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Risk insurance in a transition economy

Evidence from rural Romania[1]

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Abstract

The hypothesis of Pareto-optimal risk-sharing is tested in a transition economy using a new dataset of a representative sample of 364 rural households from Romania. Income shocks are identified as instances of adverse weather, crop failure, animal diseases, illness, and unemployment spells. Despite limited participation of Romanian rural households in formal insurance and credit markets, we fail to reject the hypothesis of full insurance of total non-durable consumption and its components. Survey responses indicate that the main channels of consumption smoothing are self-insurance (for adverse weather, crop failure and animal diseases), public transfers (for unemployment spells, maternity and childcare), and to a lesser extent, family ties. We find that adverse weather is associated with higher growth rates of non-food expenditures. Furthermore, richer households are better able to cope with crop failure than poorer households. An alternative explanation to our not rejecting the hypothesis of full insurance is that some shocks to consumption (such as illness) play the role of preference shifters of the utility function.

JEL classifications: O12, O5, P2.
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1. Motivation

Development economists have extensively analysed the ability of households to smooth consumption in face of adverse income shocks.[2] Transition economies, however, have generally not been the object of such studies (with the notable exception of Russia[3]), mainly because of data limitations. This paper aims to bring new evidence to this literature. Using a unique dataset from rural Romania, it examines whether Pareto-optimal risk-sharing is achieved, and identifies differences in households' ability to cope with income losses based on their characteristics.

Income variations at the household level are measured with variables which quantify the occurrence and magnitude of income and consumption shocks such as adverse weather, crop failure, and animal diseases, spells of illness and unemployment, maternity and childcare. The data enable us to circumvent an attenuation bias problem which usually arises in empirical tests of optimal risk-sharing due to measurement error in income or profits.[4] In the empirical specifications, this problem is avoided by measuring income variations directly with subjective shock indicator variables (for example, the number of workdays lost due to an illness or a spell of unemployment).

Among transition economies, Romania is chosen as our object of study because it has a large rural sector and has faced a particularly difficult period of transition marked by two economic crises. Forty percent of the country's labour force is employed in agriculture, although the sector's contribution to total output during the 1990s has only been around one fifth of total output (World Development Indicators, 2003). Romania has faced two severe economic recessions: between 1990 and 1992, its per capita GDP fell by 19 percent; after a short recovery, per capita income contracted again by 6 percent in 1997, and 5 percent in 1998. Only in 2003, after 13 years of economic hardship, did the country's per capita output reach and even exceed its 1990 level (albeit by a mere 2 percent).[5]

Throughout the 1990s, public benefits have been an important source of formal insurance for Romanian households. Social protection transfers accounted for 10.8 percent of GDP in 1999 (IMF, 2006, p. 88). In early 2002, the Romanian government implemented the Minimum Income Guarantee scheme which supplements the actual income of a family to meet a minimum level. Sahn *et al.*

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[2] For a description of the main issues on this subject, see Alderman and Paxson (1994), Townsend (1995) and Morduch (1995).

[3] Russian households have been analysed in papers such as Skoufias (2003), Stillman (2001), Mu (2003), Notten (2004) and Guariglia and Kim (2003, 2004). We discuss this literature in detail in Section 2.

[4] For a detailed discussion on the subject, see Deaton (1997). Skoufias (2003) documents the extent to which measurement and imputation errors in income and consumption are responsible for misleading Ordinary Least Squares estimates of the relevant parameters in a sample of Russian households, and implements an instrumental variables strategy whereby directly measured shock variables are used to isolate exogenous variation in income.

[5] Based on per capita income in constant local currency units (World Development Indicators, 2003).

(2000) document the crucial role played by government transfers in helping poorer households cope with increased vulnerability during the difficult times of economic transition.

Additionally, rural Romania is an interesting setting for this analysis because rural households have been particularly credit-constrained throughout the 1990s. For instance, using the 1998 Surveys of Rural Households and Enterprises, Chaves *et al.* (2001) show that only 20 percent of rural households borrowed in the market for cash loans in 1998. As little as 1.1 percent of rural households borrowed from formal lenders (private and state banks) while 10.1 percent used semi-formal lenders (for example, credit cooperatives). These figures are suggestive of the borrowing constraints faced by Romanian families.

This analysis, although focusing on the Romanian case, is relevant to a larger set of transition countries, including Moldova, Albania, Bulgaria and Ukraine. These countries share an underlying specificity of the rural sector: significant contribution to employment,[6] implementation of legislative changes, including land reforms aimed at enabling the transition from state ownership to private ownership of agricultural land, and high land fragmentation. This study aims to provide evidence of the ability of rural households to smooth their consumption. This evidence is critical for policy-making (for instance, in the design of social safety-net programmes) and is relevant in the context of high poverty levels in transition countries.[7]

In the data, we find no evidence against a Pareto-efficient allocation of consumption when Romanian rural households are faced with shocks to their income stream. This, however, does not necessarily imply that the efficient outcome is achieved; the empirical results may be confounded by the role played by some types of shocks (such as illness) as preference shifters of the utility of consumption. We also find that poorer households are less able to cope with shocks (such as crop failure and bad weather) than richer households. Finally, the occurrence of adverse weather is positively correlated with the growth rate in non-food consumption.

The remainder of the paper is organized as follows. In Section 2 we review the literature; Section 3 discusses the data and descriptive statistics; Section 4 presents the econometric strategy and the variables used in the regressions. The main

[6] In Moldova, roughly 50 percent of the labour force is employed in agriculture. As in Albania, the sector contributes about a quarter of GDP. Bulgaria's agricultural sector contributes slightly less than Romania's to the country's GDP (12 percent in 2002–3) and employs a quarter of the labour force, while Ukraine's is about 15 percent of total income and employs one fifth of the labour force (2001) (World Development Indicators, 2003).

[7] The World Bank estimates that Romania's poverty headcount – for the $2.15 per day international poverty line (at 1993 PPP) – was 28 percent in 1994. It was as high as 74 percent in Moldova in 1999 while in Ukraine it continuously increased throughout the 1990s up to 31 percent (1999). In 1996, one person in five had a consumption level lower than $2.15 per day in developing Europe and Central Asia (World Development Indicators, 2003). Note that the $2.15 per day poverty line is commonly referred to as the $2 per day poverty line.

empirical findings are outlined in Section 5 and we draw some conclusions in Section 6.

2. Previous work

Cochrane (1991), Mace (1991) and Townsend (1994) laid the foundations of the theoretical framework for Pareto-optimal risk-sharing. Most of the existing empirical literature focuses on developing countries, with the exception of Mace (1991), who tests the full insurance hypothesis in the United States, using a wide range of utility functions.[8] The literature on developing countries brought a large body of evidence that households' consumption is remarkably smooth while households' income is subject to large variations.[9] Jalan and Ravallion (1999) show, for instance, that households in rural China are partially insured regardless of wealth level. However, the hypothesis of perfect risk insurance is universally rejected in their sample.

The insurance networks investigated by the authors vary greatly. Deaton (1992) and Jalan and Ravallion (1999) take the village as their unit of analysis, while Morduch (1990) concentrates on the role of caste ties in mutual insurance. Grimard (1997) draws on the anthropological literature to investigate whether households in Cote d'Ivoire take part in spatially diversified risk-sharing arrangements with members of their own ethnic group. Similarly, Fafchamps and Lund (2003) show that mutual insurance does not appear to take place at the village level, but rather that households receive help primarily through networks of friends and relatives. Furthermore, Rosenzweig and Stark (1989) argue that households may try to diversify their kinship ties spatially, for instance by sending their daughters as brides in other villages, in order to mitigate the effects of the locally covariant nature of the risks they face. Recently, Munshi and Rozsenzweig (2005) have shown that economic development in India has brought about a decline in the role of traditional networks (based on caste ties) as social insurance safety nets. In particular, the authors state that rising incomes and better opportunities have led the wealthiest members of traditional networks to exit those networks, in turn

[8] Different utility functions were also considered in other studies. For example, Dubois (2001) allows for heterogeneity in risk aversion and uses an isoelastic utility function (in the class of CRRA functions) to model preferences of households in Pakistan. The author shows that households involved in sharecropping contracts better insure their consumption against risk. Zhang and Ogaki (2001) use a hyperbolic relative risk aversion utility function and find evidence supporting the decreasing relative risk aversion hypothesis in the ICRISAT data from rural India, failing to reject full-risk insurance at the village level but rejecting it at the inter-village level.

[9] See, for example, Townsend (1994), Chaudhuri and Paxson (2001) and Morduch (2001) for India; Paxson (1993) for Thailand; Jacoby and Skoufias (1997) for Bangladesh, Ethiopia, Mali, Mexico and Russia; Fafchamps and Lund (2003) for the Philippines; Deaton (1992) and Grimard (1997) for Cote d'Ivoire; and Dubois (2000) for Pakistan.

leading the poorest members to be worse off due to the reduced ability of the traditional networks to provide insurance in the face of adverse income shocks.

In order to capture idiosyncratic shocks to income, Grimard (1997) and Jalan and Ravallion (1999) use variations in total household income. On the other hand, Townsend (1994) looks at the impact of certain income components on the growth rates of consumption, thus allowing the elasticity of consumption with respect to income to differ across income sources. In specifications identifying the effects of income and consumption shocks on coping behaviours of Philippine rural households, Fafchamps and Lund (2003) use directly measured, subjective shock variables instead of changes in income as regressors. This strategy is also employed by Skoufias (2003) in a sensitivity test of the effect of income fluctuations on the growth rate of consumption in a sample of Russian households.[10] As in this paper, this strategy achieves two goals: first, it avoids a potential endogeneity problem caused by measurement error in the income variable and imputation error in the consumption variable; second, the directly measured shocks serve as proxies for sudden changes in both income and consumption.

The typical empirical model used for tests of full insurance usually estimates an excess sensitivity parameter, namely the elasticity of per capita consumption with respect to idiosyncratic income shocks. Townsend (1994) uses the difference between the individual and the group average consumption as the dependent variable. Other studies use the methodology proposed by Ravallion and Chaudhuri (1997) and include time-group dummies as explanatory variables in order to control for the aggregate component of income variations, thus allowing the income variable to only capture idiosyncrasies (Grimard 1997, Jalan and Ravallion, 1999, and Skoufias, 2003). However, a major limitation of the testing strategy is the fact that the test itself provides little guidance on what explains its results and which are the real insurance groups and post-shock coping mechanisms that work in achieving (partial or full) insurance.

Several studies focus on the consumption behaviour and coping strategies of households in transition economies. Skoufias (2003) and Notten (2004) assess the ability of Russian households to smooth consumption using multiple rounds of the Russian Longitudinal Monitoring Survey (RLMS) for selected years before and after the 1998 financial crisis. Skoufias (2003) finds that Russian households' consumption is only partially protected against income fluctuations. Some of the coping strategies of households are: adjusting non-food consumption to protect food consumption, borrowing money, adjusting labour supply and selling assets. The author also assesses the vulnerability of Russian households to income shocks based on their observable characteristics, and finds that poorer and urban households face a higher level of co-variation between their income and consumption

[10] Some of the shocks in Fafchamps and Lund (2003) are crop failure, unemployment, sickness spells, and funerals. Skoufias (2003) uses dummies for unemployment spells and wage arrears as income shock proxies.

changes than wealthier and rural households, respectively. Notten (2004) uses an additional round of the RLMS and a dynamic variant of Skoufias' model to confirm that the hypothesis of Pareto-efficient risk-sharing is rejected in the full sample; however, urban households are more vulnerable than rural households in face of income shocks.

In two related studies of Russian households' self-insurance behaviours during the 1990s, Guariglia and Kim (2003, 2004) focus on the role of specific mechanisms such as precautionary savings and moonlighting in achieving consumption smoothing. In their earlier article, the authors document a strong precautionary reason for saving by households that face earnings uncertainty (proxied by the probability of suffering wage arrears). Their second study finds that the precautionary savings hypothesis is also supported in sub-samples of households in which the head holds only one job. However, when the household head holds two jobs, households no longer save in light of earnings uncertainty (proxied by the probability of primary job loss). In that case, the alternative self-insurance mechanism appears to be moonlighting.

Using selected years of the RLMS, Mu (2003) investigates the differential effect of education on the ability of Russian households to smooth consumption. The author stratifies the data by non-financial asset value and uses information on shocks to isolate the exogenous variation in income. An interaction term between the predicted income variable and household head's education level is used with the aim of allowing for differential effects in households' ability to smooth consumption. Mu (2003) finds an education effect on consumption smoothing for high-asset households but not for low-asset households, and rejects the null hypothesis of full insurance in the full sample of households.

3. Data and summary statistics

We use data collected from two waves of a survey on a representative sample of 364 Romanian households from rural areas. Interviews with households from 40 villages in 21 counties were conducted at the end of 2003 and 2004 (for a description of the survey methodology, see the Appendix). Although data were collected for a wealth of variables,[11] in this paper we use the information on household characteristics, total non-durable consumption and its components,[12] and the incidence and magnitude of income shock. Self-produced food is valued at mean

[11] These include household characteristics, consumption, income, informal transactions, informal borrowing and lending, as well as data on participation in formal insurance and credit/savings markets.

[12] Food, non-food and self-produced (food) consumption were reported using the traditional 30 day recall period. No changes were implemented in the data collection methodology between the two surveys, in order to ensure comparability across the two years (2003 and 2004).

Table 1. Summary statistics: household characteristics and monthly consumption* (364 households)

Variable	Mean 2003	Std. Dev.	Mean 2004	Std. Dev.
No. of household members	4.07	1.47	3.89	1.55
No. of children**	0.89	1.07	0.73	1.18
Age of survey respondent	48.09	14.39	51.22	14.34
Education of respondent (No. of yrs schooling)	10.16	3.19	9.75	3.17
Agricultural experience of respondent (No. of yrs)	22.96	17.25	25.52	17.00
Food expenditure	2.23	1.43	2.21	1.55
Non-food expenditure	1.47	1.48	1.40	2.55
Value self-produced food	3.58	2.24	4.66	4.09
Total non-durable consumption	7.29	3.96	8.28	5.75

Notes: * Expressed in 2003 million Romanian LEI (ROL).
** This is the number of children under 14 living in the household.

prices for different categories of foodstuffs in the county residence.[13] Table 1 summarizes the main household characteristics.[14] The average rural household in the survey has the following consumption structure: approximately one half of total non-durable consumption is self-produced, almost 30 percent represents food spending, and the remainder represents non-food expenditures.

Detailed information was collected on instances of adverse weather,[15] crop failure, and animal diseases.[16] Furthermore, questions were asked about the number of workdays lost because of illness, unemployment spells, maternity, childcare and other events such as funerals and weddings. Tables 2 and 3 present descriptive statistics for the subjective income shocks. Fifty percent of the households interviewed in 2003 and 14 percent of households in the next year reported adverse

[13] The households reported quantities for the following consumption foodstuffs: cereals, vegetables, fruit, potatoes, alcohol, milk, meat, and eggs. The source of average county-level foodstuffs prices is the Bursa Agricola supplement to the Bursa newspaper, dated January 16, 2004 and January 16, 2005. Since the imputed value is based on market prices collected in several marketplaces in each household's county, this is most probably an overestimate of the 'true' value of self-produced food.
[14] A comparison of our sample summary statistics with those from the dataset used by Amelina *et al.* (2004) and those from the Family Budget Surveys (National Institute for Statistics, 2004) is available from the authors upon request.
[15] Including: drought, fire, flood and sleet.
[16] For example, the household head was asked about the amount of income lost in the case of each shock, whether help was received from any source, the source of help, and the sum in Romanian LEI (ROL) received as help.

Table 2. Summary statistics: directly measured (subjective) income shocks

Shock	Number of cases 2003	Households affected (%)	Number of days	Households received help (%)	Number of cases 2004	Households affected (%)	Number of days	Households received help (%)
Adverse weather	181	50	–	22	51	14	–	29
Crop diseases	44	12	–	14	24	7	–	21
Animal diseases	40	11	–	15	18	5	–	2
Illness	57	16	85	39	45	12	57	5
Unemployment	9	2	48	56	8	2	104	8
Maternity	6	2	212	50	7	2	106	6
Childcare	7	2	257	57	1	0	120	1
Others	8	2	–	50	7	2	–	57

weather for agricultural production. Almost one third of all households received some form of help or undertook activities to cope with the income shock (for example, sales of previous cereal stock, animals and agricultural equipment). None of the households reported having received formal insurance or taken loans prior to or after the occurrence of the income shocks, in either year. Crop failure affected about 12 percent of households in 2003 and 7 percent of households in 2004. Again, the main mechanism for smoothing consumption in the case of crop failure (and animal diseases, which affected fewer households) appears to have been some form of self-insurance.

Sixteen percent of survey respondents reported that one household member was afflicted with an illness spell in 2003 (the corresponding figure in 2004 was 12 percent). Unemployment spells were only experienced by household members in 2 percent of households in each year. It is noteworthy, however, that these and other events which would tighten a household's budget constraint, although fewer in number, were 'insured' by a larger percentage of households. For example, between 60 and 76 percent of households received monetary help during unemployment spells, maternity, or childcare. In these cases, post-shock help primarily arrived from relatives or from employers (as unemployment benefits or maternity/childcare paid leave). The sources of help in cases of illness spells were most diverse; households either resorted to self-insurance activities, or received help from relatives, neighbours and employers (public transfers).

The dataset reveals a reduced degree of participation in formal insurance and credit/loan markets by rural households in Romania. In 2004, 17 percent of all interviewed households made a loan application (slightly fewer than in 2003), and the same share of households had a contract with an insurance firm in either year. Insurance contracts, however, were primarily sought for work accidents and life

Table 3. Summary statistics for sources of help and amounts received post-shock (pooled dataset)*

Shocks	Self-insured** [1]	Neighbors [2]	Relatives [3]	Government benefits [4]	Formal insurance or credit [5]	Other [6]	% hh reported help
Adverse weather							
% hh	17.2	0.0	2.6	8.6	0.0	1.7	**30.1**
Mean sum	5.5		1.9	2.7		10.0	
Crop diseases							
% hh	10.3	2.9	0.0	1.5	0.0	1.5	**16.2**
Mean sum	3.0	–		–		1.0	
Animal diseases							
% hh	8.6	0.0	3.4	0.0	0.0	1.7	**13.7**
Mean sum	8.0		1.0			7.0	
Illness							
% hh	6.9	1.0	6.9	6.9	2.9	5.9	**30.5**
Mean sum	1.1	0.2	2.6	7.6	2.1	4.6	
Unemployment							
% hh	5.9	0.0	11.8	41.2	0.0	17.6	**76.5**
Mean sum	4.9		–	5.35		10.8	
Maternity							
% hh	0.0	0.0	0.0	46.2	0.0	15.4	**61.6**
Mean sum				13.9		–	
Childcare							
% hh	0.0	12.5	12.5	37.5	0.0	12.5	**75.0**
Mean sum		24.0	0.2	3.4		–	

Notes: All figures are computed as a percentage of households that reported an income shock. The difference up to 100 percent is represented by households which reported an income shock but did not report whether or not they received help.
* Expressed in 2003 million ROL (per month for illness, unemployment, maternity and childcare; lump sum for adverse weather, crop failure and animal diseases).
** The following activities are considered to be self-insuring: sales of livestock, sales of cereals from the stock, sales of equipment and tools, usage of savings, cash and jewelry, and asking children to work more on the farm.

Table 4. Partial correlation matrix between changes in consumption and regressors

	Δ food consumption	Δ non-food consumption	Δ self-produced food consumption	Δ total non-durable consumption
Δ Adverse weather dummy	0.068 [0.212]	0.163* [0.004]	0.054 [0.298]	0.088 [0.098]
Δ Crop diseases dummy	0.094 [0.081]	0.032 [0.568]	0.073 [0.170]	0.086 [0.107]
Δ Animal diseases dummy	–0.022 [0.690]	–0.025 [0.656]	–0.033 [0.567]	–0.043 [0.461]
Δ Illness shock – no. of days	0.005 [0.925]	–0.001 [0.985]	0.038 [0.513]	0.017 [0.761]
Δ Unemployment shock – no. of days	–0.022 [0.682]	0.027 [0.640]	–0.025 [0.660]	–0.016 [0.777]
No. of newborns	–0.052 [0.342]	–0.083 [0.144]	–0.102* [0.056]	–0.079 [0.134]
Δ No. of children under 14	0.042 [0.436]	–0.032 [0.577]	0.049 [0.397]	0.028 [0.632]

***Note 1*:** * represents significance at the 5 percent level. Standard errors of the partial correlation coefficients are reported in brackets.
***Note 2*:** In the regressions, the number of observations may change between regressions since the no. of available datapoints for different information sets changes (due to missing responses). In order to preserve as much of the information we have from the dataset as possible, we choose not to restrict the regressions to the households for which we have full data on all the variables.

(approximately one quarter of 'insured' households), illness (approximately 10 percent) and loss/theft of property (less than 10 percent).[17] In 2003, only one household had an insurance contract against loss of income from crop failure and two households held such a contract in 2004.[18]

Table 4 presents partial correlation coefficients between growth rates of different components of consumption (food, non-food, self-produced food, and total non-durable) and changes in the indicator variables capturing income shocks. The positive correlation coefficient between the change in the adverse weather dummy and changes in non-food expenditure is the only statistically significant estimate, suggesting possible coping mechanisms employed by households in the wake of bad weather – for example, increased demand for construction materials and damage repair. The lack of statistical significance of the other partial correlation coefficients in the table, shows that growth rates of consumption are (unconditionally) uncorrelated with changes in income as proxied by the shock indicators and shock magnitude variables. Next, these preliminary results are tested with regression analysis.

[17] Car insurance is mandatory and was reported to be held by almost three quarters of all interviewed respondents.
[18] Similarly, in each year, only one household had an insurance contract against loss of property from fire.

4. Econometric strategy

In this section, we discuss the econometric specification yielded by the social planner's problem of utility maximization of a risk-sharing community (for details, see Bardhan and Udry, 1999). For reasons of tractability of the testable implications, it is assumed that the utility of consumption is of CRRA type and is the same for all community members.[19] It is also assumed that community members have the same rates of time preference. Preferences are separable across time and states, as well as between leisure and consumption.[20] We allow the marginal utility of consumption to be affected by some shocks (such as illness) and specify the following functional form:

$$U(c_{ijt}, S_{ijt}) = \frac{1}{1-\psi} c_{ijt}^{1-\psi} S_{ijt}^{-\theta}$$

where the variable S increases with the amplitude of the shock and is re-scaled in such a way that S equals one when there is no shock. (ψ is the inverse of the elasticity of substitution, θ is the preference shifter; $i = 1, \ldots, N$ is the household index, $j = 1, \ldots, J$ is the community index, and $t = 1, \ldots, T$ is the time index).

The first-order condition to the Pareto programme for testing the hypothesis of full-risk insurance results in the following econometric specification (proposed, for example, by Ravallion and Chaudhuri, 1997):

$$\Delta \ln(c_{ijt}) = \sum_{l,k} \delta_{l,k} D_{l,k} + \theta \Delta \ln(S_{ijt}) + \varepsilon_{ijt} \quad (1)$$

where the first term on the right-hand side of the equation is a summation of time–community dummies. The dummies are defined such that $D_{l,k} = 1$ when $l = j$ and $k = t$. The time–community dummies are meant to capture changes in the resource constraints faced by the community at different times. They are a proxy for the aggregate community-level shocks to income, that is, the component of risk against which the household cannot insure. We focus on the specification which directly follows from (1):

$$\Delta \ln(c_{ijt}) = \sum_{l,k} \delta_{l,k} D_{l,k} + \sum_{m} \gamma_m \Delta \ln(S_{m,ijt}) + \varepsilon_{ijt} \quad (2)$$

[19] A CARA utility function leads to similar testable implications, except that the variables are in levels.

[20] Townsend (1994) allows for non-separability of consumption and labour, controlling for village-level labour. Furthermore, Mace (1991) shows that the first-order conditions implied by a power utility function which is non-separable across consumption goods are consistent with the testable implications of the single-good case.

where $\Delta \ln(S_{m,ijt})$ represents the change in the m^{th} idiosyncratic shock variable, and $\{\gamma_m\}_{m=1,\ldots,M}$ is the set of excess sensitivity parameters. Notably, θ is *not* an excess sensitivity parameter; instead, the term $\Delta \ln(S_{m,ijt})$ needs to be controlled for in the regression, as it represents changes in preferences.

From Equation (2), it is apparent that there is an inescapable problem of identification. Specifically, the excess sensitivity parameters $\{\gamma_m\}_{m=1,\ldots,M}$ cannot be separately identified from the preference shifter θ for those shocks which indeed affect the marginal utility of consumption.[21] A positive and significant coefficient on the change in illness shocks may be interpreted either as shifts in preferences (which means that when one faces a health shock, one needs to consume more in order to achieve the same utility level) or as over-insurance (that is, an illness spell leads to an increase in the consumption growth rate when the individual receives an amount of help in excess of her growth rate of consumption, conditional on her characteristics).

Assuming θ equals zero, Equation (2) provides us with a test for Pareto-optimal risk-sharing. First, we run an *F*-test of joint significance on all dummy coefficients. If the null hypothesis that the dummies did not matter were rejected, then we would conclude that households' consumption responds to the resource constraint of the community to which they belong. Second, we run *F*-tests of joint significance on coefficients of changes in income shocks. Rejecting the null hypothesis in these tests would indicate that household consumption growth rates co-vary with idiosyncratic changes to income, which is evidence against the hypothesis of perfect risk-sharing.

Four dependent variables are considered: expenditures on food items, expenditures on non-food items, the imputed value of self-produced food consumption, and total non-durable consumption (the sum of the three components).[22] The set of income shocks includes adverse weather, crop failure, animal diseases (all of which are represented by indicator variables), illness (number of labour days lost because of illness) and unemployment (number of days spent in unemployment).[23]

In all specifications we control for potential preference shifters with two household composition variables: the number of newborns in 2004 and the change in the number of children less than 14 years of age living in the household. We present both ordinary least squares (OLS) estimates and two-stage least squares (2SLS) estimates, as we allow the household composition variables to be endogenous. Following the practice in the literature, we use several instruments for the household composition variables: the age of the survey respondent, the age

[21] Naturally, there may exist not only one, but a series of preference shifters, each accompanied by a different θ coefficient; however, in the discussion we refer to only one such coefficient for simplicity.

[22] The consumption data are expressed in adult equivalent terms using an adjusted number of household members based on the formula $n^{\theta} = (A + 0.5B)^{0.9}$ where A = number of adults and B = number of children (World Bank, 2003).

[23] We do not include variables for maternity and childcare in the regressions because too few such instances are reported to obtain meaningful results.

squared, the number of years in agriculture, the education level (number of years of school) and the lagged number of household members.[24]

5. Empirical findings

Regression results are reported in Tables 5 to 7. First, we note that the *F*-tests on the village-dummy coefficients all lead to a rejection of the null hypothesis that aggregate shocks do not matter. Furthermore, there is clear evidence that the coefficients on the shock variables are insignificantly different from zero. This is the case in all regressions presented in the paper. We therefore conclude that per capita consumption co-moves with the aggregate resource constraints. Income variations, proxied by shock indicator variables and 'magnitude' variables, are not systematically correlated (as a group) with consumption growth rates for different consumption components.

In Table 5, one notable exception is the statistically significant coefficient on the weather shock dummy in the case of non-food consumption. In particular, the coefficient estimate indicates that households in regions afflicted by adverse weather experienced increases in non-food consumption between 55 and 75 percent higher than those which did not. No other income shock appears to be correlated with the growth rate of total non-durable consumption or its components.[25]

In order to determine whether the conclusions drawn from the previous table hold for poorer and richer households alike, we test a second empirical model. The question of whether insurance schemes are less efficient for poorer households has been investigated, for example, by Jalan and Ravallion (1999). While poor households are likely to have a high notional demand for insurance, they are also likely to be more rationed in access to formal credit and insurance. To test whether their consumption is more vulnerable to income shocks, we split the sample into rich versus poor households based on total per capita non-durable consumption. Households whose per capita non-durable consumption is twice as high as the sample median in the pooled dataset are defined as rich households.[26] Interaction

[24] In the first set of regressions, to assess the relevance of instruments, we report the *p*-value of the *F*-test for joint significance of all instruments for each endogenous variable. We also report the *p*-value of the Hansen J test for identification of instruments. These statistics are not shown in subsequent regressions for space reasons.

[25] Furthermore, our findings are robust to alternative measures of the shocks, e.g., an illness shock dummy instead of the number of days of the illness spell, and an unemployment shock dummy (for shocks longer than 60 days) instead of the number of days of the unemployment spell. The results are available from the authors upon request.

[26] Alternative definitions of a 'rich' household dummy led to similar results. For example, we experimented with splitting the sample in richer households which have per capita total-non durable consumption higher than the median for each year, or the higher median of the two years. Since the definition of 'rich' was less stringent, the results were weaker (and are not presented here).

Table 5. Village level regressions

	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS
Dependent variable →	Δ Food consumption		Δ Non-food consumption		Δ Self-produced food consumption		Δ Total non-durable consumption	
Δ Adverse weather dummy	0.0005	0.1142	0.5544***	0.7591*	0.0955	0.1203	0.1604	0.2343
	[0.1578]	[0.2192]	[0.1775]	[0.4133]	[0.1834]	[0.2689]	[0.1593]	[0.2638]
Δ Crop diseases dummy	–0.0746	0.2589	–0.4656	0.0693	–0.1716	0.2338	–0.1818	0.2263
	[0.2460]	[0.3035]	[0.3424]	[0.5070]	[0.2778]	[0.3548]	[0.2539]	[0.3315]
Δ Animal diseases dummy	–0.2051	–0.0005	–0.1481	0.3319	–0.2127	0.0561	–0.2037	–0.0023
	[0.1747]	[0.2390]	[0.2161]	[0.4864]	[0.2004]	[0.3105]	[0.1668]	[0.2540]
Δ Illness shock – no. of days	0.0006	–0.0003	–0.0006	–0.0033	0.0008	0.0002	–0.0004	–0.0010
	[0.0016]	[0.0019]	[0.0018]	[0.0032]	[0.0015]	[0.0020]	[0.0012]	[0.0017]
Δ Unemployment shock – no. of days	–0.0009	–0.0031	0.0011	0.0023	–0.0018	–0.0022	–0.0014	–0.0021
	[0.0020]	[0.0033]	[0.0028]	[0.0051]	[0.0030]	[0.0035]	[0.0022]	[0.0029]
No. of newborns	–0.3627*	–1.0388	–0.7143**	–9.9139*	–0.5476*	–4.0146	–0.4164*	–4.0327
	[0.1956]	[2.7966]	[0.3416]	[5.8861]	[0.2897]	[2.7991]	[0.2379]	[2.9866]
Δ Number of children under 14	0.1500	1.6631*	0.0444	3.1640*	0.1370	1.8911**	0.1169	1.9983**
	[0.1035]	[0.9176]	[0.1262]	[1.6556]	[0.1108]	[0.8758]	[0.1008]	[0.9860]
Observations	349	340	320	311	350	337	350	337
R^2	0.83	–	0.80	–	0.78	–	0.84	–
p-value *F*-tests relevance of instruments (1st)	–	0.0374	–	0.0881	–	0.0228	–	0.0492
p-value *F*-tests relevance of instruments (2nd)	–	0.0300	–	0.0307	–	0.0221	–	0.0353
p-value Hansen test of overidentification	–	0.0478	–	0.2481	–	0.02531	–	0.1111
p-value *F*-test: shock coefficient = 0	0.8647	0.8314	0.0850	0.4742	0.8142	0.9210	0.6872	0.7797
p-value *F*-test: dummy coefficient = 0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

***Notes*:** Robust standard errors in brackets.

* Significant at 10 percent; ** significant at 5 percent; *** significant at 1 percent.

Coefficients for village dummy variables not shown. In Table 5, the Hansen test is run on the model excluding the dummies.

The endogenous variables are the number of newborns in 2004 and the change in the number of children under fourteen between 2003 and 2004. The instruments are household head age, age squared, the experience and schooling of the household head, and the number of members lagged.

Table 6. Village level regressions, with ΔShocks and [ΔShocks * 'Rich household' indicator]

	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS
Dependent variable →	Δ Food consumption		Δ Non-food consumption		Δ Self-produced food consumption		Δ Total non-durable consumption	
Δ Adverse weather dummy	–0.0032	0.1750	0.5811***	0.8783**	0.0611	0.1171	0.1478	0.2593
	[0.1649]	[0.2597]	[0.1851]	[0.3866]	[0.1858]	[0.2742]	[0.1642]	[0.2673]
Δ Weather dummy * Rich hh	0.0527	–0.1148	–0.2767	–1.5366	–0.1839	–0.4746	–0.1892	–0.5474
	[0.2887]	[0.4649]	[0.3821]	[1.2140]	[0.3200]	[0.4785]	[0.2813]	[0.4721]
Δ Crop diseases dummy	–0.1803	0.0698	–0.7073*	–0.4499	–0.3342	–0.0540	–0.3228	–0.0701
	[0.2849]	[0.3593]	[0.4065]	[0.4750]	[0.3233]	[0.3781]	[0.2973]	[0.3487]
Δ Crop disease dummy * Rich hh	0.4304	0.9890	1.0125	2.0207**	0.8064	1.2717**	0.6885	1.2129*
	[0.5293]	[0.6233]	[0.6793]	[0.9592]	[0.5690]	[0.6435]	[0.5287]	[0.6226]
Δ Animal diseases dummy	–0.2272	–0.1800	–0.2207	0.0145	–0.0158	0.1669	–0.1021	–0.0008
	[0.2043]	[0.2852]	[0.2309]	[0.4209]	[0.1880]	[0.3096]	[0.1723]	[0.2411]
Δ Animal disease dummy * Rich hh	0.0027	0.6535	0.2738	1.2897	–0.9870*	–0.5682	–0.4956	0.0361
	[0.3655]	[0.5665]	[0.5381]	[0.9617]	[0.5086]	[0.6627]	[0.3899]	[0.5766]
Δ Illness shock – no. of days	0.0008	0.0004	–0.0008	–0.0040	0.0009	–0.0001	–0.0004	–0.0013
	[0.0017]	[0.0021]	[0.0019]	[0.0033]	[0.0015]	[0.0021]	[0.0012]	[0.0018]
Δ Illness shock * Rich hh	–0.0051	0.0031	0.0062	0.0269*	–0.0050	0.0041	–0.0014	0.0080
	[0.0041]	[0.0076]	[0.0053]	[0.0141]	[0.0044]	[0.0069]	[0.0043]	[0.0069]
Δ Unemployment shock – no. of days	–0.0014	–0.0036	0.0037	0.0007	–0.0042*	–0.0062**	–0.0025	–0.0046
	[0.0023]	[0.0037]	[0.0028]	[0.0046]	[0.0024]	[0.0032]	[0.0021]	[0.0033]
Δ Unemployment shock * Rich hh	0.0010	–0.0006	–0.0111	0.0066	0.0087	0.0132	0.0036	0.0083
	[0.0055]	[0.0118]	[0.0078]	[0.0191]	[0.0065]	[0.0089]	[0.0061]	[0.0090]
	–0.3553*	–1.0846	–0.7193**	–8.4155	–0.6037**	–3.4103	–0.4497*	–3.3764
No. of newborn babies	[0.1954]	[3.6005]	[0.3034]	[6.8132]	[0.2985]	[2.8517]	[0.2438]	[3.1081]
	0.1522	2.1539*	0.0760	2.7268*	0.1277	1.8415**	0.1191	1.8932*
Δ Number of children under 14	[0.1056]	[1.1784]	[0.1294]	[1.5181]	[0.1133]	[0.8666]	[0.1033]	[0.9680]
Observations	349	349	320	311	350	337	350	337
R^2	0.83		0.81		0.79		0.84	
p-value *F*-test: dummy coefficient = 0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Notes: Robust standard errors in brackets.

* Significant at 10 percent; ** significant at 5 percent; *** significant at 1 percent. Coefficients for village dummy variables not shown.

Table 7. Village level regressions, with ΔShocks and [ΔShock * Amount received as help]

	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS
Dependent variable →	Δ Food consumption		Δ Non-food consumption		Δ Self-produced food consumption		Δ Total non-durable consumption	
Δ Adverse weather dummy	0.0590	0.1595	0.5336***	0.6889*	0.1286	0.1315	0.1762	0.2352
	[0.1547]	[0.2134]	[0.1820]	[0.3700]	[0.1865]	[0.2436]	[0.1640]	[0.2637]
Δ Weather dummy * Help	–0.2335*	0.0560	0.1140	0.7207	–0.1590	0.1459	–0.0869	0.3561
	[0.1320]	[0.3256]	[0.0855]	[0.5699]	[0.1460]	[0.3891]	[0.1015]	[0.4913]
Δ Crop diseases dummy	–0.0906	0.2125	–0.5544	–0.0690	–0.1490	0.1842	–0.1962	0.2273
	[0.2548]	[0.3474]	[0.3514]	[0.5412]	[0.2910]	[0.3607]	[0.2647]	[0.3884]
Δ Crop disease dummy * Help	0.2497**	0.1869	0.4234***	0.3130	–0.0549	–0.1284	0.1467	0.0541
	[0.1170]	[0.1573]	[0.1580]	[0.2604]	[0.1465]	[0.1851]	[0.1211]	[0.1853]
Δ Animal diseases dummy	–0.2103	–0.0209	–0.1636	0.3633	–0.2259	0.0190	–0.2107	0.0541
	[0.1852]	[0.2857]	[0.2288]	[0.5109]	[0.2096]	[0.3089]	[0.1763]	[0.3083]
Δ Animal disease dummy * Help	–0.0109	–0.1177	0.0737	–0.1552	0.0251	–0.0842	0.0204	–0.1271
	[0.0378]	[0.0895]	[0.0714]	[0.1335]	[0.0360]	[0.0836]	[0.0323]	[0.1017]
Δ Illness shock – no. of days	0.0006	0.0009	–0.0011	–0.0014	0.0009	0.0012	–0.0004	–0.0000
	[0.0017]	[0.0020]	[0.0020]	[0.0034]	[0.0016]	[0.0021]	[0.0013]	[0.0020]
Δ Illness shock * Help	–0.0001	–0.0002*	0.0001	–0.0001	–0.0001	–0.0002	0.0000	–0.0002
	[0.0001]	[0.0001]	[0.0001]	[0.0002]	[0.0001]	[0.0001]	[0.0001]	[0.0001]
Δ Unemployment shock – no. of days	–0.0043	–0.0087	0.0029	0.0017	0.0036	0.0015	–0.0002	–0.0032
	[0.0037]	[0.0070]	[0.0041]	[0.0101]	[0.0050]	[0.0069]	[0.0038]	[0.0076]
Δ Unemployment shock * Help	0.0003	0.0005	–0.0002	–0.0000	–0.0005	–0.0004	–0.0001	0.0001
	[0.0002]	[0.0004]	[0.0003]	[0.0007]	[0.0003]	[0.0005]	[0.0002]	[0.0005]
No. of newborns	–0.3402*	–0.3287	–0.7153**	–8.6073	–0.5359*	–2.7460	–0.4061*	–4.0579
	[0.1979]	[3.0531]	[0.3456]	[5.7883]	[0.2932]	[2.7896]	[0.2406]	[3.4072]
Δ Number of children under 14	0.1317	1.8342*	0.0370	3.2803**	0.1207	1.7949**	0.1046	2.4497**
	[0.1092]	[1.0648]	[0.1304]	[1.6518]	[0.1152]	[0.8683]	[0.1043]	[1.2006]
Observations	349	349	320	320	350	350	350	350
R^2	0.83		0.81		0.78		0.84	
p-value *F*-test: dummy coefficient = 0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

***Notes*:** Robust standard errors in brackets.
* Significant at 10 percent; ** significant at 5 percent; *** significant at 1 percent.
Coefficients for village dummy variables not shown.

terms between the 'rich household' indicator variable and changes in shocks to income are then included in the regressions. The results are reported in Table 6.

Overall, there is no evidence that richer households better insure food consumption than poorer households. However, after crop failures, richer households' growth rates of non-food consumption, self-produced consumption and total non-durable consumption are higher than those of poorer households. Illness spells also correlate with growth rates of non-food consumption and are higher in rich households by almost 3 percent relative to poor households. The latter may reflect either the preference shifting role of illness shocks or the rich households' ability to cope better with expenditures on medical treatment.

In the last empirical model, households that reported receiving a specific sum of post-shock assistance were allowed systematically lower excess sensitivity parameters than households that reported receiving little or no help. In particular, we include interaction terms between the amount received after each shock and the shock variables. The results are presented in Table 7. The coefficient estimates on the interaction terms are positive and significant in the OLS specifications for the crop failure shock in the case of food spending and non-food spending. These could indicate that households that received more money better insured their food expenditures than those that did not report having received monetary help. However, caution is called for in interpreting this result, because the amount received as help could be endogenous to anticipated changes in consumption.

The significance of the insurance-group dummies in all the empirical specifications suggests that consumption responds to movements in the resource constraint of the villages. However, one cannot determine, based on these results, the exact insurance group, the extent of insurance achieved within each group, or that achieved for each income shock. While the *F*-tests on the potential insurance group dummy coefficients indicate that aggregate shocks do matter, this econometric specification (Equation 2) does not permit an assessment of the strength of the co-movement between the growth rate of per capita consumption and the growth rate of consumption of the 'true' insurance group.

6. Discussion and conclusions

In this paper, we have tested the hypothesis of Pareto-optimal risk-sharing in rural areas from a transition economy (Romania), using survey data collected for 2003 and 2004 on a representative sample of 364 rural households. We are motivated to investigate risk insurance in rural communities due to the specificity of the rural sector in transitional economies, the sharp economic contraction experienced by most countries in transition throughout the 1990s, and the low participation rates of rural households in formal credit and insurance markets. A new and rich dataset has enabled us to avoid the standard econometric problems posed by measurement error in income. More specifically, income shocks were identified with indicator variables for instances of adverse weather, crop failure and animal diseases, as well as 'magnitude' variables indicating the number of workdays lost due to spells of illness and unemployment. In the econometric specifications, preference shifters such as changes in household composition, were included and treated as endogenous.

The null hypothesis of full insurance is not rejected in our sample. Households in rural Romania experience a positive, statistically significant increase in the growth rate of consumption of non-food items in the wake of adverse weather. There is some evidence that richer households cope better with crop failure than poorer households. Furthermore, households that report having received help after crop failures appear to have been better insured against this income shock than those households that did not receive any help. Nevertheless, endogeneity of the amount of help received may be a concern. Tabulations from survey responses suggest that consumption smoothing is achieved primarily through three channels: self-insurance (in the case of bad weather, crop failure, and animal diseases), public transfers (in the case of unemployment, maternity and childcare) and, to a lesser extent, family ties. Some caution is needed, however, in concluding that Pareto-optimal risk-sharing is achieved in Romanian villages because some income shocks (e.g., illness) may play the role of preference shifters.

It is noteworthy that the conclusions of this study are aligned to those of previous analyses of Russian households' ability to smooth consumption during the 1990s (Skoufias, 2003; Notten, 2004). Skoufias (2003) found that rural household consumption in Russia between 1994 and 2000 was fully insured from idiosyncratic income fluctuations, while Notten (2004) concluded that it was urban households that were more vulnerable to income shocks (despite lower poverty rates) during the same period. These findings are remarkable in light of the fact that the incidence of wage arrears was higher for Russian households in rural areas than for those in urban areas, and was positively correlated with consumption poverty rates (Desai and Idson, 1998). All studies on consumption smoothing in Russia (including Mu, 2003), found that in samples comprising both rural and urban households, full risk-sharing is rejected. It is thus concluded that Russian households were only partially able to insure their consumption streams during the 1990s.

To our knowledge, there are no studies of Romanian household consumption during the 1990s to enable a direct comparison with findings for Russia. Our analysis is concerned with the years 2003 and 2004, a time when the Romanian economy had recovered well from the two crises in 1992/3 and 1997/8. Lokshin and Ravallion (2000) document the welfare impact of the 1998 financial crisis in Russia, a covariate shock which brought about further increases in wage arrears, pension arrears, and consumption poverty. During the period when we collected the data, wage arrears in Romania accounted for 12 percent of total arrears (June 2003), a 'relatively low number among transition countries' (IMF, 2004, p. 7). While the two countries shared relatively similar rates of consumption poverty at the time of our survey (in 2002/3, the \$1/day and \$2/day poverty headcount ratios were 2 and 13 percent, respectively), Russia's poverty rate was starkly higher than Romania's during the 1998 crisis (and in subsequent years).[27] These facts may provide some guidance as to why we fail to reject full insurance in our sample while studies on Russian households find evidence of partial insurance only.

While our conclusions are somewhat optimistic, future research should focus on identifying those shocks that increase the vulnerability of rural households. Furthermore, analysing shock-specific coping mechanisms would be of use in the design of social safety net programmes aimed at protecting the livelihood of rural households in transition economies.

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[27] The average poverty headcount ratio in 1998 was 35.6 percent in Russia and 12.2 percent in Romania (based on the $2/day poverty line). (Authors' calculations using the World Bank's POVCALNET with default PPPs).

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Appendix

Sample and survey methodology

The interviews were conducted and the questionnaires were filled out by field interviewers during 'face-to-face' sessions with household members. Field support was provided by The Gallup Organization in Romania. The household sample has the following characteristics:

- Sample size: 364 households, exclusively from rural areas.
- Sample type: stratified, probabilistic, two-stage sample.
- Stratification criteria: degree of development of rural localities (three categories) and eight geographic areas based on historical regions, (Muntenia, Oltenia, Banat, Crishana-Maramuresh, Transylvania, Moldova, Dobrudgea and Bucharest).
- Sampling: probabilistic selection of localities (40 rural), sample units (streets) and households. Households were selected using the random route method.
- Representativity: the sample is representative for the rural Romanian household population, with a maximum sampling error of 4.5 percent.
- Data were not weighted.