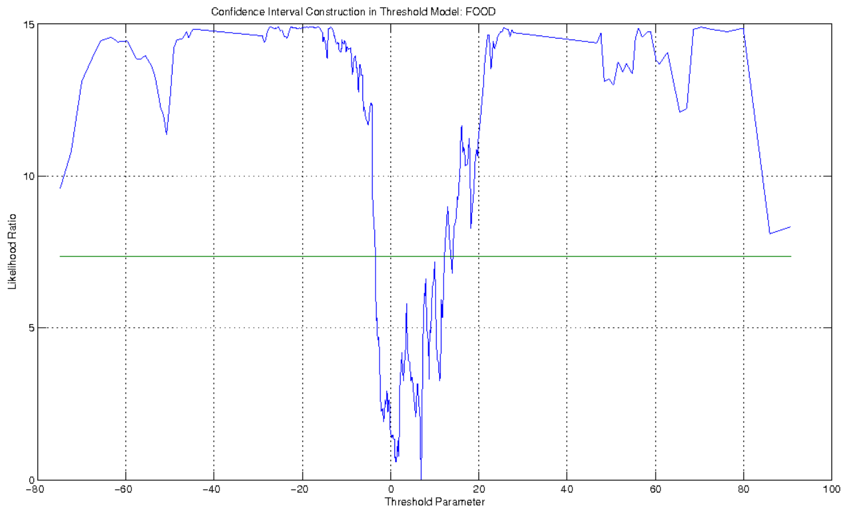


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Figure 3: Estimated Shocks to Revenues.

Density

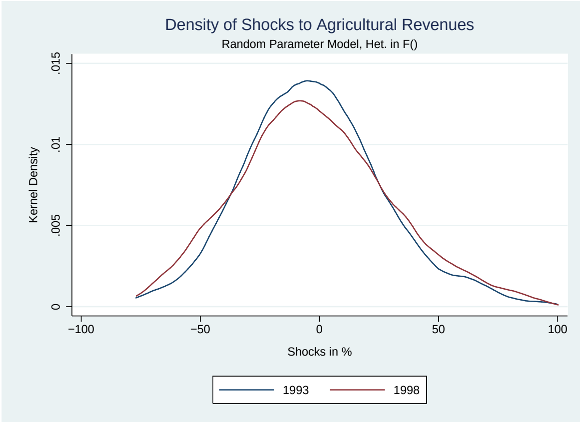
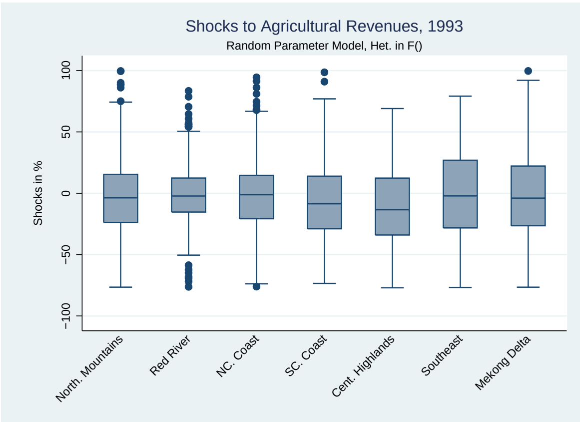


Figure 4: Estimated Shocks to Revenues.

Boxplots, by Regions, 1993



Boxplots, by Regions, 1998

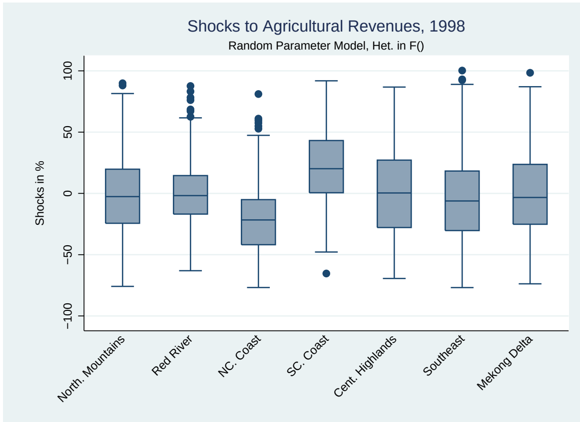


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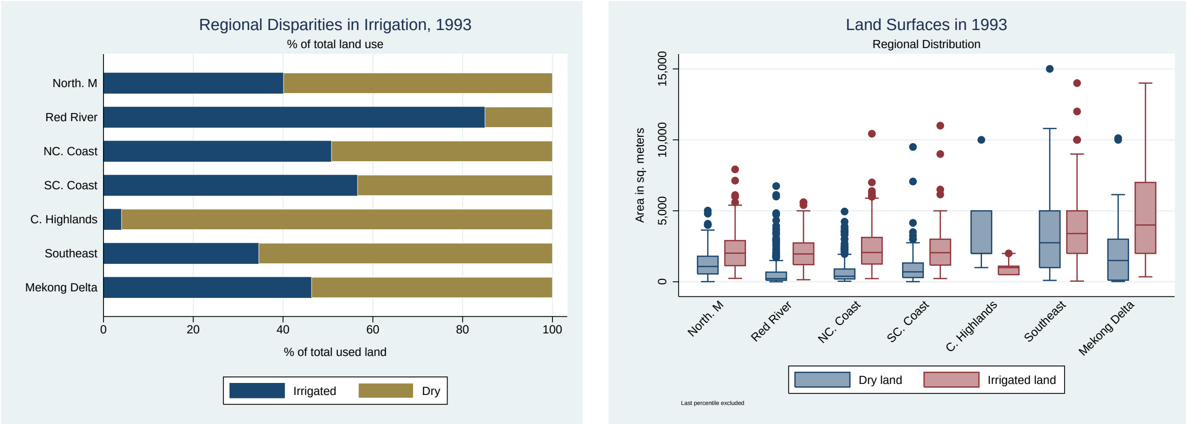
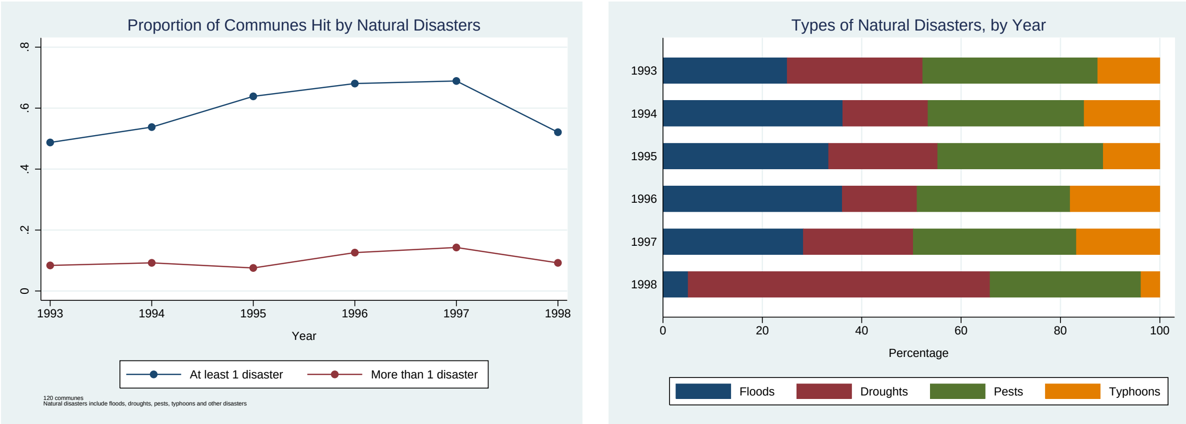
Figure 5: Instruments.

Land use in 1993



Natural disasters at commune level (1993-1998)



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CHAPTER 3

Financial Integration and Macroeconomic Volatility: Does Financial Development Matter?

3.1. Introduction

International financial integration has considerably increased since the late 1980s and 1990s, and it is considered as a source of important potential benefits. First, opening to international capital markets provides additional resources to finance investment and may therefore lead to greater capital accumulation, especially in countries where the saving capacity is constrained by a low level of income. In addition, financial integration can lead to more efficient capital allocation by enhancing market discipline and by strengthening the banking system. Together, increased capital allocation and increased allocative efficiency are expected to lower the cost of investment, and hence to foster higher growth. Another major source of benefits is to facilitate international risk sharing by providing more opportunities for portfolio diversification. This channel provides additional means of insurance for firms, allowing them to invest in high-risk/high-return activities and to fully exploit their comparative advantage by reducing production risk induced by more specialized activities. Finally international trade in assets should yield consumption smoothing benefits by allowing risk averse agents to better protect themselves against idiosyncratic shocks.

However, if these potential benefits are well established in theory, the empirical evidence is mixed and rather weak. While most of the empirical literature dealing with financial integration had focused on assessing the impact of capital account openness on the growth rate (Edison et al. (2002)), the attention has recently shifted to the relationship between financial open-

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ness and macroeconomic volatility. After the financial crisis of the 1980's and 1990's which followed capital account liberalization reforms, some authors have argued that financial integration could be a source of greater macroeconomic volatility, exposing vulnerable countries to sudden reversals of capital flows (Kaminsky and Reinhart (1999)). According to this line of argument, some countries may be more likely to experience higher macroeconomic volatility, either because they lack a policy instrument to smooth cycles, or because they lack the adequate financial institutions to cope with large and sudden reversals of capital flows.

Even without considering extreme episodes of macroeconomic volatility such as financial crises, it might also be the case that financial integration, associated with weak domestic financial institutions, exacerbates existing distortions due to credit market imperfections, thus yielding higher business cycle volatility. In the presence of informational asymmetries and/or limited enforceability of contracts for example, capital account openness provides additional liquidity to the domestic banking system and higher leverage for borrowing firms. In this context, financial integration may amplify the financial accelerator mechanism identified by Bernanke et al. (2000).

From a welfare perspective, there are two alternative ways to see the relationship between financial integration and macroeconomic volatility. The first view is that financial integration should help countries to untie consumption and output streams, allowing risk averse agents to smooth consumption and leaving output volatility inconsequential for welfare. Another way is to consider that in addition to consumption volatility, output volatility is also detrimental for welfare. Along this line, Ramey and Ramey (1995) have shown that volatility has a detrimental impact on output growth even after controlling for investment volatility.

Existing empirical evidence is mostly based on cross sectional analysis, and suggests either the absence of any significant link between financial openness and macroeconomic volatility in general, or that consumption volatility tends to increase with the degree of financial integration for low and middle income countries (Prasad et al. (2003)). Regarding consumption growth volatility, this contradicts the idea that capital account openness allows international risk sharing and consumption smoothing.

This paper is an empirical attempt to determine whether domestic financial conditions matter in the relationship between international financial integration and volatility. More specifically, we use a panel of 90 countries over the period 1960-2000 to examine explicitly the role of the interaction effects between international and domestic finance in the relationship between financial integration and volatility. We look at consumption growth volatility to assess whether more financially integrated countries have experienced higher degrees of consumption smoothing, and to what extent does this depend on the level of domestic financial development. Moreover, since output growth volatility has been shown to have adverse effects on economic growth, we also examine whether or not financial openness has been associated with more volatile output growth rates.

The remainder of the paper is structured as follows: section 2 reviews the related literature, section 3 presents the data and the methodology, section 4 discusses the results and section 5 concludes.

3.2. Related Literature

3.2.1. Financial Integration and Macroeconomic Volatility. Economic theory does not give a clear-cut prediction on the expected impact of financial integration on volatility. Under standard preferences, agents are risk averse and hence trade in international assets should allow them to smooth consumption over time. If taste shocks are important, however, allowing for more international trade in assets would drive consumption volatility up. For output growth volatility, the impact is also ambiguous. On the one hand, opening the capital account can yield lower output

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volatility by promoting production base diversification. On the other hand, output volatility can rise if the consequence of financial integration is to facilitate the exploitation of comparative advantages and to yield increasing production specialization. To analyze this impact, most models are based on standard two-country dynamic stochastic general equilibrium setups. Their predictions vary and depend on the nature of the assumed shocks that hit the economy (e.g. Mendoza (1994), Baxter and Crucini (1995), and Sutherland (1996) amongst others).

Compared to the rich literature dealing with the empirical impact of financial integration on economic growth, the number of empirical studies focusing on macroeconomic volatility is much more limited.

3.2.2. Empirical Evidence. Most existing empirical evidence suggest the absence of a strong relationship between financial integration and macroeconomic volatility.

Razin and Rose (1994) assess the impact of current and of capital account openness on volatility of output, consumption and investment by using a cross-sectional approach. They estimate the following regression model:

$$\sigma_{ji} = \alpha + \beta_{jC} FC_i + \beta_{jK} FK_i + \varepsilon_{ji}$$

where $j = Y, C, I$ are the variables of interest (output, consumption and investment), and FC_i (*resp.* FK_i) is a measure of current account (*resp.* capital account) openness. The main result is the absence of any significant relationship between openness and any of the volatility series.

Easterly et al. (2004) examine the sources of output growth volatility for a broad sample of countries over two long periods, 1960-1978 and 1979-1997. Using 2-period panel OLS and IV methods, they find that trade openness exposes a country to greater volatility, but neither the level of private capital flows, nor the volatility of these flows, have a significant impact on output growth volatility. The level of financial development, however, appears to have a significant smoothing effect on output growth, although the impact is nonlinear. Deep financial systems seem to reduce volatility, but only up to a certain threshold. This threshold for private credit is estimated to be around 100 percent of annual GDP which is relatively high.

According to Sutherland's model, financial openness should magnify monetary shocks and dampen budgetary shocks. Buch et al. (2002) test Sutherland's model by focusing on OECD countries and using annual data from 1960 to 2000. They propose the following model:

$$\sigma_{it} = \alpha_{0,i} + \alpha_{1,t} + \beta_1 \sigma_{it}^{controls} + \beta_2 FO_{it} + u_{it}$$

where σ_{it} is the standard deviation of the cyclical component of real GDP computed over 5-years time periods, and FO_{it} is a measure of financial openness. The main result is the absence of any significant relationship between financial openness and output volatility, supporting thus the model's predictions.

Kose et al. (2003) (henceforth KPT) look at the volatility of output growth, of consumption growth and also at the relative consumption volatility (ratio of consumption volatility to output volatility), for a sample of 76 countries over the period 1960-1999. They use two indicators of financial openness: a dummy variable for capital account restrictions and private capital flows. The results confirm the smoothing impact of financial development and the positive impact of trade openness on volatility. Financial openness appears with a non significant positive sign when regressed on output and consumption volatility, but its impact is strongly significant and non linear when looking at the relative consumption volatility. These results suggest that increasing financial integration brings benefits in terms of consumption smoothing only beyond a certain level of financial openness (the estimated threshold for private capital flows is around 49% of

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GDP). Below that level, consumption volatility is found to increase with the degree of financial integration. It must be noted that only some industrialized countries experience such high levels of private capital flows relative to their GDP. Since this result holds also for relative consumption volatility, the authors argue that the positive impact of financial integration on consumption volatility cannot be explained away by the fact that integrated countries have experienced economic crisis.

Previous empirical studies have tried to assess the influence of financial conditions on volatility by looking at both domestic and external finance, independently of each other. This paper seeks to investigate further these links by examining explicitly the interaction effects between international financial integration and domestic financial development in their relationship to macroeconomic volatility.

3.2.3. Financial Integration, Financial Development and Macroeconomic Volatility. Aghion et al. (1999) and Aghion et al. (2000) show that economies with low level of domestic financial development should experience more volatile growth rates. However, Beck et al. (2001) argue that this is not necessarily the case, and that the effect of financial development on volatility depends on whether the economy is affected by real or monetary shocks. Using a panel of 63 countries over the period 1960-1997, they find no robust relationship between financial development and output growth volatility.

There has been a recent growing interest in analyzing the interdependence between domestic and foreign financial markets. Chang and Velasco (1999) examine the influence of foreign banks and foreign investors on domestic banking systems, while Caballero and Krishnamurthy (2001) focus on the role of the domestic financial system to access international markets. In Broner and Ventura (2005), domestic and foreign risk sharing are connected because the government cannot discriminate between domestic and foreign agents. Because of this mechanism, they show that when the asset market is incomplete due to sovereign risk, financial globalization can lead to losses of risk sharing opportunities both within and between countries, and hence to losses in welfare.

Leblebicioglu (2008) analyzes formally the interaction effects between domestic credit market imperfection and financial integration. She develops a two-country two-sector real business cycle model where one of the countries faces asymmetric credit conditions in the sense that traded good (T) firms have access to international finance while non traded good (NT) firms are restricted to the imperfect domestic capital market. The credit market imperfection in the home country comes from an assumption that entrepreneurs in the NT sector borrow directly from workers to finance their investment. In doing so they also face a borrowing constraint specified as a collateral constraint. The proportion of net worth determining the maximum amount of loans is the parameter that represents the domestic credit market imperfection. In this model, after a positive productivity shock in the NT sector, workers want to consume more but they are also poorer because of terms of trade effects. Under perfect financial integration, workers can borrow from the foreign country to sustain their consumption level. Under autarchy however, the only way workers can increase their revenue is to work more for the T sector. This worsens the terms of trade and hence renders the home consumption bundle more expensive which then dampens the increase in consumption. In this environment, productivity shocks in the credit constrained NT good sector bring higher consumption volatility and higher relative consumption volatility under financial integration than under financial autarky.

In this paper, we examine empirically the interaction effects between the domestic financial sector and international financial integration. We use the GMM-IV estimator proposed by Arellano and Bover (1995) and Blundell and Bond (1998) to ask (1) whether financial integration has a significant impact on macroeconomic volatility, and (2) whether this relationship depends on the level of financial development. The following section presents the data and the methodology.

3.3. Data and Methodology

3.3.1. GMM-IV Panel Estimation Methods. The use of GMM-IV panel methods offers many advantages compared to the estimation methods previously used in the literature, most of which are cross-section based or rely on very short panels. First, it improves on cross-sectional analysis by exploiting the temporal dimension of the data, and this additional source of variability provides more degrees of freedom to estimate the parameters of interest. Second, by estimating a fixed effects model, one can control for unobserved time invariant heterogeneity in the data. Third, by using lagged variables as instruments, GMM-IV estimators deal explicitly with the potential endogeneity of all explanatory variables[1]. Fourth, this class of estimator is consistent for large N and small T, which suits well the structure of our sample.

We want to look at the impact of financial integration on medium to long term volatility, while keeping the time dimension of the dataset long enough. Therefore, we choose to work with non-overlapping five-year periods from 1960 to 2000. This gives an unbalanced panel of 90 countries and 8 time periods. Since there is no reason a priori to specify a dynamic equation for macroeconomic volatility, the model is estimated both under a static and a dynamic version. The estimation results suggest however that past volatility is empirically relevant in explaining current volatility both for consumption growth and output growth. The following presentation of the regression framework is thus based on a dynamic specification.

[1]The type of endogeneity that is allowed for in Arellano and Bover (1995) is one in which a variable X_{it} may be correlated with current and past values of the error term v_{it}, but not with future realizations (weak exogeneity).

Consider the following regression model:

$$y_{it} = \alpha y_{it-1} + \beta x_{it} + \eta_i + v_{it}$$

with η_i and v_{it} independently distributed across i, $E[\eta_i] = E[v_{it}] = E[\eta_i v_{it}] = 0$ for $i = 1, ..., N$ and $t = 2, ..., T$, and $E[v_{it}v_{is}] = 0 \ \forall t \neq s$.

With this specification and our panel structure (long N and short T), OLS and WITHIN estimators are biased, Maximum Likelihood estimators will depend heavily on the assumed distribution for initial conditions and the 2SLS estimator proposed by Anderson and Hsiao (1981) lacks asymptotic efficiency. Instead, Bond (2002), Arellano and Bond (1991) and Arellano and Bover (1995) have proposed linear GMM-IV estimators which are consistent and asymptotically efficient under relatively weak assumptions. The "System-GMM" estimator developed by Arellano and Bover (1995) consists in estimating a system of equations (one for each time period) specified in levels and in first differences. Adequate lagged levels of endogenous and predetermined variables, along with contemporaneous levels of strictly exogenous variables are then used as instruments for the first differenced equations, exploiting the following moment conditions:

$$E\left[Z^{'}\triangle v_i\right]$$

where Z is the matrix of instrument and $\Delta v_i = (\Delta v_{i3}, \Delta v_{i4}, ..., \Delta v_{iT})'$. Under the additional assumption that the first differences Δx_{it} are uncorrelated with the individual fixed effects η_i, appropriate lagged values of $\triangle x_{is}$ also enter the instrument matrix for the equations in level. The GMM-IV estimator then minimizes

$$J_N = \left(\frac{1}{N}\sum_{i=1}^{N}\triangle v_i^{'}Z_i\right) W_N \left(\frac{1}{N}\sum_{i=1}^{N}\triangle Z_i^{'}v_i\right)$$

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with

$$W_N = \left[\frac{1}{N} \sum_{i=1}^{N} \left(Z_i' \widehat{\triangle v_i} \widehat{\triangle v_i}' Z_i \right) \right]$$

as a weighting matrix. $\widehat{\Delta v_i}$ are consistent estimates of the first differenced residuals obtained in a first step. If the disturbances v_{it} are homoskedastic, then this "two-step" estimator has an asymptotically equivalent "one-step" version[2].

The validity of the assumed moment conditions can be tested with Hansen's or Sargan's overidentifying restriction tests. Serial correlation tests are also needed to assess the validity of the instruments.

3.3.2. Estimation strategy and Data. We consider the following two equations for the dynamic specification:

$$\sigma_{ijt} = \alpha\sigma_{ijt-1} + \beta_1 Q_{it}' + \beta_2 FD_{it} + \beta_3 FI_{it} + \eta_i + u_{it} \tag{3.42}$$

$$\sigma_{ijt} = \alpha\sigma_{ijt-1} + \beta_1 Q_{it}' + \beta_2 FD_{it} + \beta_4 FD_{it} * FI_{it} + \eta_i + u_{it} \tag{3.43}$$

with $i = 1, ..., N$, $t = 1, ..., 8$ and where σ_{ijt} denotes the standard deviation of the annual growth rate of variable $j = Y, C, C + G$ computed over 5-years windows. We consider GDP (Y), private consumption (C) and total consumption ($C + G$). All these variables are expressed in real per capita terms. Q_{it} is a set of control variables, FD_{it} is a measure of financial development, and FI_{it} is a measure of financial integration. The parameters of interest are β_2, β_3, and β_4 which captures the potential interaction effect between financial integration and financial development. With this formulation, we allow the impact of one of these two variables to depend on the level of the other. The coefficients β_2 and β_3 in (3.42) are the

[2]Simulations show that the asymptotic standard errors tend to be too small for the "two-step" version. Windmeijer (2000) analyzes this issue and proposes finite sample corrections for the variance.

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marginal effects of, respectively, financial development and financial integration, *unconditional on the level of the other variable.* In contrast, β_3 in (3.43) represents the marginal impact of financial integration *conditional on the level of financial development being zero*, and the analog interpretation for β_2 also holds.

The data are taken from the Penn World Tables (mark 6.1) and the World Development Indicators[3]. Standard determinants of macroeconomic volatility are included in the control set Q: we control for the volatility of inflation and of terms of trade, for the degree of trade openness and also for the share of agriculture in GDP to capture primary product dependence. We also include time dummies in the regressions. Table 4 shows the correlation matrix of the selected variables.

We use a measure of domestic credit to the private sector as a proxy for financial development. This is the value of credits provided by financial intermediaries to the private sector divided by GDP. This measure of financial development is standard in the finance literature[4], and it excludes credit issued to the governments, to government agencies, and to public enterprises, as well as credits provided by the central bank. While this measure does not directly capture credit market imperfections, we can interpret higher levels of domestic private credit as an indication of greater financial intermediary development. For financial integration, we chose not to use qualitative measures for two reasons. First, to the extent that they are *de jure* measures, they do not necessarily capture the effective exposition to capital flows. Latin America for example has relatively tight capital controls but also high levels of capital flows, while on the other hand, Africa has relatively low capital controls without experiencing high levels of capital flows. The second reason is that qualitative measures do not vary over

[3]Complete data description is given in table 1

[4]See Levine et al. (2000) for a discussion on this indicator compared to alternative ones, in a financial development/growth context.

time as much as quantitative measures. Among the existing *de facto* measures, we use the share of private gross capital flow on GDP because it is the most widely available measure in terms of period and country coverage.

Figures 1 to 3 show some basic trends in the evolution of the main variables of interest. For the whole sample[5], financial integration and financial development rose steadily over the period 1960-2000, with an acceleration of financial integration since the mid 1990's (figure 1). On the other hand, output growth volatility declined significantly from 1960 to 2000, with interruption periods of higher volatility, in the 1970's and the 1990's. Private consumption is more volatile than output volatility over the whole sample, but total consumption volatility is closer to output volatility, underlining the consumption smoothing role of government expenditures.

3.4. Results

We estimate equations (3.42) and (3.43) with the "System-GMM" estimator described above[6]. Both the "one step" and "two step" versions of the system estimator are implemented to check whether the results are sensitive to heteroskedasticity. We focus first on output growth volatility and on absolute consumption growth volatility (private consumption and total consumption). When building the instrument matrix, we treat all explanatory variables as being potentially endogenous, with the exception of the time dummies, the agricultural share of GDP, and the volatility of terms of trade which we treat as strictly exogenous[7] .

The estimation results are given in tables 3a to 3e. The *t*-statistics are based on robust standard errors for the "one-step" version, and on Windmeijer's finite sample correction for the "two-step" version. Serial correlation tests are reported in the tables to assess the validity of the chosen instruments. No second order serial correlation is detected, so lagged

[5]See the country list in table 2.
[6]We use the `xtabond2` program developed for `STATA` by Roodman (2006)
[7]Treating terms of trade volatility as endogenous did not change the results.

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variables of endogenous variables starting from lag $t-2$ and backward are valid instruments. We choose however to be conservative in selecting the number of variables to include in the instrument set. Roodman (2009) shows that instrument proliferation in similar settings is a serious concern which can undermine the standard Hansen tests for instrument validity. Therefore, we include a subset of all valid instruments in our instrument list which consists in only the most recent valid lag of the endogenous variables. Moreover, we report both Hansen's and Sargan's tests as the latter is less vulnerable to instrument proliferation.

We report standardized coefficients[8] which have the expected sign. The lagged dependent variable coefficient is positive and significant with magnitude less than one. Given that we are considering five-year periods, this suggests that output and consumption volatility are relatively persistent. Moreover, this also supports the dynamic specification adopted here. Inflation volatility impacts positively on output growth volatility, as do terms of trade volatility and the share of the agricultural sector in GDP. However, these variables do not have a significant influence on consumption growth volatility. Trade openness also appears with a positive and significant coefficient, which is in line with Rodrik (1998) argument: more open economies are more specialized and thus experience larger income shocks, which, combined with imperfect capital markets, lead to greater macroeconomic volatility. This result is also consistent with the findings of Kose et al. (2003), and Easterly et al. (2004).

The decline in output growth volatility over the sample period is better explained by the evolution of trade openness, inflation, primary product dependence and terms of trade, rather than by the financial variables. For output growth volatility, the financial variables do not have any significant impact on volatility, regardless of whether we consider the interaction term

[8]The coefficients are the estimated standard deviation change in the dependent variable for one standard deviation change in the corresponding explanatory variable.

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or not. The point estimates for (3.43) suggest that financial integration has a positive impact on output growth volatility up to a certain level of financial development (around 70%-80% GDP), but the coefficients are far from being statistically significant. This finding is consistent with previous empirical results and with most theoretical models which predict an ambiguous impact of financial integration on output growth volatility, depending on the nature of the shocks that hit the economy. For domestic financial development, this result is in line with Beck et al. (2001).

We now turn to consumption volatility. When the interaction between financial development and financial integration is not taken into account, estimates of (3.42) show that the marginal impact of financial development on volatility is negative for private and total consumption growth volatility, while the impact of financial integration is positive. These coefficients are however not significantly different from zero at the 95% confidence level. In other words, taken independently of each other, domestic and external financial conditions do not seem to affect consumption volatility. This result contradicts the idea that allowing for more trade opportunities in international assets should allow agents to better share risk and to smooth their consumption plan. Although surprising, this finding is in line with previous empirical studies that did not find any significant relationship between the degree of financial integration and macroeconomic volatility.

However, if we look now at the estimates of (3.43), we see that accounting for the interaction term matters when evaluating the marginal impact of financial integration on consumption volatility. Including the interaction term in the regression equation, the coefficient of financial integration (β_3) becomes positive and strongly significant. This means that conditional on the level of financial development being zero, consumption volatility increases with the degree of financial integration. Besides, the interaction term (β_4) has a significantly negative coefficient, suggesting that as the level of financial development increases, the positive impact of financial integra-

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tion on consumption volatility looses strength. Moreover, since $|\beta_4| > |\beta_3|$, there is eventually a point at which financial development is sufficiently high (say FD^*) to allow the marginal impact of financial integration on consumption volatility to change sign. In other words, financial integration has a positive impact on consumption volatility when financial development is low, but when the domestic financial system is strong enough, i.e when $FD_{i,t} > FD^*$, financial integration lowers consumption volatility.

Previous empirical work seeking to assess the impact of financial integration on macroeconomic volatility found either the absence of a robust link, or that financial integration impacts positively on consumption volatility. The main contribution of this paper is to show that the impact of financial integration on consumption volatility depends on the level of financial development. Consumption volatility increases with financial integration for low levels of financial development, and smoother consumption is associated with financial integration for high levels of financial development. From a policy perspective, this result suggests that reforms aiming at strengthening the domestic financial system should be a prerequisite to capital account liberalization.

Computing the threshold level FD^* of financial development from the unstandardized point estimates, it appears that the benefits of financial integration in terms of private consumption smoothing occur after financial development (i.e the GDP share of credits to the private sector) has reached a level of about 55%-60% (see table 5). This is a relatively high level of financial development as only 17% of our sample (mostly industrial countries) experience such levels of financial development. We obtain similar results after considering a static specification of (3.42) and (3.43). Moreover, the results do not vary much whether we consider "one-step" or "two-step" estimation, suggesting that heteroskedasticity does not influence our results. Finally, the results are robust to alternative financial

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development indicators[9].

Next, from these point estimates, we compute the total marginal effect of financial integration conditional on the level of financial development as:

$$\beta_{it}^{FI} = \frac{d\left[\sigma_{it}\right]}{d\left[FI_{it}\right]} = \beta_3 + \beta_4 FD_{it}$$

and its associated standard error as:

$$SE\left(\beta_{it}^{FI}\right) = \left[VAR\left(\beta_3\right) + FD_{it}^2 VAR\left(\beta_4\right) + 2FD_{it}COV\left(\beta_4, \beta_3\right)\right]^{\frac{1}{2}}$$

Both the total marginal effects and their associated standard errors are functions of FD_{it}. Figures 4a and 5a show the estimated coefficients and their corresponding 95% confidence intervals for absolute and relative consumption volatility. As can be seen, these confidence intervals reach their minimum value close to the estimated threshold, and they get wider as one moves away from it. For both private and total consumption, the estimated coefficient is significantly positive for low levels of financial development, it is close to zero for intermediate range and negative for high values of financial development.

Standard errors get quite large as we move away from the estimated threshold. A possible explanation is that multicollinearity effects introduced by the interaction term inflate the variance of the estimated coefficients. The sample correlation coefficient between financial integration and the interaction term (see table 5) is indeed relatively high (0.88). Multicollinearity would however only influence the precision of the estimator, and not consistency. Hence, this potential effect only strengthens our finding. Our results are conservative in the sense that even in the presence of

[9]Similar results are obtained with alternative indicators based on private credit (private credit provided by the banking sector, private credit by deposit money bank), and also with other indicators such as liquid liabilities (M3) as a % of GDP, or financial depth (M2) as a % of GDP.

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potentially inflated variances due to multicollinearity effects, financial integration remains significantly associated with higher consumption volatility for low levels of financial development, and with smoother consumption for sufficiently developed financial systems. Without multicollinearity effects, the confidence intervals around the estimated total marginal impact would be narrower, yielding a higher threshold level of financial development below which financial integration impacts positively on consumption volatility, and a lower threshold level of financial development above which financial integration is expected to bring consumption smoothing benefits.

We saw that financial integration affects consumption volatility but not output volatility. In order to be sure that the changes in consumption volatility are not driven by changes in output volatility we also look at the ratio of consumption growth volatility to output growth volatility. The results for relative consumption volatility are reported in tables 3d and 3e[10] and they confirm what we found for the absolute level of consumption volatility. Financial integration has a strong positive impact on relative consumption volatility for low levels of financial development. Above a threshold level of financial development (around 65%-70% of GDP for private consumption, see table 5), the marginal impact of financial integration is to reduce consumption volatility relative to output volatility.

Overall, these results suggest that for most countries in the sample the marginal effect of financial integration is to increase absolute and relative consumption volatility. Only a small number of countries with sufficiently developed financial systems will experience consumption smoothing benefits from financial integration. Looking at absolute private consumption volatility, figure 6a shows a cross plot of financial integration against financial development for countries with low levels of financial development

[10]In contrast with output and consumption equations, serial correlation tests detect second order serial correlation. Hence, only lags starting from $t-3$ and backward provide valid instruments for the endogenous variables.

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(below 35% of GDP). These are the countries for which financial integration is significantly associated with more volatile consumption. Most of the developing countries in the sample belong to this group. African countries are typically characterized by low levels of both financial development and financial integration. Among these countries with low level of financial development, we also find some Latin American countries with relatively higher levels of financial integration, and which have been subject to financial crises in the 1980's (Mexico) and in the 1990's (Argentina). Figure 6b instead plots the few countries with level of financial development above the estimated threshold level (59%). These are the countries for which financial integration is expected to bring consumption smoothing benefits. Most of these are rich and industrialized countries.

Finally, we want to have an idea of the magnitude at which consumption volatility responds to changes in the degree of financial integration. We compute the corresponding elasticities as:

$$\varepsilon_{it} = \frac{d\left[\sigma_{it}\right]}{d\left[FI_{it}\right]}\frac{FI_{it}}{\sigma_{it}} = \left(\beta_3 + \beta_4 FD_{it}\right)\frac{FI_{it}}{\sigma_{it}}$$

These elasticities are evaluated at the mean value of financial integration and of financial development over the period 1960-2000. Figures 7 and 8 show these elasticities for a selected group of countries. If we look at countries with low level of financial development (credit to the private sector below 35% GDP), the elasticity of absolute private consumption volatility ranges from 0.01% (Zimbabwe) to 0.34% (Guatemala), but most values of the estimated elasticities lie between 0.01% and 0.1%. By contrast, for countries with high level of development (above 59%) these elasticities range from -0.37% (Japan) to -0.01% (Italy), with most values between -0.2% to -0.01%.

Summarizing our findings, a first result was that the decline in output volatility over the sample period is better explained by the traditional in-

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dicators rather than by the financial variables. Second, for low levels of financial development consumption volatility increases with financial openness, both in the absolute and relative to output volatility. However, when the domestic financial system is sufficiently developed, financial integration yields consumption smoothing benefits. The estimated threshold level of financial development at which the marginal impact of financial integration on volatility changes sign is relatively high. Only 17% of the sample at most experience consumption smoothing benefits from financial integration, most of which being industrialized countries.

3.5. Conclusion

In theory, the ability to trade internationally in assets should help risk-averse agents to untie their consumption stream from their income stream and thus facilitate consumption smoothing. However, recent empirical evidence has suggested either the absence of a significant correlation, or the opposite relationship, namely that more financially integrated countries have experienced more volatile consumption, especially for emerging market economies in the late 1980's and 1990's.

The contribution of this paper is to show that the interaction between domestic and external market matters in assessing the relationship between financial integration and consumption volatility. Financial integration is associated with higher volatility in consumption growth rates if the level of domestic financial development lies below a threshold level. This result holds both for consumption in absolute terms and relative to output volatility. The threshold level of financial development, measured by the share of private credits to GDP, is estimated to be around 55%-60% for absolute consumption volatility and around 65%-70% for relative consumption volatility. Above this level, consumption smoothing benefits are expected. It appears however that only a limited number of industrial countries benefit from international financial integration as far as consumption smoothing

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is regarded. In terms of policy, this suggests that sound domestic financial system should be a prerequisite to capital account liberalization reforms in developing countries.

Our findings are consistent with some general equilibrium models with frictions both in the domestic and in the international financial markets (Leblebicioglu (2008)). These results support the idea that when the domestic financial system is weak, exposition to international capital flows might exacerbate existing distortions due to capital market imperfections, and hence amplify economic fluctuations. An other interpretation goes along the lines of Broner and Ventura (2005) in the sense that rising financial globalization can be associated with the destruction of risk sharing opportunities when asset markets are incomplete.

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Tables

Table 1: Sample Size and Pre-Transfer Income.

Variable name and description	*Source*
Output	**Summers and Heston PWT 6.1**
Real GDP per capita (Constant price: Laspeyres)	series code: RGDPL
Private Consumption	**Summers and Heston PWT 6.1**
Consumption Share of RGDPL	series code: KC
Government Consumption	**Summers and Heston PWT 6.1**
Government Share of RGDPL	series code: KG
Inflation	**World Bank WDI**
log(1+inflation), GDP deflator (annual %)	series code: NY.GDP.DEFL.KD.ZG
Terms of Trade	**World Bank WDI**
Net Barter ToT (1995 = 100)	series code: TT.PRI.MRCH.XD.WD
Agriculture	**World Bank WDI**
Value added of the agricultural sector in % of GDP	series code: NV.AGR.TOTL.ZS
Trade Openness	**World Bank WDI**
Value of imports and exports in % of GDP	series code: NE.TRD.GNFS.ZS
Financial Development	**World Bank WDI**
Domestic credit to the private sector in % of GDP	series code: FS.AST.PRVT.GD.ZS
Financial integration	**World Bank WDI**
Gross private capital flows in % of GDP	series code: BG.KAC.FNEI.GD.ZS

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Table 2: Country List. Algeria, Argentina, Australia, Bangladesh, Barbados, Belgium, Benin, Bolivia, Botswana, Brazil, Burkina Faso, Burundi, Cameroon, Canada, Central African Republic, Chad, Chile, China, Colombia, Congo (Rep.), Costa Rica, Cote d'Ivoire, Cyprus, Denmark, Dominican Republic, Ecuador, Egypt, El Salvador, Fiji, Finland, France, Gabon, Gambia, Ghana, Greece, Guatemala, Honduras, Hong Kong SAR, India, Iran, Ireland, Italy, Jamaica, Japan, Jordan, Kenya, Korea, Lesotho, Madagascar, Malawi, Mali, Mauritania, Mauritius, Mexico, Morocco, Netherlands, New Zealand, Nicaragua, Niger, Nigeria, Norway, Pakistan, Panama, Paraguay, Peru, Philippines, Rwanda, Senegal, Seychelles, Sierra Leone, Singapore, South Africa, Spain, Sri Lanka, Sweden, Syrian Arab Republic, Tanzania, Thailand, Togo, Trinidad and Tobago, Tunisia, Turkey, United Kingdom, United States, Uganda, Uruguay, Venezuela, Zambia, Zimbabwe.

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Table 3a: Estimation Results.

Dependent: Output Growth Volatility				
Standardized Coefficients	**One-Step System**		**Two-Step System**	
Lagged Dependent Variable	.170 *(1.74*)*	.171 *(1.78*)*	.177 *(2.21)***	.176 *(1.97)***
Inflation Volatility	.187 *(2.07)***	.203 *(2.35)***	.210 *(2.49)***	.237 *(3.49)****
Terms of Trade Volatility	.152 *(2.60)****	.148 *(2.56)***	.154 *(2.37)***	.145 *(2.12)***
Agriculture Share	.170 *(2.40)***	.168 *(2.42)***	.146 *(2.07)***	.125 *(1.86)**
Trade Openness	.125 *(2.08)***	.121 *(1.86)**	.116 *(1.84)***	.121 *(1.81)**
Financial Development (FD)	-.005 *(.12)*	-.0006 *(.01)*	-.004 *(.09)*	.003 *(.09)*
Financial Integration (FI)	.018 *(.76)*	.019 *(.22)*	.024 *(.98)*	.047 *(.70)*
FD*FI		-.020 *(.16)*		-.054 *(.54)*
Sargan test (p-value)	.589	.975	.289	.627
Hansen test (p-value)	.933	.972	.782	.849
AR(1) test (p-value)	.041	.043	.069	.075
AR(2) test (p-value)	.348	.348	.400	.410
AR(3) test (p-value)	.381	.395	.426	.454

t-statistics in parentheses, Windmeijer correction in "Two Step System"

(*), (**) *and* (***) *denote coefficient different from zero at 90%, 95% and 99% confidence level*

Time dummies are included but not reported

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Table 3b: Estimation Results.

Dependent: Private Consumption Growth Volatility				
Standardized Coefficients	**One-Step System**		**Two-Step System**	
Lagged Dependent Variable	.290 *(3.12***)*	.264 *(2.95***)*	.305 *(3.24)****	.261 *(2.85)****
Inflation Volatility	.053 *(.60)*	.038 *(.44)*	.041 *(.46)*	.039 *(.42)*
Terms of Trade Volatility	.099 *(1.38)*	.085 *(1.29)*	.099 *(1.34)***	.081 *(1.14)*
Agriculture Share	.020 *(.32)*	.016 *(.27)*	.016 *(.25)*	.023 *(.40)*
Trade Openness	.245 *(2.15)***	.296 *(2.59)***	.243 *(2.16)****	.293 *(2.20)***
Financial Development (FD)	-.094 *(1.51)*	-.033 *(.64)*	-.091 *(1.36)*	.003 *(.09)*
Financial Integration (FI)	.030 *(.62)*	.244 *(2.16)***	.032 *(.065)*	.263 *(2.22)***
FD*FI		-.353 *(2.46)***		-.383 *(2.65)****
Sargan test (p-value)	.886	.927	.530	.706
Hansen test (p-value)	.971	.988	.791	.967
AR(1) test (p-value)	.002	.002	.007	.007
AR(2) test (p-value)	.406	.331	.432	.364
AR(3) test (p-value)	.403	.415	.472	.466

t-statistics in parentheses, Windmeijer correction in "Two Step System"

(*), (**) *and* (***) *denote coefficient different from zero at 90%, 95% and 99% confidence level*

Time dummies are included but not reported

Table 3c: Estimation Results.

Dependent: Total Consumption Growth Volatility				
Standardized Coefficients	**One-Step System**		**Two-Step System**	
Lagged Dependent Variable	.222 *(2.70***)*	.187 *(2.42**)*	.218 *(2.49)***	.180 *(2.53)***
Inflation Volatility	.265 *(3.02)****	.256 *(2.99)****	.269 *(2.65)****	.267 *(3.17)****
Terms of Trade Volatility	.091 *(1.23)*	.079 *(1.13)*	.096 *(1.20)*	.092 *(1.18)*
Agriculture Share	.112 *(1.55)*	.114 *(1.70)**	.105 *(1.98)***	.118 *(2.20)***
Trade Openness	.152 *(1.69)**	.192 *(1.99)***	.144 *(2.05)***	.176 *(1.96)***
Financial Development (FD)	-.083 *(1.51)*	-.016 *(.30)*	-.079 *(2.27)***	-.029 *(.62)*
Financial Integration (FI)	.043 *(.72)*	.287 *(2.27)***	.038 *(.62)*	.266 *(2.11)***
FD*FI		-.368 *(2.10)***		-.335 *(1.90)**
Sargan test (p-value)	.885	.926	.526	.704
Hansen test (p-value)	.409	.555	.833	.986
AR(1) test (p-value)	.000	.001	.002	.002
AR(2) test (p-value)	.190	.036	.268	.376
AR(3) test (p-value)	.608	.657	.642	.823

t-statistics in parentheses, Windmeijer correction in "Two Step System"

(*), (**) and (***) denote coefficient different from zero at 90%, 95% and 99% confidence level

Time dummies are included but not reported

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Table 3d: Estimation Results.

Dependent: Relative Consumption Volatility (private)				
Standardized Coefficients	**One-Step System**		**Two-Step System**	
Lagged Dependent Variable	.132 *(.87)*	.081 *(.76)*	.118 *(.73)***	.075 *(.64)*
Inflation Volatility	.011 *(.06)*	.020 *(.13)*	-.021 *(.15)*	-.001 *(.01)*
Terms of Trade Volatility	.023 *(.44)*	.000 *(.02)*	.010 *(.26)*	-.002 *(.05)*
Agriculture Share	.073 *(.92)*	.075 *(.95)*	.069 *(.91)*	.067 *(.72)*
Trade Openness	.293 *(2.30)***	.293 *(2.21)***	.299 *(2.35)***	.298 *(2.47)***
Financial Development (FD)	.038 *(.42)*	.126 *(.139)*	.048 *(.39)*	.141 *(1.49)*
Financial Integration (FI)	.004 *(.08)*	.336 *(2.46)***	.023 *(.41)*	.334 *(2.90)****
FD*FI		-.422 *(2.94)****		-.413 *(3.39)****
Sargan test (p-value)	.947	.821	.453	.382
Hansen test (p-value)	.319	.332	.441	.521
AR(1) test (p-value)	.000	.001	.056	.032
AR(2) test (p-value)	.044	.033	.175	.118
AR(3) test (p-value)	.225	.366	.330	.442

t-statistics in parentheses, Windmeijer correction in "Two Step System"

(*), (**) *and* (***) *denote coefficient different from zero at 90%, 95% and 99% confidence level*

Time dummies are included but not reported

Table 3e: Estimation Results.

Dependent: Relative Consumption Volatility (total)				
Standardized Coefficients	**One-Step System**		**Two-Step System**	
Lagged Dependent Variable	.399 *(2.41**)*	.313 *(1.89*)*	.405 *(2.70)***	.312 *(2.18)***
Inflation Volatility	-.006 *(.06)*	-.006 *(.07)*	.017 *(.36)*	-.035 *(.58)****
Terms of Trade Volatility	-.004 *(.10)*	-.026 *(.62)*	-.019 *(.35)*	-.016 *(.32)*
Agriculture Share	.149 *(1.90)**	.173 *(2.26)***	.126 *(1.50)*	.147 *(1.88)**
Trade Openness	.312 *(2.47)***	.306 *(2.34)***	.311 *(2.77)****	.304 *(2.54)***
Financial Development (FD)	-.041 *(.61)*	.076 *(1.28)*	-.054 *(.82)*	.049 *(.71)***
Financial Integration (FI)	.010 *(.16)*	.476 *(3.09)****	.009 *(.14)*	.447 *(2.58)****
FD*FI		-.564 *(3.42)*		-.474 *(2.35)***
Sargan test (p-value)	.243	.421	.241	.420
Hansen test (p-value)	.320	.333	.444	.524
AR(1) test (p-value)	.000	.001	.003	.003
AR(2) test (p-value)	.019	.036	.023	.028
AR(3) test (p-value)	.339	.657	.369	.588

t-statistics in parentheses, Windmeijer correction in "Two Step System"

(*), (**) *and* (***) *denote coefficient different from zero at 90%, 95% and 99% confidence level*

Time dummies are included but not reported

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Table 4: Correlation Matrix.

	Vol(Y)	**Vol(C)**	**Vol(inf)**	**Vol(ToT)**	**Agric.**	**Open.**	**FD**	**FI**	**FI*FD**
Vol(Y)	1.00								
Vol(C)	.5593	1.00							
Vol(inf)	.3004	.2381	1.00						
Vol(ToT)	.3615	.2159	.1574	1.00					
Agric.	.2897	.1514	.1279	.3000	1.00				
Open.	.1455	.2355	.0566	-.0442	-.1592	1.00			
FD	-.3581	-.2876	-.1872	-.3119	-.5994	.0410	1.00		
FI	-.0121	.0464	.0335	-.0776	-.2242	.3332	.2535	1.00	
FI*FD	-.1073	-.0494	-.0191	-.01404	-.2683	.3609	.4609	.8844	1.00

Table 5: Estimated Thresholds of Financial Development (private credit in % of GDP).

Point estimates for the threshold level of FD at which the marginal effect of FI on volatility changes sign

Dependent variable	$Vol(C)$	$Vol(C+G)$	$\frac{Vol(C)}{Vol(Y)}$	$\frac{Vol(C+G)}{Vol(Y)}$
Dynamic specification, one-step	58.9	66.5	67.7	71.8
Dynamic specification, two-steps	58.4	67.8	68.9	80.2
Static specification, one-step	54.9	64.3	67.0	67.8
Static specification, two-steps	55.2	65.1	66.8	67.5

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Figures

Figure 1: FI and FD.

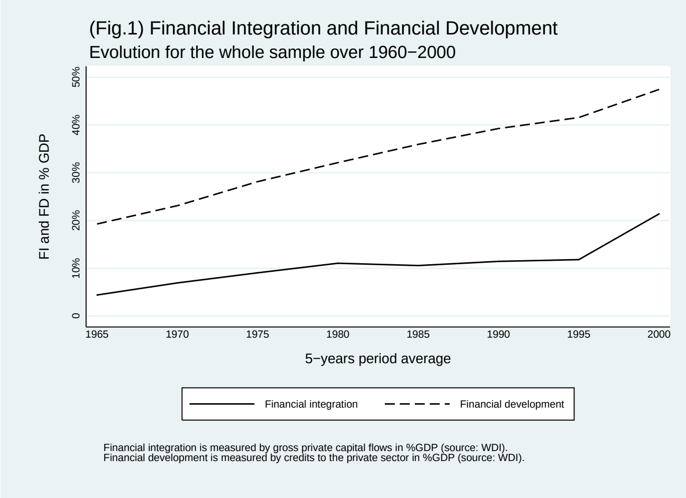

Figure 2: FI and FD.

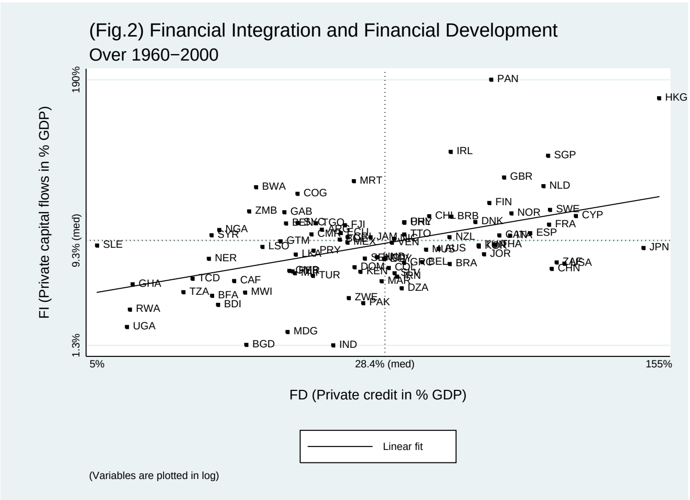

Figure 3: Macroeconomic Volatility.

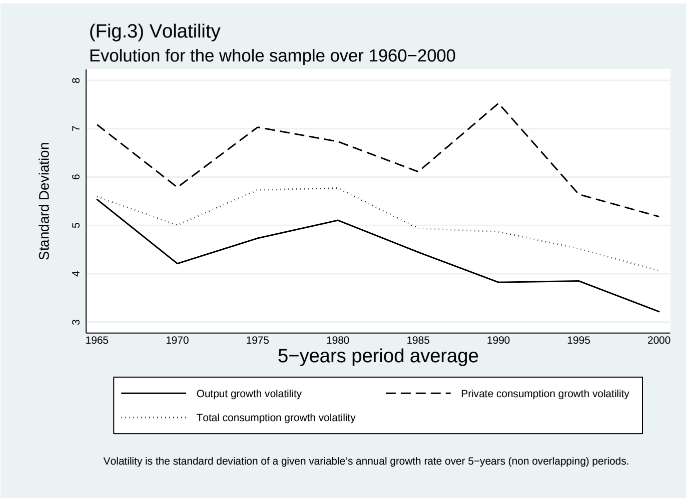

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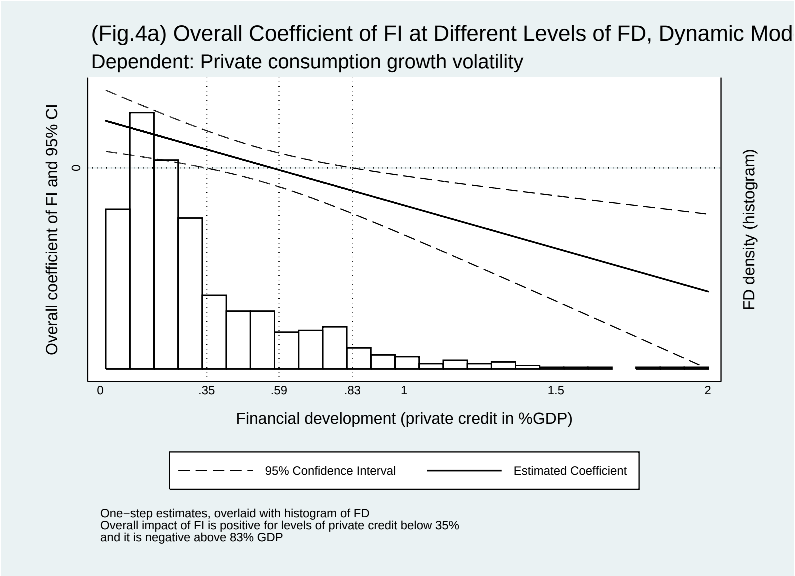
Figure 4: Private Consumption, Dynamic Model.



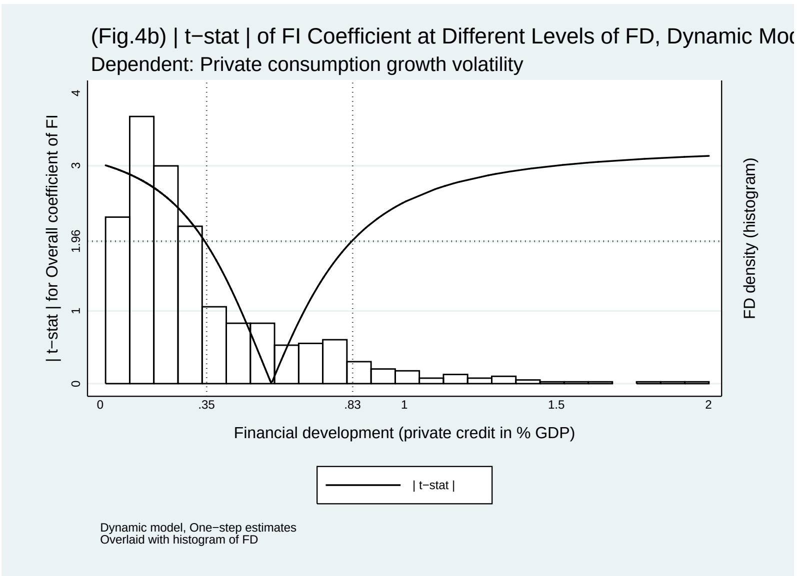


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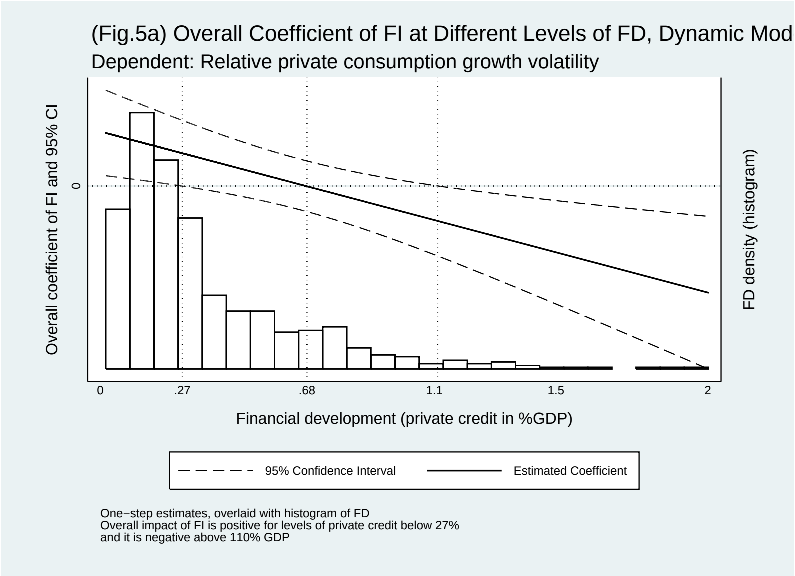
Figure 5: Relative Consumption, Dynamic Model.



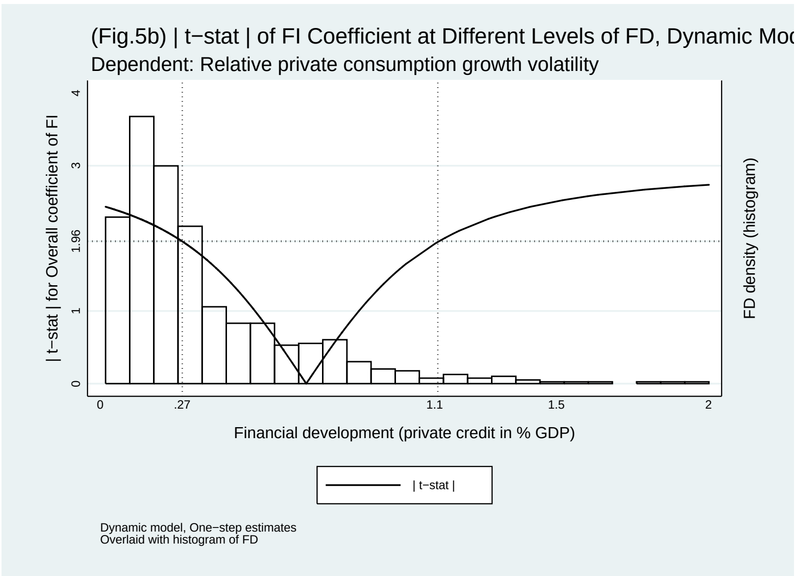


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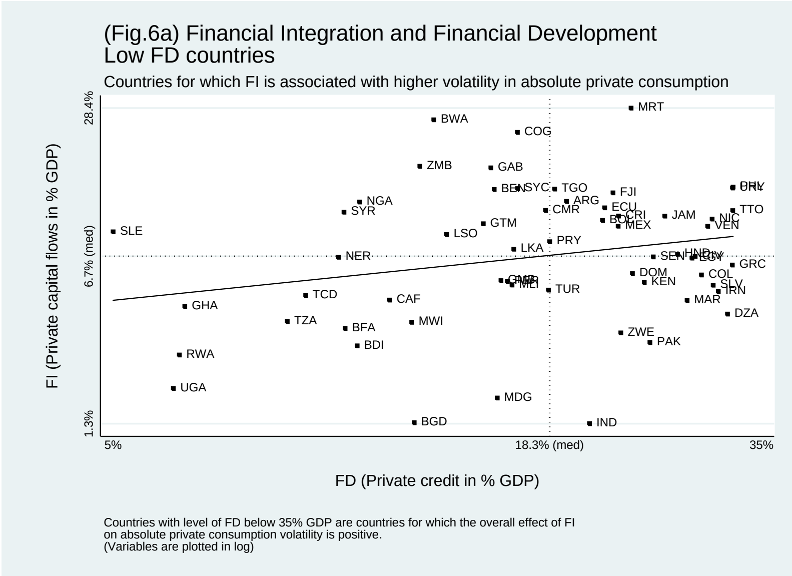
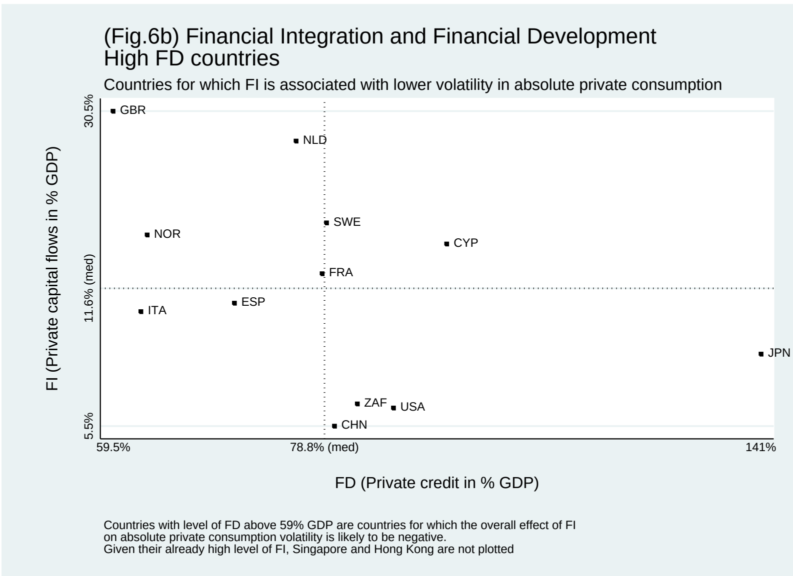
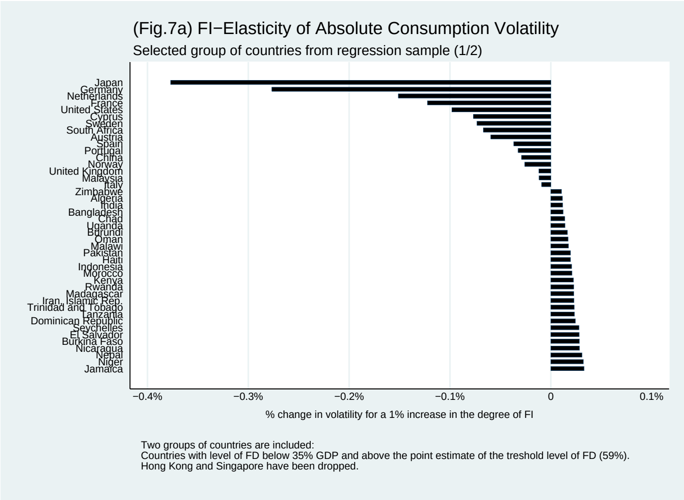
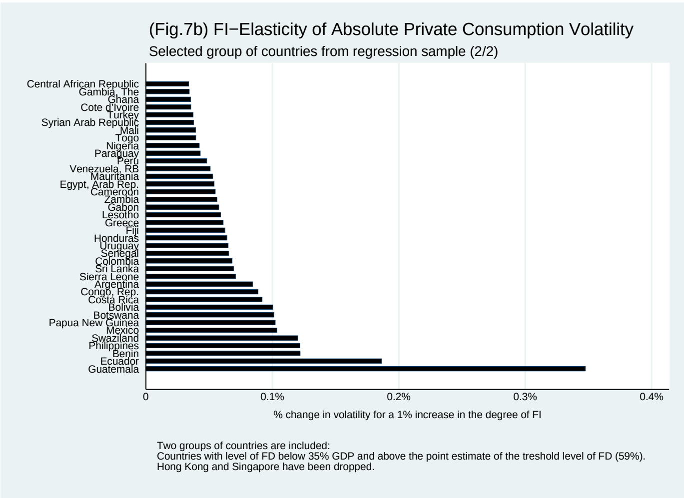
Figure 6: FI and FD in Low and High FD Countries.

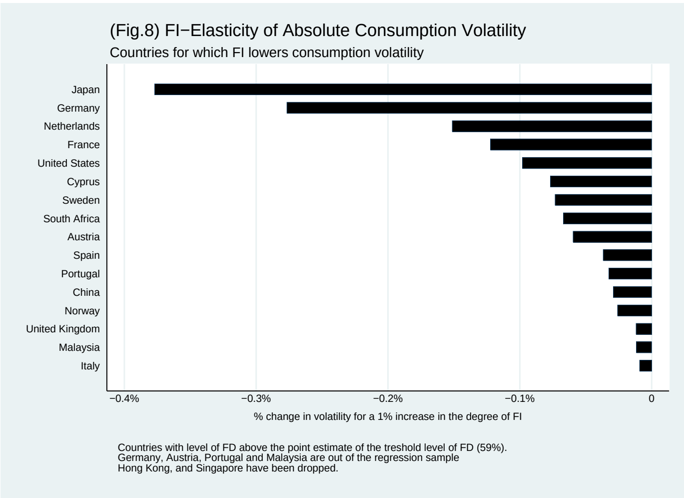




Figures 7 and 8: FI Elasticity of Private Consumption Volatility.







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