Health shocks and consumption smoothing in South Africa: do remittances have a role to play?

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Abstract

Many poor households particularly in developing countries experience substantial fluctuations in their income due to idiosyncratic shocks such as death or major illness to members of the households. Health shocks may induce consumption fluctuations if not insured. This paper investigates, using the National Income Dynamic dataset from South Africa, the effect of health shocks on consumption and the degree to which households use remittances to insure against health shocks. Our results show that households are insured against shocks and experience an increase in remittances in response to health shocks. We correct for reverse causality and endogeneity and find that remittances do indeed smooth household consumption on average.

Key words: *income smoothing, remittances, shocks, volatility.*

1 Introduction

Many poor households particularly in developing countries are exposed to various shocks: death of household members, changing agroclimatic conditions, the loss of employment, family sickness or death of the head of the household, retirement of a worker with no pension or collapse of a family business. These unexpected shocks can make these very poor people more vulnerable. There has been an emerging thread of literature looking at the patterns of income and consumption smoothing in the risky environments of developing countries. However the results are (surprisingly) mixed. (see *Barrera and Pérez-Calle, 2005; Asfaw and Braun, 2004; Dercon and Krishnan, 2000; Lindelow and Wagsta, 2007; Wagstaff, 2007). For example,* Using a panel data from rural Ethiopia (Dercon and Krishnan, 2000), looked at the individual nutritional status, to test whether individuals can smooth nutritional levels over time and whether households are able to share risk so that nutritional levels are smooth across members of the households. Their regression results seem to support the hypothesis of consumption insurance in the case of total food consumption. Townsend (1995) finds that the percentage of the year that an adult male is sick has no impact on consumption. Kochar (1995) models wage income and informal borrowing as a function of illness in the family, as measured by a member of the family experiencing a loss of work due to illness. She finds that illness to the male lowers wage income and increases informal borrowing during peak periods in the agricultural cycle, but that there are no effects during slack periods and no effects of female illnesses.

Although the results of Towsand and Kocher shed some light on the consumption smoothing literature they are somewhat questionable since no attempt is made in these studied to distinguish the impact of minor sickness and major sickness on consumption as Gertler et al (2002) put it "Even if families are able to insure illness shocks on average, they may be able to more effectively insure the frequent small illness shocks as opposed to the large rare shocks". To address Gertler et al (2002) investigated the ability of families in Indonesia to insure consumption over periods of major illness using panel data set. Their results show that Indonesian households are not able to fully insure consumption against the economic costs of illness. More specifically they found that illness is associated with a fall in consumption of 0.84 percent of baseline.

Unlike Dercon and Krishnan, 2000 and Townsend (1995), some scholars failed to find evidence in support of consumption smoothing. For example, Asfaw and Braun (2004) used a two years panel data, to assess the impact of illness on consumption of rural households in rural Ethiopia and the capacity of inter and intra risk sharing arrangements in insuring consumption against illness. Their finding indicates that the illness of a household head has a negative impact on consumption. That is, it lowers the weekly purchased food consumption of the household by 24 percent and the non-food consumption items by 28 percent. Barrera and Pérez-Calle (2005) findings also suggests that health shocks have a negative impact on consumption growth in Columbia, and that urban households are not as good as rural ones at pooling risk.

A study by Lindelow and Wagsta (2007) studied the impact of self-assessed health of the head of household on income, household labor supply and medical expenditures. The results indicate that negative health shocks—defined as a worsening of self-assessed health—have a significant and sometimes large impact on income, labour supply, and medical expenditure. Wagstaff (2007) finds evidence against food consumption smoothing in Vietnam using different measures of health shocks such as the death of a working household member, a long inpatient spell and drops in the body mass index of the household head.

Thus far we have looked at evidence on consumption smoothing, but how do households protect themselves against these shocks? Numerous studies have examined the mechanisms through which households in developing countries protect their consumption from production and income fluctuations. Among others, Townsend (1994), Udry (1994), Ligon, Thomas and Worall (2002), and Fafchamps and Lund (2003) investigated risk-pooling mechanisms to deal with shock. Further, in line with lifecycle hypothesis some households may deal with these shocks by falling back on their previous saving which were accumulated when times were good (see Paxson 1992; Rosenzweig and Wolpin 1993; Udry 1994). There is also some evidence to suggest that some households rely on informal community sharing of risks by taking part in insurance and credit markets, the list goes on. ((e.g., Fafchamps et al., 1998; Binswanger and McIntite, 1987; Bromley and Chavas, 1989; Townsend, 1995a; Udry, 1990; Udry, 1994; S. Coate and M. Ravallion, 1993; Fafchamps, 1992; Carter, 1995; Reardon, Delgado and Malon, 1992). Finally some studies have proven that households use ex post mechanism such as remittances to cope with shocks (Wu, 2006; Miller and Paulson, 1999; Yang and Choi, 2007; Clarke and Wallsten, 2004).

The emerging consensus among the latter studies seem to be that migration and remittances are part of an overall livelihood strategy by which households try to insure against shocks in disaster prone regions. In what follows we briefly review the latter studies. Miller and Paulson (1999), using cross-sectional information and time series data on rainfall and GDP in 73 Thailand's provinces, conclude that remittances behave in a way that is consistent with insurance. More specifically, they find that unexpected negative shocks lead to an increase in remittances whilst positive shocks (e.g. increase in income) bring about a decrease in remittances. A study by Yang and Choi (2007) used a panel households survey data from the Philippines to examine the relationship between income shocks and remittances. They found that an increase in income is accompanied by a decrease in remittances. This they argue is consistent with an insurance motivation for remittances.

Yang (2008) provides cross-country evidence on the response of international flows to hurricanes and concludes that hurricane exposure leads to large increases in remittance flows.
In his paper Cochrane (1991) attempted to test for consumption insurance, and to measure as to which shocks are and aren't insured. Many variables yielded mixed results: on the one hand full insurance was rejected for illness and involuntary job loss; on the other hand the full insurance was not rejected for job loss due to strike and involuntary move, and spells of unemployment. Gubert (2002) studied the link between remittances and shocks (i.e. loss in crop production, illness and death) in the Kayes area of Western Mali. They found that both shocks significantly raised remittances in Western Mali.

Clarke and Wallsten 2004 use a household panel dataset for Jamaica that includes not only remittance data but also household level information on damage inflicted by a major hurricane. Their finding reveals that although exogenous shock leads to an increase in remittances, but remittances offer only partial insurance, increasing by about 25 cents for every dollar of hurricane damage. Attzs (2008) explores the linkages between poverty and disaster vulnerability in the context of remittance flows to households in the Caribbean. He finds that remittances tend to increase in the aftermath of natural disasters.
A survey of households in four villages in Pakistan after a devastating earthquake in 2005 reveals that migrant remittances were important factors in disaster recovery and reconstruction (Suleri and Savage, 2006).

Halliday (2006) utilizes panel data from El Salvador to analyse the use of trans-national migration as an ex post risk management strategy. His findings suggest that agricultural shocks, such as livestock loss and harvest loss, lead to an increase in remittances received by Salvadorian households. Wu (2006) studied the role of migrant remittances in the livelihoods of the people of Aceh, focusing on the impact of the tsunami and humanitarian aid, his results show that remittances increased in response to tsunami. Evidence from Haiti also shows that remittances provided a great deal of relief to those affected by cyclone (Fagen 2006).

Although many studies have investigated consumption smoothing and mechanisms through which households in developing countries protect their consumption from production and income fluctuations, there have been no such studies conducted in South Africa. Further even the existing studies have various shortcomings (1) many of these studies don't have adequate data to appropriately investigate these topics – typically use cross-sections rather than panels data. One major shortcoming of cross sectional data is that such analyses cannot look at changes in remittances or income by household. (2) While these studies often control for household characteristics, it is not possible to control for household fixed effects in cross sectional analysis. (3) Very few existing studies have specific data on actual household-level shocks, making it impossible to assess the degree of insurance remittances might provide. Finally, these studies do not explicitly deal with the problem of endogeneity, which is very serious and negatively affect any results. As Yang et al put it "productive investments funded by migrant remittances can raise household income, leading to positive correlations between household income and remittances. Alternately, remittances may reduce households' need to find alternative income sources, leading to a negative relationship between remittances and domestic-source income".

This study will bridge the gap by first providing empirical evidence of consumption smoothing, and mechanisms through which households in South Africa use protect their consumption from production and income fluctuations. We present our empirical results in two stages. We first explore whether households can insure against specific idiosyncratic shocks such as illness. We then explore how households protect consumption against these shocks by examining the coping mechanisms they employ.

2 Nonparametric Kernel densities of income and consumption

This section will analyse the degree to which households are able to insure themselves against risk. To achieve this we use nonparametric Kernel density estimation (KDE). Several recent studies have employed nonparametric KDE methods on grouped data to obtain estimates of national, regional, and global poverty (see studies by Sala-i-Martin 2002a, 2002b, 2004, 2006; Ackland, Dowrick, and Freyens, 2007). Part of the reason why this method has been frequently used by some scholars is because unlike parametric approaches, it does not require prior beliefs about the functional form of the underlying distribution. Second, it is convenient to use because it reproduces the entire income distribution from a manageable amount of data.

Figure 1 and 2 shows the empirical kernel estimates of the densities of income and consumption for the period 2008 to 2010. The underlying data clearly reveals some interesting properties of these variables, and yields information that is very useful in guiding and deepening the empirical analysis. First, the density of income is clearly developing a multimodal profile over time, while the same does not seem to apply to consumption, whose density profile seems to be rather unimodal. The densities of income and consumption for the period 2008 to 2010 seem to suggest the presence of some forms of insurance mechanism that allow the smoothing of consumption across different income groups of households.

Figure 1, Empirical density of income and consumption 2008

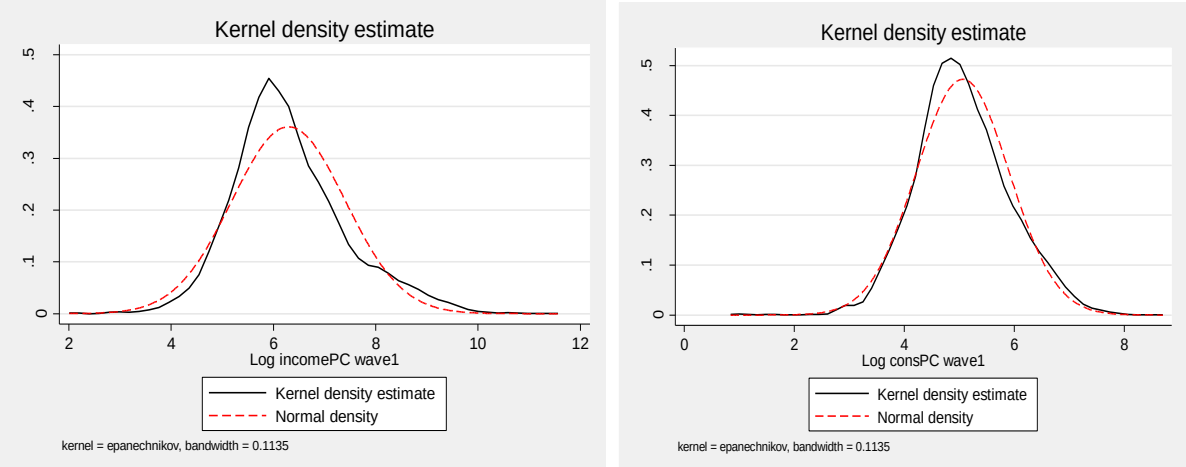
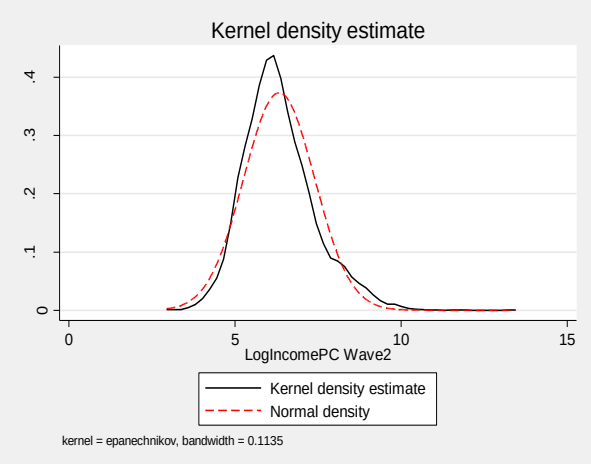
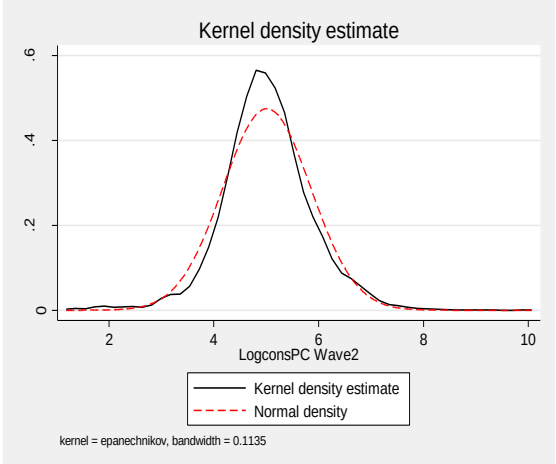


Figure 2, Empirical density of income and consumption 2010





Although the use of the kernel density estimate, as depicted in the above diagrams, shared some light on the the degree to which households are able to insure themselves against risk, it is only suggestive but not a rigorous test. It does not control for other factors that can affect consumption, and do nothing to address endogeneity issues. This calls for the use of a methodology that is better equipped to address these issues. Thus to rigorously explore the degree to which households are able to insure themselves against risk we use various panel data econometric techniques.

3 Estimation Strategies

This section will outline the empirical strategies that will be used to estimate the impact of the health status on consumption in South Africa. Since this paper widely applies various panel data estimation techniques, an attempt will be made to provide a brief overview on their relevance and importance as we go along. Three panel data models will be used: pooled ordinary least square (OLS), fixed effects model (FE), and the Two-Stage Least-Squares (2SLS). The major attraction of the last two panel data models is that they account for individual characteristics of cross-sectional units (i.e. allows controlling for unobserved differences across households or provinces) and help to minimise the problem of endogeniety. This endogeniety problem appears when the model specification is poor due to the left-out of important independent variables (Greene, 1993). To analyse the degree to which households are able to insure themselves against risk we measure the impact of health status on consumption. We start by estimating a pooled OLS regression model which relates consumption to a health shock measure. Pooled panel method is similar to the method of standard ordinary least squares. The difference between them is that the pooled OLS

estimation widens the database by pooling together cross sectional and time series observations of the sample to get more reliable estimates. A negative relationship is hypothesized between consumption and health shock. This model is specified as follows:

$$C_{it} = \alpha_0 + \alpha_1 H_{it} + \alpha_2 X_{it} + \varepsilon_{it} \quad \ldots\ldots 1$$

Where C_{it} is the consumption of household i at time t; H_{it} is the health shock faced by household i at time t. The error term $\boldsymbol{\varepsilon}_{it}$ includes both preference shocks and measurement error and is distributed identically and independently. The risk sharing model predicts that α_1 = 0, i.e., health shocks should have no role in explaining change in household consumption. The crucial assumption underpinning equation 1 is that $\boldsymbol{\varepsilon}_{it}$ is uncorrelated with any covariates in the regression. This is quite an assumption and if violated we may run into econometric difficulties — estimates based on equation (1) will be biased. To address the heterogeneity bias, in the second stage of our analysis we used a fixed effects specification as shown in equation 2. The major attraction of the fixed effect model is that it accounts for heterogeneity among cross-sectional units.

$$C_{it} = \alpha_0 + \alpha_1 H_{it} + \alpha_2 X_{it} + \delta_i + \varepsilon_{it} \quad \ldots\ldots 2$$

One potential shortcoming of the both OLS and fixed effect estimators discussed so far is that they regards all explanatory variables as exogenous and especially treats health shock as independent of consumption. This is however quite an assumption, because consumption and health shock maybe endogenously related. If indeed this assumption fails, all FE and Pooled OLS estimators will be biased and inconsistent. One way of accounting for possible endogenous regressors is to pursue an instrumental variables approach. This is the strategy adopted in this section.

$$C_{it} = \alpha_0 + \alpha_1 H_{it-1} + \alpha_2 X_{it} + \delta_i + \varepsilon_{it} \quad \ldots\ldots 3$$

3.1 Regression results

Table 1 below presents the estimated coefficients of the idiosyncratic shocks on the total consumption. Firstly, we begin by reporting the results based on the 2 methods which are potentially exposed to endogeneity problems: the pooled OLS, fixed effects. The estimates obtained on both the pooled OLS and fixed effects suggest that on average consumption is not insured from idiosyncratic shocks in South Africa. More specifically, consumption is found to be significantly correlated with idiosyncratic health shocks. The results on controlled variables are also similar: Age of the household, education and household size were found to be statistically significant with respect to the food consumption. Column 4 of table 3 reports the results based on the instrumental variable approach. Before we pursued an instrumental variables approach we checked whether health shock is not correlated to the error term (i.e. performed endogeneity test). The chi-square statistic with a p-value of 0.000 made us to reject the null hypothesis that health shock is not correlated with the regression error. To account for this endogeneity problem we used lagged health shock variable as a possible instrument for health shock variable. However we had to make sure that the lagged health shock is a relevant instrument for the health shock variable. The rule of thumb (at least in the case of a single endogenous variable) is that one should only proceed with IV estimation if the F value on the 1st stage of 2SLS > 10. Our result show that F value on the 1st stage of 2SLS =10.

Table 2 ***Regression results: what affects the coefficient on consumption?***

	MODEL 1	MODEL 2	MODEL 3
VARIABLES	**POOLED-OLS**	**FIXED EFFECT**	**2S L SQ**
Illness	-0.034	-0.035	0.704
	(0.000)	(0.000)	(0.470)
LnHHSIZE	0.280	0.314	0.302
	(0.000)	(0.000)	(0.000)
lnEDU	0.063	0.039	0.054
	(0.000)	(0.000)	(0.000)
lnAGE	0.047	0.389	0.034
	(0.000)	(0.000)	(0.000)
Number of instruments			1

First-stage *F*-statistics		10
Endogeneitytest	Chi-sq(=0.000	

The results on the OLS, fixed effect and IV estimates of the impact of changes in lagged health shock on changes in consumption are dramatically different, highlighting the importance of the IV approach to this question. Unlike the OLS, fixed effect estimates, instrumental variable estimates suggest that, we cannot reject the hypothesis of full insurance. The coefficient on health shock measure is insignificant; indeed, they are wrong-signed, indicating that illness is associated with higher levels of consumption, not lower. These results are in line with many studies such as the work of Gertler *at el* (1997). These authors argue that, the hypothesis of full insurance depends on whether one is dealing with consumption insurance against relatively minor health changes or severe illnesses.

4 How do Households Insure their consumption?

After noticing that indeed households do somehow smooth their consumption (see results in Tables 1 above), it is interesting to ask: How do households Insure their consumption. This question is particularly important to ask because there is evidence to suggest that markets in developing countries are incomplete. Existing studies suggest that households could use a number of different means to insure consumption against income shocks. These include: remittances, adjusting labour supply including child labour, reducing educational expenditures, sale of non-land non-productive assets like gold and jewelery, increasing borrowing and setting of non-land assets and productive assets like livestock. For the purpose of this paper we focus on the role of remittances.

5 Empirical analysis

To rigorously explore the relation between remittances and income shocks we econometrically test whether remittances increased in response to illness. This analysis follows Harrower and Hoddinott (2005), Fafchamps and Lund (2002) and Park (2006) in viewing remittances as an ex post coping strategy households use following a shock. This will be estimated using pooled OLS (i.e. equation 4) and fixed effects model (i.e. equation 5) and instrumental variable models (i.e. equation 6) as shown below:

Firstly, we use the baseline Pooled OLS (POLS) estimator which assumes homogeneity of intercepts and slopes (a rather heroic assumption), and which gives equal weight to the within and between variances in the data

$$LnR = \alpha_0 + \alpha_1 H_{it} + \alpha_2 X_{it} + \varepsilon_{it} \quad \text{.....4}$$

Secondly, we make use of the Fixed Effects (FE) estimator which assumes heterogeneity of intercepts (a reasonable assumption in such a diverse panel of households), and which makes use only of the within variation in the data, which purges the correlation between the unobserved heterogeneity and the regressors.

$$LnR_{it} = \alpha_0 + \alpha_1 H_{it} + \alpha_2 X_{it} + \delta_i + \varepsilon_{it} \quad \text{.....5}$$

Given the possibility of endogeneity, we used Instrumental Variables (IV) estimator which provides asymptotically consistent estimates and the first lag of illness is our identifying instrument

$$LnR = \alpha_0 + \alpha_1 H_{it-1} + \alpha_2 X_{it} + \delta_i + \varepsilon_{it} \quad \text{.....6}$$

Where LnR are remittances received household i at time t; H_{it} is the health shock faced by household i at time t. The error term ε_{it} includes both preference shocks and measurement

error and is distributed identically and independently. The difference between these models has already been explained in section three above.

Table 3 ***Regression results: what affects the coefficient on remittances?***

	MODEL 1	MODEL 2	MODEL 3
VARIABLES	**POOLED-OLS**	**FIXED EFFECT**	**2S L SQ**
Illness	0.03	0.18	1.24
	(0.108)	(0.010)	(0.000)
LnHHSIZE	-0.19	0.04	-0.17
	(0.000)	(0.786)	(0.019)
lnEDU	0.05	0.11	0.04
	(0.008)	(0.240)	(0.448)
lnAGE	-0.04	0.22	-0.07
	(0.010)	(0.240)	(0.168)
Number of instruments			1
First-stage *F*-statistics			9.9
Endogeneitytest	Chi-sq(	=0.001	

Table 3 presents the estimation results based on equation 1-3. Columns (1) report the Benchmark OLS regression results. Although significant and positive, the coefficients of illness is very small – 0.03. The results on controlled variables such as age of the household and household size were found to be negative and statistically significant with respect to remittances. In contrast, education presented positive and significant estimate with respect to remittances.

Columns (2) report fixed effect estimation, the coefficient on illness still presents positive and becomes strongly significant. Some controlled variables such as age of the household and household size have become positive and insignificant. This suggests that the benchmark OLS regression results might have been biased.

To address the endogeneity problem the next column (3) of Table 3 report the IV estimates. There is a marked increase in the illness coefficient estimated by IV compared to that estimated by the standard fixed effect and pooled OLS estimator. The results on controlled are more similar to pooled OLS than fixed effect model: variables such as age of the household and household size were found to be negative and statistically significant with respect to remittances. In contrast, education presented positive and significant estimate with respect to remittances.

One question of interest is whether or not the instrument is consistent in producing sufficient Exogenous variations in illness. We pursued this question by performing all the necessary specification tests. First we checked whether health shock is not correlated to the error term (i.e. performed endogeneity test). The chi-square statistic with a p-value of 0.001 made us to reject the null hypothesis that health shock is not correlated with the regression error. To account for this endogeneity problem we used lagged health shock variable as a possible instrument for health shock variable. However we had to make sure that lagged health is a relevant instrument for health shock. The rule of thumb (at least in the case of a single endogenous variable) is that one should only proceed with IV estimation if the F value on the 1^{st} stage of 2SLS > 10. Our result show that F value on the 1^{st} stage of 2SLS =9.9.

Conclusion

This paper investigated, using the National Income Dynamic dataset from South Africa, the effect of health shocks on consumption and the degree to which households use remittances to insure against health shocks. Our empirical analysis commenced with the kernel density estimation method which provided useful features of the income and consumption distributions. The densities of income and consumption displayed the presence of some forms of insurance mechanism that allow the smoothing of consumption across different income groups of households. Given the limitations of the kernel density estimation method (i.e. it does not control for other factors that can affect consumption, and do nothing to address endogeneity issues); rigorous econometric methods were subsequently used. The results based on econometric methods show that households are insured against shocks and that they experience an increase in remittances in response to health shocks.

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