Informal insurance, public transfers and consumption smoothing

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Abstract

In many developing countries, public programs in the form of food aid distribution and food-for-work programs are often meant to protect vulnerable households from consumption and nutrition downturns by providing a safety net. Few studies have evaluated the impact of these programs. Furthermore, households often use a variety of informal mechanisms to cope with risk, including mutual support and risk-sharing. In this paper we look into the extent to which food aid helps to smooth consumption by reducing the impact of negative shocks, paying attention to program placement effects. Using panel data from Ethiopia, we find that despite poor targeting of the food aid, the programs reduce some of the vulnerability to common shocks via intra-village risk sharing. JEL CODES D91, I38, O17

1 Introduction

In recent years, the need to develop better safety nets in developing and transition economies has been generally acknowledged (see e.g.Drèze and Sen (1990), World Development Report 2000/01). In rural areas of the developing world, they often take the form of direct transfer programs, via food aid distribution and public employment programmes with in-kind wages. Despite calls for more long-term safety nets, often these programmes are still largely relief programmes, responding to local or national emergencies, even though this may be changing (Clay and Stokke (1991)). In any case, these programmes are typically meant to support the poor and vulnerable, to avoid current and future deprivation and insufficient nutrition[1].

[1] Different terms tend to be used to describe the objectives of these programs. Often, they aim to promote food security, which can be defined as the freedom from the risk of insufficient

The problems with food-based support programs and their efficiency in developing countries has received a lot of attention (for reviews see Ravallion (1991), Clay (1986), Barrett (2001)). Much of this literature has been concerned with questions about the programme objectives, their long-run sustainability and dependency problems (Maxwell and Singer (1979), Ruttan (1993), Stewart (1998), Barrett (2000)) or the incentive effects of transfers on labour supply, food production and other productive activities (Sahn and Alderman (1996), Dorosh et al. (1995), Maxwell and Singer (1979), Maxwell (1991), Maxwell et al. (1994), Mohapatra et al. (1997), Barrett (1998a), Bezuneh et al. (1988)). Other studies try to quantify the net transfer benefits, taking into account the opportunity cost of time spent on food-for-work (Datt and Ravallion (1994)). There is a sizeable literature on the impact of ration systems and supplementary feeding programmes (Beaton and Ghassemi (1982), Kennedy and Alderman (1987), Alderman (1991)). A few papers have directly addressed the issue of nutrional impacts of food distribution and food-for-work programmes (Athanasios et al. (1994), Janyne, Strauss et al. (1999)), while some have focused on the indirect effects, such as on-farm investment (Bezuneh et al. (1988), Bezuhen and Deaton (1997)).

In recent years, much attention has been paid to the problems related to the targeting of transfers (Besley and Kanbur (1990), Sen (1995), van de Walle and Nead (1995)). Building on the success of the Maharastra Employment Guarantee Scheme, self-selection based employment schemes are often advocated as providing a partial solution to these targeting problems (Drèze and Sen (1990), Ravallion (1991)), even though this may not be without problems either (Barrett (2001), Alderman and Lindert (2001)). Empirical work on rural data has tried to quantify these targeting issues: are the poor reached (Jayne et al. (1999, 2001), Teklu and Asefa (1999), Clay et al. (1999), Clay (1986), Ravallion (1990), von Braun (1995)).

To the extent that empirical research has focused on the impact in terms of welfare, much of this work suffers from at least four problems. First, most of the studies, especially on food aid and food-for-work, focus on whether the poor are reached or not, without directly evaluating the impact on the livelihoods of the poor. Secondly, even if they do, they rarely address the issue of the impact in terms of nutritional *risk*, and focus only on the direct effect on current incomes and nutrition, partly due to the lack of longitudinal data that can document vulnerability and welfare dynamics (Barrett (2001)). Thirdly, and linked to this, they do not consider the presence of alternative ways of coping with consumption or nutrition shortfalls, such as via asset depletion and informal support networks (Morduch (1995), Townsend (1995), Deaton (1997)). The impact evaluation of the program should take these alternatives into account, for example given possible important crowding out effects (Attanasio and Rios-Rull (1998)). Fourthly, they fail to acknowledge the econometric problems related

nutrition, thereby avoiding current and future deprivation. Different authors use different definitions. Terms such as 'food security', 'nutritional risk' or 'vulnerability' are used in a similar sense (Beaton (1987), Morduch (1994), Maxwell (1996), Dercon and Krishnan (2000), Christiaensen (2000), Barrett (2001)).

to program placement effects (see Rosenzweig and Wolpin (1994) for a classic treatment). In particular, the recipients of support may receive it due to certain characteristics, unobserved to the researcher, that also impact on the recipients' nutrition or consumption outcomes, biasing the results of the impact evaluation. The key contribution of this paper is that it can deal with all these problems. In particular, we combine insights and modelling approaches from the risk sharing and consumption smoothing literature to study the net impact of safety nets on household welfare, accounting for the econometric problems posed by the evaluation of program interventions.

Ethiopia provides a useful case-study in this respect. It is one of the poorest countries in the world by any indicator. Per capita GDP is estimated at about 140 US dollars, child malnutrition (stunting) is estimated at well-above 50 percent during the 1990s and adult malnutrition is about 25 percent (World Bank (1999), Christiaensen and Alderman (2001), Dercon and Krishnan (2000)). Furthermore, its population is living in highly risky environment: drought is a recurrent phenomenon, requiring large public responses (as in 1994 and 1999) or, combined with failing public policy and war, triggering a large scale famine in 1974 and in 1984-85. Ethiopia is also an important recipient of food aid, arguably increasingly dependent on it. World Food Programme estimates for 1994-98 suggest that Ethiopia is second largest recipient of food aid in the world (after Bangladesh). In the 1990s, volumes of food aid accounted for about 5 to 15 percent of production (Clay et al. (1998)). Food aid is largely distributed via food-for-work programmes - the best estimate puts its share at 63 percent of food aid, while the rest is largely distributed as direct (free) transfers. Food-for-work and direct food aid distribution are virtually the only publicly provided safety net in rural Ethiopia. A few recent studies have documented and analysed the effectiveness of food aid delivery, uncovering important deficiencies, although the focus has largely been on targeting issues (Sharp (1997), Clay et al. (1998), Jayne et al. (1999, 2001), Barrett et al. (2001)).

The next section will present a theoretical framework to test the impact of a safety net on households faced with income risk. Section 3 presents the empirical model, discussing the way the programme placement effects are handled. Section 5 gives the data used and section 6 the empirical results. Section 7 concludes.

2 Theoretical framework

In order to analyse the impact of the safety net provision, we explicitly want to take into account risk, intertemporal behaviour and the existence of community and household based mechanisms to cope with the consequences of risk[2]. For this, let us characterise first the behaviour of welfare over time under the hypothesis that these mechanisms work perfectly. We will then proceed with discussing how imperfections in these mechanisms will show up in the evolution

[2] Since for the empirical application, we specifically use household level data, we do not consider intrahousehold issues in this model. For an analysis of these issues in the context risk using the same Ethiopian data, see Dercon and Krishnan (2000).

of outcome data. Then, we will introduce a safety net and discuss how the observed outcomes would be qualified by it, focusing on the way the safety net transfers will affect the household directly, as well as via the community based mechanisms. To do so, consider a world with missing insurance markets. For the moment, we allow for credit markets. Let households i maximize intertemporal expected utility, with instantaneous utility of individual u_i defined over consumption c_{it}. We assume that the household is risk averse ($U_i' > 0, U_i'' < 0$). Denote T as the time horizon of the household and s a state of the world (out of S possible states) with probability p_s ($\sum_{s=1}^{S} p_s = 1$)[3]. Household face risky (exogenous) income y_{it}, have a discount rate of β and have access to a risk-free asset with return r. At any point τ, the household will choose c_τ that maximizes:

$$\max_{c_{i\tau}} \quad u_i(c_{i\tau}) + \sum_{t=\tau+1}^{T} \beta^{t-\tau} \sum_{s=1}^{S} p_s u_i(c_{it}) \tag{1}$$

subject to the intertemporal asset constraint, that assets A_{it} in the beginning of each period should obey:

$$A_{it} = (1 + r) A_{it-1} + y_{it-1} - c_{it-1} \tag{2}$$

Assuming no bequest motive ($A_{iT+1} = 0$), then this problem results in the standard permanent income result that expected utilities move in lock step over time (Deaton (1992)), or, using E as the expectations operator:

$$u_i'(c_{it}) = \beta(1 + r)E\left[u_i'(c_{it+1})\right] \tag{3}$$

Equation (3) allows for credit and savings to smooth consumption. The fact that the marginal utility at t is only equal to *expected* marginal utility in $t+1$ is a reflection of the fact that insurance markets are missing. An empirical formulation of equation (3) would suggest that only shocks to permanent income would change optimal consumption relative to before - transitory shocks would be smoothed (Paxson (1993), Deaton (1992)).

Next, assume that the community in which this household lives has a risk-sharing mechanism in operation, so that mutual insurance is offered to each other. Given risk-aversion, both agents have an incentive to share risk. The mechanism is at first assumed to be perfectly enforceable, no private information exists and it covers I individuals. The scheme provides then a Pareto efficient allocation. Using notation as before, we can write this problem then as if joint utility function of the different community members i, weighted by Pareto weights is maximised subject to a joint income constraint, where the Pareto weights θ_i can be interpreted as determining the share each member obtains in the arrangement, allocated by a social planner (Townsend (1994), Udry (1994), Ligon (1998)). Given these weights, the planning problem can then be

[3] In the formulation used, income is independently identically distributed. The results on risk sharing and consumption smoothing can be generalised to stationary Markov processes. See e.g. Deaton (1992), Ligon et al. (1998), Thomas and Worrall (2000).

written as maximising expected joint utility:

$$\max_{\forall c_{i\tau}} \quad \sum_{i=1}^{I} \theta_i (u_i(c_{i\tau}) + \sum_{t=\tau+1}^{T} \beta^{t-\tau} \sum_{s=1}^{S} p_s u_i(c_{it})) \tag{4}$$

given the available resources, which at each period t are defined as:

$$\sum_{i=1}^{I} A_{it} = \sum_{i=1}^{I} \left((1+r) A_{it-1} + y_{it-1} - c_{it-1} \right) \tag{5}$$

From the first order conditions of this problem, and only considering interior solutions, the full-insurance result follows, that the relative allocation between any two households i and j in any period of time t and $t+1$ (ex-post, i.e. after uncertainty has been resolved) will be determined by:

$$\frac{u'_{it}}{u'_{jt}} = \frac{\theta_j}{\theta_i} = \frac{u'_{it+1}}{u'_{jt+1}} \tag{6}$$

In other words, whatever state of the world materialised, relative marginal utilities are equal - with the lack of expectations operators the hallmark of full insurance (Ligon (1998)). Combining (6) and (3) suggests that the credit which allowed (3) to be valid is in fact used for the benefit of the whole community. The community risk-sharing arrangement can only deal with within-community (or idiosyncratic) shocks; credit and savings can then be used for community-level (or common) shocks, resulting smooth consumption both between households and over time[4]. Clearly, this is a useful benchmark to discuss credit market imperfections, problems with the risk sharing arrangement and the effects of safety nets.

Introducing a safety net would improve outcomes, if only through adding free resources to the community (which makes it different from an insurance system). But the insurance effects are rather subtle. First, consider a safety net transfer, targeted to someone suffering from an idiosyncratic shock. The transfer would merely reduce the transfers needed within the community to achieve (6), i.e. it would just crowd out within-community transfers. Suppose that the transfer were poorly targeted, so that those experiencing the shock do not receive support. This is not a problem in this case: the transfer would be allocated according to (6), so that those facing the shock would still benefit. Crowding in would be possible. Targeting is irrelevant for outcomes if there is a perfect risk sharing arrangement[5]. A safety net for common shocks would

[4] While providing consumption smoothing, within-village insurance combined with between-village credit is not enough to yield fully predictable consumption over time for each household. Besides strong restrictions on utility functions and on the relationship between time preference and interest rates, it also requires between-village insurance - i.e. (3) is only valid in expectation.

[5] In this discussion, it is assumed that the Pareto Weights are assumed to be predetermined by the agreement, i.e. they do not change for example due to transfers. If public transfers induce changes in the agreement, then would have to be taken into account, leaving some role for targeting.

only crowd out credit and savings to the extent that the transfers deal with transitory shocks. Permanent shocks are not covered by credit in (3): i.e. the safety net would mainly add welfare if it provided protection against such shocks. Examples are common shocks that destroy the asset base, e.g. droughts that kill livestock herds, earthquakes that destroy property, epidemics and other 'catastrophic' shocks. In short, abstracting from the overall resource transfer effect, the safety net would not change outcomes for idiosyncratic shocks since it would merely crowd out the within-community transfers. It would only affect the impact of common shocks, to the extent that these shocks are permanent.

Suppose now credit markets are imperfect, so that (3) does not hold. For example, consider that only collateralised loans are possible. Then it must be the case decisions on consumption in each period t must obey that:

$$A_{t+1} \geqslant 0 \tag{7}$$

Adding this constraint to the problem in (1) and (2) results in a standard modification of equation (3). Let λ_t be the multiplier on this constraint, then (3) should be rewritten as:

$$u_i'(c_{it}) = \beta(1+r)E\left[u_i'(c_{it+1})\right] + \lambda_t \tag{8}$$

If (7) binds, then the lack of credit results in lower consumption at t than optimal: consumption is less smooth, since only savings can be used for intertemporal smoothing. A safety net now has another potential benefit: it can not only help to reduce the impact of permanent common shocks, but also with transitory common shocks[6]. Given (6), the other results are unchanged: since the informal insurance arrangement is assumed to be perfectly enforceable, whatever the resources available, the sharing rule is still valid. The issue of targeting is again largely irrelevant.

Introducing imperfections to the risk-sharing arrangement creates more problems for the analysis of the impact of food aid. Typically, two problems could be considered: asymmetric information and enforcement problems. Problems such as moral hazard central in market-mediated insurance and would also result in less than optimal insurance. But arguably, this class of problems are less important in informal systems based on families and neighbours, where monitoring is relatively straightforward. Enforcing the arrangement across all states of nature and over time could be more difficult: even though ex-ante, it would have paid a household to enter the arrangement to insure against downside risk, but if a good state of the world materialised, the household may be better off to leave the arrangement. Incorporating this problem in a contract to make it sustainable (self-enforcing) has received a lot of attention in recent years[7]. Essentially, the problem can be thought of as the model in (4) and (5), but with an additional constraint, stating that the expected intertemporal utility of staying

[6] Any imperfection in savings markets would further result in net welfare gains via the safety net (on this, see Dercon (1999)).

[7] Coate and Ravallion (1993) consider static contracts, Ligon et al. (1997), Kocherlakota (1996) and others have looked at optimal contracts in a dynamic context.

in the arrangement and non-reneging on promises, outweighs in each period the expected utility of leaving the grouping and reversing to 'autarky'. Using Θ and
to denote respectively whether the household sticks to the arrangement, and reverts to autarky, this sustainability condition can be written as:

$$u_i(c_{i\tau}|\Theta) - u(c_{i\tau}|\quad) \geq \sum_{t=\tau+1}^{T} \beta^{t-\tau} \sum_{s=1}^{S} p_s u_i(c_{it}|\quad) - \sum_{t=\tau+1}^{T} \beta^{t-\tau} \sum_{s=1}^{S} p_s u_i(c_{it}|\Theta) \tag{9}$$

Defining the solution to this problem is not self-evident, especially when savings is possible as well. The solution takes the form of an updating rule on the Pareto weights, based on the 'original' Pareto weights θ_i plus the cumulative sum of the Lagrange multipliers on the sustainability constraints for person i (Ligon et al. (1997), Thomas and Worrall (2000), Attanasio and Rios-Rull (2000)). In particular, let $\mu_{i\tau}$ be the multiplier at period τ, then the relative allocation between households i and j takes the form:

$$\frac{u'_{it}}{u'_{jt}} = \frac{\theta_{j0} + \sum_{t=0}^{\tau} \mu_{jt}}{\theta_{i0} + \sum_{t=0}^{\tau} \mu_{it}} \tag{10}$$

The point is that a binding sustainability constraint for a particular household will increase its weight, implying that it needs a higher share in the arrangement than before. The shift in favour of the household is persistent[8]. Any factors that affect the sustainability constraint could now have an impact on the allocation between the agents, resulting in possible less protection offered. Savings is such an example: since households can now self-insure, it would limit the scope of mutual insurance, so that relative to imperfect enforceable risk sharing without savings, some households may have less overall protection (Ligon et al. (1998))[9].

At a basic level, the introduction of a safety net has similar effects as before: it would help to insure common shocks, while it may even plug the holes left in terms of idiosyncratic insurance. Targeting transfers for common shocks would still induce (partial) crowding in, and partial crowding out if targeted to those facing idiosyncratic shocks. However, the introduction of a safety net can then also have rather unexpected additional effects that need to be taken into account. Suppose that it offers insurance for aggregate shocks. Just as in the case of savings, the effects are ambiguous. Surely it provides an increase in ex-ante welfare since the impact of aggregate shocks is now reduced, but it may also affect the sustainability constraints: some may find their overall autarky welfare

[8] Foster and Rosenzweig (2000) exploit this feature to test this model, by noting that past positive transfers will be negatively related to new transfers conditional on shocks.

[9] Ligon et al. (1998) show that, if savings is possible within a context of imperfect enforceable informal insurance, and given the assumptions of their model, (8) needs to be modified by adding a term which is a function of the sustainability constraint of the risk sharing arrangement. Ex-ante welfare is improved through savings, since aggregate shocks can be smoothed, while (observable) savings can show committment to the informal arrangement, but by making autarky more attractive, it may reduce welfare by limiting the extent of mutual insurance offered and received.

increased sufficiently that the (imperfect) risk-sharing offered before would even be cut back, reducing the welfare of others in the mutual support system (Attanasio and Rios-Rull (1999, 2000)). Note that protection for aggregate shocks is potentially causing the reduction in idiosyncratic insurance. Albarran and Attanasio (2001) present some evidence that suggests crowding out of informal insurance consistent with this model, using data from Progresa in Mexico. Targeting of aggregate insurance may be a solution, to the extent that those most likely to suffer due to the sustainability constraints are only receiving the assistance, i.e. because those they rely on are likely to hit sustainability constraints if the assistance is untargeted. To the extent that the poor are those who have suffered most shocks in the past, this may be feasible in practice. But just as with most targeting, the informational requirements are high. Note that poorly targeted aggregate insurance may induce a reduction in idiosyncratic insurance, beyond untargeted insurance. Finally, coverage for some idiosyncratic shocks by a safety net could also have complicated effects. Beyond crowding out some mutual insurance, it could also reduce insurance for other idiosyncratic shocks, by affecting the position of households in autarky. Targeting this assistance may be a way out, but poorly targeted assistance may again make things worse for the others.

Two other routes would be possible to design safety nets that would not induce welfare losses or to minimise crowding out of idiosyncratic insurance. Both involve finding ways to reduce the incentives of participants to deviate from the arrangement due to the increase in autarky values. The solution would be to make the safety net conditional on participation in the mutual mechanism, so that the safety net would be lost if the household were to leave the arrangement. The simplest form would be to give the aggregate protection to the mutual insurance group. However, this would require the safety net operator to be able to identify the group and monitor its continued existence as a group. If the group cannot be observed or monitored, an optimal mechanism may be designed to induce the group to stay together by allowing other group members to punish deviators by denying them aggregate insurance. Attanasio and Rios-Rull (2000) discuss some possible mechanisms which could deliver this outcome. In any case, current practices appear to be far from these mechanisms.

3 The empirical model

The previous section provides a setting to test the key question of this paper: does the distribution of food aid improve the ability of households to deal with shocks and in this way improve welfare? To investigate this, it is useful to consider an empirical formulation, similar to the ones used to test the existence of full insurance in communities and whether consumption is smooth over time. Recall the key predictions of both models: first, the perfect risk-sharing model suggests that allocations between agents should not be affected by idiosyncratic shocks, while only common (village level) shocks should matter. Consumption smoothing in the permanent income model implies that only permanent

shocks should matter, while transitory shocks should not affect the allocation of consumption. This implications refer to the evolution of marginal or expected marginal utilities over time and households. Specific assumptions about the utility functions are needed to get similar findings in the space of consumption, some resulting in models in levels of consumption or in logs[10]. We use a generic formulation, expressed in logs, linking shocks directly to the evolution of consumption. To start, we can state in general that consumption at each point in time will be some specific function of:

$$c_{it} = f(Y_{it}^P, Y_{it}^T, Y_{it}^{CT}, Y_{it}^{CP}, \psi_{it}, \omega_t^C) \tag{11}$$

in which Y_{it}^P is household permanent income, Y_{it}^T is household level transitory income, Y_{it}^{PT} is community level permanent income, Y_{it}^{CT} is community level transitory income, while ψ_{it} and ω_t^C are household and community specific factors influencing how household level allocations follow from household and community level income. They include factors such as seasonality, time preference but also, if risk-sharing takes place, the relative Pareto weights and possibly the history of the support system. The theoretical models discussed in the previous section have specific predictions about the role of different factors. For example, the perfect risk-sharing model would predict that the individual income outcomes in each period would have no effect, controlling for community level permanent, transitory income and the household and community level controls. The permanent income hypothesis would predict that none of the transitory sources has an effect. The two models together would predict that only permanent common income shocks would matter. Transitory sources would matter if the credit markets are imperfect, while individual income would still have an impact in the partial risk sharing case due to enforcement problems[11]. By considering a dynamic model, we can formulate the problem directly in terms of outcomes of different sources of risk - events causing changes in permanent and transitory income. By lack of any specific guidance on how to parametrise specifically the model, let us consider that the log of consumption is a linear function of these events, given fixed and time-variant household and community characteristics. Let us call the observed risky events S, allowing some to be causing permanent income effects, e.g. death, disability, landslides while others cause transitory effects, e.g. illness, rainfall. The shocks can be both idiosyncratic and common. Higher S is assumed to imply higher income. This means that we can write (11) as

$$\ln c_{it} = \alpha S_{it}^P + \beta S_{it}^T + \gamma S_{it}^{CP} + \delta S_{it}^{CT} + \eta X_{it} + \theta_i \tag{12}$$

[10] For example, Townsend (1994) uses exponential utility functions, and this yields a model in levels of consumption; Cochrane (1991) and others have used CRRA utility functions, resulting in expressions in terms of logs of consumption. Quadratic utilities as in Hall (1978) result in consumption in the following a random walk over time.

[11] Strictly speaking this would not be correct when considering the imperfect enforceability model, where history matters. This can be incorporated by considering time varying ψ and ω^C. We will discuss this in the estimation of the model.

in which X_{it} capture observable household and village level control variables linked to income[12], while θ_i are observable and unobservable household and community fixed factors influencing consumption outcomes, including the determinants of permanent income. Under perfect (within-village) risk-sharing, $\alpha = \beta = 0$,(while $\gamma > 0$, and unless credit markets are perfect, $\delta > 0$). Perfect credit markets would imply that $\beta = \delta = 0$,(while $\gamma > 0$, and unless within-village risk sharing takes place, $\alpha > 0$). Unless between-village insurance takes place, $\gamma > 0$. Imperfections in informal risk-sharing arrangements would result in idiosyncratic shocks to impact on consumption ($\alpha > 0, \beta > 0$), while imperfections in credit markets would result in (at least) $\delta > 0$. Taken together, positive values for any of these coefficients on the sources of risk would be signs of imperfect smoothing and insurance. Any effect of savings or credit on informal idiosyncratic insurance would similarly show up in the form of positive coefficients on the idiosyncratic risk variables.

To nest different imperfect outcomes better, it needs to be taking into account that in an imperfect world savings is typically still feasible. Consequently, downside transitory risk would in general be harder to cope with than upside risk. Furthermore, the presence of unobservable fixed effects will potentially cause econometric problems, so a more familiar formulation of the empirical model can be obtained by estimating fixed effects, or equivalently, differencing (12). Using $\triangle$ to denote changes between t and $t-1$, and distinguishing positive from negative transitory shocks, we can write:

$$\begin{aligned} \triangle \ln c_{it} &= \alpha \triangle S_{it}^{P} + \beta_1 \triangle S_{it}^{T}|_{\triangle S_{it}^{T} \geq 0} + \beta_2 \triangle S_{it}^{T}|_{\triangle S_{it}^{T} < 0} + \gamma \triangle S_{it}^{CP} \\ &\quad + \delta_1 \triangle S_{it}^{CT}|_{\triangle S_{it}^{CT} \geq 0} + \delta_2 \triangle S_{it}^{CT}|_{\triangle S_{it}^{CT} < 0} + \eta \triangle X_{it} \end{aligned} \tag{13}$$

in which under imperfect markets $\beta_2 > \beta_1 \geq 0$ and $\delta_2 > \delta_1 \geq 0$, while the other expected signs are unchanged from the discussion before.

Equations (12) and (13) are useful to test the impact of a safety net. If food aid is simply a form of income support system, lifting up incomes, irrespective of events, then it would show up as a permanent income change (if it is expected to be permanent) or a transitory income change. If it is a safety net, providing protection against shocks, then it would show up in change of the coefficient on the different risk variables. Relative to the counterfactual of no safety net with imperfect risk-sharing and credit markets, an effective safety net would restore the perfect credit and informal insurance result ($\alpha = \beta_1 = \beta_2 = \delta_1 = \delta_2 = 0$), while even $\gamma = 0$ may be achieved. A test of the effectiveness of the safety net would then be the extent to which the coefficients are becoming closer to zero.

The econometric problem arises from possible endogeneity of the program. To see this, consider first the standard approach to evaluating programs. Let us consider the program effect as a dummy shifter for inclusion in the program or not (π_{it}). (In a further version, this will be extended to introduce also the

[12] The time variant parts of factors determining ψ_{it} and ω_t^C are also assumed to be captured by X_{it}.

size of transfers, although conceptually they are not much different.) Equation (12) can then be rewritten as:

$$\ln c_{it} = \alpha S_{it}^{P} + \beta S_{it}^{T} + \gamma S_{it}^{CP} + \delta S_{it}^{CT} + \eta X_{it} + \theta_i + \pi FA_{it} \tag{14}$$

in which π measures the impact of the program - helping to boost consumption in that period or not. The standard program placement program can be understood as the problem that certain unobservables may be correlated with whether a person receives the program - i.e. that $FA_{it} = 1$ is correlated with particular θ_i. One solution in the panel is that the program is not always observed, so a fixed effects estimator of (12) (or equivalently, equation (13) with the change in coverage of the program as an additional dependent variable) would both get rid of the heterogeneity and solve the program placement program. This is the approach we take.

The complication is that it would be consistent with perfect credit and risk sharing that the impact of FA_{it} on the level of consumption should be very small! So, finding no program impact would be consistent with a perfectly functioning program. Surely, this does not help our test. To assess its impact, we must look more directly at the way the program can affect the consequences of shocks, i.e. to see whether it reduces the shocks faced by households. To do this, we will *interact* negative shocks with the presence of a program - and investigate whether shocks are insured via the program. Since we are considering food aid programs, it seems reasonable to restrict us to large common but transitory shocks (like a drought), although this could be extended (see the econometric discussion). Introducing such a program in (12) and differencing gives us:

$$\begin{aligned} \triangle \ln c_{it} \quad = \quad & \alpha \triangle S_{it}^{P} + \beta_1 \triangle S_{it}^{T}|_{\triangle S_{it}^{T} \geq 0} + \beta_2 \triangle S_{it}^{T}|_{\triangle S_{it}^{T} < 0} + \gamma \triangle S_{it}^{CP} \\ & + \delta_1 \triangle S_{it}^{CT}|_{\triangle S_{it}^{CT} \geq 0} + \delta_2 \triangle S_{it}^{CT}|_{\triangle S_{it}^{CT} < 0} \\ & + \delta_2^{f}.FA_{it.} \triangle S_{it}^{CT}|_{\triangle S_{it}^{CT} < 0} + \eta \triangle X_{it} \end{aligned} \tag{15}$$

where the impact of the program on the household's ability to smooth consumption is measured by δ_2^f. For the program to be effective, one would expect $-\delta_2 < \delta_2^f < 0$, i.e. negative shocks have smaller effects when the program is in place. Since the shocks are exogenous, if programs are placed due to some time-invariant characteristics θ_i as in (14), (15) does not suffer from this, since this heterogeneity is controlled for in this difference model. However, the final complication is that programs may be well be placed due to some time-variant factors – such as gradual soil degradation due to harsher effects of past droughts, or in general some other form of marginalisation, or even due to some gradual shift in political favours to one region, then program placement effects could still be present (as if there is heterogeneity in (15)). Time-variant heterogeneity is obviously very hard to address. But if one is willing to assume some structure to it, then this is possible to be dealt with. In particular, assume that this time variant heterogeneity enters in equation (15) as a fixed factor (so that in (12), in the level equation, there is a individual specific trend: households get gradually

better or worse off, not captured by observables at t). In that case, running a fixed effects regression on (15) ('a double difference') then this would solve any econometric problem that may be caused by this effect. Note that this assumes that current common shocks are not the *only* reason for placing the program. If this was the reason, then (15) or its difference would not make much difference, so this will show up in the regressions.

But this is not quite the end of the story: if there is perfect risk sharing within the community, then, as was argued before, targeted transfers will just be treated as an individual shock, and distributed among the villagers. Even in imperfect risk-sharing arrangement, some of the receipts may well be distributed. The consequence is that simply having a program present in your village or group may affect the consequences of shocks - i.e. your common shock would be insured by the others receiving aid. An alternative scenario is also possible: the transfers given to others in the village may crowd out informal transfers that they should give to other individuals. So if you receive transfers, you will be better off due to the program (bad shocks have a smaller impact) but if you are not receiving them and there is a program in the village, you may be losing from it, i.e. may the impact of the shock higher. To allow for this, we also introduce not just whether the household is covered by the program (FA_{it}) but also whether the village is covered or not ($VFA_{it} = 1$ or 0). The model to be estimated is then:

$$\begin{aligned} \triangle \ln c_{it} &= \alpha \triangle S_{it}^{P} + \beta_1 \triangle S_{it}^{T}|_{\triangle S_{it}^{T} \geq 0} + \beta_2 \triangle S_{it}^{T}|_{\triangle S_{it}^{T} < 0} + \\ &\quad \gamma \triangle S_{it}^{CP} + \delta_1 \triangle S_{it}^{CT}|_{\triangle S_{it}^{CT} \geq 0} \\ &\quad + \delta_2 \triangle S_{it}^{CT}|_{\triangle S_{it}^{CT} < 0} + \delta_2^{f}.FA_{it.} \triangle S_{it}^{CT}|_{\triangle S_{it}^{CT} < 0} \\ &\quad + \delta_2^{v}.VFA_{it.} \triangle S_{it}^{CT}|_{\triangle S_{it}^{CT} < 0} + \eta \triangle X_{it} \end{aligned} \tag{16}$$

where we expect a program that has an individual impact to have $-\delta_2 < \delta_2^{f} < 0$, and where $\delta_2^{v} > 0$ suggests crowding out for example linked to enforcement of informal insurance agreements, while $\delta_2^{v} < 0$ is evidence in favour of informal risk-sharing. This model will be estimated, first as described above (which then controls for fixed individual heterogeneity in the levels of consumption) and secondly, by differencing (16), which then controls for time-variant (trend) heterogeneity in the levels of consumption, as a more appropriate control for placement effects.

4 Data and descriptive statistics

Ethiopia is an obvious case to study the impact of safety nets on household ability to keep consumption smooth. It is one of the highest recipients of food aid, while it is faced with harsh environmental and climatic conditions. Donors and the government have committed themselves to forming a well-functioning safety net. The government's National Policy of Disaster Prevention and Management

(FDRE, 1993) stated that 'no human life shall perish for want of assistance in time of disaster'. In the Food Security Strategy (FDRE, 1996) a distinction was made between food-for-work or other income generating labour schemes (supplementary employment and income schemes), aimed at able-bodied adults, and targeted interventions for especially vulnerable groups. They cover both interventions in large scale crisis and programmes designed to reach particular groups over longer periods. In practice, a very large proportion of interventions involves food aid. Food aid has long contributed to food supplies in Ethiopia. This dependence has been exacerbated by the food shortages during the famine in 1984-85, the increasingly desperate situation in many rural areas in the late 1980s, linked to civil war and political turmoil. The annual volume of cereal food aid has typically been about 2,000 to 6,000 metric tons per year in the period 1986-1995, representing about 5 to 15 percent of production. Even in average years, the volume of cereal food aid in a given region can account for 25 percent or more of total marketed supply of grain, increasing to up to 50 percent in drought years (Clay et al. (1998)).A substantial portion (over 80 percent in bad years) of food aid has been used for emergency relief purposes.

Still much of it is distributed via food-for-work programs, but often the workload is not clear while self-targeting is rarely used, with wages higher than opportunity costs of time, resulting in more people applying to work than can be accomodated. In effect, this means that the distinction between food aid and food-for-work may not be that useful for our purposes. In this version of the paper, we are not addressing potentially different impacts.The more important question for our purposes is to what extent aid assists the poor and vulnerable. Sharp (1997), who reviewed a large body of evaluation studies as well conduct several new case studies, found that food aid has in recent years been spread too thinly over too many areas and too many people. Little evidence of area targeting can be found. Furthermore, in most cases, participants to schemes are selected at the community level, but there is a clear reluctance to select some households while excluding others, so that much larger numbers are involved in the programmes than what they were intended for. The result is that targeting errors of inclusion (providing aid to people who are not in the intended target group) are a greater problem than errors of exclusion (failing to provide aid to the people who need it most) (p.75). The result is that often too little aid is provided to the poorest to make much difference. A similar result was found in the sub-sample of the large nationally representative HICES/WMS survey for 1995/96. Daniel Molla et al. (1998) found the most important factor determining access to food aid was simply whether a programme existed in the area before. Half the food aid distributed went to households with more than sufficient food from their own resources . It should be stressed that these types of findings are not uncommon across other developing countries. Nevertheless, they appear to have encouraged many donors to reassess their activities in these areas. Subsequent, careful econometric studies of food aid in Ethiopia (Jayne, Strauss et al.(1999)) seems to confirm these pattern.

The data used in this paper come from three rounds of the Ethiopian Rural Household Survey, collected in 1994 and 1995. This is a panel data survey col-

lected by the Economics Department of Addis Ababa University in collaboration with the Centre for the Study of African Economies at Oxford University. It covers 15 villages, representative for different areas across the country, and a total of 1450 households were interviewed. The attrition rate in this panel is very low - about 3 percent per year. The survey has detailed information on households, including consumption, assets and income, as well as the shocks they faced. Furthermore, it contains detailed information on participation in free food aid and food-for-work programs.

Consumption per adult equivalent[13] (in 1994 prices) is relatively low: about 80 birr on average, which was then about 12 US dollars a day. Using a local nutriotional poverty line for 2200 Kcal per adult, this suggests about 40 percent do not get sufficient calories on average. Shocks are very common, even in this short period considered and even if on average this was not a particularly bad period in recent Ethiopian rural history. In about a quarter of the villages, a serious drought occurred while diseases affected crops and livestock in many others. An average household would lose several person days a month due to serious illness (more details are in Dercon and Krishnan (2000)). Ability to cope with shocks is generally known to be quite limited. Using a qualitative survey, most households reported many episodes of serious hardship linked to shocks in the last twenty years, related to drought, illness, policy changes and other factors. For example, close to 80 percent of the sample suffered major economic hardship due to drought, mainly during the famine of the mid-1980s.

Efforts have clearly been made to supply the rural population with food aid. But how effective is it? First, in our sample we have a high percentage of households receiving food aid or benefiting from food-for-work in the six months before each round of the survey: about 20 percent in both round 1 and 3, and even 39 percent in round 2.However, the spatial and temporal spread is very diverse. In five villages (out of 15) we found always programs present, in three never while in 7 there was sometimes a programme to disappear afterwards. Also the coverage in terms of households changed considerably over time. Table 1 gives details of a few villages.

Table 1 Percentage of households receiving food aid per round in selected villages

village name	Round 1 (1994a)	Round 2 (1994b)	Round 3 (1995)
Atsbi	64	6	52
Geblen	79	97	5
Ankober	0	98	0
Shumsha	96	80	62
Yetmen	0	0	0

Source: Ethiopian Rural Household Survey.

[13] The consumption data are based on summing and valuing food and non-food consumption obtained via own production, the market and via gifts. It is expressed in real terms by using a consumer price index, using the average household in the first round as a base. It is expressed in adult equivalent units using nutritional equivalence scales based on WHO data for East Africa. All data issues are discussed in Dercon and Krishnan (2000).

As can be seen, one village (Ankober) suddenly had a program with virtually complete coverage, to disappear in the other rounds. In Geblen, the program, very active before, disappeared. Only in Shumsha, (not far from the tourist destination Lalibela - a preferred destination of heads of mission an evaluation teams of donors and NGOs...), coverage was always high, with in round 1, six agencies identified as giving food aid in one way or another. tables 2 to 4 give some indication about the targeting of the programme. First, we look at the whether the poor in preceding period t-1 received the aid or not during the period between two rounds t and t-1. The poor are identified using a poverty line based on the cost of obtaining sufficient consumption to yield 2200 Kcal per adult and some allowance for non–food. Details are in Dercon and Krishnan (2000). Effectively about 40 percent are poor in each round, although there is considerable mobility. Ignoring for obvious reasons the data from the first round, table 1 shows that of the about 26 percent of households receiving aid, more than half were non-poor in round t-1. In short, targeting of the poor it is not quite succeeding.

Table 2 Is food aid targeted to the poor. Percentage of households receiving food aid by poverty status

	non-poor (t-1)	poor (t-1)	total (t-1)
no food aid (t,t-1)	52	22	74
food aid (t,t-1)	14	12	26

Source: Ethiopian Rural Household Survey.

Table 3 Is food aid targeted to the poor. Percentage of households receiving food aid by rainfall experience

	worst rains	median rains	best rains
no food aid (t,t-1)	28	27	21
food aid (t,t-1)	8	2	13

Source: Ethiopian Rural Household Survey.

Table 4 Is food aid targeted to the poor. Percentage of households receiving food aid by agricultural shock experience

	worst shocks	median shocks	least shocks
no food aid (t,t-1)	27	27	21
food aid (t,t-1)	7	6	12

Source: Ethiopian Rural Household Survey.

Table 3 introduces common shocks: village level rainfall. By dividing the sample into groups according to whether the rains in the six months preceding a round belonged to a the lowest tercile (worst rains), middle tercile (median rains) and the best rain tercile, as well as by whether food aid was received. of those receiving food aid, most food aid went to those with the best rains, while among the people that did not receive food aid, relatively more were bad rains in that

particular period. Different tables, such as looking at the preceding rains versus current food aid did not change this picture very much. Finally, in the data we also have information on overall shocks to crops, including plant diseases and other idiosyncratic shocks. Households were again divided into terciles by crop shocks and by receiving food or not, and similar patterns emerge: at least using simple descriptive statistics, the evidence on targeting of the poor or vulnerable is not very strong. Of course, a more complete evaluation requires regression analysis.

5 Results

In this section, we will estimate equation (16) using these panel data from Ethiopia. The specification used is standard and similar as in Dercon and Krishnan (2000). This means that the logarithm of consumption per adult equivalent is regressed on individual and common shocks, controlling for seasonality in prices and labour requirements, and controlling for change in the demographic composition of the household (including number of female and male adults, sex of the head). Shocks included are rainfall shocks, idiosyncratic shocks related to crops, idiosyncratic shocks related to livestock (disease, death) and illness shocks in the household. In this paper, I only report the variables of interest (the rest of the results are available upon request). See also Dercon and Krishnan (2000) - the effects of the control variables is not much different from those in that paper. The difference in specification with this previous paper is (a) the introduction of a possible impact of the food aid program and (b) a distinction is now made between better than normal rain (a positive shock) and worse than normal rain (negative shock), since theory would predict possibly differential impact. For a test of the effectiveness of the safety net in case things go wrong, this specification is superior. Table 5 gives the results. The first set of results is for the model controlling for individual (fixed) heterogeneity, the second set controls heterogeneity in the trend of consumption: The latter will then control for example for placement effects stemming for placing programs in areas that facing a relatively higher vulnerability, in terms of ability to cope with shocks over time.

Table 5 Regression results: fixed effect regressions explaining the logarithm of consumption per adult equivalent (errors corrected for cluster effects).

	'fixed effects' (fixed heterogeneity)		'double difference' (time-variant heterog.)	
	coefficient	t-value	coefficient	t-value
rainfall	1.19	3.68 **	1.32	7.68 **
rainfall if bad	0.52	3.37 **	1.04	7.16 **
rainfall bad*food aid	0.04	0.67	0.06	0.70
rainfall bad*village aid	0.06	0.76	-0.29	2.31 *
number of observations		2475		2475
**=significant at 1 percent, *= significant at 5 percent				

The regression also includes controls for seasonality in prices, peak labour periods, sex head, dependency ratio, male and female adults and household-specific shocks. See text and Dercon and Krishnan (2000) for details. 'Rainfall' is the percentage deviation from long term average levels in the main rainy season relevant for consumption data, 'rainfall bad' is the same variable but only for those observations where rainfall was below the average. The coefficient measures then the additional effect on consumption from bad shocks, as in a model with savings but no credit. 'Rainfall bad*food aid' is the previous variable multiplied by whether the individual received food aid - trying to measure the (difference in) impact of the shock if the household received food aid. Finally, 'rainfall bad*village food aid' is the same as before but now the issue is whether the village received food aid (defined as more than 5 percent of households received some) - testing crowding out or sharing of benefits within the village as in a risk sharing arrangement. Note that the definitions apply to the levels model, and the actual regressions are difference or double difference models.

First, looking at the results of the regression with controls for individual fixed heterogeneity, we notice that current levels of consumption are significantly affected by rainfall suggesting imperfections in insurance and credit arrangements. Bad rain shocks have a large impact on consumption than better rain, suggesting that negative common shocks are not well handled. However, in this specification, both individual food aid and living in a village with a food aid program has no significant impact - clearly surprising. Note that this controls for placement of programs in areas correlated with fixed unobservable household or area characteristics. For example, if food aid is systematically targeted to those with low (or high) consumption, this effect is controlled for in our regression, so this cannot be the cause of the insignificant effects. The second set of results suggest that this was not sufficient in terms of controls for placement. Once we control for the possibility that there is time-variant heterogeneity and allow for placement effects are correlated with this type of heterogeneity, then the results change: receiving food aid as a household still has insignificant effects, but if food aid is given in a community, then this reduces the impact of the shock significantly. This is consistent with the presence of at least partial risk sharing within the community: food aid crowds in community support. This effect is the only one: the household itself does not seem to benefit significantly more

once the effect via the community sharing is accounted for.

The size of the effect gives some indication of the effectiveness of the safety net. First, an additional bad rainfall shock of 10 percent reduces consumption by about 23.6 percent. The safety net has some impact, but it is still not large, especially compared to the scale of the food aid operation in Ethiopia. Those covered by the safety net still typically face reduction of consumption by 20.7 percent when a (marginal) bad rainfall shock of 10 percent occurs. In other words, about 12 percent of a rainfall shock is covered by the safety net. Finally, comparing before and after controlling for time-varying heterogeneity, the impact of the program becomes positive on the ability to cope with shocks from having no effect. This is consistent with program placement in areas that have a lower ability to cope with these shocks, so that the impact of the program was at first underestimated.

6 Conclusions

The paper has analysed the impact of public support programs on the ability of households to smooth consumption when faced with negative shocks, taking into account the presence of informal insurance systems. We used panel data from Ethiopia, including detailed shock and consumption data, as well as information on food aid and food-for-work programs to test this. Particular attention was paid to the possibility program placement effects in evaluation these programs. The empirical analysis has shown that common shocks in these communities have large, uninsured effects. Downside risk results in a substantially higher effect than a positive shock. Food aid does not appear to have a large impact. In particular, we did not a significant reduction of vulnerability to bad rainfall shocks via a direct effect on the recipient of the food aid. This may well be related to poor targeting so that aid rarely is given at times when it is really needed. Descriptive statistics appear to confirm this. However, if there is a food aid or Food-for-Work program in the community the household is living in, then we find a lower sensitivity to downside risk (reducing the impact of downside risk by about a 12 percent). While this is not very high, it is significant. Finally, even though there are concerns about the targeting the appropriate individual households, it appears that programs were placed in more vulnerable areas. This could be detected from the way the time-varying heterogeneity seems to have affected the estimates.

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