TOWARD BETTER MEETING THE NEEDS OF THE FOOD INSECURE: THREE ESSAYS ON THE THEORY AND REALITY OF FOOD ASSISTANCE POLICIES IN THE SAHEL

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TOWARD BETTER MEETING THE NEEDS OF THE FOOD INSECURE:
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ABSTRACT

Food insecurity is a significant challenge in the world, and nowhere more than in sub-Saharan Africa. The policy options available to combat food insecurity have been expanding in recent years, providing increased flexibility over where—and what—food is procured, and what form of transfer recipients receive. In designing policies key questions arise related to the impacts of procuring food in developing countries, what recipients prefer to receive, and the relative impacts of cash versus food transfers.

This dissertation takes a microeconomic approach to filling some of the gaps in our knowledge of food assistance policy impacts. In the first paper we exploit a unique natural experiment to assess the performance of local procurement in Burkina Faso, and to test a number of hypotheses and claims. We find that procuring locally saves time and cost, does not affect local food prices, and has positive impacts on smallholder suppliers. Recipients also prefer local commodities.

In the second and third papers we develop a theoretical household model to investigate cash versus food transfers in Niger, taking advantage of a randomized trial and a large-scale household survey. The first paper examines the importance of the contents of the food basket. The model predicts that an extra-marginal transfer of a staple grain will have negative impacts on dietary diversity relative to a cash transfer, whereas an extra-marginal transfer of higher quality

food will have positive impacts. I confirm that these predictions hold in Niger.

The third paper examines the differential impacts of food versus cash transfers on informal credit and gift exchange. The model predicts that cash recipients will be more likely to use transfers to pay debts, and this impact will be more pronounced when food prices are rising, as the expectation of rising prices erodes the relative value of cash to food in terms of future consumption. Findings in Niger confirm these predictions, and highlight several implications of the relative scarcity of cash versus food.

These papers inform food assistance policy in the Sahel, and provide a novel lens through which to understand the mechanisms behind food assistance policy impacts.

BIOGRAPHICAL SKETCH

Joanna Upton never suspected that she would become an economist. After a childhood and high school in the beautiful Sierra Nevada Mountains, she studied linguistics, French, and music theory at Boston University, and spent her free credit hours taking courses on the classics and human infectious disease. Her aspirations on first heading to Niger as a student in 2001 were linguistic and cultural in nature; she became fluent in French and in Hausa, learned how to construct a talking drum from scratch, and returned to Niger after her college graduation to stay for a stretch in the remote North with a family of nomadic pastoralists, just because it seemed like the right thing to do at the time.

She started working for a small non-profit organization supporting schools and communities in the Sahara desert. She thought at first that she would continue to work in education, then realized that kids cannot go to school if they cannot stay healthy, which they cannot do if their families lack enough money for food to eat. Gradually her drive to better understand was coupled with a sense of obligation to do more about the poverty and hunger she encountered—or at least to better understand the mechanisms behind it, and policies that attempt to fight it.

A series of small miracles brought her first through a Master degree at the Fletcher School, where she focused on the institutional backdrop of development policy, and then to Cornell University and Chris Barrett's research group, where she became a development economist.

She is also an avid gardener, a casual pianist, an enthusiastic chef, and a dedicated stepmother to a wonderful teen-age boy and a ridiculously cute epileptic cat.

This dissertation, and moreover the progress against human suffering that through it and my future work I aspire to forge, is dedicated to the memory of my sisters:

Julia Kathleen Upton (March 12, 1977 – March 5, 1992)

and

Suudi Dadji (ca 1982 – March 5, 2010)

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Finally, I would be neither who nor where I am without the blessing of my immediate families, my partner and son Alan and Orson Leonard, my sister and brother-in-law Jen and Mike Woo, and my parents John and Roxie Upton. Last but not least I thank my loving grandmother, Lee Upton, for ceaselessly warming my heart and lighting my way.

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INTRODUCTION

Food security exists when "all people at all times have access to sufficient, safe, nutritious food to maintain a healthy and active life" (FAO 1996). Its four agreed-upon dimensions are the *availability* of food, having the resources and infrastructure to *access* that food, making appropriate *use* of accessible foods, and an environment of sufficient *stability* to ensure that these conditions are met over time (FAO 2009). In a world with food production sufficient to meet the needs of the global population, and after over 60 years of domestic and international food assistance efforts to redistribute food and resources over space and time, the goal of food security for all remains tragically, and shamefully, elusive.

Both globally and within most countries—including most of the least developed countries in sub-Saharan Africa—more than enough calories are produced to meet the energy needs of the population. And yet, roughly 12% of the world's population—closer to 25% in sub-Saharan Africa, and over 60% within some countries—is undernourished, suffering from insufficient energy intake and macro-deficiencies (FAO 2014). The devastation of a lack of food affects children disproportionately. An estimated 148 million children under the age of five globally suffered from stunting in 2012, and 99 million were underweight (WB 2013). While the incidence of these conditions has been declining, the absolute numbers of affected children have been increasing in some locations, nowhere more so than in sub-Saharan Africa; the number of stunted children increased by 30% from 1990 to 57 million in 2012, and the number of those underweight by 15% to over 27 million (ibid). Childhood under-nutrition is not only of acute concern, but can have lifelong and even inter-generational effects on health, cognition, and productivity (Chen and Zhou 2007; Maccini and Yang 2009; Victoria et al. 2008; Maluccio et al. 2009; Ramakrishnan et al. 1999).

It is needless to say, then, that meeting the world's food needs is still a pressing concern. This forces us to first better understand the problem, which is, as noted above and pointed out emphatically recently by Pinstrup-Andersen (2013), in only rare cases one of the availability of food. While climate change threatens to alter production capacities and change both the levels and distribution of food around the globe (Cane and Lee 2013), food production capacity is by most accounts globally sufficient (FAO 2014). Even at a regional, national, or local level, availability is rarely the source of the problem, as where production is low or variable markets are usually flexible and robust, and demand (where expressed in monetary terms) can be met by (perhaps imported) supply. It is a lack of access, due primarily to poverty but also to failure of infrastructure, that perpetuates food insecurity for the world's poorest (Pinstrup-Andersen 2013). In turn, there are concerns regarding the use of available food; poverty combined with the availability of cheap, low quality calories often leads to both macro- and micro-nutrient deficiencies even among those who might be able to, with different knowledge and priorities, consume sufficient nutrient-rich foods. Childhood micronutrient deficiencies abound even in middle-income countries, and rates of obesity among the malnourished are also on the rise (WHO 2014). Finally, sociopolitical instability, especially in the face of increasing stressors from climate change, poses a perpetual threat to the effective functioning of food systems (Barrett 2013). Threats to stability often parallel threats to food security, and the two can in turn exacerbate each other, such as when food shortages and/or food price hikes engender riots, which then threaten the capacity of both political systems and market infrastructure to deliver food. Sub-Saharan Africa is arguably the greatest hotbed for this confluence of stressors, with both stability and food security uniquely threatened by both climate change and population pressures (Barrett and Upton 2013).

Once we begin to get a grasp of the nature of the problem, the next major challenge in meeting the world's food needs is understanding the tools available to do so. Traditionally, food insecurity was treated as a problem of availability, and food aid involved transoceanic shipment of predominantly cheap calories from areas of surplus production to those in acute need. This system, while surely saving many lives over the course of the decades, was largely both ill-informed and politically motivated. At its conception in 1954, the United States food aid program, Food for Peace, was as much about disposing of surplus food production that resulted from farm-support subsidies and promoting those foods as exports as about helping the hungry (Barrett and Maxwell 2005).

It has been a long and slow process to shift the prevailing ideology, and budge the political machinery, toward a more flexible food assistance system. But in recent years, phenomenal progress has been made in this regard, and there has been what the World Food Programme (WFP) termed a "revolution" from "food aid to food assistance" in the emergence of new food assistance methods and the elaboration of a more adaptable toolkit (Omamo et al. 2010). One of the primary drivers of this progress has been the political process of untying food aid, or divorcing national commitments of food assistance dollars from the requirement that they be used to purchase foods within donor countries and ship them, in the case of the U.S. specifically on domestic flag carriers, to those in need. Some of this—particularly in the EU, which untied its aid in 1996, and Canada which untied its aid in 2008—has been in natural response to internal changes in subsidy structures that result in lower levels of available food surpluses and make tied aid less desirable from a domestic perspective.

The United States, historically the provider of roughly half of all food aid globally, has been the slowest to follow suit. In 2010-2011, the United States Department of Agriculture

piloted a release of some food assistance funds for local procurement of food in recipient countries. Success with those pilot projects has arguably helped to shift the political structure more in that direction. The Obama Administration has been working toward greater flexibility in food aid, and the 2014 Farm Bill allowed both the elimination of monetization (the sale of commodities overseas to fund other development activities) above the 15% floor still required by law, in addition to increasing the flexibility of U.S. Title II food assistance funding, which Obama intends to increase further (USAID 2013; USAID 2014). The requirement of the percentage of U.S. food that must be shipped on U.S. flag carriers dropped from 75% to 50% in 2012, but political pressures from U.S. interest groups are still strong, and a bill currently on the Senate floor would increase that figure back to 75%, a step backwards for efficiency in food assistance (Peterson 2014; Barrett and Lentz 2014). In any case, direct transfers from donor countries now account for just about half of all food aid, down from 90% twenty years ago and 70% just ten years ago (WFP 2014).

This brings us to the core question of what are the tools, or policy instruments, available in this expanding food assistance toolkit, and what do we know about them. Having options to choose from means understanding those options, and informing the decisions of policy actors in choosing between different tools and designing programs given the context and circumstances. There is much to discover as to how different tools perform, relative to the traditional system of food aid provision, and relative to each other, across the range of metrics we care about: timeliness of provision; costs, to both donors and recipients; impact on local suppliers, directly or through market prices; other impacts on communities, such as through effects on social safety nets and other local institutions; meeting recipients preferences; and lastly—but for many most

importantly, for the sake of the goals of food assistance—meeting recipients' nutritional needs, through improvements in both energy intake and dietary diversity.

Different food assistance tools vary in terms of the type and location of food procurement as well as what is eventually received by recipients, be it food (and what type or origin of food), vouchers, and/or cash. One very logical adaptation, where availability suffices, is to purchase food in the country where it is needed (local purchase) or in a nearby third country (regional or triangular purchase). Lentz and co-authors (2013) confirmed that local and regional purchase (LRP) saves significant time, and in most cases cost, relative to transoceanic delivery. Other important concerns relate to impacts on prices and markets, possible benefits for local smallholder suppliers, and meeting recipients' preferences. Providing vouchers to recipients can be thought of as a more extreme form of local procurement, in which recipients go to market vendors to purchase food, often (depending on the program design) with more flexibility of food selection.

We can in turn, however, give recipients the ultimate flexibility by providing assistance directly in cash in lieu of in kind. Cash assistance can likewise be cost-saving and faster to provide than in-kind aid (Lentz et al. 2013). It brings with it, however, a number of important questions, particularly along the use dimension of food security: what is the marginal propensity to consume (MPC) food from cash transfers versus from food or vouchers, and the resulting impacts on food consumption and dietary diversity? While interest in the MPC of in-kind versus other transfer types, or forms of income, has been present in research and policy communities for decades, the focus has for the most part been on high-income country contexts like the U.S. In developing countries, there was less demand for research into these kinds of questions, in no small part because the option to provide transfers other than in kind was largely unavailable.

These new policy options being on the table expands the immediate importance of understanding the performance and possible unintended spillover effects of different transfer types in different (particular poor, food insecure) contexts.

While theory predicts that the improved flexibility from cash transfers should lead to welfare gains relative to in-kind aid, evidence in that regard is mixed. The author's work on the case of cash versus food transfers in Niger showed that food was largely preferred by local recipients to cash, and led to greater dietary diversity impacts (Hoddinott et al. 2013). The mechanisms behind this, and other related findings, are not well understood. There are also unaddressed questions about the impacts of cash versus food, including how the form of transfer differently impacts social insurance mechanisms like informal credit and gift exchange.

In work with Chris Barrett's research team that resulted among other things in a book chapter with Erin Lentz (Upton and Lentz 2012), the author reviewed the evidence available on these food assistance tools and their performance toward a range of objectives. We highlight several key gaps in the findings available, with respect to the content of the questions addressed (per the proceeding paragraphs), the nature and diversity of contexts in which they are addressed, and the rigor of the methods used. The objective of this dissertation is to fill some of these key gaps, by bringing economic theory, quality data, and rigorous methods to several pressing questions about these emerging food assistance tools. All three papers take for a context Sahelian sub-Saharan Africa, one of the most vulnerable and food-insecure regions in the world and hence among the most important places to deepen our understanding of food assistance tools, their mechanisms, and their relative results.

The first paper of this dissertation exploits a unique natural experiment to assess the performance of local and regional procurement in Burkina Faso, with analysis of the impacts of

food procurement and of recipient preferences for local versus imported foods. We test a number of claims and hypotheses related to both procurement and distribution of local foods. We test first the very logical hypotheses that procuring locally would save time and cost relative to transoceanic shipments. We then test the very fundamental intuition from economic theory that the effective demand (supply) shock of a food procurement (distribution) within a developing country market puts upward (downward) pressure on local food prices. We test in turn the hypothesis that local suppliers benefit from purchases through decreased transactions cost as well as learning about quality standards. On the recipient side, we assess the often repeated (but previously untested) claim that recipients would be more satisfied with local commodities than with similar imported foreign commodities.

The specific case analyzed involves the local procurement from smallholder farmers for a school-feeding program in Burkina Faso. In a region with a history of receiving Title II U.S. food aid under the United States Agency for International Development (USAID), a number of schools had to be dropped from the program due to an administrative arrangement with the local government. The non-profit agency that had been implementing the USAID program stepped in to these schools with funding from the United States Department of Agriculture to implement a local procurement program, purchasing cowpeas from farmers in the same districts and millet from elsewhere within the country to replace the bulgur wheat and beans that had previously been provided. This led to a novel natural experiment, providing for direct comparison between schools receiving U.S. foods and those receiving local commodities, all within an over-lapping zone of the same two provinces and operated by the same non-governmental organization.

Cost and timeliness comparisons found that local food procurement cost slightly over half that of U.S. foods, and took slightly over half the time from the identification of suppliers to

delivery to schools. Impacts on prices were established through a seemingly-unrelated regressions econometric approach, using secondary price data and controlling for several key confounding variables. It was found that, while purchases had no significant impact on prices, millet distribution had an economically and statistically significant downward impact on millet prices in the distribution region.

Recipient and farmer impacts were assessed through a post-distribution survey, using the USAID imported food aid distribution zone as a counterfactual. We find robust results that the local commodities are preferred to U.S. commodities across a range of attributes, including taste, appearance, and storability. U.S. commodities, including pre-cooked bulgur wheat, have distinct advantages with respect to preparation time and effort. Benefits identified for smallholder cowpea suppliers included decreased travel distance and time, a higher price received (due to sales later in the season), and learning about cowpea quality standards and improved storage practices.

These results have significant implications for LRP programming. In this context, the cost and timeliness savings are considerable. Price impacts, however, raise a caution, in that even small quantities can lead to important—if in some cases beneficial—impacts on local prices. This underscores the importance of ex ante impact analysis to assess the most appropriate food assistance modality option. The results also confirm claims about local preferences, while it remains to be seen as to the degree to which local preferences impact consumption and nutrition outcomes. The smallholder impacts assessed in this setting are remarkable, and indicate that it can be not only feasible but beneficial to work with small-scale suppliers. Certain concerns need to be addressed in this area, however, in quality assurance and in making purchasing conditions accessible to smallholders. This study contributes to the evidence base

regarding both the risks and potential of LRP, which can not only improve the efficiency of food procurement for developing countries but contribute to other more development-oriented objectives.

The second and third papers turn to questions related to receipt of cash versus food transfers in Niger, taking advantage of a randomized controlled trial and a large-scale household survey. For these papers I develop a theoretical household decision model, and derive and test its predictions around a few core questions of interest theoretically and of importance for food assistance policy. The first of these papers examines predictions related to the infra- versus extra-marginality of different components of the food basket—as opposed to the food basket as whole—and how that relates to the impact of food versus cash on dietary diversity. The second tests the ways in which food versus cash transfers differently impact social insurance mechanisms, informal credit, and gift-giving.

Building on prior findings with John Hoddinott and Susanna Sandstrom (Hoddinott et al. 2013), the first of these two papers seeks to resolve the puzzle of the conditional superiority of in-kind transfers relative to cash transfers in meeting recipient preferences and greater impacts on dietary diversity. Simple economic theory, dating back to Southworth (1945), tells us that cash transfers should be fundamentally superior to food transfers (Barrett 2002). If a food transfer is extra-marginal, such that the food provided is more than the household would otherwise consume, households might be compelled to sell food. These transfers constrain the household's choices, and if resale is subject to transactions costs, then recipients would be made strictly better off if given a cash transfer. If transfers are infra-marginal, such that the food provided is less than households would otherwise consume, there should be no difference between the two transfer types as households are unconstrained by the food transfer and merely

substitute in-kind for purchased food. In neither case should households prefer, or achieve better outcomes from, an in-kind transfer. Puzzlingly, however, empirical investigations—including our own in Niger—often fail to support this theory, finding that some households prefer food and/or consume more food with food than with cash transfers.

Taking the Southworth model as a starting point, this paper develops a dynamic household utility model that brings in preferences over two food goods—a basic staple grain and a second composite good that represents dietary diversity—as well as transaction costs and a dynamic borrowing constraint. The model yields a few relatively straight-forward predictions regarding the impacts of food versus cash transfers on dietary diversity. These predictions beg us to reconsider the importance of the contents of the food basket provided, and the infra- or extra-marginality of each component as opposed to of "food" more generally. Namely, the model predicts that if a staple grain provided is extra-marginal, it should lead to *negative* impacts on dietary diversity relative to cash, as the transaction cost involved in selling the excess food lowers its shadow price and causes the household to substitute toward consumption of the staple and away from more diverse foods. If, however, a more expensive or high quality food is provided, the same substitution effect will lead to households substituting toward the higher quality food, making that extra-marginal transfer have a *positive* impact on dietary diversity relative to cash.

While the data show that the impact of the food relative to cash on dietary diversity is positive on the whole, when we divide out the two components we indeed find that the impact of providing the staple grain relative to cash is negative, whereas the impact of providing beans and oil (rarer foods for many households to consume) is positive. This reflects the fact that both components are largely extra-marginal for households, the grain because it is locally produced

and the legume because it is expensive and not typically purchased when less expensive (and lower quality) foods are more readily available. I then examine how impacts vary between groups based on the infra- or extra-marginality of each component. Since this information is not available for cash recipients, I construct a propensity score for the propensity of being extra-marginal in each commodity. I find some evidence that the benefits of providing food for dietary diversity decrease in the extra-marginality of the staple grain and increase in the extra-marginality of the higher quality food, and this effect is more pronounced in the harvest season, when the food transfers are extra-marginal for more of the population.

These findings reveal part of the mechanism behind the superiority of food transfers relative to cash for dietary diversity outcomes, and in particular the importance of both local consumption patterns and local market participation frictions. The first important insight is that the extra-marginality of different components of the food basket, not just the food basket as a whole, can affect its relative impacts on food consumption choices. In turn, the presence of a transaction cost creates a friction that leads to fundamental differences in the trade-offs recipients face and hence their use of cash versus food transfers. While food transfers in kind can lead to increased food consumption, whether this consumption increases or decreases dietary diversity depends on whether the household would otherwise consume the food provided. These findings should lead us to considering the contents of the food basket more carefully, in light of recipients' counterfactual consumption behavior, and the implications for potential dietary improvements from changes in that behavior.

The third paper delves deeper into the cash vs. food question with an examination of the relative impacts of cash versus food on inter-temporal consumption smoothing and informal safety nets. Informal social insurance mechanisms can be very important for the rural poor as

devices for smoothing consumption over time and protecting against shocks, especially in the absence of formal credit markets. These mechanisms can take diverse forms, including informal borrowing and lending with state-contingent compensation terms (Udry 1994), as well as inter-household gift-giving. These different mechanisms can be substitutable, with gift-giving for example engaged in to serve the same ends as credit and/or savings (Behrman et al. 1997).

Given the importance of social insurance mechanisms for household welfare and food security, especially in environments with livelihoods fraught with high levels of risk and uncertainty (Besley 1995), there is cause for concern as to how providing external transfers may impact informal consumption smoothing mechanisms. Some highlight the concern that external transfers might "crowd out" informal mechanisms (e.g., Albarran and Attanasio 2003), while others suggest that crowding out is not a significant concern, or even that injections of resources into rural economies could reinforce these mechanisms by providing the lubrication of added liquidity (Cox et al. 2004). One question that hasn't been rigorously examined is the degree to which the form of transfer provided, such as in cash or in-kind, has an impact on how informal insurance mechanisms are affected. In the case of food assistance, do cash versus food transfers perform differently with respect to crowding out, or reinforcing, social insurance mechanisms? In addition, do cash and food have differential impacts on households' choices to prioritize longer-term food security over short-term consumption and dietary diversity by paying debts and/or giving transfers, and in so doing sacrificing today's consumption to expand the future budget set?

The theoretical household model integrates a few key features in order to provide predictions on the differences between use of cash versus food transfers. First, as part of the standard inter-temporal asset constraint, we allow that the ceiling on future borrowing (and/or,

equivalently, likelihood of receiving transfers in the future) is an increasing function of current debt repayment (and/or, equivalently, transfers given to other households). The more a household pays back (or gives away) today, the more access it will have to borrowing (or likely it will be to receive gifts) later. Second, selling the food transfer is possible but subject to a transaction costs; in buying food households face a market retail price p, but if they want to sell it they face p-θ, or receive a lower price than the retail price (due to travel, timing, and/or the seasonal lack of buyers).

Consistent with the precautionary savings principle (Barrett 2002), the model shows that sacrificing today's consumption (even at very low levels) to give transfers and/or pay debts is a rational strategy for improving consumption prospects (through reciprocal transfers and/or a higher borrowing ceiling) in the future. The transaction cost involved in selling food and expectations over future prices are the main drivers of differences between cash and food transfers. Thus, when households expect food prices to rise, they are more likely to repay debts or make private transfers when they receive a cash transfer. The expected price rise risks eroding the purchasing value of the cash transfer and so it is relatively less costly (in terms of foregone future consumption) to repay debts or make private transfers if the public transfer is received in cash rather than in food. In turn, if debts must be paid back in cash, food recipients would have to sell food in order to repay debt. A household receiving a public food transfer faces the transaction cost θ_t, however, if it converts some of its transfer to cash. This raises the cost of making a cash transfer (or repaying a cash debt) compared to a household that received a public cash transfer, making these activities further less likely for food recipients than for cash recipients. These two predictions imply that the magnitudes of the difference in the impacts of

public cash and public food transfers will be smaller when food prices are static or falling because only the second prediction, but not the first, affects these impacts.

The empirical evidence shows that, consistent with the model, cash recipients are more likely to pay back debts, and pay larger amounts on average, than food recipients, particularly when food prices are rising during the lean season. Food recipients are more likely to give food gifts, on average of smaller values than cash repayments. This pattern is linked to food consumption, in that while cash recipients are more likely to repay debts they also experience lower impacts on dietary diversity than do food recipients (Hoddinott et al. 2013). The relative scarcity of food versus cash, and how it changes between periods, is further reflected by differences in borrowing behavior. Cash recipients are more likely than food recipients to take out loans in the leanest season to meet food needs as they arise. Food recipients then take out more cash loans during the harvest season, reflecting the shifting needs and priorities between seasons and the relative scarcity of cash when food prices are falling during the harvest.

These three papers employ economic theory and unique data from sub-Saharan Africa to contribute to our understanding of food assistance tools and their impacts. The Burkina Faso study answers several essential questions about LRP, in a particular context in which it can have clear advantages (particularly in cost and time savings) and where food assistance is frequently needed. We confirm the logical, and policy-important, suspicion that it can save cost and time to purchase food locally in lieu of shipping it across the Atlantic, and that, at least under certain conditions, purchases have no impact on local prices. We also confirm that recipients experience greater satisfaction with local foods, and that with some of the right efforts local smallholder suppliers can benefit from purchases.

The subsequent chapters on cash versus food transfers elucidate the relative impacts of cash versus food in a uniquely important context, within a poor, rural, and extremely food insecure population. These findings have important implications for food assistance policy, around both the choice of cash versus food and the contents of the food basket. The first of these papers finds that consumption pattern of each good in the food basket can have unique implications for the food consumption impact of providing that good; extra-marginally provided goods, in particular, can have positive impacts if they are goods that increase diversity in the consumption basket but negative impacts otherwise. This unique finding informs the much debated issue of food aid quality, regarding the potential trade-offs between providing less expensive and/or lower quality foods to a larger number of recipients and specifically targeting higher quality foods (including fortified high-nutrient products) to a smaller number of needier individuals (Yang et al. 2013). I find in Niger that providing inexpensive grain that is extra-marginal for recipients, either by virtue of being a less-preferred commodity or due to availability of home production, has negative impacts on dietary diversity relative to providing cash, making cash a strictly better option for nutritional goals than bulk grains. The opposite is however true in the case of providing a higher quality food, and hence food, if chosen carefully, could prove to be a better option for improving nutrition. A clear implication of this finding is that providing higher quality foods, even if it means being able to reach a smaller number of recipients, is a more effective policy in terms of improving food security and meeting nutritional needs than providing cheap staple grain. These findings cannot, however, address questions of distribution within the household, and it may not be safe to assume that households choose optimally with respect to the well being of all of their members.

Finally, the final paper develops our understanding of why the form of transfer can have implications for informal credit and gift exchange. Cash is more vulnerable to use for gift-giving and debt repayment when there are transaction costs involved in selling food, in particular in a dynamic environment when food prices are rising. This is part of a rational strategy to smooth consumption over time, but may have detrimental impacts on short term food consumption outcomes for cash recipients. The model's prediction is of theoretical interest for household models in development microeconomics, but also can help to inform transfer choices and better understand the likely use of different resources, and resulting performance toward short-term objectives.

The findings in Niger together raise important ethical questions about transfer choices. One such question speaks to the debate on paternalism in food assistance policy (See Cunha 2014). In Niger we see that providing a legume, which households would otherwise not consume, induced consumption of that food and increased dietary diversity relative to cash, in part because cash transfers were used to pay back debts. This raises the question of whether, if households make different choices when given a food transfer that provides less flexibility than cash, it is then appropriate for the aid donor to restrict recipient choices in order to potentially achieve a specific sought after outcome, which implicitly second-guesses the household's choices and behavior given the trade-offs it faces. The recent move toward cash transfers has been framed around a move away from a paternalistic approach, and better meeting recipients' preferences by providing them with more choice.

The case of Niger raises an additional debate related to recipient choice, however, in that assuming that more flexibility is necessarily better for recipients is also imposing certain assumptions about recipients' preferences and needs. Recipients may in fact have cause to prefer

to receive food in spite of the lack of flexibility—as was by and large the case in Niger. This food preference may be linked to the outcomes we observe, in that cash recipients faced different pressures and trade-offs, and food recipients ate more diverse diets. Better meeting recipients' needs and preferences should hence begin with the choice of transfer type, and not be assumed to be better achieved with cash transfers (Gentilini 2014). More research should also be done to assess the links between transfer preferences and outcomes, in particular the degree to which recipients' stated preferences provide information about likely outcomes they will experience from different transfer types.

These important policy implications highlight the need to test the predictions of this model in other contexts, in order to draw more externally valid conclusions and inform food assistance policy globally. While caution should be exercised in applying these findings in contexts too different from that of the Sahel, the contribution of this dissertation spans beyond the contexts at hand by producing economic intuition that can frame these questions in future investigations, particularly with respect to the impact of cash versus food transfers. This research can thus help us to better understand and choose transfer options based on the populations' preferences and context, and in light of the objective of combatting food insecurity among vulnerable populations.

REFERENCES

Albarran, Pedro and Orazio P. Attanasio (2003). Limited commitment and crowding out of private transfers: Evidence from a randomized experiment. *Economic Journal, 113:* C77-C85

Barrett, Christopher B. and Erin C. Lentz (2014). Highway robbery on the high seas. *The Hill*, May 29 12:00pm, on line at http://thehill.com/blogs/pundits-blog/transportation/207565-highway-robbery-on-the-high-seas (accessed May 30, 2014).

Barrett, Christopher B., Ed. (2013). Food Security and Sociopolitical Stability. Oxford: Oxford University Press, September 2013.

Barrett, Christopher B. and Joanna B. Upton (2013). Food Security and Sociopolitical Stability in Sub-Saharan Africa. Chapter in Barrett, Christopher B., Ed. (2013). Food Security and Sociopolitical Stability. Oxford: Oxford University Press, September 2013.

Barrett, Christopher B. and Daniel G. Maxwell (2005). Food Aid After Fifty Years: Re-casting its role. Abingdon Oxon, New York: Routledge, 2005.

Barrett, Christopher B. (2002). Food security and food assistance programs. *Handbook of Agricultural Economics, 2*(B), Chapter 40: pp. 2103-2190.

Behrman, Jere R., Andrew Foster and Mark R. Rosenzweig (1997). Dynamic savings decisions in agricultural environments with incomplete markets. *Journal of Business & Economic Statistics, 15*(2): 282-292.

Besley, Timothy (1995). Nonmarket institutions for credit and risk sharing in low-income countries. *Journal of Economic Perspectives, 9*(3): 115-127

Cane, Mark A. and Dong Eun Lee (2013). What do we know about the climate of the next decade? Chapter in Barrett, Christopher B., Ed. (2013). Food Security and Sociopolitical Stability. Oxford: Oxford University Press, September 2013.

Chen, Y. and L.A. Zhou (2007). The long-term health and economic consequences of the 1959-1961 famine in China. *Journal of Health Economics, 26*: 659-681.

Cox, Donald, Bruce E. Handsen and Emmanuel Jiminez (2004). How responsive are private transfers to income? Evidence from a laissez-faire economy. *Journal of Public Economics, 88*: 2193-2219.

Cunha, Jesse M. (2014). Testing paternalism: cash versus in-kind transfers. *American Economic Journal: Applied Economics 6*(2): 195-230.

Food and Agriculture Organization (2014). The Multiple Dimensions of Food Security: Food Security Indicators. Available on line at: http://www.fao.org/publications/sofi/en/ (accessed May 17, 2014).

Food and Agriculture Organization (2009). *Declaration of the World Summit on Food Security, WSFS 2009*. Rome: Food and Agriculture Organization of the United Nations.

Food and Agriculture Organization (1996). World Food Summit 1996, Declaration on World Food Security, Rome.

Gentilini, Ugo (2014). Our daily bread: What is the evidence on comparing cash versus food transfers? World Bank Social Protection and Labor Discussion Paper No. 1420.

Hoddinott, John, Susanna Sandstrom and Joanna Upton (2013). The impact of cash and food transfers: Evidence from a randomized intervention in Niger. Under revision for *American Journal of Agricultural Economics.*

Lentz, Erin C., Simone Passarelli and Christopher B. Barrett (2013). The timeliness and cost effectiveness of the local and regional procurement of food aid. *World Development 49*: 9-18.

Maccini, Sharon and Dean Yang (2009). Under the weather: health, schooling, and economic consequences of early-life rainfall. *American Economic Review, 99*(3): 1006-1026.

Maluccio, John A., John Hoddinott, Jere R. Behrman, R. Martorell, Agnes R. Quisumbing, and Aryeh Stein (2009). The impact of improving nutrition during early childhood on education among Guatemalan adults. *The Economic Journal, 119*: 734-763.

Omamo, Steven Were, Ugo Gentilini and Susanna Sandstrom, Eds. (2010). Revolution: From Food Aid to Food Assistance. Innovations in overcoming hunger. World Food Programme, 2010.

Peterson, Kristina (2014, Apr 24). White House warns bill would crimp foreign food aid. *Wall Street Journal*.

Pinstrup-Andersen, Per (2013). Food Policy for Food Security. Presentation at the *Food Security in a Vulnerable World* symposium, Cornell University, September 12, 2013.

Ramakrishnan, U., R. Martorell, D.G. Schroeder, and R. Flores (1999).
Role of intergenerational effects on linear growth. *Journal of Nutrition, 129*(suppl): 544S–9S.

Udry, Christopher (1994). Risk and insurance in a rural credit market: An empirical investigation in Northern Nigeria. *Review of Economic Studies, 61*: 495-526.

United States Agency for International Development (2014). Food Aid Reform. On line at: http://www.usaid.gov/foodaidreform (accessed May 18, 2014).

United States Agency for International Development (2013). The Future of Food Assistance: U.S. Food Aid Reform. Fact Sheet. Available on line at:
http://www.usaid.gov/sites/default/files/documents/1869/USAIDFoodAidReform_FactSheet.pdf
(accessed May 18, 2014).

Upton, Joanna B. and Erin C. Lentz (2012). Expanding the food assistance toolbox. Chapter in Barrett, Christopher B., Andrea Binder and Julia Steets (Eds). Uniting on Food Assistance: The case for transatlantic cooperation. Abingdon Oxon, New York: Routledge, 2012.

Victoria, C.G., L. Adair, C. Fall, P.C. Hallal, R. Martorell, L. Richter, and H.S. Sachdev (2008). Maternal and child undernutrition: consequences for adult health and human capital. *Lancet, 371*: 340-357.

World Bank Group (2014). Data: Joint Childhood Malnutrition Estimates. Available on line at: http://data.worldbank.org/child-malnutrition/compare-regional-burdens (accessed May 16, 2014).

World Health Organization (2014). Nutrition Challenges. Online at: http://www.who.int/nutrition/challenges/en/ (accessed May 20, 2014).

Yang, Yan, Jan Van den Broeck, and Lawrence M. Wein (2013). Ready-to-use food-allocation policy to reduce the effects of child undernutrition in developing countries. *Proceedings of the National Academy of Sciences, 110*(12): 4545-4550.

LOCAL FOOD FOR LOCAL SCHOOLS:

AN ANALYSIS OF THE IMPACT OF LOCAL PROCUREMENT FOR A SCHOOL FEEDING PROGRAM IN BURKINA FASO

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ABSTRACT

This paper presents findings from a local food aid procurement initiative in support of a school feeding program in Burkina Faso. Exploiting a natural experiment in which some schools received foods imported from the United States while others received foods procured locally, we confirm that local procurement resulted in significant savings in delivery time and commodity costs, met food quality standards, and did not impact market prices. Further, local suppliers—members of small farmers' associations—experienced positive learning impacts and profitability gains, while recipients were generally more satisfied with locally-sourced commodities.

Keywords: food assistance; local and regional procurement; school feeding; small farmers; Africa; Burkina Faso

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1. INTRODUCTION

International food assistance needs have traditionally been treated as a problem of availability, and therefore approached through transoceanic delivery of foods produced in donor countries. However, it has been increasingly recognized that food insecurity is often a problem of access or utilization, not availability. In such cases, a better approach might be to purchase foods locally and/or provide those in need with the means to do so (Barrett and Maxwell, 2005).

Further expansion of funding for flexible food assistance choices, such as local and regional procurement of foods (LRP), may hinge in part on evidence that purchasing locally (within the destination country) or regionally (in a third country) can minimize costs and improve timeliness, and that the quality of foods purchased in developing countries can be assured (USGAO 2009; USDA 2009). It is also essential to understand the impacts of local food purchases and distributions on local market prices, and whether local purchases can benefit local producers or recipients relative to traditional food aid shipped from the donor country. These questions are important for two reasons. First, agencies must avoid causing inadvertent harm by a switch to LRP. Second, LRP may have desirable impacts beyond the cost efficiency and improved timeliness objectives commonly cited by its proponents.

This paper assesses the tradeoffs and synergies associated with locally purchasing foods for a school feeding program in the land-locked Sahelian republic of Burkina Faso. We exploit a rare natural experiment to directly compare the outcomes of recipients and producers living in LRP communities with food aid recipients and producers in matched nearby communities that received transoceanic food aid handled by the same agency. This opportunity allows us to directly compare LRP versus food aid shipped from the donor country along multiple dimensions: cost, timeliness, food quality and safety, recipient satisfaction, and benefits for

smallholder producers, enabling a rigorous, holistic view of prospective differences. We find important synergies, such as purchasing locally reduces costs while also supporting local producers. There may also be tradeoffs, however, such as if local purchases provide food quickly but at higher costs for some (typically processed) commodities.

2. BACKGROUND

(a) Food Assistance and LRP

LRP is not a new practice. While the bulk of food assistance was traditionally provided in-kind, LRP has increased as a proportion of global food aid from about 17% in 2000 to 67% in 2010 (WFP 2011). This change has been driven by policy reforms in Europe, Canada and, most recently, the United States (US), where the practice remains politically controversial. The bulk of LRP purchasing has been undertaken by the United Nations' World Food Programme (WFP). Because the US only began large-scale LRP in 2008, US-based nongovernmental organizations (NGOs) are relative novices at the practice.

Two commonly cited advantages of LRP are its potential for cost savings and faster delivery relative to transoceanic food aid shipments (Upton and Lentz 2011). Numerous studies comparing purchases in sub-Saharan Africa to transoceanic deliveries finds cost savings of between 13 and 50% (OECD 2005; Lentz and Barrett 2007; Tschirley and del Castillo 2007; USGAO, 2009). A comparative study in sub-Saharan Africa found that transoceanic food took on average 21 weeks, whereas locally or regionally procured foods took five or six weeks respectively; other studies have found similarly dramatic savings in time (USGAO 2009). These advantages helped secure US Congressional approval for a LRP pilot program, run by the US Department of Agriculture (USDA) under the 2008 Farm Bill, and LRP funding through

supplemental international disaster assistance funding to the US Agency for International Development (USAID).

Other claims and concerns about LRP abound but lack rigorous or widespread evidence. First, there has been much concern expressed regarding the potential of LRP to harm consumers in the source region by driving up local food prices, but there has been no price analysis of which we are aware to investigate those concerns.[1] A second concern is whether foods procured in low-income countries can meet the quality and safety standards humanitarian agencies employ with traditional, transoceanic food aid; but we know of no careful studies of those concerns (Villa and Mathys 2011). Third, claims have been made that purchases may benefit local producers by various avenues, including reducing transaction costs, enhancing access to markets, or inducing learning and improved farming practices (WFP 2006; Tschirley and del Castillo 2007). Finally, some observers hypothesize that locally purchased foods may be more culturally appropriate or otherwise preferred by recipients to similar commodities sourced in distant donor countries (USGAO 2009). Such claims have been exceedingly difficult to test, however, in the absence of clean comparative analysis of LRP relative to transoceanic food aid delivery, a comparison we are uncommonly able to make in this paper.

(b) Burkina Faso

The Burkina Faso project presents an important opportunity for analysis of LRP for four key reasons. First, Burkina Faso is both a primarily agricultural country with significant grain and legume production and it is land-locked, potentially making transoceanic shipment of food time-consuming and expensive relative to LRP. Second, it is an extremely poor country in a region that is frequently in need of food assistance. Third, the non-emergency nature of the

[1] Garg et al. (2013) begins to fill this gap.

program further enabled a focus on the impacts of the purchases themselves on other stakeholders.

Finally, and most importantly for the purpose of our research design, the delivery of locally-sourced foods in Burkina Faso coincided with simultaneous delivery of US-sourced foods under a USAID Multi-Year Assistance Program (MYAP) implemented by the same agency for the same purpose in a zone contiguous to the LRP zone. This provided not only an ideal basis of comparison for measuring the performance of LRP with respect to cost and timeliness, but also a unique natural experiment that allowed us to identify impacts of LRP on recipients and communities across multiple dimensions. We are thus able to evaluate a number of claims made for or against LRP and to explore some of the potential synergies or tradeoffs among the various objectives advanced as people argue for or against undertaking LRP in low-income countries.

(c) The Local Education Assistance and Procurement Project

Under USDA pilot funding, Catholic Relief Services (CRS) in Burkina Faso developed the Local Education Assistance and Procurement project (LEAP) to integrate local procurement into a long-standing school feeding program. LEAP provided food to 364 schools in 8 departments in the Gnagna and Namentenga provinces. 58,127 students received 20 daily rations per month over the period April to June 2011. Each ration contained 180 grams of millet, 45 grams of cowpeas (a small white bean nutritionally comparable to lentils), and 25 grams of Vitamin-A fortified vegetable oil.

(i) The Distribution Region and Schools

The Gnagna and Namentenga provinces suffer from generalized poverty and food insecurity. A random survey of 310 farmers in LEAP and MYAP departments indicates that

almost all farmers in the region are net buyers of food and rely on small cash crop harvests of cowpeas and peanuts to meet all non-food needs and supplement food needs in the dry season. Due to a shortage in storage technology and the urgency of meeting other needs, most farmers sell right after the harvest when prices are low, even when they may have to buy the same foods later at higher prices.[2] Many aggregators only travel to local markets at the peak time, so farmers who fail to sell early risk having to travel further and pay prohibitive transport costs, eroding the potential benefit of waiting for a higher price.

The school feeding program is of great importance for the recipient schools and children. Many families cannot afford to prepare lunch at home, so children often go without a mid-day meal in the absence of a school feeding program. It is also common for families in rural areas to live far from schools; a very large number live between four and six kilometers from the nearest school, making it challenging for children to go home for a mid-day meal even if one could be provided.

According to our survey of 120 randomly selected LEAP schools, communities and schools bear several costs in running a feeding program. These include daily food preparation, cooking fuel, and additional cooking supplies such as salt, potassium, and water. [3] These costs, while small in absolute terms, are significant for the school communities. School cooks are universally mothers of students at the school. While more than half work as volunteers, in some schools each cook is paid on average $4 per month, in cash or food. Salt and potassium together

[2] This phenomenon is common, and linked to the lack of credit availability. Poor rural farmers effectively take out high interest loans by selling their product early, paying de facto "interest" in the form of the foregone higher price and the additional cost of buying the same food later (Barrett 2007; Stephens and Barrett 2011).
[3] Wood for cooking fuel is almost always gathered in the forest and brought in by the students.

cost schools on average 800F ($1.80) per week.[4] These costs are often paid with contributions to local parent teacher associations (PTAs), but in some cases the cooks have to bring the potassium themselves on the days they prepare the meal. Some schools finance these supplies by selling the packaging materials in which they received foods.

(ii) The Procurement Modalities

The three goods delivered to schools were provided through three different purchasing methodologies. A summary of the quantities purchased of each commodity, by region and supplier, is provided in Appendix Table 1.A1. Vitamin-A fortified vegetable oil was purchased from a processing company through a competitive tender for over 72 metric tons (MT) posted in the capital city newspaper. The resulting contract with the winning bidder specified the quality criteria that had to be demonstrated by independent certification, as well as delivery quantities, locations, timing, and that payment would occur upon receipt of the delivery notes from each recipient school.

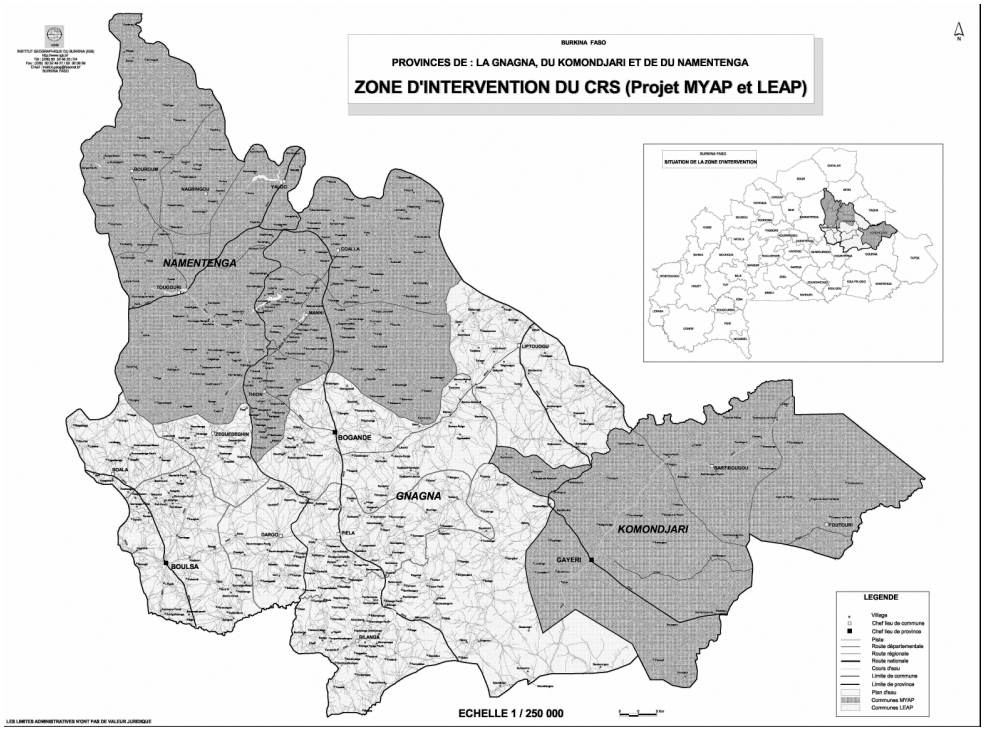
To purchase 628.1 metric tons (MT) of millet, LEAP staff identified four viable producers' cooperatives (or unions) within the Boucle de Mouhoun region, the surplus millet production region nearest to the distribution zone (at a distance of roughly 500 kilometers). Each cooperative had between 600 and 5000 individual members divided into between 22 and 87 small associations. Not only do the cooperatives transmit trainings and information to a large number of smaller organizations and farmers, they also serve a role similar to that of large wholesalers, aggregating grains from small farmers in order to supply large clients. The experience selling to a purchaser like CRS was not new for these groups, as they had prior

[4] Averaged across all schools, the per child cost of potassium and salt is approximately 90 F CFA (roughly $0.20) for the 60-day ration period.

experience selling to the Government or the WFP. Each cooperative supplied between 54.1 and 319 metric tons of millet.

The 143.5 MT of cowpeas were purchased very locally, using vouchers distributed to PTAs. There were no large cooperatives in the distribution zone, and 22 small farmers' associations of between 10 and 58 individual members each were identified. All of those identified were interested in participating. The cowpea quantity purchased was very small relative to national production, between 1.3 and 21.4 MT per farmer association. A random survey of 160 LEAP farmers revealed that the quantities were significant for the farmers directly involved. The average association member sold 0.4 MT total in the 2010-2011 season; 90% reported having sold less than one ton, and over half sold less than a third of a ton. The LEAP purchases represented over half of the total surplus quantities produced by all members combined.

Figure 1.1: The LEAP and MYAP Intervention Regions



3. METHODOLOGY AND RESULTS

To assess the performance and impacts of local procurement through LEAP relative to delivery of the transoceanic food aid, we utilize the natural experiment created by the simultaneous implementation of the LEAP and MYAP programs in contiguous areas by the same agency (CRS) for the same purpose. The LEAP and MYAP zones bisected the same two provinces, and hence were remarkably similar (Figure 1). The same main roads cross the zones, providing access at similar distances to the capital city, and the markets are similar in diversity, frequency, and price patterns.[5] Schools in both programs had been receiving commodities sourced in the United States under the MYAP in prior years; but reduced resources, especially due to higher global food prices, had forced CRS to drop some schools from that program. It was able to replace them with USDA LRP resources procured locally. The two programs were in turn divided along relatively arbitrary administrative lines, meaning that the program implemented would not be systematically correlated with the outcomes of interest. That the same agency implemented both, and with the same deadline for delivery to schools, makes the counterfactual ideal for timeliness and cost comparisons—which we supplement with more general comparisons of LEAP to a range of transoceanic food deliveries over the same period. CRS also managed quality testing through the National Laboratory for both programs, so that we can compare test results alongside recipient experiences. The cultural and ecological similarity provides in turn a natural control for most of the scope of unobservable variation between the communities, and hence a compelling case for assessment of the impressions and preferences of recipients and impacts on local cowpea suppliers. Combined with a range of controls for recipient and producer characteristics, this Burkina Faso case study offers an unprecedented

[5] An extensive review of regional markets was undertaken by the authors at the start of the study, and prices of the key commodities were monitored on a weekly basis.

natural experiment for exploring the relative performance of local procurement as compared to transoceanic food aid delivery.

We first consider timeliness and cost relative to transoceanic food aid shipments, then results with respect to quality standards. We will then address price impacts, benefits for producers, and lastly recipient preferences.

(a) Timeliness

While especially important in emergency food assistance programs, timeliness remains important in any food program; the ability, for example, to be sure to meet a pre-determined delivery deadline for schools is essential. The average length of delays in different parts of the process differs between LRP and transoceanic food aid, as does the ability to manage and compensate for unexpected delays and complications.

First, we compute the number of elapsed weeks between initiating procurement to delivery to schools under the MYAP and LEAP projects, averaged across all three commodities. Following the comparative study design by Lentz et al. (2013), we define the key comparable events of importance across the LEAP and MYAP programs as follows. The award date is the date on which the funds are awarded by the donor. Initiation of procurement is the date of the call forward for the MYAP, and the date of identification of domestic suppliers for LEAP. The time at which the foods are made available for quality testing is the date of arrival in the warehouse for the MYAP, and the date of assembly in suppliers' warehouse for LEAP. Finally, we consider the date of actual delivery to schools. These dates are presented in Table 1.1. From identification of suppliers to delivery took on average 15.3 weeks for LEAP, versus 47 weeks for the MYAP; local procurement took only one-third of the time to deliver.

Table 1.1: Comparative Timing, LEAP and MYAP

KEY DATES	LEAP		MYAP	
	Date	Weeks (from Procurement Startdate)	Date	Weeks (from Procurement Startdate)
Call Forward / Identification of suppliers	Dec 15, 2010 - Jan 28, 2011	0	Jun 8, 2010	0
MYAP: Shipment from U.S.			Dec 16, 2010	27
MYAP: Arrival in Lomé			Jan 16, 2011	32
Availability for Quality Testing	Feb 15, 2011	9	Jan 27-Apr 18, 2011	33 to 45
LEAP: Contract for oil	Mar 23, 2011	14		
LEAP: Contracts for millet	Feb 17-Mar 7, 2011	9 to 12		
Delivery to Schools	Mar 25-Apr 7, 2011	14 to 16	Apr 14-Jun 3, 2011	45 to 51

One concern with local purchase relates to possible length of time required and difficulty in identifying appropriate suppliers, particularly for procurement from smaller producers or farmer based organizations less familiar with tendering processes. As this was a first local purchase experience for CRS in Burkina Faso, the project staff had to undertake this process from scratch. To procure millet and cowpeas, they first obtained information about grain associations and cooperatives in the appropriate regions by attending cereal auctions and contacting regional representatives of the Ministry of Agriculture. They then contacted associations to assess their capacity and willingness to participate, and had to build their trust, which involved visits by grain cooperative representatives to the agency's office in Ouagadougou and/or follow-up visits with association members by staff while they were undertaking other activities in the procurement regions. The process in its entirety began in early November, at most six weeks prior to the identification of suppliers. If we include this in the above comparison, the LEAP purchases took approximately 22 weeks, still less than half the time for transoceanic delivery.[6]

[6] The pertinent Award Dates were September 30 for LEAP and June 13 for MYAP (in the latter case a week *after* the Call Forward, as given prior experience the office was permitted to initiate the call forward prior to signing of

Several factors created additional delays for both programs, in particular for the MYAP. First, the time from call forward to port delivery for the MYAP was 32 weeks, whereas the median delivery times for U.S. emergency shipments more generally have been found to be closer to 20 weeks (USGAO 2009; Barrett and Maxwell 2005). The MYAP commodities faced significant delays between arrival at the port in Lomé and arrival in Ouagadougou, due in part to civil unrest in Côte d'Ivoire following contested presidential elections that diverted port traffic from Abidjan (Côte d'Ivoire) to Tema (Ghana) and Lomé (Togo). Hence the port was over-burdened, and the availability of transit vehicles from Lomé to Ouagadougou was limited. Subsequent student uprisings due to police violence in Burkina Faso may have contributed to the excessive delay in the government's final delivery to schools. These delays were clearly beyond the control of both agency staff and food suppliers.

LEAP likewise experienced unanticipated delays, due to these same political complications as well as the newness of the purchase experience, such as in drafting contracts and arranging quality testing. Nonetheless, since the suppliers themselves were responsible for delivery and did not receive payment until after product was received at the schools, they had a strong incentive to meet contractual deadlines and managed to deliver the food on time.

These direct comparisons of the timeliness differences between two programs run by the same agency are supported by a broader comparison of the timeliness of LEAP to the average delivery time to Ouagadougou across 71 different transoceanic food aid shipments over the same period, covering a range of commodities and programs run by a variety of agencies (Lentz et al. 2013). The transoceanic deliveries took on average 19.7 weeks longer (15.3 weeks on average for LEAP, and 35 weeks on average for transoceanic deliveries). This difference is statistically

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the actual contract). If we measure from these dates the time to delivery to schools is approximately 26.5 weeks for LEAP and 46 weeks for MYAP.

significant at the 1% level. These results, presented in Table 1.2, corroborate prior studies' findings of considerable timeliness gains from LRP.

Table 1.2: Comparative Timing, Several Commodities and Programs[a]

	LRP	**Food Shipped from US**	**Difference**
Commodity 1	Millet (1)	SF Bulgur Wheat (12)	
Weeks to delivery	15.29	35.6	20.31***
Commodity 2	Cowpeas (1)	Lentils (8)	
Weeks to delivery	15.57	33.96	16.39***
Commodity 3	Vegetable Oil (1)	Vegetable Oil (2)	
Weeks to delivery	9.86	36.19	26.33***
Commodity 4		Rice (32)	
Weeks to delivery		36.53	
Commodity 5		CSB (9)	
Weeks to delivery		32.87	
Commodity 6		Cornmeal (1)	
Weeks to delivery		22.43	
Cross commodity average	15.29	34.96	19.67***

Source: Lentz et al. (2012)

[a] Numbers in parentheses are numbers of observations of U.S. commodity deliveries. These include "truncated" deliveries over the period, or those not yet arrived at the time of submission of this draft. The end delivery times reported are hence slightly conservative estimates of actual delivery times.

*** Statistical significance at the 1% level

(b) Cost

A concern in any food assistance program is cost, especially as food prices rise and donor funding for food assistance is on the decline. The agency chose rations to be identical in weight and similar in calories, fat, and protein between the two programs.[7] We compare the cost relative to commodity weight, ration size in grams, gram of protein, kilocalorie, and child served with 60 daily rations.

The cost basis is slightly different for LRP versus transoceanic food deliveries. For the MYAP program, the agency paid commodity cost, ocean freight, internal transportation,

[7] A list of micronutrient content of LEAP and MYAP commodities is available upon request.

shipping and handling (ITSH) to Ouagadougou, and quality testing. LEAP expenses included commodity costs, quality testing, additional administrative cost related to the voucher system, and delivery from source regions to schools. Other administrative costs and overheads are excluded, since the same agency undertook the two projects and these costs were similar. As with any new program, there were some startup costs associated with the agency learning how to undertake LRP, especially procuring from local producers and small suppliers. For example, identifying local millet and cowpea suppliers created additional costs in terms of staff time (e.g., a LEAP staff member attending cereal auctions). Nonetheless, due to the high skill level of local staff, and connections and reputation of the implementing agency in the intervention communities, learning how to implement LRP appears to have been low cost and the number of staff members was similar between the two programs; CRS staff confirmed that the administrative costs of the two programs were quite comparable.

The per ton costs for the millet and bulgur delivered were $438.60 and $895.20, respectively, for cowpeas and lentils $585.02 and $1,095.09 respectively, and for vegetable oil $2,112.04 for LEAP and $1,857.64 for the MYAP.[8] These costs are broken down in detail in Table 1.3. The US vegetable oil was purchased at a much lower price, due in part to a change in the world price of vegetable oil during the period and in part due to the ongoing crisis in Côte d'Ivoire that led to importation constraints. The higher price that LEAP paid for vegetable oil was largely compensated for, however, by the cost of ocean freight for the MYAP commodities. Lentz et al. (2013) compare LEAP costs against those from several food aid shipments to Burkina Faso from the US during the same period find very similar results; the cost savings due

[8] The agency in this case did not pay for delivery of MYAP commodities from Ouagadougou to schools; the Government of Burkina Faso bore that expense. As such, a conservative estimate is included for comparison, based on the delivery cost of vegetable oil (per ton from Ouagadougou).

to local purchase are 59% for the grain and 47% for the legumes, while the vegetable oil purchased locally costs 14% more.

The LEAP ration contained more fat and protein than the MYAP ration. Hence, the combined daily MYAP ration cost $0.04 per kilocalorie, $1.60 per gram of protein, and $0.62 per gram of fat, whereas the combined daily LEAP ration cost $0.02, $0.95, and $0.36, respectively. One can likewise look at the cost per student for the three month ration (an estimated 20 per month, or 60 daily rations). On average, LEAP cost $9.48 per child and MYAP cost $15.41 per child for the three-month period. As LEAP cost 38% less, this case certainly confirms prior findings of significant cost savings from LRP.

Table 1.3: Comparative Costs ($/MT), LEAP and MYAP

	LEAP	MYAP
Commodity Cost (& Vouchers)		
Millet / bulgur wheat	339.27	386.73
Cowpeas / lentils	546.45	585.85
Vegetable oil[a]	2065.00	1322.12
Ocean Freight and Transport to Ouagadougou		
Bulgur wheat	N/A	442.87
Lentils	N/A	442.87
Vegetable oil	N/A	477.41
Transport to Schools[b]		
Millet / bulgur wheat	80.78	50.00
Cowpeas / lentils	20.02	50.00
Vegetable oil	47.04	50.00
Quality Testing		
Millet / bulgur wheat	18.55	15.60
Cowpeas / lentils	18.55	16.37
Vegetable oil[a]	N/A	8.10
Totals		
Millet / bulgur wheat	438.60	895.20
Cowpeas / lentils	585.02	1095.09
Vegetable oil	2112.04	1857.64
Cost per Child (for three months)[c]		
Combined Ration	9.48	15.41

[a] For LEAP, the vegetable oil cost per ton includes quality certification.

[b] For MYAP, CRS did not pay transport to schools from Ouagadougou; this cost is a conservative estimate based on the oil cost / ton from Ouagadougou (the MYAP schools are on average further from Ouagadougou than the LEAP schools).

[c] This cost is based on the ration of 180 grams of grains, 45 grams of legumes, and 25 grams of vegetable oil per day per child, for 20 rations per month or 60 total rations.

(c) Quality

The LEAP project was subject simultaneously to the quality standards specified by its contract with the USDA, those suggested by CRS headquarters, and those of the government of Burkina Faso. The Government of Burkina Faso standards for cowpeas were more stringent than the USDA standards, but it had not yet developed standards for millet. The various criteria, and averaged national laboratory results, are summarized in Table 1.4.

Table 1.4: Quality Testing, Standards and Results

Quality Criteria	Millet		Cowpeas		
	USDA Contract	LRP Result[a]	USDA Contract	GoB	LRP Result[a]
Moisture Content (maximum percent)	≤ 11%	5.8%	≤ 13%	≤ 12%	8.7%
Damaged Grains (maximum percent)	---	---	---	≤ 1%	17.7%
Broken Grains (maximum percent)	≤ 1%	0	≤ 1%	---	0.0%
Foreign Matter, organic (maximum percent)	≤ 1%	0	≤ 2%	≤ .75%	0.4%
Foreign Matter, inert (maximum percent)	---	---	≤ 1%	≤ .25%	0.2%
Live Insects (number, per 100g)	0%	0.25	0%	0%	0.095
Aflatoxins (parts per billion)	---	0	---	≤ 10ppb	0.0396

[a] Results are averages across all commodity samples, with a minimum of one sample per supplier.

A few of the LEAP samples were found non-compliant with the government standards. In the case of millet, the single violation was a sample containing a live insect. The farmers' cooperative responsible for the violation was instructed to treat and clean the stock prior to delivery. Non-compliance in the cowpea procurements was related mainly to the presence of dirt and broken beans, criteria not required by the USDA and/or not involving health risks. The laboratory recommended that the product was safe and could be sorted by recipients.

None of the U.S.-sourced commodities delivered to Ougadougou failed to meet product quality and safety standards. However, 3% of the bulgur wheat and 5% of the lentils intended for Burkina Faso did not arrive or were rejected on arrival at the port. In this case, therefore, we find no support for concerns that LRP runs greater risks of losses due to quality or safety problems. Not only were LRP losses less than those from in-kind food aid shipments, but procuring locally

had the advantage that non-compliant commodities could be returned to suppliers for replacement or treatment. U.S. commodities rotten or damaged during shipment are never replaced, but can only be rejected. When rejected, there is a risk that they will be diverted and consumed, creating unintended health hazards.

To assess recipients' experience with food quality, we asked a random sample of 240 recipient schools, on a Likert scale of 1 to 5 (1 for "almost all rejected" and 5 for "almost all consumed"), what portion of the foods received could be prepared and eaten, relative to what portion discarded due to damage, pests, and foreign matter. While commodities distributed under both programs were by and large consumed, recipients report discarding a greater portion of the LEAP commodities due to dirt or other foreign matter.[9] Recipients reported that the LEAP commodities, in particular millet, required more cleaning. These findings are consistent, given that the rejection of transoceanic lots took place before delivery to recipients, whereas some cleaning of harmless organic matter was left to recipients in the case of LRP. Although perceptions of food quality may overstate the safety of transoceanic bulgur wheat relative to locally procured millet—and these perceptions cannot replace testing—products that require cleaning may increase the costs borne by recipients, and this problem may be more likely with locally-sourced foods relative to transoceanic shipments, as in this case.

(d) Market Price Impacts

A core question surrounding LRP concerns how prices respond in both level and volatility to the procurement and distribution of food assistance. Purchasing foods by definition increases the demand in the source market used, which can increase consumer prices. Likewise,

[9] The Likert scale averages for the LEAP commodities were 4.66 and 4.76 for millet and cowpeas, respectively, and for the MYAP commodities were 4.82 and 4.97 for bulgur wheat and lentils, respectively. Fewer than 5% of respondents answered below a 4 (for "consumed/prepared most"), and none answered below 3. The Ranksum test revealed differences in favor of each of the MYAP commodities that were significant at the 1% level.

food distribution can augment supply and thereby decrease prices. If prices change, there are both winners and losers. For example, poor local consumers may be harmed by a price increase, but poor producers may be harmed by a price decrease. There may of course be no price impact if, for example, markets are sufficiently integrated with other market sources so as to respond with flows in volume as opposed to changes in price, or if the purchases or distributions are too small to affect even poorly integrated local markets.

Confounding factors that can simultaneously influence prices pose a key complication in estimating the price impacts of food assistance procurements or distributions. In some cases, food assistance is provided in response to events that themselves affect local market prices, such as increases in world food prices or local transport costs, a local climate shock, or seasonality, in which case it is very easy to misinterpret a positive association of food purchases with higher food prices as reflecting a causal impact of food procurement. While including controls for many observable confounding variables can help reduce the likelihood of biased estimates of the statistical relationship between food procurement or distribution and market prices, we know of no reliable statistical means of establishing the causal impact of food assistance on market prices.

With that crucial caveat in mind, Garg et al. (2013) econometrically estimate the market price and price volatility impacts of LRP activities in seven different countries. That analysis, which we almost exactly replicate here, includes millet and cowpea prices in Burkina Faso under LEAP.[10] The analysis employed monthly time series data from January 2000 to July 2011 in seven markets: Bogandé in the distribution region, Dédougou in the millet source region, and

[10] Vegetable oil price effects could not be econometrically estimated due to a lack of a high-quality vegetable oil price series that preceded procurement activity.

five central markets.[11] Controlling for the consumer price index (CPI), transport CPI, temperature and precipitation data, local seasonality in harvests, and global market prices for cowpeas and millet, we estimate the association of LRP procurements and food distributions in Burkina Faso with price levels and price volatility – measured as the standard deviation of prices – across space, time, and commodities. We use the following specification: [12]

$$\mathbf{P}_{it}^{cs} = \alpha + \beta' \mathbf{P}_{it-k}^{cs} + \lambda' \mathbf{LRP}_{it-d}^{cs} + \delta' \mathbf{X}_{it} + \phi_i^{cs} + \epsilon_{it}^{cs} \tag{1}$$

where ***P*** is the natural logarithm of the price, and the superscripts *c* and *s* represent the commodity (millet or cowpeas) and marketing channel (wholesale or retail), respectively. ***LRP*** is the volume purchased, ***X*** is a vector of control variables as described above; the subscript *i* represents the specific market, *t* the time-period, and *d* the number of LRP lags. Finally, we include market fixed effects, ϕ_i^{cs}, so as to control for unobserved time invariant spatial heterogeneity. The error term, ϵ, is stationary, mean zero and i.i.d. normal.

Given the risk of bias associated with the inclusion of the one-month lag of price in addition to market-specific fixed effects, in the spirit of the Arellano-Bond approach we instrument for the lag of price using the second lag of price (Arellano and Bond 1988). The results obtained are qualitatively identical to the non-instrumented variant reported by Garg et al. (2013), which provides further detail on the data and estimation methods.

As apparent in Table 1.5, the cowpea and millet procurement had no statistically significant correlation with cowpea or millet retail prices in any market in Burkina Faso.

[11] The central markets included Sankariaré in the capital city of Ouagadougou, as well as Bobo Diolasso, Pouytenga, Léo, and Yalgo.

[12] With just one procurement per LEAP commodity, Garg et al. (2013) and this slightly refined version could not estimate the effect of LEAP procurement alone, so they combine LEAP and WFP purchasing activities to estimate the impact of LRP purchases, regardless of the implementing agency.

Likewise, there was no statistically significant association between procurements and market price volatility. However, millet distribution – as distinct from procurement – had an economically and statistically significant negative association with retail market prices with a one month lag. Millet distributions also had a positive and statistically significant association with retail price volatility in Burkina Faso. Thus the price impacts analysis, which must be interpreted with care given the impossibility of cleanly establishing causality in the observational data, fails to reject the null hypothesis that local procurement in Burkina Faso had no impact on market prices, although there is some suggestion that food distribution had some effect in millet markets only. Of course, market price impacts of food distribution would be felt no matter whether commodity is sourced locally or in the donor country and thus does not reflect adversely on LRP per se.

(e) Producers

(i) Overview and Methodology

Some advocates of LRP argue that purchasing food from local suppliers can strengthen markets and smallholder livelihoods and profits (Tschirley and del Castillo 2007). By comparing the experiences and outcomes of farmers in the Gnagna and Namentenga provinces whose associations sold cowpeas to CRS against those cowpea farmers in neighboring communities (including MYAP communities) whose associations were not eligible to sell cowpeas to CRS, we can identify the impact of CRS' procurement activities on smallholder producers who are members of the farmer associations with whom CRS contracted.[13]

[13] A similar approach was not feasible for millet suppliers because the supplying cooperatives encompass the entire production region, and there were no closely neighboring but non-participating cooperatives from which to derive a control group.

The identification strategy for impacts on cowpea suppliers relied primarily on the natural experiment provided by the adjoining LEAP and MYAP intervention zones. In the LEAP zone

Table 1.5: Price Impacts of Procurement and Distribution

	Millet[a]		Cowpeas[a,b]	
	Contemporaneous	Previous Month	Contemporaneous	Previous Month
In Procurement Markets				
Price Level	2.265	1.564	---	---
	(2.224)	(1.576)		
Price Volatility	-1.825	-1.241	---	---
	(3.957)	(5.319)		
In Non-Procurement Markets				
Price Level	0.0388	0.0278	---	---
	(1.559)	(1.117)		
Price Volatility	-3.051*	-0.965	---	---
	(1.680)	(1.098)		
Across All Markets				
Price Level	0.807	0.576	---	---
	(1.291)	(0.928)		
Price Volatility	-2.326*	-0.697	---	---
	(1.342)	(0.781)		
In Distribution Markets				
Price Level	-4.928	-17.62	---	---
	(10.90)	(14.39)		
Price Volatility	4.832	6.277	---	---
	(16.68)	(15.45)		
In Non-Distribution Markets				
Price Level	-3.163	-13.48**	1.870	-0.207
	(4.730)	(6.707)	(8.562)	(10.78)
Price Volatility	8.753**	9.830**	-11.17	-14.21
	(4.127)	(3.977)	(18.44)	(42.04)
Across All Markets				
Price Level	-3.717	-14.42**	-0.0658	-0.774
	(4.358)	(6.074)	(10.21)	(12.03)
Price Volatility	8.662**	9.729***	11.61	-10.64
	(3.796)	(3.475)	(24.03)	(44.51)

[a] Standard errors in parentheses
[b] Due to the small number of procurements, and the fact that procurement and distribution were in the same location, it was not possible to estimate the full range of impacts of cowpea distribution.
*, **, and *** represent statistical significance at the 1%, 5%, and 10% levels, respectively

food was distributed and purchased locally. In the MYAP zone, food was distributed but none purchased. Thus, while market, agricultural, and livelihood conditions were similar, cowpea farmers in LEAP zones had access to an additional seller, namely the procuring agency (CRS), that MYAP farmers did not, for reasons not correlated with their attributes and due to a largely arbitrary assignment of particular communities to LEAP or MYAP program support. In order to exploit this natural experiment, we identified all farmers' associations registered in the LEAP and MYAP zones. We stratified by department—with four departments in the MYAP zone and eight in the LEAP zone—allowing for department-level fixed or random effects, which permit us to control for unmeasured or unobservable factors that differ throughout the provinces. We then drew 20 farmers randomly from the lists of all association members in each of the LEAP departments for a sample of 160 prospective LEAP suppliers, and randomly selected 150 farmers from those associations in the MYAP departments for the control group. As sampling weights varied by department, all the statistical results reported below are adjusted accordingly.[14]

The post-distribution survey administered to both groups includes personal and production characteristics, and examined two key categories of outcomes: farmer knowledge and behavior, and farmer profitability, assessed by transaction costs and revenues. Questions about prices, revenues, and transaction costs were asked for the project year (the 2010-2011 agricultural season) and the prior year (the 2009-2010 season), and we hence examined the degree to which the project year improved relative to the prior year. While using recall data might introduce some measurement error, there is no reason to suspect that the error would be systematically correlated with the treatment variable. It may decrease the efficiency of estimates, but is unlikely to create bias.

[14] The total members of farmers' associations identified and sampled, and resulting sampling weights, are available upon request.

Table 1.6: Mean Characteristics by Intervention Zone

	MYAP	LEAP	LEAP - MYAP
Demographics (percentages, unless otherwise noted)			
Age (years)	39.82	39.99	0.17
Female	63%	34%	-29%***
Level of Education (years of formal schooling)	1.27	1.41	0.14
Formal Education	15%	16%	1%
Literate	64%	64%	0%
Muslim	23%	40%	17%***
Animist	10%	15%	5%
Protestant	16%	16%	0%
Catholic	44%	28%	-16%***
Gourmantche	47%	50%	3%
Mossi	42%	48%	6%
Peulh	3%	0%	-3%**
Household Size (number of total members)	10.34	11.86	1.52**
Active Members (ratio)	0.58	0.67	0.09***
Production Characteristics			
Land Cultivated (ha)	3.02	3.48	0.46*
Land allocated to Cowpeas (%)	59%	54%	-5%
Cowpea Production (kgs)	368.53	489.31	120.78
Land Owned (% of Land Cultivated)	70%	97%	%27***
Prior Clients			
Sold through Association, 2009-2010	0%	7%	-7%***
Trainings			
In Animal Husbandry	0%	4%	4%**
In Management Practices	47%	58%	11%*
In Storage Practices	27%	52%	25%***
In Marketing	3%	6%	3%
Types of Trainings (Numbers of categories)	1.33	1.99	0.66***
Trained by CRS Partners	20%	35%	15%***
Trained by Ext Agent	35%	13%	-22%***
Trained by Farmers' Assn	1%	13%	12%***
Accessed Credit	12%	6%	-6%*
Observations	150	160	

*, **, and *** represent statistical significance at the 1%, 5%, and 10% levels, respectively.

We examine the difference between the randomly sampled members of farmers' associations that sold to LEAP and those in the MYAP zone, in factors that could not have been affected by the intervention (Table 1.6). There are several significant differences between the two groups. For example, those in the MYAP zones are more likely to be female; this is due largely to the fact that the local government of the Thion department in the MYAP region only recognizes women's farmers' associations, so an inordinate number of women were surveyed in that locale. This explains the difference in percentage of land owned (70% in the MYAP region versus 97% in the LEAP region), in that women are not typically culturally permitted to own land. The other differences of interest are in the types of trainings received, which are likely due to the fact that agencies offer trainings at the department level. Including these variables and using department-level fixed effects controls for these differences.

(ii) The Model and Estimation Strategy

We examine the effect of membership in an association that sold to LEAP, which can be thought of as an intent-to-treat (ITT) effect. We also consider just those who sold to the association that sold to LEAP this year, generating an average-treatment-effect-on-the-treated (ATET) that can, however, be subject to producer-level selection effects for which we cannot adequately control. Outcomes of interest are examined according to the following econometric model:

$$y^* = \alpha + \beta_0 LEAP + \boldsymbol{X}'\boldsymbol{\beta_1} + \boldsymbol{D}'\boldsymbol{\beta_2} + \varepsilon \tag{2}$$

where y^* is the outcome of interest, $\boldsymbol{\beta_0}$ is the coefficient of interest either on the association membership (ITT) or direct participation (ATET) indicator variable for LEAP suppliers, $\boldsymbol{X}$ is a vector of individual controls, $\boldsymbol{D}$ is a vector of department/enumerator fixed or random effects,

and ε is a mean zero, normal and independent and identically distributed error term. Characteristics that vary within and among groups and that may affect outcomes are included as controls in $\boldsymbol{X}$. A description of the outcome and control variables used, and mean differences across a range of characteristics, are presented in Appendix Tables 1.A2, 1.A3, and 1.A4, respectively. All continuous outcomes were estimated using both random effects (REs) and fixed effects (FEs). As RE estimators are more efficient, we report the RE estimates, unless the Hausman test rejected the consistency of the RE estimator, in which case the FE results are reported and duly noted (full econometric results for both the RE and FE estimators are included in Appendix Tables 1.A5 through 1.A10). Ordinal outcomes are examined similarly using a fixed effects ordered logit model, and binary outcomes likewise with a random effects logit model.

Both economic theory and significant differences in observables (as per Table 1.6) guide us in choosing the regression specification, in particular the control variables that capture factors that may be correlated with both membership in LEAP associations and the outcomes of interest (See Appendix Table 1.A3 for descriptions of the control variables used). As a check on the robustness of the reported estimates, in the spirit of extreme bounds analysis (Leamer and Leonard 1983; Leamer 1985) we assess the relationships of interest using various combinations of control variables, examining the degree to which the coefficient estimate of interest remains similar in magnitude and statistical significance subject to different choices of conditioning variables. The coefficients reported are those of the regressions that are theoretically preferred, i.e., that contain the controls that differ systematically between groups (e.g., gender) and/or that are assessed to be more likely to be related to the outcome of interest (e.g., previous trainings received in the relationship between LEAP association membership and quality knowledge). We discuss results that proved particularly sensitive in magnitude and/or statistical significance to

different specifications of controls in order to distinguish statistically fragile from robust findings.

(iii) Results: Farmer Knowledge and Behavior

Although unconditional comparisons between LEAP and MYAP zone farmers reveal no statistically significant differences in practices, the multivariate econometric evidence does reveal important, statistically significant differences (see Appendix Table 1.A2 for descriptions of the outcome variables used). The direction and significance of these results are summarized in Table 1.7 (see Appendix Tables 1.A9 and 1.A10 for the full econometric results). LEAP purchases led direct participants to engage in improved storage practices. While the ATET is positive, the ITT in this case is negative, suggesting that non-participating members of the LEAP associations were less likely to employ improved storage practices due to the purchase. We hypothesize that, given the demand shock induced by the LEAP purchases, there was a high early demand among aggregators who visit the region for the remaining stock. Hence, those not participating in the LEAP sales directly had clients present to purchase their cowpeas even sooner than usual, meaning that storage time was minimal. This reduced storage time would lessen the need for storage facilities or techniques.

Table 1.7: Impacts on Farmer Behavior

	Member of LEAP Association (ITT)[a]	Direct Participant (ATET)[a]
Quality Knowledge	+++	+
Storage	---	+++
Small Investments	+++	
Traction Investments		++

[a] The "+" or "-" symbols indicate a positive or negative coefficient; the number of signs indicates the significance, +/-, ++/--, +++/--- for 10%, 5%, and 1%, respectively.

Members of LEAP farmers' associations also demonstrate better knowledge of quality criteria for cowpeas. A variable was constructed indicating the number of USDA-relevant quality criteria recognized by farmers, including lack of insects, minimum amount of foreign matter, and low moisture content. Once again, while there was no statistically significant difference between the two regions in an unconditional bivariate test, the multivariate regression results, including controls for prior clients and trainings received, indicate that those in LEAP associations had greater knowledge of these standards than did farmers in the MYAP region. These estimates were positive and significant for both the ITT and the ATET, implying that all members, including non-participants, learned about quality standards.

The surveys were undertaken after the sales were realized, and as the following planting season was beginning. Hence, while it was too early to assess any improvements in productive efficiency and on-farm outcomes, we were able to assess changes in purchases of productive assets. Participating association members increased their purchases in the project year of small productive assets (such as hoes and shovels), and direct participants increased their purchases of larger traction assets (such as traction animals and vehicles). This suggests that the purchases may have led to improvements in on-farm management practices and productive efficiency, but a follow-up survey would be required in order to assess these outcomes rigorously.

(iv) Results: Farmer Profitability

Possible indicators of profitability include increases in the price and revenue received by farmers and reductions in transaction costs, or the time and distance travelled in order to sell a given quantity. Profitability and transaction cost impacts are summarized in Table 1.8 (see Appendix Table 1.A2 for descriptions of the outcome variables used, and Tables 1.A6 through 1.A10 for the full econometric results).

Table 1.8: Summary of Farmer Profitability Impacts

	Member of LEAP Association (TTT)	Direct Participant (ATET)
	Random Effects, OLS or Ordered Logit[a]	
Price Received		
Price received for cowpeas in project year (CFA)	-41**	+18.9
	(+49%)	(+53%)
Reported difference from the prior year[b]	HIGHER	HIGHER**
Profitability		
Reported difference from the prior year[b]	HIGHER	HIGHER
Revenue		
Revenue from cowpeas in project year (CFA)	+16,668*	+31,091**
	(+25%)	(+47%)
Change project year relative to the prior year (CFA)	+1,076**	+8,541
	(+2%)	(+13%)
Travel and Time, project year relative to prior year		
Individual transactions to sell cowpeas (#)	-4	-1
	(-60%)	(-15%)
Number of trips taken to sell cowpeas	-0.4	-0.4
	(-24%)	(-24%)
Reported difference from the prior year[b]	FEWER***	MORE
Total distance travelled to sell cowpeas (km)	-11*	-14**
	(-33%)	(-42%)
Time travelling to sell cowpeas (min)	-32**	-29**
	(-32%)	(-29%)

Notes: Results from the Random Effects estimators are reported in the cases in which they were found to be unbiased, relative to the Fixed Effects models. If found biased, the Fixed Effects estimates are reported. These latter include: the ATET of *Price received for cowpeas in project year,* and both estimates for *Individual transactions to sell cowpeas.*

[a] Standard errors in parentheses

[b] These outcomes were ordinal based on Likert-scale questions, and estimated using the ordered logit

*, **, and *** represent statistical significance at the 1%, 5%, and 10% levels, respectively.

We find that the mean price received by direct participants was on average 19 CFA/kg higher (about 10% relative to the average price received that year), but approximately 41 CFA lower (approximately 19%) for LEAP association members more broadly. These outcomes are validated by farmers' subjective assessments; direct participants report receiving a higher price during the project year relative to the prior year, while for association members more broadly this assessment is not statistically significant. While the LEAP project purchased cowpeas at

market price and had no discernible effect on market prices, as discussed already, we hypothesize that those who sold to LEAP received a higher price due to the fact that they waited to sell their product until later in the season, and hence benefited more directly from predictably inter-seasonal price changes than did those in the MYAP zone who sold to traders immediately post-harvest. Non-participants in the LEAP zone in turn received a lower price (reflected in the ITT effect) because, given the demand shock induced by the purchases, they had greater opportunity to sell to aggregators early in the season when prices are lowest (consistent with the storage outcome discussed above). This inference was supported by our discussions with individual farmers who supplied LEAP, who commonly said that in the absence of the LEAP purchases they would have sold earlier. This is due to both impatience to meet immediate needs and the fact that aggregators visit local markets immediately after harvest and opportunities to sell are greatly diminished later in the season. While eager on the one hand to earn the higher, later season price, farmers had to trust the agency staff a great deal in forgoing earlier opportunities to sell their product.

The purchases also led to increased revenues for participants, of on average 31,091 CFA (roughly $65), or 47% relative to average revenue in the prior season. The point estimate for the average increase in revenue for all association members is 16,668 CFA, or a 25% increase relative to the prior year, but this was not significant under the preferred specification. Point estimates of the change in profitability for the project year relative to the prior year were also positive, but statistical significance was sensitive to specification. The price and revenue results are presented in Table 1.9 (see Appendix Tables 1.A6 and 1.A7 for the full econometric results).

Table 1.9: Farmer Price and Revenue Results

	Fixed / Random Effects[a]				Ordered Logit[a,b]	
	Price Received, 2010-2011[c]		Total Revenue, 2010-2011[d]		Sales Price	
	(RE)	(FE)	(RE)	(RE)		
Member of LEAP Association	-40.961***		16.668		0.825	
	(7.914)		(12.958)		(0.819)	
Member, & sold to CRS		18.916*		31.091**		1.335**
		(9.821)		(12.309)		(0.456)
Age	-0.047	-0.032	0.200	0.135	-0.015	-0.014
	(0.302)	(0.231)	(0.490)	(0.488)	(0.013)	(0.013)
Female	-1.698	3.728	-19.060	-19.654*	-0.193	-0.255
	(7.226)	(7.881)	(11.797)	(11.623)	(0.301)	(0.272)
Level of Education	3.864	2.204	1.778	2.923	-0.13	-0.08
	(2.786)	(3.100)	(4.604)	(4.609)	(0.215)	(0.178)
Land Cultivated (ha)	-0.786	-2.236	-7.005	-3.662	-0.196**	-0.276***
	(1.679)	(1.597)	(17.369)	(17.288)	(0.062)	(0.066)
Allocated to Cowpeas (%)	0.201	0.175	-0.647	-7.509	0.012	0.014*
	(0.134)	(0.167)	(13.783)	(13.783)	(0.013)	(0.008)
Land Owned (%)	0.106	0.067	2.182	7.024	-0.010*	-0.011***
	(0.107)	(0.129)	(15.616)	(15.757)	(0.006)	(0.002)
Sold through Association, 2009-2010	-0.384	---	62.906**	---	-0.304	-0.257
	(16.729)		(26.151)		(0.447)	(0.461)
Prim Retail Clients, 2009-2010	7.354	3.736	-1.664	-7.501	---	---
	(6.725)	(6.112)	(11.044)	(11.154)		
Trained by CRS & Partners	-10.129	-11.338	-29.281**	-22.513*	---	---
	(7.679)	(11.609)	(12.718)	(12.472)		
Trained by State Agents	18.354**	0.035	9.566	7.373	---	---
	(8.612)	(11.027)	(14.392)	(13.918)		
Trained by Farmers' Assn	22.395*	17.493	14.21	9.605	0.449	0.172
	(12.980)	(11.490)	(21.900)	(22.319)	(0.453)	(0.514)
Observations	257	257	277	277	221	221

Notes: Additional controls (not shown) include: Ethnicity (Gourmantche and Peulh (Mossi excluded)), Religion (Animist, Muslim, and Protestant (Catholic excluded)), and Household Size

[a] Standard errors in parentheses

[b] The Logit are results of the qualitative assessment, asked on a Likert scale (relative to the prior season).

[c] Prices in CFA Francs ($1 = 443.4 FCFA, July 1, 2011), per kg of dry cowpeas.

[d] Revenues in thousands of CFA Francs ($1 = 443.4 FCFA, July 1, 2011).

*, **, and *** represent statistical significance at the 1%, 5%, and 10% levels, respectively.

Finally, while LEAP participants may have borne some cost for storing goods for longer, they benefited farmers by having to travel less to sell their product. Direct participants in LEAP travelled on average 42% less, or 14 fewer kilometers, to sell cowpeas; this confirms qualitative evidence, as many participants reported traveling to far away markets in the previous year but sold to the school within their community in the project year. They also spent less time travelling to sell than did non-participants, by a statistically significant average of 29 minutes (29%). While these differences are averages, for some individuals the difference was even more dramatic. A member of the association Tidogo Hambri ("Develop Our Village") in Liptougou reported that in the prior year he took his relatively large surplus of 15 100 kg bags 150 kilometers away to Pouytenga, which took him a total of 9 hours. In the project year he travelled only 500 meters from his farm to sell the same quantity at about the same price to the local school through his farmer association.

The reduced travel distance and time held for the ITT effect as well, and in similar magnitudes (on average 11 fewer kilometers, and 32 fewer minutes). This confirms our previous hypothesis, in that given the demand shock non-participating local suppliers would have more easily met local demand without having to travel as far as they would in the absence of agency purchases. Several farmers also discussed having to make fewer trips to market or undertaking fewer transactions. Our point estimates for the number of transactions and trips (in the project year relative to the prior year) are consistently negative, but their statistical significance is sensitive to specification. However, the self-reported measure confirms that the number of trips for LEAP association members decreased. The results for transactions are presented in Table 1.10.

Table 1.10: Transaction Cost Results

	Random Effects[a]				Ordered Logit[a,b]	
	Distance Travelled (km), Project-Prior Year		Travel Time (min), Project-Prior Year		Number of Trips	
Member of LEAP Association	-11.159*		-31.739**		-1.179***	
	(6.657)		(11.690)		(0.339)	
Member, & sold to CRS		-13.844**		-28.765**		0.135
		(6.373)		(11.259)		(0.474)
Age	-0.056	-0.038	0.217	0.29	0.005	0.005
	(0.254)	(0.252)	(0.446)	(0.444)	(0.021)	(0.020)
Female	4.839	7.338	1.284	7.89	-1.017	-1.031
	(6.043)	(5.923)	(10.610)	(10.464)	(0.700)	(0.772)
Level of Education	-0.058	-0.125	-0.883	-0.859	0.243**	0.242**
	(2.313)	(2.305)	(4.062)	(4.071)	(0.099)	(0.101)
Land Cultivated (ha)	-6.161***	-5.531***	-12.960***	-11.670***	-0.674**	-0.674**
	(1.432)	(1.438)	(2.514)	(2.541)	(0.342)	(0.326)
Allocated to Cowpeas (%)	-0.134	-0.147	-0.177	-0.174	-0.3	-0.33
	(0.112)	(0.110)	(0.197)	(0.194)	(0.546)	(0.557)
Land Owned (%)	-0.084	-0.066	-0.193	-0.182	0.221	0.239
	(0.085)	(0.083)	(0.149)	(0.147)	(1.006)	(1.048)
Sold through Association, 2009-2010	14.727	---	37.391	---	-0.188	-0.194
	(13.875)		(24.364)		(0.119)	(0.133)
Prim Retail Clients, 2009-2010	1.024	1.965	-4.168	-4.247	0.006	0.007
	(5.741)	(5.772)	(10.080)	(10.197)	(0.014)	(0.014)
Trained by CRS & Partners	-0.743	0.38	-5.565	-3.485	-0.011***	-0.011***
	(6.483)	(6.300)	(11.384)	(11.130)	(0.003)	(0.003)
Trained by State Agents	-7.445	-6.883	5.005	8.573	-0.789***	-0.844***
	(7.141)	(6.909)	(12.539)	(12.206)	(0.118)	(0.168)
Trained by Farmers' Assn	-1.292	3.376	-45.949**	-39.951*	-0.661*	-0.684*
	(11.553)	(11.666)	(20.286)	(20.609)	(0.347)	(0.351)
Observations	300	300	300	300	234	234

Notes: Additional controls (not shown) include: Ethnicity (Gourmantche and Peulh (Mossi excluded)), Religion (Animist, Muslim, and Protestant (Catholic excluded)), and Household Size

[a] Standard errors in parentheses

[b] The Logit are results of the qualitative assessment, asked on a Likert scale (relative to the prior season).

*, **, and *** represent statistical significance at the 1%, 5%, and 10% levels, respectively.

(f) Recipients

(i) Overview and Methodology

An advantage of LRP may be that recipients can receive foods with which they are more familiar, that are hence more culturally appropriate and/or preferred (Tschirley and del Castillo 2007). Foods that are preferred may in turn be more likely to be consumed, which could improve consumption outcomes (Violette et al. 2013). These claims have however scarcely been measured beyond anecdotal evidence (Upton and Lentz 2011). Food preferences have never to date been assessed in the context of a school feeding program. In this case, we have cause to be interested both in the preferences of children—which may make them more likely to clean their plates—and the experience of preparers, who are commonly (as in this case) poor women volunteers.

We sampled schools by stratifying by department, then randomly selecting 15 schools from each of the eight LEAP departments and a sufficient number from each of the four matched MYAP departments to obtain 120 schools each for the LEAP treatment and MYAP control groups. As with the producer surveys, all statistical results that follow are adjusted for sampling weights.[15] Two surveys were administered to each school, the first to the school director and the second with an experienced (or the head, if one existed) school cook. The director survey covered school characteristics, such as the quality of infrastructure, distance to markets, enrollment, attendance, and composition of students. The cooks' survey addressed the quality of foods received, as well as preferences for foods across a range of consumption (e.g., appearance, texture, taste, nutrition) and preparation (e.g., cooking time, water and fuel use) attributes. School cooks were asked to rank their and the students' preferences for each commodity and

[15] The departments, total numbers of schools, numbers of schools drawn, and resulting sampling weights can be provided upon request.

attribute on a Likert scale of 1 (low) to 5 (high).[16] They were then asked to compare the commodities with respect to preparation characteristics, likewise on a scale of 1 to 5. Preferences regarding preparation requirements were registered relative to commodities received in the prior year to generate difference-in-differences estimates comparing LEAP schools – whose rations changed from the MYAP mix of imported bulgur wheat and lentils to locally-sourced or millet and lentils – against MYAP schools whose rations did not change. As there were very few responses of either 1 (very unsatisfied / liked much less) or 2 (unsatisfied / liked less), these two categories were combined for the analysis into an "unsatisfied" category.

(ii) Model and Estimation Strategy

The elicited rankings only order stated preferences, so first we test for unconditional differences between the LEAP and MYAP recipients' satisfaction with their rations using a Mann-Whitney median test of whether two independent samples come from the same distribution. We then integrate controls using a multivariate ordered logit model since there may be systematic, rather than merely random, differences between the LEAP and MYAP schools. Controlling for confounding factors in this natural experimental setting allows us to establish a causal relationship between receiving locally sourced foods and cooks' stated preferences for the specific commodities received.

We estimate the following ordered logit model:

$$y^* = \alpha + \beta * LEAP + \boldsymbol{X}_1'\gamma_1 + \boldsymbol{X}_2'\boldsymbol{\gamma}_2 + \varepsilon + \delta$$

$$\begin{aligned} y = 1 \; if \;\; & y^* \leq \mu_1 \\ 2 \; if \; & \mu_1 < y^* \leq \mu_2 \\ 3 \; if \; & \mu_2 < y^* \leq \mu_3 \end{aligned}$$

[16] While it would have been interesting to speak with students themselves, this was not possible due to their young ages. Experienced cooks, however, seemed to have little difficulty discussing their charges' preferences, based on the children's eagerness, remarks, complains, and likelihood of finishing their meals.

$$4 \; if \; \mu_3 < y^* \leq \mu_4 \tag{3}$$

where $\boldsymbol{y^*}$ represents the recipient's latent cardinal valuation of the food assistance ration, which is grouped into one of the four ordinal response options, $\boldsymbol{y}$, according to where $\boldsymbol{y^*}$ falls relative to unobserved cut-off points $\boldsymbol{\mu_1}$- $\boldsymbol{\mu_4}$. The parameter α is a constant, *LEAP* is an indicator variable taking value one for a LEAP school and zero in a MYAP school, $\boldsymbol{X_1}$ is a vector of respondent-specific controls, and $\boldsymbol{X_2}$ is a vector of school-level controls. $\boldsymbol{\beta}$ is the coefficient of interest, reflecting how receiving local-sourcing of commodities affects recipient satisfaction, relative to food aid commodities shipped from the United States, controlling for other factors that might influence preferences and that might vary systematically between LEAP and MYAP schools. The coefficient vectors $\boldsymbol{\gamma_1}$ and $\boldsymbol{\gamma_2}$ reflect the effects of the control vectors $\boldsymbol{X_1}$ and $\boldsymbol{X_2}$, respectively. A description of the variables and mean differences across characteristics are presented in Appendix Tables 1.A11 and 1.A12. The error term can be decomposed into two components: $\boldsymbol{\varepsilon}$ and $\boldsymbol{\delta}$, which include respondent- and school-specific unobservable characteristics, respectively. Department-level random effects control for a number of factors that may affect the distribution of outcomes.

(iii) Results: Consumption Attributes

A summary of results for student's satisfaction with consumption attributes is presented in the upper panel of Table 1.11 (see Appendix Tables 1.A13-1.A14 for the full econometric results). The column headed 'Bivariate' in Table 1.11 shows the Mann-Whitney test results as to in which region (LEAP or MYAP) recipients were more unconditionally satisfied with the commodity they received. The overwhelming majority of schools in both the LEAP and MYAP regions were satisfied or very satisfied with the rations received; with respect to general

satisfaction only 3.4% (8.7%) of LEAP recipients and 1.7% (5.6%) of MYAP recipients reported being either "unsatisfied" or "very unsatisfied" with the cereal (legume) received. However, these test results suggest greater satisfaction with the commodities received by LEAP respondents along most commodity characteristics. LEAP respondents were more strongly satisfied with the legumes received across all elicited characteristics than were MYAP respondents. The only exception for the cereal was cleanliness; the US-sourced bulgur wheat was rated as cleaner than the locally-sourced millet. Respondents complained in particular of presence of dirt and rocks in the millet, which required more sorting prior to preparation than the bulgur wheat, but did not affect its conservation (reflected in the fact that millet is still preferred with respect to storability).

While the bivariate tests suggest significant differences in satisfaction between the LEAP and MYAP regions, factors other than the commodity distributed may affect these differences. The column 'Multivariate' in Table 1.11 shows which group of recipients was more satisfied with the commodity received, controlling for school and respondent characteristics. The locally-sourced commodity remains preferred by recipients on virtually all criteria, especially for legumes. The millet is still considered less satisfactory with respect to cleanliness, albeit with less statistical significance. The only change relative to the bivariate results regards the perception of nutritional quality; once controls are added, both MYAP commodities are perceived as nutritionally superior.[17]

[17] Some cooks expressed the impression that the bulgur wheat ration was more 'fattening,' which may have been confounded with nutritious in that they consider this a positive thing. With respect to actual nutritional content, the local ration is in fact richer in micronutrients. Micronutrient information on the LEAP and MYAP commodities is available upon request.

Table 1.11: Commodity Preferences

Criteria	Commodity Preferred			
	GRAIN (millet / bulgur wheat)		LEGUME (cowpeas / lentils)	
	Bivariate Test^	Multivariate Test^	Bivariate Test^	Multivariate Test^
Consumption Attributes				
Taste	LEAP**	LEAP	LEAP	LEAP***
Ration Size	LEAP**	LEAP	LEAP***	LEAP**
Texture	LEAP***	LEAP*	LEAP***	LEAP***
Appearance	LEAP***	LEAP**	LEAP***	LEAP***
Cleanliness	MYAP***	MYAP**	LEAP	LEAP
Storability	LEAP***	LEAP***	LEAP**	LEAP
Nutrition	LEAP	MYAP***	LEAP**	MYAP***
General Satisfaction	LEAP	LEAP	LEAP	LEAP***
Preparation Attributes				
Time	MYAP***	MYAP***	MYAP***	MYAP***
Effort	MYAP***	MYAP***	MYAP***	MYAP***
Cost	MYAP***	MYAP*	MYAP***	MYAP
Fuel Use	MYAP***	MYAP***	MYAP***	MYAP***
Water Use	MYAP***	MYAP***	MYAP***	MYAP
Oil Use	LEAP*	LEAP*	MYAP	MYAP

^ Bivariate tests are the Mann-Whitney; multivariate tests are estimated using an ordered logit.
*, **, and *** represent statistical significance at the 1%, 5%, and 10% levels, respectively.

(iv) Results: Preparation Attributes

The advantages of the U.S. commodities emerge when it comes to preparation. As summarized in the bottom panel of Table 1.11, school cooks report that locally-sourced millet unambiguously takes more time, effort, cooking fuel, water, and oil to prepare than does imported bulgur wheat (see Appendix Tables 1.A15 and 1.A16 for the complete econometric results). This is not surprising, as the bulgur wheat is pre-prepared and hence designed to cook quickly, whereas the millet is raw and unprocessed. While respondents rate cowpeas as also taking more time, effort, and fuel, the two commodities are prepared together, and qualitatively most preparers stated that it was the millet that accounted for the increased demand on school

resources. However, the additional resources required were primarily in time; no statistically significant differences in expenditures by PTAs for additional supplies were found between LEAP and MYAP schools. Many preparers suggested that providing millet in a pounded form would reduce cooking time and effort, while they admitted the trade-off that pounded millet doesn't store as well and may be less nutritious.

Overall, we find that cooks and students in LEAP schools are more satisfied than those in the MYAP schools in spite of the fact that the cooks in the LEAP region bear increased preparation costs – primarily time – relative to those who receive US-sourced commodities. One explanation for this may lie in that the cooks are also mothers, and while they prefer to prepare the MYAP commodities, they would rather the children eat what they most like and what is familiar. This was supported with qualitative remarks from respondents, who stated that while as cooks they preferred to receive the imported commodities, which reduce their workload, as mothers they preferred to receive the local commodities. These results hold across both commodities and when controlling for many potentially confounding factors.

4. SUMMARY: TRADEOFFS AND SYNERGIES IN LOCALLY SOURCING FOODS FOR SCHOOL FEEDING PROGRAMS

These results reveal that local food aid procurement, even on a very small, localized scale, can work well in a non-emergency context. Positive synergies can be exploited. However, there are also tradeoffs that need to be considered, and risks that, while avoidable, must be carefully monitored and managed.

A key synergy is that both purchasing agencies and local suppliers face reduced costs. CRS paid 20% less purchasing the three commodities, and suppliers travelled on average 42%

less and spent 29% less time selling them. Suppliers in turn received higher prices by waiting to sell, while the LRP purchases did not impact market prices. An additional benefit lay in that agency purchases led to benefits in learning about product quality and storage practices among smallholders in the supplier farmer associations.

These results may not apply in all cases; the appropriateness of the form of the transfer, agency capacity, and the local context all contribute to the success of food assistance programs (Barrett et al. 2009). In this case, the procurement scale was very small, and surveys were undertaken soon after procurement, possibly reflecting only short-term outcomes. The purchases in turn only occurred once per commodity, and we do not have evidence as to whether or not these impacts lasted, as in for example if the participants managed to prolong the benefits by gaining the confidence of large buyers in subsequent seasons. This would be an interesting avenue for further research. These results do however show that under certain conditions the purchases themselves can accrue net benefits for suppliers.

These benefits were attained in this case on a small-scale, involving direct interaction with smallholder farmers. Buying smaller also, however, entails tradeoffs, particularly with respect to assuring product quality. Products from smallholder suppliers are more likely to be heterogeneous. Quality testing has to be done more meticulously, and other follow-up measures are often necessary to assure quality. Buying from larger suppliers can help with quality assurance, and also reduces the number of necessary contracts and transactions. In addition, for some processed products such as vegetable oil, the considerable comparative advantage of modern, large-scale donor country processors may offset, or even trump, the added transport costs of transoceanic deliveries.

How to weigh this set of tradeoffs depends on the objectives and context of the program. The advantages of buying from large suppliers may be essential, for example when buying quickly to meet emergency needs. A non-emergency LRP program such as the school feeding program we study, on the other hand, can plan ahead and directly integrate development-related goals, such as working with smallholders. Assuring quality standards may in this case require additional logistics and testing costs; but these logistics and costs are demonstrably smaller than ocean freight. It may entail more advanced planning as well, such as in identifying smallholder suppliers and working with them in advance to improve quality in the prior planting season. However, even an entire growing season in the Sahel may be shorter than the time required to transport goods from the US to Ouagadougou. The ability to identify and build the trust of smallholder suppliers in this case relied in part on the skill of local staff and prior agency experience in the intervention region. It is possible that a lack of these advantages would lead to additional delays. Given the magnitude of cost and time savings, however, it is clear that additional activities to assure the validity of suppliers and quality of foods can be integrated into local purchases while still obtaining cost and time advantages relative to transoceanic shipment.

Other tradeoffs may exist, as in this case, regarding the nature of the commodities supplied. Transoceanic shipments can include semi-processed foods, such as pre-cooked bulgur wheat, that may not be available locally and that reduce preparation costs for recipients. One response may be to use a fraction of the saved cost to support processing costs locally, especially if the local commodity is otherwise preferred, as in the Burkina Faso case with respect to millet. It may, for example, make sense to provide vouchers for milling to severely liquidity constrained schools in order to compensate for the burden of processing foods in a more raw form.

The prospective disruption of local markets by agency procurement or distribution activities is an ever-present concern. While there is no evidence of local procurements in Burkina Faso affecting market prices, food aid distribution was associated with statistically significantly lower and more volatile market prices for millet, in spite of the relatively small quantities delivered. This underscores the importance of ex ante response analysis to assess the appropriateness of local purchases and distributions for local markets as well as ongoing market monitoring by food assistance agencies (Barrett et al. 2009).

The simultaneous implementation of school feeding programs in neighboring departments in Burkina Faso by the same agency, with one program using locally-sourced commodities and the other importing food from the United States, afforded an uncommon natural experiment for studying the impacts of LRP along a variety of different metrics. The results reported here strongly support the permanent incorporation of LRP in the international food assistance policy toolkit. Purchases may not be fully appropriate or feasible in all contexts, and there remain cautions concerning market price impacts, food quality and safety, and the cost of processed products that necessitate careful ex ante analysis and ongoing monitoring and evaluation. The evidence clearly indicates all the same that there is potential for major timeliness and efficiency gains as well as benefits to local smallholder suppliers and recipients who prefer locally sourced products. The prospective synergies and tradeoffs among these various criteria reinforce the need for greater donor flexibility in funding food assistance, as well as for donors, operational agencies, and intended beneficiaries to clearly articulate their priority objectives during the design phase of food assistance programs.

5. REFERENCES

Arellano, M., and Bond, S. (1988). Dynamic Panel Data Estimation Using PPD: A Guide for Users. IFS working paper series, no. 88/15. London: Institute for Fiscal Studies.

Barrett, C.B. (2007). Displaced Distortions: Financial Market Failures and Seemingly Inefficient Resource Allocation in Low-Income Rural Communities. In E. Bulte, and R. Ruben (Eds.), *Development Economics Between Markets and Institutions: Incentives for growth, food security and sustainable use of the environment*. Wageningen, Netherlands: Wageningen Academic Publishers.

Barrett, C.B., Bell, R., Lentz, E.C., and Maxwell, D.G. (2009). Market information and food insecurity response analysis. *Food Security, 1*, 151-168.

Barrett, C.B., and Maxwell, D.G. (2005). *Food aid after fifty years: recasting its role.* London, England: Routledge.

Garg, T., Barrett, C.B., Gomez, M.I., Lentz, E.C., and Violette, W. (2014). Market prices and food aid local and regional procurement and distribution: A Multi-country analysis. *World Development, 49:* 19-29.

Leamer, E.E., and Leonard, H.B. (1983). Reporting the fragility of regression estimates. *The Review of Economics and Statistics, 65* (2), 306-317.

Leamer, E.E. (1985). Sensitivity analyses would help. *The American Economic Review, 75* (3), 308-313.

Lentz, Erin C., Simone Passarelli and Christopher B. Barrett (2013). The timeliness and cost effectiveness of the local and regional procurement of food aid. *World Development 49*: 9-18.

Lentz, E., and Barrett, C.B. (2007). Improving food aid: What reforms would yield the highest payoffs? *World Development 36* (7), 1152-1172.

Organization for Economic Co-operation and Development. (2005). *The Development Effectiveness of Food Aid and the Effects of Its Tying Status*. Paris, France: OECD.

Stephens, E.C., and Barrett, C.B. (2011). Incomplete credit markets and commodity marketing behavior. *Journal of Agricultural Economics 62* (1), 1-24.

Tschirley, D., and del Castillo, A. (2007). Local and regional food aid procurement: an assessment of experience in Africa and elements of good donor practice. International Development Collaborative Working Papers.

Upton, J.B., and Lentz, E.C. (2011). Expanding the food assistance toolbox. In C.B. Barrett, A. Binder, and J. Steets (Eds.), *Uniting on food assistance: The case for transatlantic policy convergence*. London, England: Routledge.

United States Department of Agriculture (2009). The Use of Local and Regional Procurement in Meeting the Food Needs of those Affected by Disasters and Food Crises. Office of Capacity Building and Development, Foreign Agricultural Service. http://www.fas.usda.gov/info/speeches/cr011509.pdf.

U.S. Government Accountability Office (2009). International food assistance: Local and regional procurement can enhance the efficiency of U.S. food aid, but challenges may constrain its implementation. Washington, D.C.: GAO.

Villa, K., and Mathys, C. (2011). Quality and safety of food assistance. In C.B. Barrett, A. Binder, and J. Steets (Eds.), *Uniting on food assistance: The case for transatlantic policy convergence*. London, England: Routledge.

Violette, W.J., Harou, A.P., Upton, J.B., Bell, S.D., Barrett, C.B., Gómez, M.I., and Lentz, E.C. (2013).Recipients' Satisfaction with Locally Procured Food Aid Rations: Comparative Evidence from A Three Country Matched Survey. *World Development 49*: 30-43.

World Food Programme (2006). Food Procurement in Developing Countries. Policy Issues, Agenda Item 5, Executive Board First Regular Session, 20-23 Feb. 2006. http://www.fao.org/righttofood/KC/downloads/vl/docs/AH444.pdf.

World Food Programme (2011). "International Food Aid Information System" http://www.wfp.org/fais/reports Accessed October 10, 2011.

APPENDIX 1

Table 1.A1: Suppliers and Quantities, by commodity and region

Region	Province	Department	Association/Union/Company Name (and meaning)	Quantity Purchased (MTs)
Cowpeas:				
Est	Namentenga	Boala	Wend la Conta ("God Provides")	2.8
			Kiswensida ("Trust in God")	3.4
		Boulsa	Lagem-baoré ("In the Same Grainery")	6.8
			Songnaaba ("Help Our Leaders")	2.9
			Wendeso ("In God's Hands")	19.6
			Basnere ("Seek a Good End")	3.9
			Teegwende ("Have Faith")	10.5
			Manegdeketa ("Continue to Improve")	
		Dargo	Teegtaaba ("Trust Eachother")	5.6
			Wendsongdo ("God is Our Aid")	4.8
			Baoyam ("Seek Wisdom")	1.5
			Teegwende ("Have Faith")	1.3
Centre-Nord	Gnagna	Piela	Boayaaba ("Love Eachother")	21.4
		Bilanga	Taami-Mani ("Better to Unite")	5.3
			Kanyoapori ("Continue to progress")	5.3
		Bogandé	Union Findyaaba ("Together for Development")	24.8
			Poogoundiman ("We took one step, but two is better")	13.7
		Liptougou	Tidogou Hambri ("Develop Our Village")	4.7
			Taangnabou ("Think Alike")	5.3
			Total Quantity of Cowpeas Procured (MT):	143.5
Millet:				
Boucle du Mouhoun	Nayala	47 Departments	Union des Groupements pour la Commercialisation des Produits Agricoles de la Boucle du Mouhoun (UGCPA)	54.1
	Mouhouh			
	Kossi			
	Banwa			
	Les Bale			
	Sourou			
	Mouhoun	17 Departments	Union des Groupements des Producteurs pour la Commercialization des Céréales (UGPCC)	99.6
	Kossi			
	Nayala	47 Departments	Union Regionale de Producteurs de Sémences (URPS)	319
	Mouhoun			
	Kossi			
	Banwa			
	Les Bale			
	Sourou			
	Nayala	6 Departments	Union des Groupements des Producteurs de Cereales de Nayala (UGPCER)	155.4
			Total Quantity of Millet Procured (MT):	628.1
Vegetable Oil:				
Centre	Kadiogo	Ouagadougou	Etablissement Moussa Ouedraogo et Frères (EMOF)	72.2
			Total Quantity of Vegetable Oil Procured (MT):	72.2

Table 1.A2: Variable Definitions, Producer Outcome Variables

Outcome	Variable Description	Variable Label	Variable Definition
Transaction Costs	Difference in no. of transactions	*Transactions, This Year - Last Year*	Change in number of individual sales transactions of cowpeas, project year relative to prior year
	Difference in no. of trips for sales	*Trips, This Year - Last Year*	Change in number of trips taken to sell cowpeas, project year relative to prior year
	Difference in total distance travelled	*Distance Travelled, This Year - Last Year*	Change in total distance travelled to sell cowpeas (in kilometers), project year relative to prior year
	Difference in total time spent travelling	*Travel Time, This Year - Last Year*	Change in total time spent travelling to sell cowpeas (in minutes), project year relative to prior year
	Difference in number of trips (subjective)	*No. of Trips*	Likert scale from 1 (="many fewer trips in prior year") to 5 (="many more trips in prior year")
Profitability	Most frequent price received this season	*Price Received, 2010-2011*	Price quoted as "usual price" received 2010-2011 season (CFA)
	Difference in sales price this year	*Sales Price*	On a scale of 1 (="much lower than prior year") to 5 (="much higher than prior year")
	Total revenue this season	*Total Revenue, 2010-2011*	Total revenue from cowpeas 2010-2011 season (CFA)
	Difference in revenue	*Difference in Revenue, This Year - Last Year*	Change in revenue from cowpeas project year relative to prior year
	Difference in profitability (subjective)	*Profitability*	Likert scale from 1 (="much lower than prior year") to 5 (="much higher than prior year")
Knowledge and Behavior	Knowledge of Quality Standards	*Quality Knowledge*	Ordinal, number of the USDA quality criteria recognized as "criteria that describe your highest quality cowpeas"
	Conservation Practices	*Improved Storage*	Dummy variable, equal to one if use double- or triple-lined bags (in place of bottles, barrels, or un-lined bags)
	Traction-related productive investment	*Traction Asset*	Dummy variable, equal to one if more animal/traction assets (carts, donkeys, oxen) were purchased in the project season than in the prior season
	Small-scale productive investments	*Small Asset*	Dummy variable, equal to one if more small productive assets of similar values (shovels, hoes) were purchased in the project season than in the prior season

Table 1.A3: Variable Definitions, Producer Control Variables

Control	Variable Description	Variable Label	Variable Definition
Program and Participation	Member of LEAP Association	*Member of LEAP Association*	= 1 if member of an association that sold to LEAP, 0 otherwise
	Sold to LEAP	*Member, & Sold to CRS*	= 1 if sold cowpeas through the association to LEAP, 0 otherwise
Respondent/ household demographics	Age	*Respondent age*	In years
	Gender	*Female*	= 1 if respondent is female, 0 otherwise
	Level of Education	*Level of Education*	= 0 if no literacy = 1 if Koranic school only = 2 if some literacy = 3 if some primary school = 4 if some middle or high school
	Religion	*Muslim* *Animist* *Protestant* *Catholic*	= 1 if Muslim, 0 otherwise = 1 if Animist, 0 otherwise = 1 if Protestant, 0 otherwise = 1 if Catholic, 0 otherwise
	Ethnicity	*Mossi* *Gourmantche* *Peulh*	= 1 if Mossi, 0 otherwise = 1 if Gourmantche, 0 otherwise = 1 if Peulh, 0 otherwise
	Household Size	*HH Size*	Total number of HH members, defined as those who eat and sleep within the household
	Ratio of active members	*Active members (ratio)*	Total number of members who contribute to agricultural labor, divided by total number or HH members
Respondent/ household production	Land cultivated, 2010-2011	*Land Cultivated (ha)*	Amount of land cultivated this season (hectares)
	Land owned, 2010-2011	*Land Owned (%)*	Percentage of land cultivated this year owned by the respondent's household
	Land allocation to cowpeas	*Allocated to Cowpeas (%)*	Percentage of cultivated land allocated to cowpeas (alone or associated), 2010-2011
	Cowpea as primary revenue	*Cowpeas as primary revenue*	= 1 if cowpea sales are the household's primary revenue source, 0 otherwise
	Cowpea production	*Cowpea Production (KGs)*	Quantity of cowpeas produced project season (KGs)
	Cowpea sales	*Cowpeas Sold (%)*	Percentage of cowpeas sold that were produced the project season
Prior Clients	Sales through the farmers' association	*Sold through Association, 2009-2010*	=1 if the farmer sold *any* quantity through the farmers' association in the prior season
	Primarily small-quantity sales	*Prim Small Sales, 2009-2010*	=1 if the farmer sold *most* of his/her cowpeas to aggregators or households in prior season
Trainings	Trainings in animal husbandry	*Livestock Trainings*	=1 if received prior training in animal husbandry
	Trainings in on-farm management practices	*Trainings in Management Practices*	=1 if received prior training in on-farm management practices, such as pest-management, cropping, or irrigation
	Trainings in post-harvest practices	*Trainings in Storage*	=1 if received prior training in post-harvest (conservation) techniques
	Trainings in sales/marketing	*Trainings in Marketing*	=1 if received trainings in marketing of agricultural commodities
	Trainings Received	*Types of Trainings*	Number of trainings received on agricultural techniques

Table 1.A4: Mean Characteristics, ITT/Control and ATET/Control

	Member of LEAP Association (ITT)			Member, and Sold to CRS (ATET)		
	MYAP	LEAP	LEAP - MYAP	Non-participants	Participants	Participants - Non-participants
Demographics (percentages, unless otherwise noted)						
Age (years)	39.82	39.99	0.17	39.63	40.32	0.69
Female	0.63	0.34	-29%***	0.53	0.41	-12%**
Level of Education (years)	1.27	1.41	0.14	1.29	1.43	0.14
Formal Education	0.15	0.16	0.01	0.16	0.15	-0.01
Literate	0.64	0.64	0	0.64	0.65	0.01
Muslim	0.23	0.4	17%***	0.23	0.46	23%***
Animist	0.1	0.15	0.05	0.14	0.11	-0.03
Protestant	0.16	0.16	0	0.19	0.11	-8%*
Catholic	0.44	0.28	-16%***	0.39	0.32	-0.07
Gourmantche	0.47	0.5	0.03	0.47	0.51	0.04
Mossi	0.42	0.48	0.06	0.44	0.47	0.03
Peulh	0.03	0	-3%**	0.02	0	-0.02
HH Size (no. of members)	10.34	11.86	1.52**	10.89	11.49	0.6
Active Members (ratio)	0.58	0.67	0.09***	0.59	0.68	0.09***
Production Characteristics						
Land Cultivated (ha)	3.02	3.48	0.46*	3.03	3.61	0.58**
Allocated to Cowpeas	0.5884	0.5368	-0.0516	0.5648	0.5576	-0.0072
Cowpea Production (KGs)	368.53	489.31	120.78	375.57	515.91	140.34*
Cowpeas as Primary Revenue	0.55	0.71	16%***	0.54	0.78	24%***
Land Owned	0.6979	0.9717	%27***	0.7516	0.9724	%22***
Cowpeas Sold	0.3904	0.569	%17***	0.4172	0.5845	%16***
Prior Clients						
Sold through Association, 2010-2011	0	0.76	76%***	0	1	1
Sold through Association, 2009-2010	0	0.07	-7%***	0.01	0.09	8%***
Prim Small Sales, 2009-2010	0.22	0.44	-22%***	0.23	0.49	26%***
Trainings						
in Animal Husbandry	0	0.04	4%**	0.02	0.02	0
in Management Practices	0.47	0.58	11%*	0.51	0.56	0.05
in Storage Practices	0.27	0.52	25%***	0.31	0.53	22%***
in Marketing	0.03	0.06	0.03	0.04	0.06	0.02
Types of Trainings (No.)	1.33	1.99	0.66***	1.44	2.02	0.58***
Trained by CRS Partners	0.2	0.35	15%***	0.22	0.37	15%***
Trained by Ext Agent	0.35	0.13	-22%***	0.31	0.13	-18%***
Trained by Farmers' Assn	0.01	0.13	12%***	0.01	0.16	15%***
Accessed Credit	0.12	0.06	-6%*	0.1	0.07	-0.03
Observations	150	160		188	122	

*, **, and *** represent statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 1.A5: Behavioral Outcomes, ITT (Member of LEAP Association) and ATET (Member, and sold to CRS)

	Ordered Logit, Fixed Effects[a]		Binomial Logit, Random Effects[a,b]					
	Quality Knowledge		Improved Storage		Increased Small Asset Purchases		Increased Traction Asset Purchases	
Member of LEAP Association (ITT)	1.989***		-1.982***		3.923**		0.121	
	(0.502)		(0.371)		(1.683)		(0.865)	
Member, & sold to CRS (ATET)		0.687*		1.692***		-0.474		3.191**
		(0.370)		(0.500)		(0.998)		(1.171)
Age	0.017	0.014	0.028**	0.016	-0.027	-0.033*	0.015	0.001
	(0.012)	(0.012)	(0.010)	(0.010)	(0.017)	(0.017)	(0.011)	(0.011)
Female	0.066	-0.004	-0.692**	-1.340***	-0.974	-1.614**	-0.561	-1.600**
	(0.586)	(0.574)	(0.280)	(0.402)	(0.690)	(0.748)	(0.477)	(0.539)
Level of Education	0.112	0.17	-0.045	-0.025	0.468**	0.282	-0.774***	-1.164***
	(0.113)	(0.108)	(0.097)	(0.115)	(0.224)	(0.246)	(0.176)	(0.205)
Animist	0.125	0.239	-0.692	-0.866	1.203	0.824	-1.261*	-1.053
	(0.372)	(0.344)	(0.441)	(0.570)	(0.814)	(0.915)	(0.667)	(0.769)
Muslim	0.456	0.588	0.308	0.553	0.186	0.438	0.621*	0.670*
	(0.387)	(0.402)	(0.306)	(0.350)	(0.500)	(0.538)	(0.363)	(0.372)
Protestant	-0.019	0.71	-0.605**	0.352	0.782	1.260*	-0.017	-0.123
	(0.514)	(0.488)	(0.285)	(0.352)	(0.610)	(0.673)	(0.485)	(0.548)
Gourmantche	2.034**	2.166**	-1.500***	-0.492	1.961*	2.3	0.08	-1.264
	(0.819)	(0.729)	(0.330)	(0.537)	(1.133)	(1.625)	(0.637)	(0.854)
Peulh	2.039***	2.243***	21.05	12.448	5.323**	4.024**	-20.566	-11.457
	(0.506)	(0.613)	(83268.012)	(557.247)	(1.930)	(2.031)	(60561.938)	(1193.538)
HH Size	-0.022	-0.024	0.116***	0.104***	0.076	0.097*	0.084**	0.115**
	(0.020)	(0.023)	(0.028)	(0.031)	(0.049)	(0.054)	(0.034)	(0.038)
Active Members (ratio)	0.3	0.272	-0.067	-0.624	1.647	0.362	-1.117	-1.607**
	(0.586)	(0.531)	(0.495)	(0.558)	(1.006)	(1.097)	(0.725)	(0.778)
Land Cultivated (ha)	0.051	0.067	-0.181***	-0.211***	-0.328**	-0.475**	0.140*	0.106
	(0.103)	(0.101)	(0.054)	(0.061)	(0.149)	(0.182)	(0.081)	(0.094)
Land allocated to Cowpeas (%)	0.011	0.007	0.020***	0.014**	0.026**	0.019	-0.006	0
	(0.008)	(0.008)	(0.005)	(0.006)	(0.010)	(0.012)	(0.007)	(0.008)
Land Owned (%)	-0.007	-0.004	0.002	0.003	0.006	-0.004	-0.004	-0.012*
	(0.005)	(0.004)	(0.003)	(0.004)	(0.015)	(0.016)	(0.006)	(0.007)
Sold through Association, 09-10	0.343	0.058	---	---	---	---	---	---
	(0.393)	(0.443)						
Primarily Retail Clients, 09-10	0.725**	0.57	1.769***	1.315***	-4.193***	-4.852***	1.356***	0.807**
	(0.288)	(0.374)	(0.238)	(0.265)	(0.634)	(0.741)	(0.323)	(0.348)
Livestock Trainings	2.416**	2.164**	-0.44	0.485	3.116**	18.24	-19.768	---
	(0.822)	(0.777)	(0.686)	(0.834)	(1.269)	(1791.644)	(41015.639)	
Trainings in Management Practices	0.579	0.535	0.194	-0.102	-0.864*	-0.576	1.179**	1.611***
	(0.515)	(0.423)	(0.257)	(0.291)	(0.488)	(0.569)	(0.364)	(0.414)
Trainings in Storage Practices	1.126**	0.938**	1.089***	1.469***	2.243**	1.748**	1.276**	1.046
	(0.504)	(0.378)	(0.288)	(0.445)	(0.724)	(0.800)	(0.490)	(0.644)
Trainings in Marketing	0.213	0.202	0.573	0.319	-25.958	-13.977	-0.19	-0.551
	(0.430)	(0.540)	(0.641)	(0.709)	(253740.823)	(1118.763)	(0.649)	(0.847)
Observations	300	300	300	280	300	171	300	241

[a] Standard errors in parentheses

[b] The Hausman Test confirmed the consistency of the Random Effects model for each of these outcome variables.

*, **, and *** represent statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 1.A6: Revenue and Profitabiliy, Random Effects, ITT (LEAP Association) and ATET (Sold to CRS)

	Random Effects[a,b]							
	Price Received, 2010-2011[c]		Price Received, Project-Prior Year[c]		Total Revenue, 2010-2011[c]		Difference in Revenue, Project - Prior Year[c]	
Member of LEAP Association (ITT)	-40.961***		-21.567		16668.318		1075.873	
	(7.914)		(13.400)		(12957.628)		(12806.644)	
Member, & sold to CRS (ATET)		-22.189**		-9.418		31090.573**		8541.107
		(7.742)		(11.205)		(12309.386)		(11454.176)
Age	-0.047	0.086	-0.113	-0.008	199.615	135.169	-99.49	-104.439
	(0.302)	(0.311)	(0.469)	(0.475)	(489.869)	(488.967)	(480.877)	(478.346)
Female	-1.698	3.889	-25.798**	-25.747**	-19059.93	-19654.178*	-12772.707	-13078.711
	(7.226)	(7.393)	(10.906)	(10.990)	(11796.815)	(11623.475)	(11414.535)	(11235.393)
Level of Education	3.864	3.512	-7.834*	-9.287**	1778.064	2923.4	-4289.373	-4116
	(2.786)	(2.875)	(4.303)	(4.344)	(4603.921)	(4609.337)	(4584.117)	(4559.683)
Animist	6.972	1.155	14.728	8.941	-7005.414	-3661.645	-6920.906	-6876.635
	(10.531)	(10.835)	(17.840)	(17.578)	(17368.761)	(17287.537)	(18292.968)	(17900.252)
Muslim	10.568	8.825	-1.902	0.283	-647.423	-7508.911	20029.507	18238.032
	(8.244)	(8.545)	(12.236)	(12.429)	(13782.600)	(13783.618)	(13021.739)	(12953.806)
Protestant	-5.845	-9.135	1.187	-0.379	2181.734	7024.07	-10963.861	-9676.254
	(9.769)	(10.191)	(16.341)	(16.674)	(15615.592)	(15756.871)	(15444.219)	(15488.877)
Gourmantche	-12.809	-10.624	-3.581	-0.574	-36677.449**	-40941.999**	-15277.684	-16312.28
	(8.718)	(9.067)	(14.023)	(14.334)	(14213.514)	(14310.010)	(13765.944)	(13765.958)
Peulh	2.68	3.453	-76.946*	-74.128	19258.579	25820.023	-5411.492	-3198.103
	(29.709)	(30.805)	(46.751)	(47.672)	(50483.016)	(50633.427)	(46580.188)	(46477.379)
HH Size	-0.634	-0.89	-0.12	-0.078	3574.335**	3559.873**	1859.724*	1915.751*
	(0.668)	(0.692)	(1.013)	(1.022)	(1119.849)	(1121.341)	(1109.318)	(1101.915)
Land Cultivated (ha)	-0.786	-0.577	-3.766	-4.331*	7754.818**	7486.011**	1930.73	1657.466
	(1.679)	(1.761)	(2.550)	(2.625)	(2764.430)	(2796.564)	(2782.305)	(2800.795)
Allocated to Cowpeas (%)	0.201	0.271**	-0.043	0.068	-320.897	-345.339	-235.782	-216.809
	(0.134)	(0.138)	(0.234)	(0.235)	(218.742)	(216.490)	(218.408)	(214.019)
Land Owned (%)	0.106	0.018	-0.034	-0.124	127.709	134.568	38.229	16.794
	(0.107)	(0.109)	(0.221)	(0.221)	(172.096)	(169.750)	(184.093)	(181.472)
Sold through Association, 09-10	-0.384		-44.200**		62906.061**		7854.126	
	(16.729)		(21.939)		(26151.284)		(24191.965)	
Prim Retail Clients, 2009-2010	7.354	4.852	16.708	19.746*	-1664.287	-7501.282	-4595.525	-6507.142
	(6.725)	(6.998)	(10.192)	(10.339)	(11044.069)	(11154.262)	(10636.914)	(10681.391)
Trained by CRS & Partners	-10.129	-11.36	-5.384	-12.014	-29280.641**	-22513.209*	-9341.891	-8492.953
	(7.679)	(7.819)	(12.520)	(12.384)	(12717.615)	(12471.843)	(12568.915)	(12205.406)
Trained by State Agents	18.354**	28.439***	-18.447	-14.33	9566.118	7372.868	-2171.861	-1523.761
	(8.612)	(8.578)	(13.810)	(13.886)	(14392.447)	(13917.820)	(13936.210)	(13489.547)
Trained by Farmers' Assn	22.395*	17.812	33.991*	25.823	14210.13	9605.129	-20159.057	-23828.139
	(12.980)	(13.693)	(18.079)	(18.559)	(21900.359)	(22319.054)	(20472.635)	(20684.957)
Observations	257	257	170	170	277	277	234	234

[a] Standard errors in parentheses

[b] Random Effects founds to be consistent, using the Hausman test, for all outcomes *except* the ATET for price received, and both the ITT and the ATET for change in price relative to prior year, for which the Hausman test rejecting the consistency of the RE estimator.

[c] Prices and revenues in CFA Francs ($1 = 443.4 FCFA, July 1, 2011); prices in CFA/KG of dry cowpeas.

*, **, and *** represent statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 1.A7: Revenue and Profitabiliy, Fixed Effects, ITT (LEAP Association) and ATET (Sold to CRS)

	Fixed Effects[a,b]							
	Price Received, 2010-2011		Price Received, Project-Prior Year		Total Revenue, 2010-2011		Difference in Revenue, Project - Prior Year	
Member of LEAP Association (ITT)	-78.809***		-30.549		-19091.269		41842.445	
	(19.565)		(53.359)		(42524.947)		(43105.041)	
Member, & sold to CRS (ATET)		18.916*		4.908		39208.738**		19477.191*
		(9.821)		(17.473)		(13920.998)		(11585.549)
Age	0.008	-0.032	0.101	0.395	336.544	163.55	38.678	-9.515
	(0.230)	(0.231)	(0.662)	(0.774)	(374.732)	(436.041)	(362.974)	(363.689)
Female	3.387	3.728	-18.969	-30.979	-25162.210*	-20968.953	-20855.713	-20076.214
	(8.056)	(7.881)	(16.917)	(20.515)	(13095.045)	(14133.338)	(13582.755)	(13863.401)
Level of Education	1.047	2.204	-10.757	-14.695	1064.451	4416.989	-5306.992	-4102.757
	(3.059)	(3.100)	(9.294)	(9.903)	(4230.253)	(4291.358)	(4150.981)	(4307.661)
Animist	4.66	6.289	-12.556	-12.214	-19323.718	-13222.412	-20052.93	-17210.806
	(9.956)	(9.705)	(21.705)	(23.785)	(14565.346)	(13704.602)	(15986.627)	(15718.205)
Muslim	4.54	1.283	-10.453	-1.705	15168.234	3408.559	22355.651**	18546.457
	(6.331)	(5.859)	(21.187)	(25.026)	(13016.262)	(13565.064)	(10784.137)	(11343.365)
Protestant	2.762	5.269	16.943	4.27	17836.108	23993.942*	4780.237	6982.08
	(11.917)	(12.049)	(25.786)	(24.580)	(12079.421)	(14457.668)	(10302.786)	(10342.724)
Gourmantche	-7.138	-8.349	26.693	25.217	2978.482	1733.263	-464.186	-2105.858
	(10.471)	(10.251)	(22.993)	(22.081)	(13356.656)	(13692.391)	(11147.633)	(11159.493)
Peulh	-20.318	-18.847	-93.615	-98.165*	11313.807	17653.33	-26994.094	-25375.941
	(45.717)	(44.603)	(56.777)	(54.952)	(26395.790)	(28344.027)	(24724.166)	(24885.624)
HH Size	0.013	-0.004	-2.681	-1.702	3109.042**	2511.225**	922.826	853.96
	(0.595)	(0.627)	(2.714)	(2.868)	(1214.143)	(1219.934)	(1055.156)	(1077.305)
Land Cultivated (ha)	-2.21	-2.236	-2.304	-5.961	5820.050**	7380.175**	-898.297	-659.538
	(1.557)	(1.597)	(3.164)	(4.467)	(2700.325)	(3046.391)	(3016.858)	(3210.242)
Allocated to Cowpeas (%)	0.179	0.175	-0.044	0.106	-198.211	-213.721	-370.016*	-375.585*
	(0.168)	(0.167)	(0.369)	(0.353)	(214.156)	(229.241)	(212.196)	(217.673)
Land Owned (%)	0.067	0.067	0.054	0.033	9.026	25.387	72.842	67.775
	(0.128)	(0.129)	(0.283)	(0.298)	(93.174)	(101.303)	(84.550)	(86.353)
Sold through Association, 2009-2010	13.213		-78.371**		72373.368**		18174.717	
	(9.904)		(34.095)		(23402.041)		(22654.728)	
Prim Retail Clients, 2009-2010	6.058	3.736	7.166	16.994	-8964.3	-17583.413	-15849.026	-18230.118
	(6.298)	(6.112)	(18.424)	(23.919)	(11008.216)	(13449.240)	(11639.111)	(13502.110)
Trained by CRS & Partners	-12.383	-11.338	-9.495	-11.958	15760.68	21106.107	28260.288	30762.450*
	(11.574)	(11.609)	(18.778)	(20.830)	(15048.311)	(17652.294)	(17301.751)	(18057.562)
Trained by State Agents	-1.298	0.035	-10.7	-8.657	24012.518	25648.581	21880.877	22587.578
	(10.747)	(11.027)	(15.923)	(15.362)	(17064.031)	(17430.165)	(17468.048)	(17217.384)
Trained by Farmers' Assn	13.04	17.493	32.345*	31.103*	169988.553**	180340.335**	36249.429	41660.093
	(10.654)	(11.490)	(17.063)	(16.953)	(63335.336)	(66890.195)	(42127.662)	(38506.253)
Observations	257	257	170	170	277	277	234	234

[a] Standard errors in parentheses

[b] Prices and revenues in CFA Francs ($1 = 443.4 FCFA, July 1, 2011); prices in CFA/KG of dry cowpeas.

*, **, and *** represent statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 1.A8: Transaction Costs, Random Effects, ITT (LEAP Association) and ATET (Sold to CRS)

	Random Effects[a]							
	Distance Travelled (km), Project-Prior Year		Travel Time, Project-Prior Year		Transactions, Project-Prior Year		Number of Trips, Project-Prior Year	
Member of LEAP Association (ITT)	-11.159*		-31.739**		-1.316		-0.427	
	(6.657)		(11.690)		(1.780)		(0.272)	
Member, & sold to CRS (ATET)		-13.844**		-28.765**		-0.102		-0.41
		(6.373)		(11.259)		(1.765)		(0.261)
Age	-0.056	-0.038	0.217	0.29	-0.084	-0.069	0	0.001
	(0.254)	(0.252)	(0.446)	(0.444)	(0.068)	(0.070)	(0.010)	(0.010)
Female	4.839	7.338	1.284	7.89	-0.048	-0.456	-0.422*	-0.354
	(6.043)	(5.923)	(10.610)	(10.464)	(1.616)	(1.641)	(0.247)	(0.243)
Level of Education	-0.058	-0.125	-0.883	-0.859	-0.582	-0.698	0.054	0.049
	(2.313)	(2.305)	(4.062)	(4.071)	(0.619)	(0.638)	(0.095)	(0.094)
Animist	21.042**	18.667**	22.505	16.283	-0.378	-0.492	-0.073	-0.155
	(9.014)	(8.931)	(15.828)	(15.778)	(2.411)	(2.474)	(0.368)	(0.366)
Muslim	11.444	11.36	3.171	1.11	-0.09	0.455	-0.227	-0.222
	(7.011)	(6.942)	(12.312)	(12.264)	(1.875)	(1.923)	(0.287)	(0.284)
Protestant	-0.226	-2.588	-7.824	-13.197	-0.731	-0.865	-0.098	-0.175
	(7.920)	(7.924)	(13.908)	(13.999)	(2.118)	(2.195)	(0.324)	(0.325)
Gourmantche	1.667	2.497	0.542	2.047	-3.132	-2.928	-0.069	-0.039
	(7.238)	(7.228)	(12.709)	(12.769)	(1.936)	(2.002)	(0.296)	(0.296)
Peulh	-8.561	-9.209	-15.327	-13.952	-0.237	-0.248	0.179	0.177
	(22.943)	(22.852)	(40.286)	(40.371)	(6.136)	(6.330)	(0.938)	(0.936)
HH Size	0.432	0.218	1.933*	1.455	-0.077	0.009	0.003	0
	(0.579)	(0.575)	(1.016)	(1.015)	(0.155)	(0.159)	(0.024)	(0.024)
Land Cultivated (ha)	-6.161***	-5.531***	-12.960***	-11.670***	0.603	0.383	0.016	0.026
	(1.432)	(1.438)	(2.514)	(2.541)	(0.383)	(0.398)	(0.059)	(0.059)
Allocated to Cowpeas (%)	-0.134	-0.147	-0.177	-0.174	-0.047	-0.027	-0.001	-0.001
	(0.112)	(0.110)	(0.197)	(0.194)	(0.030)	(0.030)	(0.005)	(0.004)
Land Owned (%)	-0.084	-0.066	-0.193	-0.182	0.001	-0.016	-0.004	-0.004
	(0.085)	(0.083)	(0.149)	(0.147)	(0.023)	(0.023)	(0.003)	(0.003)
Sold through Association, 2009-2010	14.727		37.391		-15.587***		-0.064	
	(13.875)		(24.364)		(3.711)		(0.567)	
Prim Retail Clients, 2009-2010	1.024	1.965	-4.168	-4.247	-3.193**	-3.112*	-0.751**	-0.733**
	(5.741)	(5.772)	(10.080)	(10.197)	(1.535)	(1.599)	(0.235)	(0.236)
Trained by CRS & Partners	-0.743	0.38	-5.565	-3.485	-0.259	-1.951	-0.354	-0.381
	(6.483)	(6.300)	(11.384)	(11.130)	(1.734)	(1.745)	(0.265)	(0.258)
Trained by State Agents	-7.445	-6.883	5.005	8.573	-2.748	-1.88	-0.141	-0.079
	(7.141)	(6.909)	(12.539)	(12.206)	(1.910)	(1.914)	(0.292)	(0.283)
Trained by Farmers' Assn	-1.292	3.376	-45.949**	-39.951*	-3.493	-5.830*	-0.894*	-0.861*
	(11.553)	(11.666)	(20.286)	(20.609)	(3.090)	(3.231)	(0.472)	(0.478)
Observations	300	300	300	300	300	300	300	300

[a] Standard errors in parentheses

*, **, and *** represent statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 1.A9: Transaction Costs, Fixed Effects, ITT (LEAP Association) and ATET (Sold to CRS)

	Fixed Effects[a]							
	Distance Travelled (km), Project-Prior Year		Travel Time, Project-Prior Year		Transactions, Project-Prior Year		Number of Trips, Project-Prior Year	
Member of LEAP Association (ITT)	3.053		-7.453		-3.881		-1.325	
	(9.847)		(24.962)		(3.751)		(0.994)	
Member, & sold to CRS (ATET)		-15.187		-33.997*		1.069		-0.163
		(9.807)		(19.279)		(3.108)		(0.406)
Age	0.204	0.186	-0.649	-0.672	-0.221	-0.155	0.029	0.028
	(0.403)	(0.400)	(0.414)	(0.410)	(0.212)	(0.198)	(0.061)	(0.060)
Female	5.258	6.541	-4.476	-2.157	1.283	-0.851	-0.363	-0.309
	(7.375)	(7.147)	(15.139)	(14.608)	(1.969)	(2.372)	(0.507)	(0.476)
Level of Education	0.707	0.339	1.446	0.442	-0.475	-1.112	0.147	0.156
	(1.502)	(1.576)	(3.207)	(3.172)	(0.857)	(0.862)	(0.132)	(0.139)
Animist	7.098	4.929	17.006	12.105	2.43	2.42	-0.816	-0.836
	(9.957)	(10.024)	(14.584)	(14.772)	(4.399)	(4.671)	(1.066)	(1.036)
Muslim	-5.543	-5.057	14.059	16.028	0.439	3.65	-0.866	-0.925
	(9.574)	(10.405)	(12.369)	(12.414)	(3.179)	(6.017)	(1.476)	(1.544)
Protestant	-4.187	-5.244	-3.628	-6.297	5.444	4.401	-0.045	-0.034
	(5.954)	(6.009)	(11.262)	(11.152)	(7.232)	(7.449)	(0.571)	(0.549)
Gourmantche	-10.793	-9.646	-17.243	-14.816	-3.524	-4.126	-0.042	-0.019
	(8.031)	(7.841)	(16.129)	(16.203)	(4.989)	(4.854)	(0.424)	(0.439)
Peulh	-7.423	-7.314	-6.488	-7.013	3.492	0.648	0.787	0.844
	(9.465)	(9.043)	(19.443)	(17.924)	(5.156)	(3.996)	(0.637)	(0.668)
HH Size	0.147	-0.035	1.436	1.113	-0.228	0.102	-0.054	-0.062
	(0.507)	(0.518)	(0.899)	(0.886)	(0.225)	(0.220)	(0.062)	(0.069)
Land Cultivated (ha)	-3.731	-2.977	-6.989	-5.577	2.392	1.323	0.155	0.183
	(3.461)	(3.388)	(6.969)	(6.753)	(1.702)	(1.157)	(0.119)	(0.125)
Allocated to Cowpeas (%)	-0.047	-0.048	0.126	0.125	-0.291*	-0.286	-0.003	-0.003
	(0.120)	(0.118)	(0.190)	(0.183)	(0.160)	(0.184)	(0.009)	(0.008)
Land Owned (%)	-0.021	-0.012	-0.232*	-0.217	0.024	0.01	-0.001	-0.001
	(0.063)	(0.060)	(0.136)	(0.132)	(0.025)	(0.029)	(0.005)	(0.005)
Sold through Association, 2009-2010	8.705		11.601		-29.672		0.668	
	(9.685)		(21.357)		(22.452)		(1.249)	
Prim Retail Clients, 2009-2010	-8.092	-7.993	-15.884*	-14.902*	-7.814**	-5.013**	-1.465**	-1.520**
	(4.952)	(5.445)	(8.391)	(8.929)	(3.949)	(2.182)	(0.525)	(0.615)
Trained by CRS & Partners	-12.288	-12.156	-13.082	-13.195	0.948	-0.561	-0.335	-0.304
	(8.458)	(8.156)	(23.614)	(22.983)	(1.959)	(1.820)	(0.419)	(0.375)
Trained by State Agents	-1.559	-3.361	5.551	1.722	-6.247*	-5.364*	-0.155	-0.189
	(9.506)	(9.434)	(21.440)	(20.368)	(3.351)	(3.198)	(0.324)	(0.325)
Trained by Farmers' Assn	-16.753	-19.731	-120.402	-127.226	-32.353	-32.728	-1.962**	-1.982**
	(46.116)	(48.124)	(96.939)	(101.890)	(19.994)	(20.167)	(0.737)	(0.757)
Observations	300	300	300	300	300	300	300	300

[a] Standard errors in parentheses

* and ** represent statistical significance at the 1% and 5% levels, respectively.

Table 1.A10: Subjective Outcomes, ITT (LEAP Association) and ATET (Sold to CRS)

	Ordered Logit, Fixed Effects					
	No. of Trips		Sales Price		Profitability	
Member of LEAP Association (ITT)	-1.179***		0.825		0.406	
	(0.339)		(0.819)		(0.670)	
Member, & sold to CRS (ATET)		0.135		1.335**		0.268
		(0.474)		(0.456)		(0.772)
Age	0.005	0.005	-0.015	-0.014	-0.013	-0.011
	(0.021)	(0.020)	(0.013)	(0.013)	(0.015)	(0.016)
Female	-1.017	-1.031	-0.193	-0.255	-0.843**	-0.442
	(0.700)	(0.772)	(0.301)	(0.272)	(0.332)	(0.406)
Level of Education	0.243**	0.242**	-0.13	-0.08	0.014	0.072
	(0.099)	(0.101)	(0.215)	(0.178)	(0.200)	(0.174)
Animist	-0.674**	-0.674**	0.278	0.399	0.099	-0.005
	(0.342)	(0.326)	(0.365)	(0.371)	(0.206)	(0.309)
Muslim	-0.3	-0.33	0.454	0.068	-0.112	-0.207
	(0.546)	(0.557)	(0.457)	(0.478)	(0.539)	(0.518)
Protestant	0.221	0.239	0.445**	0.367	0.597	0.489
	(1.006)	(1.048)	(0.208)	(0.231)	(0.422)	(0.408)
Mossi	-0.557	-0.604	-0.698	-0.143	-0.992	-0.837
	(0.425)	(0.433)	(1.337)	(1.010)	(1.259)	(1.149)
Gourmantche	0.359	0.326	-0.485	-0.366	-0.268	-0.308
	(0.459)	(0.443)	(0.843)	(0.899)	(0.782)	(0.777)
HH Size	0.046	0.048	0.021	0.039	0.055	0.055
	(0.049)	(0.053)	(0.037)	(0.032)	(0.041)	(0.047)
Land Cultivated (ha)	-0.188	-0.194	-0.196**	-0.276***	-0.077	-0.02
	(0.119)	(0.133)	(0.062)	(0.066)	(0.095)	(0.084)
Allocated to Cowpeas (%)	0.006	0.007	0.012	0.014*	0.002	0.005
	(0.014)	(0.014)	(0.013)	(0.008)	(0.016)	(0.015)
Land Owned (%)	-0.011***	-0.011***	-0.010*	-0.011***	-0.017**	-0.017**
	(0.003)	(0.003)	(0.006)	(0.002)	(0.007)	(0.008)
Sold through Association, 2009-2010	-0.789***	-0.844***	-0.304	-0.257	-1.452**	-1.572**
	(0.118)	(0.168)	(0.447)	(0.461)	(0.610)	(0.570)
Prim Retail Clients, 2009-2010	-0.661*	-0.684*	0.449	0.172	-0.404	-0.269
	(0.347)	(0.351)	(0.453)	(0.514)	(0.377)	(0.425)
Constant	1.065***	1.063***	1.879***	1.533***	1.280***	1.418***
	(0.091)	(0.096)	(0.187)	(0.267)	(0.369)	(0.420)
Observations	234	234	221	221	230	230

[a] Standard errors in parentheses

*, **, and *** represent statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 1.A11: Variable Definitions, Recipient Control Variables

Outcome	Variable Description	Variable Label	Variable Definition
Program	Program, LEAP or MYAP	*LEAP*	= 1 if LEAP, 0 otherwise
School-level	Distance to market	*Market Distance*	In kilometers
	Enrollment	*Enrollment*	Total number enrolled, all grades
	Ethnic composition of students	*Gourmantche*	Gourmantche students (%) ; (remainder dominantly Mossi, some Peulh)
	Religious composition of students	*Muslim* *Animist*	Muslim students (%) Animist students (%) (remainder Christian)
	Informal School	*Informal School*	= 1 if a CEBNF, a non-formal school for older students who missed the age for primary school
Respondent-level	Age	*Respondent age*	In years
	Ethnicity	*R_Gourmantche* *R_Peulh*	= 1 if Gourmantche, 0 otherwise = 1 if Peulh, 0 otherwise (remainder Mossi)
	Religion	*R_Muslim* *R_Animist*	= 1 if Muslim, 0 otherwise = 1 if Animist, 0 otherwise (remainder Christian)

Table 1.A12: Mean Characteristics, Recipients

Control Variable	MYAP	LEAP	LEAP-MYAP
	Mean	Mean	
School-level characteristics (percentages, unless otherwise noted):			
Distance to Market (km)	8.03	5.77	-2.26***
Enrollment (total no.)	137.8	165.3	27.5**
Religious Composition:			
Muslim	31%	25%	-6%
Animist	36%	28%	-8%*
Protestant	15%	23%	8%**
Catholic	18%	22%	4%
Ethnic Composition:			
Gourmantché	52%	41%	-11%
Mossi	43%	54%	11%*
Peulh	5%	4%	-1%*
Informal School	3%	3%	1%
Respondent-level characteristics (percentages, unless otherwise noted):			
Age (years)	38.36	37.71	-0.65
Female	100%	100%	0
Literate	47%	47%	0%
Religion:			
Muslim	39%	28%	-11%*
Animist	12%	11%	-1%
Protestant	16%	25%	9%*
Catholic	33%	36%	3%
Ethnicity:			
Gourmantché	48%	40%	-8%
Mossi	47%	56%	9%
Peulh	3%	3%	0%

*, **, and *** represent statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 1.A13: Millet Multivariate Results, General Preferences[a]

	Taste	Ration Size	Texture	Appearance	Cleanliness	Storability	Nutrition	Gen Satisfaction
LEAP	**0.212**	**0.306**	**0.986***	**1.046****	**-1.784****	**2.532*****	**-1.962*****	**0.111**
	(0.300)	**(0.410)**	**(0.556)**	**(0.419)**	**(0.723)**	**(0.358)**	**(0.247)**	**(0.144)**
Respondent Age	-0.003	-0.012	-0.001	0.002	0.01	-0.027	-0.018	-0.012
	(0.020)	(0.018)	(0.017)	(0.018)	(0.016)	(0.022)	(0.016)	(0.014)
R_Gourmantche	0.051	0.352	0.901	0.201	0.121	0.047	-0.76	-0.623
	(0.452)	(0.391)	(0.615)	(0.333)	(0.657)	(0.379)	(0.747)	(0.756)
R_Peulh	1.702	1.129**	0.63	1.246	-0.575	-1.268	-1.37	-0.994
	(1.219)	(0.557)	(0.606)	(0.847)	(0.777)	(0.945)	(0.911)	(0.702)
R_Muslim	0.101	0.071	-0.606	-0.712*	-0.971***	-1.459***	-0.893**	-0.930*
	(0.468)	(0.431)	(0.492)	(0.367)	(0.252)	(0.346)	(0.277)	(0.497)
R_Animist	0.146	-1.362	-0.123	-0.721	-0.903	-1.536*	-0.594	-0.922
	(0.498)	(0.906)	(0.675)	(0.676)	(0.720)	(0.912)	(0.992)	(1.092)
Informal School	0.811	0.628	1.070**	0.794*	0.631	-0.001	1.695	0.079
	(0.934)	(0.754)	(0.449)	(0.478)	(0.790)	(1.660)	(1.153)	(0.657)
Market Distance	-0.056**	0.050**	0.04	0.038	0.023	0.036**	-0.031	0.047**
	(0.026)	(0.022)	(0.026)	(0.030)	(0.023)	(0.015)	(0.026)	(0.022)
Enrollment	0	0.001	0.001	0.003**	0.002	0.004***	0.002	0.001
	(0.001)	(0.003)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
Gourmantche (%)	-0.001	-0.020*	-0.011	-0.012*	-0.023**	-0.019**	-0.013**	-0.006
	(0.005)	(0.011)	(0.008)	(0.007)	(0.010)	(0.010)	(0.006)	(0.007)
Muslim (%)	-0.001	-0.015	0.002	-0.007	0.006	-0.004	-0.003	0.012
	(0.008)	(0.014)	(0.010)	(0.009)	(0.011)	(0.012)	(0.006)	(0.012)
Animist (%)	0.001	-0.016*	0.003	0.002	0.012	-0.004	-0.013**	0.002
	(0.007)	(0.009)	(0.009)	(0.007)	(0.010)	(0.011)	(0.006)	(0.009)
Constant	0.722***	0.898***	0.761**	0.767**	1.022***	1.436***	1.572***	0.928***
	(0.068)	(0.153)	(0.323)	(0.253)	(0.247)	(0.206)	(0.158)	(0.153)
No. of Schools	217	219	220	218	215	203	215	220

[a] Standard errors in parentheses

*, **, and *** represent statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 1.A14: Cowpeas Multivariate Results, General Preferences[a]

	Taste	Ration Size	Texture	Appearance	Cleanliness	Storability	Nutrition	Gen Satisfaction
LEAP	**0.708***	**0.619****	**3.096*****	**1.790*****	**0.719**	**0.109**	**-2.773*****	**1.989*****
	(0.380)	**(0.246)**	**(0.328)**	**(0.269)**	**(0.439)**	**(0.493)**	**(0.474)**	**(0.411)**
Respondent Age	-0.006	-0.001	-0.011	0.032**	0.042**	0.014	0.024**	0.037***
	(0.012)	(0.013)	(0.016)	(0.010)	(0.021)	(0.023)	(0.010)	(0.009)
R_Gourmantche	0.422	-0.191	-0.02	-0.245	-0.456	0.333	-0.702	-0.665
	(0.505)	(0.455)	(0.490)	(0.326)	(0.367)	(0.688)	(0.694)	(0.449)
R_Peulh	1.251	0.912	1.974**	1.425**	2.971	0.179	0.506	1.814*
	(1.211)	(1.011)	(0.771)	(0.692)	(2.289)	(2.259)	(0.561)	(1.025)
R_Muslim	-0.39	-1.086**	-1.117**	-0.36	-0.443	-0.842**	-1.060**	-0.519
	(0.353)	(0.372)	(0.470)	(0.481)	(0.472)	(0.405)	(0.363)	(0.443)
R_Animist	-0.025	-1.573**	-0.492	-0.59	-0.433	0.478	-1.342**	-0.829
	(0.661)	(0.713)	(0.444)	(0.653)	(0.862)	(0.707)	(0.532)	(0.676)
Informal School	-0.874	0.121	-0.735*	-1.035	-0.078	0.125	-0.866	-0.817
	(0.821)	(0.945)	(0.420)	(0.636)	(0.799)	(0.848)	(0.803)	(0.753)
Market Distance	0.029	0.012	0.021	0.022	-0.008	-0.002	0.003	-0.026
	(0.028)	(0.042)	(0.031)	(0.037)	(0.028)	(0.027)	(0.025)	(0.020)
Enrollment	-0.002	-0.001	0	0.002	0.002	0	0.003	0.001
	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)
Gourmantche (%)	-0.001	-0.008	-0.006	-0.004	-0.009	-0.029***	-0.011	-0.002
	(0.009)	(0.008)	(0.004)	(0.006)	(0.007)	(0.006)	(0.007)	(0.005)
Muslim (%)	0.006	-0.002	-0.007	-0.008	-0.005	-0.026**	-0.007	-0.008
	(0.014)	(0.012)	(0.007)	(0.010)	(0.010)	(0.009)	(0.008)	(0.010)
Animist (%)	0	-0.002	0.004	0.001	-0.003	0.001	-0.008	-0.011
	(0.012)	(0.006)	(0.010)	(0.008)	(0.012)	(0.005)	(0.009)	(0.008)
Constant	1.182***	1.069***	1.457***	1.063***	1.814***	1.602***	1.265***	1.676***
	(0.196)	(0.104)	(0.218)	(0.142)	(0.341)	(0.197)	(0.180)	(0.357)
No. of Schools	217	217	216	216	170	172	205	199

[a] Standard errors in parentheses

*, **, and *** represent statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 1.A15: Millet/Bulgur Wheat Multivariate Results, Preparation Preferences[a]

	Time	Effort	Cost	Fuel Use	Water Use	Oil Use
LEAP	**-3.769*** **	**-8.469*** **	**-1.231** **	**-5.695*** **	**-1.811*** **	**0.645* **
	(0.922)	**(2.363)**	**(0.534)**	**(1.189)**	**(0.368)**	**(0.343)**
Respondent Age	0.002	0.005	0.041**	-0.017*	0.004	0.015
	(0.018)	(0.011)	(0.019)	(0.010)	(0.017)	(0.023)
R_Gourmantche	0.141	-0.221	-0.351	-1.086	-0.808	-1.159
	(0.794)	(0.405)	(0.450)	(0.834)	(0.549)	(0.902)
R_Peulh	-0.807	-2.784**	-1.209	-0.735	1.725**	0.077
	(0.996)	(0.990)	(2.010)	(0.556)	(0.586)	(0.937)
R_Muslim	-1.223	-0.612	0.65	0.268	-0.615***	-1.281***
	(0.765)	(0.394)	(0.799)	(0.605)	(0.155)	(0.369)
R_Animist	-0.916	-0.015	-0.18	0.005	-0.385	-0.322
	(0.609)	(0.393)	(0.525)	(0.354)	(0.380)	(0.786)
Informal School	-0.19	-2.525**	-1.348	-2.520**	-0.2	-2.025
	(0.342)	(0.995)	(1.158)	(1.136)	(1.555)	(1.913)
Market Distance	0.008	-0.028	0.001	0.007	0.076	-0.021
	(0.047)	(0.045)	(0.095)	(0.049)	(0.047)	(0.017)
Enrollment	-0.005*	-0.004*	-0.006*	-0.003*	0.003	-0.002
	(0.003)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)
Gourmantche (%)	0.001	0	-0.002	0.011*	0.018***	0.012
	(0.007)	(0.009)	(0.008)	(0.007)	(0.004)	(0.009)
Muslim (%)	-0.005	-0.022**	0.002	-0.006	0.009	-0.003
	(0.011)	(0.011)	(0.010)	(0.013)	(0.008)	(0.013)
Animist (%)	0.006	0.001	0.013	0.001	0.021**	-0.005
	(0.005)	(0.004)	(0.016)	(0.005)	(0.009)	(0.011)
Constant	2.565***	2.113***	2.291***	1.890***	1.684***	1.384***
	(0.591)	(0.543)	(0.411)	(0.422)	(0.198)	(0.173)
No. of Schools	204	203	191	203	204	198

[a] Standard errors in parentheses

*, **, and *** represent statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 1.A16: *Cowpeas/Lentils Multivariate Results, Preparation Preferences*[a]

	Time	Effort	Cost	Fuel Use	Water Use	Oil Use
LEAP	**-4.060*** **	**-2.165*** **	**-0.923**	**-3.397*** **	**-0.719**	**-0.342**
	(0.980)	**(0.496)**	**(0.631)**	**(0.958)**	**(0.438)**	**(0.368)**
Respondent Age	0.004	-0.025	-0.011	-0.028*	0.001	-0.001
	(0.041)	(0.026)	(0.025)	(0.016)	(0.020)	(0.021)
R_Gourmantche	-0.499	1.063*	0.301	-0.932	-0.424	1.758**
	(0.543)	(0.638)	(0.418)	(0.618)	(1.136)	(0.637)
R_Peulh	-3.012***	-0.681	-1.753	-3.200**	-0.773	0.42
	(0.900)	(0.698)	(1.468)	(1.056)	(0.686)	(0.953)
R_Muslim	0.357	-0.261	0.962	0.889	0.428	-2.460***
	(0.999)	(0.558)	(0.753)	(1.128)	(0.791)	(0.653)
R_Animist	-0.122	-0.267	-0.352	0.574	0.414	-0.456
	(0.750)	(0.684)	(1.058)	(0.779)	(0.661)	(0.636)
Informal School	-2.541***	2.105	-1.292	-4.336**	-1.162	1.357
	(0.436)	(1.825)	(0.923)	(1.561)	(1.361)	(1.440)
Market Distance	0.008	-0.017	0.049	0.013	0.006	0.013
	(0.041)	(0.028)	(0.059)	(0.051)	(0.056)	(0.026)
Enrollment	-0.003*	-0.002	-0.004*	-0.005*	-0.004	-0.002
	(0.002)	(0.002)	(0.002)	(0.003)	(0.004)	(0.002)
Gourmantche (%)	-0.003	-0.017	-0.013***	-0.005	-0.005	-0.016
	(0.013)	(0.011)	(0.003)	(0.013)	(0.016)	(0.013)
Muslim (%)	0.028**	0.002	-0.002	0.002	0.005	0.013
	(0.009)	(0.013)	(0.012)	(0.012)	(0.009)	(0.013)
Animist (%)	0.021**	0.007*	0.004	-0.004	0.007	0.019**
	(0.007)	(0.004)	(0.013)	(0.013)	(0.010)	(0.007)
Constant	2.366***	1.647***	1.994***	1.954***	1.467***	1.801***
	(0.332)	(0.164)	(0.359)	(0.315)	(0.273)	(0.219)
No. of Schools	201	201	190	201	200	199

[a] Standard errors in parentheses

*, **, and *** represent statistical significance at the 1%, 5%, and 10% levels, respectively.

RETHINKING THE FOOD BASKET:

DYNAMIC HOUSEHOLD CHOICES AND THE USE OF CASH VERSUS FOOD TRANSFER IN NIGER

by

Joanna Upton

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ABSTRACT

Food assistance in the form of cash has increased in recent years, in part due to proven cost and timeliness advantages relative to food transfers. Moreover, economic theory generally predicts that providing greater choice should be a welfare improvement, which is taken to mean that food consumption and dietary diversity outcomes should be the same or better with cash than with food transfers. Empirical investigations have shown, however, that people sometimes prefer to receive food, and that the marginal propensity to consume food is often greater from food than from cash transfers. The mechanisms and rationale behind the conditional superiority of food transfers is not fully understood. This paper presents a model of household decision-making that integrates frictions (transaction costs) and dynamics (consumption smoothing over time through savings and credit) to generate predictions about the use of cash versus food transfers, in light of the infra- or extra- marginality of different components of the food basket. The model predicts that when food is extra-marginal a food transfer can have negative impacts on dietary diversity, relative to a cash transfer, if the extra-marginal food is an inexpensive staple grain, but positive impacts for higher quality goods. These differences are primarily due to the transaction costs involved in selling food that lower the shadow prices of extra-marginal transferred foods. I find support for this model using data from a randomized cash-food pilot project in Eastern Niger.

Keywords: cash transfers; food assistance; development economics; household models; Niger

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1. INTRODUCTION

Food assistance in the form of cash, rather than in kind, has increased rapidly over recent years. This trend is due largely to evidence that providing cash is more cost-effective than providing food, and can also be delivered more rapidly (Lentz et al. 2013). Simple economic theory, following Southworth (1945), also predicts equal or greater potential welfare gains to recipients from receiving cash as opposed to food transfers, assuming functional food markets and negligible price impacts of transfers. According to this longstanding logic, if a food transfer is extra-marginal, such that the food provided is more than the household would otherwise consume, households might be compelled to sell food. These transfers constrain the household's choices, and if resale is subject to transactions costs, then recipients would be made strictly better off if given a cash transfer. If transfers are infra-marginal, such that the food provided is less than households would otherwise consume, there should be no difference between the two transfer types as households are unconstrained by the food transfer and merely substitute in-kind for purchased food. In neither case should households prefer, or achieve better outcomes from, an in-kind transfer.

The puzzle, however, is that many households seem to prefer and fare better with in-kind transfers than with cash transfers. While there is some evidence that cash transfers lead to greater dietary diversity in some settings (Hidrobo et al. 2012, Aker et al. 2013, Schwab 2013), other studies find that in-kind transfers lead to greater dietary diversity and are preferred to cash transfers (Hoddinott et al. 2013). The reasons for such heterogeneity in preferences and outcomes are not well understood.

Further probing into microeconomic theory can help us identify several possible avenues that might explain the puzzle of the conditional superiority of in-kind food transfers toward food

consumption outcomes and/or meeting recipient preferences. First, frictions that the original Southworth model does not capture, such as transaction costs in selling (and/or buying) food may cause in-kind transfers to be worth more to some households (de Janvry et al. 1991). Second, dynamic considerations, such as expectations over future conditions and the desire to smooth consumption over time, may lead a household to spend cash transfers on goods other than food in the interest of longer term welfare (Barrett 2002). Intra-household bargaining may also play a role if different forms of income are controlled by different household members, who have different preferences and propensities to spend on different goods (Haddad et al. 1997).

A randomized cash-food distribution program among rural households in eastern Niger demonstrates an economically intriguing set of outcomes and offers an excellent setting in which to explore these prospective explanations for this puzzle. While the food basket quantity over-all was considered infra-marginal for recipients, the impacts of equivalently-valued cash and food transfers vary in significant ways. Recipients of food transfers consumed more diverse diets and were less likely to resort to food-related coping strategies, particularly in the lean season. Cash transfer recipients purchased more bulk grains, but also spent more on productive purposes (agricultural and livestock expenses) and health (Hoddinott et al. 2013). Respondents also expressed a strong preference for food transfers, with 61% of households expressing a preference to receive only food and only 10% expressing a preference to receive only cash.

Using the Southworth (1945) model as a starting point, I approach this puzzle by developing a model that integrates key frictions and dynamics in order to understand the mechanisms behind the conditional superiority of food over cash transfers for dietary diversity outcomes among survey respondents in rural Niger. I explore in particular the question of infra- versus extra-marginality and its importance for preferences and outcomes. Past studies focus on

the infra- or extra-marginality of a food basket as a whole. It is possible, however, that the infra- or extra-marginality of individual food items, not the overall food basket, most influence food consumption outcomes and determine the relative advantage of food over cash. Cunha (2014) recently examined a randomized food-cash transfer program in Mexico, involving ten different food commodities received, and found that the extra-marginality of individual components of the food basket leads to minor distortions, but recipients tended to substitute away from similar non-transferred items. I here take an approach that focuses explicitly on dietary diversity, and on the possible differential impacts on dietary diversity of providing inexpensive grains versus higher quality foods in light of the infra- or extra-marginality of each. Drawing on established literature, the model I develop integrates preferences over both staple grains and dietary diversity, a transactions cost for the sale of food, and an inter-temporal asset and borrowing constraint.

A few clear predictions emerge from this model. In keeping with Southworth, providing a transfer of either the basic staple or the high quality food should have the same effect on dietary diversity as providing cash if the transfers are infra-marginal. The extra-marginality of one or the other good, however, has different implications, since the transaction cost involved in selling unwanted food to meet other needs lowers its shadow price, leading households to substitute toward consumption of that commodity. While households may, as in the Mexico case (Cunha 2014), substitute away from non-transferred but similar commodities, this model predicts that the substitution between commodities based on their relative status could lead to differences in over-all dietary diversity outcomes. If the staple grain is extra-marginal, providing it will have a negative impact on dietary diversity relative to cash, whereas if the higher quality food is extra-marginal, providing it will have a positive impact on dietary diversity relative to cash. The model predicts additionally that cash recipients would be likely to purchase more non-food items than

food recipients when the foods are extra-marginal. There are additional implications for other behaviors, primarily informal credit and gift exchange.[1]

I test these predictions using a rich data set of household surveys collected following a randomized cash/food intervention in Eastern Niger. This context presents an ideal opportunity in a number of ways. First, the population is extremely poor and food insecure, and suffers high chronic rates of undernourishment and malnutrition. A largely politically driven transition to cash-based programming is also actively underway, to some degree globally but particularly in Niger. Given the superior performance of food to cash toward dietary diversity in this setting (Hoddinott et al. 2013), understanding what drives the impacts of these different transfer types on dietary diversity is of utmost importance.

The context and program design also offer a few unique opportunities for empirical investigation. The households surveyed are both agricultural and pastoral, providing an opportunity to understand food insecurity and household decision-making under different livelihood conditions. The surveys take place in turn in two rounds, one during the height of the lean season and the other at the beginning of the harvest, allowing me to examine the impacts of cash and food under different conditions of household production and relative scarcity of cash versus food. Finally, the choice of cash versus food transfers is randomized, enhancing the ability to test the model by identifying the relative impacts of these two transfer types.

On examination of the data, I find firstly some notable consumption patterns in the population at large, which indicate a high degree of extra-marginality less for food generally than for the specific commodities transferred. While the food transfer has a positive impact on dietary diversity overall, as the model predicts, when we divide the food transfer into values of its

[1] The asset and borrowing constraint leads to several key predictions related to the use of cash versus food transfers. These are taken up and tested in a companion paper, Upton et al. 2014.

component parts we see that globally the grain commodity has a negative impact while the legume commodity has a positive impact relative to cash. Since the grain (legume) should have either a negative (positive) impact relative to cash or be the same, depending on whether it is extra-marginal or infra-marginal, these results reflect the extra-marginal nature of the transferred goods. I then develop methods for examining how the impacts differ based on the consumption status of each good, using first the status of each transferred good for food recipients and then a propensity score method for the propensity of each good to be extra-marginal among both cash and food recipients. I find further support for the model's predictions related to dietary diversity. I do not find support, however, for its predictions regarding changes in non-food expenditures.

These findings provide both theoretical and policy relevant contributions. I extend long-standing theory on food assistance impacts using the structure and components of well-established nonseparable dynamic household models to shed more theoretical light on empirical findings that reject the longstanding Southworth hypotheses. The results can in turn inform the design, and targeting, of food assistance programs, particularly to meet dietary diversity objectives. We learn that the commodity choice matters, and that providing extra-marginal staple grains can be less desirable than providing a higher quality food, or cash, if the primary objective is improvements in dietary diversity.

This paper proceeds as follows. The next section reviews the literature on food versus in-kind transfers and the use of nonseparable household models to examine household behavior and dynamic consumption decisions, and then provides some context for the empirical setting examined. Section III then presents the theoretical model and its predictions. Section IV describes the data, empirical strategy, and tests of hypotheses, and Section V the results in light

of the model's predictions. Section VI concludes and draws out implications for policy and for future research.

2. LITERATURE AND BACKGROUND

a. Food assistance and household models

The core theory behind the literature on cash versus in-kind transfers dates from Southworth (1945), who provided a simple framework for thinking about the relative impact of these transfers on the budget set and on household utility. If household utility is defined over food and all other goods, a food transfer effectively creates a kink in the household's budget constraint, as show in Figure 2.1, with the original budget set of the household given by line AB, the budget set after a cash transfer represented by line CD, and the budget set after a food transfer by piecewise linear frontier AFD. If the in-kind transfer can be re-sold, it will be subject to transaction costs, achieving a contracted possibilities set relative to a cash transfer, reflected in the piecewise linear frontier EFD in Figure 2.1. If a transfer is in the form of food and extra-marginal, providing more food than the household would otherwise prefer to consume, then the household consumes on the upper portion of line AB in Figure 2.1. In this case the household will consume at the kink in the budget set and/or be compelled to sell food to meet other needs and reach slightly higher utility. The food transfer constrains household choice; it would be made strictly better off by a cash transfer. If the transfer is infra-marginal, providing less food than the household would otherwise consume, then the household consumes on the lower portion of line AB. In this case, the household is unconstrained by the food transfer, and hence food or cash transfer should yield the same change in utility and the impacts should be the same. A testable prediction of the Southworth model is that households should in no case prefer a food transfer relative to a cash transfer of equivalent value. A second testable hypothesis is that the marginal

propensity to consume (MPC) food is the same for cash and in-kind transfers for those for whom the food transfer was infra-marginal.

Figure 2.1: The Southworth Theory on Food Versus In-Kind Transfers

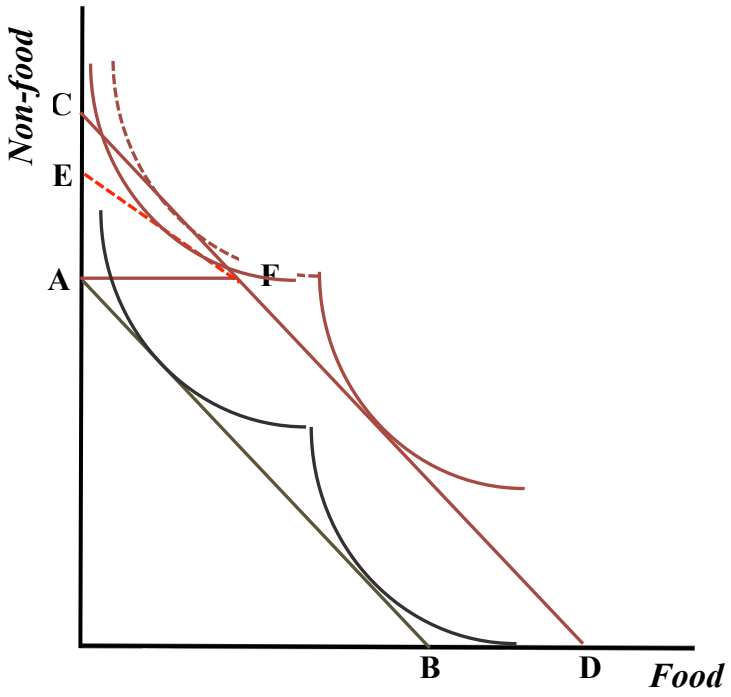


Figure 2.1: Analytics of cash versus food transfers. Line AB represents the household's initial budget line, with line CD representing the budget line when provided a cash transfer and line AFD representing the budget when provided with a food transfer (EFD in the case of food sales and transaction costs).

Given that the most common goal of food assistance programming is to increase and/or improve food consumption, a key focus of the empirical literature on food assistance and other transfer programs has been to test these hypotheses by examining the additionality of different forms of transfer, or a household's marginal propensity to consume food (MPC) when given food in-kind versus food stamps, vouchers, or cash (Barrett 2002).

Many empirical investigations have rejected the core Southworth hypotheses, finding that there are differences in consumption from cash versus in-kind or voucher (including food stamp) income, even when in-kind transfers are infra-marginal. A review of 17 studies in the United

States found that the MPC for food out of food stamps was three to ten times larger than the MPC of cash income. While this could be consistent with the theory for households constrained by extra-marginal food transfers, it is inconsistent for unconstrained households (who spend both income and food stamps on food), and yet remains true even in for infra-marginal cases (Fraker 1990). This is the essence of what is called the "cash out" puzzle, or idea that substituting cash (or earned income) for food stamps appears to reduce food purchases even though the theory predicts it should not (Breunig and Dasgupta 2005, Shapiro 2005).

The empirical literature also finds that preferences for cash and/or food are not necessarily consistent with the core theory. Some studies have examined stated or revealed preferences over cash and food transfers directly and have found that, as theory would predict, recipients usually prefer greater flexibility in the use of transfers, frequently preferring cash (Michelson et al. 2012). However, this is by no means universally the case; recipients often express preferences for food, and these preferences can depend on several factors (Upton and Lentz 2011).

Several reasons have been posited for the rejection of the core Southworth hypotheses (Barrett 2002). The first is that the Southworth model ignores the possibility of frictions in the buying and selling of food that may affect the trade-offs households face in different ways. For example, the price for which a household can sell a food transfer once received is likely less than the price for which it can buy that food given the receipt of cash. This creates a 'price band', the size of which (and hence likelihood of selling food) can vary from household to household (de Janvry et al. 1991). This transaction cost may have fixed and/or variable components that can also vary between households. This could make the kink in the budget set even more pronounced and potentially create further behavioral distortions (Key et al. 2000). A combination of

household-specific transaction costs and differential household-level valuation of food can make market participation more or less costly for certain households, leading to 'missing' markets for certain goods for certain households (de Janvry et al. 1991). Transactions costs can invalidate the assumed fungibility of food and/or change the costs entailed in receiving cash, somewhat altering the core predictions of the model.

A second key omission in the Southworth theory is that it is static, whereas the household food security problem is inherently dynamic. Inter-temporal relationships between behavior in the current period and food security outcomes in a later period could affect today's demand for food, leading to behaviors that may violate the static model. Preferences for food may for example be explained by expectations over prices. The burden of food price increases falls on recipients of cash transfers, leading some household to prefer food transfers in order to have more confidence over its real value over time (Devereux et al. 2005; Gilligan et al. 2008).

Another dynamic component is consumption smoothing over time, via savings, investment, formal or informal credit, and/or other social insurance mechanisms like reciprocal gift exchange. Households may choose to save money, pay debts, or give gifts in certain periods to increase their access to resources (including through borrowing money or receiving gifts) in other periods when resources may be more scarce. This dynamic has been integrated into a number of nonseparable household models (Deaton 1991; Besley 1995; Behrman et al.1997).

A third key area of analysis surrounds the role of intra-household bargaining. The presence of intra-household bargaining dynamics violates the assumptions of the unitary household model, meaning that different members have different preferences and/or resources between household members are not pooled. This can lead to different, and by definition less optimal, outcomes than would be predicted for a single decision-maker (Haddad et al. 1997;

Udry 1996). There is some evidence that these factors play a role in food assistance outcomes. A transfer may be infra-marginal for the household as a unit but extra-marginal for certain household members, which in the presence of bargaining and differential resource control could lead to different impacts with different transfer types. Breunig and Dasgupta (2005) find that the discrepancy between the MPC of food stamps and cash income no longer exists when one examines only single-adult households, suggesting that intra-household bargaining plays a significant role in consumption choices. Villa et al. (2012) show that intra-household bargaining may play a role in, but does not fully explain, the differential impacts of income by source on household food diversity.

There is additional, although primarily anecdotal, evidence of intra-household bargaining dimensions to food assistance preferences in developing countries, often related only to expressed preference for the form of transfer as opposed to measured outcomes. Women are more likely to express preferences for food over cash than are men, and it has been postulated that this is primarily because women are often more responsible for care-giving and hence more likely to control the use of food than cash (Devereux et al. 2005; Adams and Winahu 2006; Khogali and Takhar 2001). In one case, women explicitly expressed a preference for cash if their husbands were away from the home, and for food otherwise (Walsh 1998).

Our understanding is incomplete regarding which of these explanations —frictions, dynamic effects, or intra-household bargaining—best accounts for widespread empirical findings on differential outcomes of food assistance depending on the form of transfer delivered (Barrett 2002). This is particularly true in the case of cash versus food transfers in poor, rural, developing country settings, where it is arguably also most important to understand what drives differential impacts in order to better design and target interventions.

b. Niger, and the intervention in Zinder

Several features of the focus region and intervention make it apt for this analysis. The Mirriah department of Zinder, Eastern Niger, is culturally dominated by the Hausa, an ethnic group that traditionally relies on crop agriculture for its livelihood.[2] While 64% of all villages in the sample are majority Hausa, the Hausa cohabitate this region with several smaller ethnic groups, including the agro-pastoral Kanuri and the pastoral Fulani, Touareg, and Toubou. The second largest group this region—although a 4% minority nationally—are the Kanuri; 22.5% of all sample villages are Kanuri majority. The remaining groups are the traditionally nomadic pastoralist Touareg (majority in 7.5% of villages), Peulh (majority in 6% of villages) and Toubou (majority in no villages). Villagers throughout the region are agro-pastoralists, mixing crop agriculture with the raising of livestock (primarily small ruminants, such as goats and sheep). Communes are broadly classified however as "agricultural" or "agro-pastoral"; those classified as "agro-pastoral" make up 42% of all villages in the evaluation. This cultural composition allows for analysis across livelihood types.

The region suffers from food insecurity along several of its dimensions. Zinder is well off in terms of food production relative to most of Niger, but all the same is characterized by challenging growing conditions. Most land in the sample villages is allocated to food crops (on average 60% to millet and 17% to sorghum), with the remainder to higher-value crops used primarily as cash crops that can also be consumed as necessary (14% cowpeas, and only 5% peanuts). Yields are typically very low, and highly variable from one year to the next; and climate change and desertification are predicted to pose further threats to yields in coming years (Ben Mohamed et al. 2002). Production capacity is further strained by negligible access to

[2] The administrative divisions of Niger are first regions (which include Zinder and 6 others), then departments (within Zinder, including Mirriah and 4 others), then *communes* and villages.

financing. Whether or not annual production suffices for home consumption needs, households commonly sell their grain immediately after the harvest when prices are lowest and subsequently buy grain later at higher prices to meet food needs (Arnould 1985; Miles 1994).[3] There is thus a strong seasonal dimension to households' food availability and access conditions, and in particular pronounced seasonal price pattern due to seasonal flow reversals. This is to say that households switch between being net sellers of food at harvest to net buyers throughout the lean season (Barrett 1996). Food availability is hence highest (and prices lowest) right after the harvest, which is typically in September-October, and then decreasing (and prices increasing) throughout the year. The peak of the lean season, when household stocks are diminished and prices highest, falls in the months prior to harvest, July-August (FEWS 2014).

Availability, however, is less of a problem than access, due primarily to extreme poverty. Zinder is a key commercial hub, in part due to its close proximity (and close cultural ties) to Nigeria, making food imports readily available when needed (Eilerts 2006). Yet the region has frequently been among the hardest hit by food crises, and chronically suffers some of the nation's (and world's) highest rates of malnutrition (Grobler-Tanner 2006). The 2005 emergency mortality rates were higher in Zinder than in any other region, and an estimated 65% of the population had to resort to 'irreversible' coping strategies such as selling large livestock or production tools (Reza et al. 2008). A 2010 survey found that the global acute malnutrition rate in Zinder was 18%; the emergency threshold is 15% and rates throughout most of the country did not reach that threshold (WFP 2011a).

Niger has been a recipient of international assistance, typically in-kind food aid shipments, for decades (WFP 2011b). However, in part due to Government of Niger (GoN) strategy and in part due to other changing donor practices (Barrett et al. 2012), there is a current

[3] See Barrett (2007) and Stephens and Barrett (2010) for an investigation of this sell-low, buy-high phenomenon.

transition underway toward cash-based assistance (WFP 2010). Both the World Food Programme (WFP) and the World Bank (WB) are scaling up their use of cash programming. There are still, however, many questions to be addressed regarding the impacts of cash transfers in Niger, as well as which form of transfer is preferred by recipients and why. Households in the sample expressed overwhelming preferences for food versus cash transfers, with 73% (50%) of food (cash) recipients preferring to receive only food, 24% (34%) preferring a mix of food and cash, and only 3% (16%) preferring to receive only cash.

In addition, and potentially related to these preferences, food transfers had larger impacts on dietary diversity than cash transfers, by a difference of 10-12% (Hoddinott et al. 2013). Improving dietary diversity is often the primary goal of food assistance programs. Dietary diversity, measured by dietary diversity scores, has been found to be useful indicators of micronutrient intake in several African contexts, especially for children (Steyn et al. 2006; Moursi et al. 2008). Intake of micronutrients is of fundamental importance in turn for not only long-term health but physical and cognitive ability, and economic well-being more generally (Hetzel 1990; WHO 2009; Schofield 2014; Chen and Zhou 2007; Victoria et al. 2008). These linkages in fact make micronutrient deficiency a plausible driver of poverty and poverty traps (Barrett 2010; Barrett and Carter 2013). Given the extraordinary, and chronic, prevalence of malnutrition in Niger, improving dietary diversity in this context is of utmost importance.

3. MODEL AND PREDICTIONS

a. The Model

As Barrett (2002) argues, a useful model of food insecurity must recognize key trade-offs between food and other essential needs, such as education, care-giving, and health. It must take into account the desire to meet both today's and tomorrow's needs, i.e., to smooth consumption over time, and in turn integrate an understanding of risk and uncertainty, in food production, prices, transfers, and effectively all 'inputs' into the household's food availability function. In this section, I develop a model of household-level utility and decision-making that integrates these key components. The model is based as well on several key assumptions that are pertinent for poor, rural households like those in Eastern Niger, order to focus on a few key components of a household's decision-making process around maximizing its food security.

I assume a unitary household model, which is to say that all decision-makers have the same preferences (over the consumption of food and other goods, as well as over debt repayment/initiation and asset investment), and that all resources are pooled.[4] The decision process is dynamic, such that today's choices are affected by expectations over future income (and hence future prices).

We have hence:

$$\max_{c_{1t},c_{2t},x_t,l_l,l_q,b_t,h_t a_t} E \sum_{t=0}^{\infty} \beta^t u(c_{1t}, c_{2t}, x_t, l_{lt} | Z_t) \tag{1}$$

Where the household derives utility over two food goods – c_{1t}, a low-nutrient staple grain (e.g., millet), which is also the least expensive food available in the market, and c_{2t}, a composite of other foods, which we can think of as representing dietary diversity – as well as other market

[4] In the results (Section VI), I test the assumption of the unitary model by checking the results for only single-adult households, following Breunig and Dasgupta (2005).

goods, x, and leisure, l_l. Z_t is a vector of household (and/or community)-specific characteristics, and $1 \geq \beta > 0$ is a time discount preference parameter. The utility function satisfies the usual concavity, Inada and local non-satiation assumptions.

Each household produces just one of these consumption goods, c_{1t}. We assume also, in keeping with what is largely the case in Eastern Niger, that wage labor and other agricultural inputs are not available, so households use only home-labor (l_{qt}) for production, along with a fixed initial amount of land and productive capital, K. The production technology is hence:

$$q_{1t} = g(l_{qt}; K) \tag{2}$$

Income for purchases comes from sales of the produced good (q_{1t}), transfers in the form of c_{1t} (T_{1t}), c_{2t} (T_{2t}), or cash (T_{ct}), and current asset stock (A_t) less each period's net savings or asset investment (s_t). While food transfers are denoted separately for c_{1t} and c_{2t}, the transfers are always received together, as an alternative to a cash transfer. Hence, either T_{1t}, $T_{2t} > 0$ and $T_{ct} = 0$ or T_{1t}, $T_{2t} = 0$ and $T_{ct} > 0$. This gives us the budget constraint:

$$p_{1t}^* c_{1t} + p_{2t}^* c_{2t} + p_{xt} x_t + s_t \leq p_{1t}^*(q_{1t} + T_{1t}) + p_{2t}^* T_{2t} + T_{ct} + A_t \tag{3}$$

However, 'net savings' in this case takes into account other consumption smoothing behavior, including loans and inter-household transfers. Following Behrman et al. (1997), we assume these different forms of consumption smoothing behavior are substitutes. Net savings is hence composed as follows:

$$s_t = h_t - b_t + a_t \tag{4}$$

where h_t is debt repayment and/or gifts given to other households, b_t is debts taken out and/or gifts received from other households, and a_t is other forms of formal and informal savings including investment in livestock and other assets.

Integrating this into (3) yields:

$$p_{1t}^{*}c_{1t} + p_{2t}^{*}c_{2t} + p_{xt}x_t + a_t \leq p_{1t}^{*}(q_{1t} + T_{1t}) + p_{2t}^{*}T_{2t} + T_{ct} + b_t - h_t + A_t \tag{5}$$

The price (per calorie or kilogram) of the high quality food, c_{2t}, is always greater than the price of the cheap grain, c_{1t}, i.e., $p_{1t} < p_{2t}$.[5] These prices are denoted in the budget constraint as p_{1t}* and p_{2t}*, which are price functions that reflect a price band due to transaction costs (as per de Janvry et al. 1991).[6] Households can purchase goods at the market price, but are subject to (household-specific, variable) transaction costs when they sell foods. These prices are hence defined by the function:

$$\begin{aligned} p_{jt}^{*} = p_{jt} \; if \; c_{jt} \geq q_{jt} + T_{jt} \\ p_{jt} - \theta_t \; if \; c_{jt} < \; q_{jt} + T_{jt} \;\; for \; j = 1,2 \end{aligned} \tag{6}$$

This one-sided transaction cost reflects a number of realistic conditions faced by the survey households. First, markets are generally in close proximity, and are culturally-embedded events in which households have numerous reasons to participate, thus the marginal cost of travel to market associated with any given purchase of food is negligible. Second, merchants present at markets will sell goods in all periods, but only purchase goods in certain periods, and/or pay a lower price to purchase goods than the retail price of selling them, hence θ_t represents the margin

[5] Note that, according to nutritiondata.self.com, a kilogram of dry millet has 3,780 kcals, versus dry cowpeas at 3.430 kcals (mature seeds, raw). Given the price ratios, using price per kilogram roughly translates to the relative ratios of price per calorie.

[6] Key, Sadoulet, and de Janvry (2000) use a transaction cost with both a fixed and a variable component. Adding a fixed cost to our model would mean subtracting a constant term from the right hand side of (6) which would be multiplied by one if the household sells, zero otherwise. This has no meaningful impact on our core results so we assume only fixed costs, in the interest of clarity and parsimony.

by which the selling price for households is lower than their buying price. Finally, in areas where markets are further and/or not regularly frequented by households, itinerant merchants travel from village to village (and even household to household) to sell –but not to purchase – key staples, in which case θ_t for such households would be even larger.

The state variable, asset stock (A_t), evolves according to:

$$A_{t+1} = (1 + r_t)(\delta A_t + s_t) \tag{7}$$

where r_t is the interest rate, δ is a depreciation rate, s_t is savings, and b_t and h_t are borrowing and repayment, respectively, in time t. The amount that an individual can borrow in any given period is bounded above by:

$$b_t \leq B^{max}(A_t, H(h_t)) \tag{8}$$

where $H(h_t)$ is a prior debt repayment history function. The household can borrow more in each period the greater the value of either A_t, reflecting stock of collateral, or of $H_t(h)$, its past repayments, which is strictly increasing in each period's repayments:

$$\frac{\partial B^{max}}{\partial A_t}, \frac{\partial B^{max}}{\partial H(h_t)}, \frac{\partial H(h_t)}{\partial h_t} > 0 \; \forall \; t \tag{9}$$

This reflects that much credit is informal, hence borrowing limits are related to creditors' willingness to lend, as a function of a prospective borrower's current collateral and its repayment reliability, regardless of the household's overall debt stock, which in most cases is not knowable to the creditor. Similarly, one's likelihood of receiving gifts increases as a function of prior generosity. The implications of the borrowing constraint for the use of cash versus food transfers are taken up in more detail in a companion paper (Upton et al. 2014).

Finally, the household faces a time constraint:

$$l_{lt} + l_{qt} = L_t \tag{10}$$

I solve the household's constrained maximization problem by recovering the first order necessary conditions (FONCs) from the discrete-time present value Hamiltonian. Assuming that the utility function has the necessary properties of concavity and local non-satiation, all constraints bind with equality. With some straightforward substitution and simplification, the Langrangian becomes:

$$\begin{aligned} L = E\sum_{t=0}^{\infty} \beta^t [u(c_{1t}, c_{2t}, x_t, l_l | Z_t) + \beta\lambda_{t+1}[p_{1t}^*(g(L_t - l_{lt}) + T_{1t} - c_{1t}) + p_{2t}^*(T_{2t} - c_{2t}) - p_{xt} \\ + T_{ct} + b_t - h_t + A_t - s_t] \\ - \beta\mu_{t+1}[(1 + r_t)(\delta A_t + h_t - b_t + a_t) - A_{t+1}] \end{aligned} \tag{11}$$

Denoting the partial derivative of a function "f" with respect to variable "y" as $f_y(\bullet)$, the FONCs over consumption goods imply:

$$\frac{\partial L}{\partial c_{1t}} = E[\partial u_{c1t}(\bullet)] - \beta\lambda_{t+1}E[p_{1t}^*] = 0 \tag{12}$$

$$\frac{\partial L}{\partial c_{2t}} = E[\partial u_{c2t}(\bullet)] - \beta\lambda_{t+1}E[p_{2t}^*] = 0 \tag{13}$$

$$\frac{\partial L}{\partial x_t} = E[\partial u_x(\bullet)] - \beta\lambda_{t+1}E[p_t^x] = 0 \tag{14}$$

These imply directly that:

$$\beta\lambda_{t+1} = \frac{E[\partial u_{c1t}(\bullet)]}{E[p_{1t}^*]} = \frac{E[\partial u_{c2t}(\bullet)]}{E[p_{2t}^*]} = \frac{E[\partial u_{xt}(\bullet)]}{E[p_{xt}^*]} \tag{15}$$

Households equate the marginal utilities in consumption of each good, as weighted by within-period prices.

These optima imply reduced form expressions for optimal choice functions, for dietary diversity and purchases of non-food goods, of:

$$c_{2t}^* = c_2(p_{1t}, E[p_{1,t+1}], p_{2t}, E[p_{2,t+1}], p_{xt}, E[p_{x,t+1}], r_t, \theta_t, T_1, T_2, T_c, K, A_t, Z_t) \tag{16}$$

$$x_t^* = c_2(p_{1t}, E[p_{1,t+1}], p_{2t}, E[p_{2,t+1}], p_{xt}, E[p_{x,t+1}], r_t, \theta_t, T_1, T_2, T_c, K, A_t, Z_t) \tag{17}$$

b. Predictions: dietary diversity

In relation to the model, the primary outcome we are interested in is the change in c_2*, representing dietary diversity, given the receipt of transfers in different forms, T_{1t}, T_{2t}, *or* T_{ct}; and in particular the difference in impact of receiving a food transfer of T_{1t} and T_{2t} versus a cash transfer of T_{ct}. We can anticipate different responses to receipt of food transfers based on whether or not the transfer of each commodity is infra-marginal, wherein $c_{jt}* \geq q_{jt}* + T_{jt}$, or extra-marginal, where $c_{jt}* \leq q_{jt}* + T_{jt}$.

The first and most pertinent hypotheses that emerge are driven by the transaction cost, which effectively lowers the shadow price of a commodity for a given household if the transfer of that commodity is extra-marginal. Given the lower shadow price, the household will substitute *toward* consumption of the extra-marginal commodity relative to others. In terms of dietary diversity impacts relative to cash, this leads to three core hypotheses:

> **H1:** If a transfer T_1, the cheapest staple grain, is extra-marginal, households will face a lower shadow price of c_1, and hence will substitute toward consumption of c_1 relative to c_2, or more diverse foods. This means that transfers of T_1 will have a *negative* impact on dietary diversity relative to cash transfers (T_c) for households for whom the transfer is extra-marginal.

> **H2:** If a transfer T_2, a higher-quality (and potentially more scarcely consumed) food, is extra-marginal, households will face a relatively lower shadow-price of c_2, and hence will substitute toward consumption of c_2 away from cheaper staple grains. This means that

transfers of T_2 will have a *positive* impact on dietary diversity relative to cash transfers (T_c) for households for whom the transfer is extra-marginal.

H3: If a transfer of either T_1 or T_2 is infra-marginal, the household will face normal market prices with respect to that good. The dietary diversity impact of providing that good will be the *same* as that of providing cash (T_c).

One commodity can, however, be infra-marginal while the other is extra-marginal. There are therefore four potential cases to consider for recipients of food transfers, which lead to a few other predictions and/or nuances in these hypotheses.

Case 1: Both transfers infra-marginal

If both transfers are infra-marginal this implies that:

$$c_{1t}^* \geq q_{1t} + T_{1t} \quad => \quad p_{1t}^* = p_{1t}$$

and

$$c_{2t}^* \geq T_{2t} \quad => \quad p_{2t}^* = p_{2t}$$

In this case only H3 is at play, so we expect that the dietary diversity impacts of a food transfer (T_1 and/or T_2) would be the same for these households as for a cash transfer. Given that $p_{2t} > p_{1t}$, it would buy additional c_1 unless its marginal utility in consumption of c_2 is enough higher than that for c_1 to balance out the difference in prices. If the marginal utility of c_2 is indeed higher, it may purchase some c_2 as well, in order to equate the conditions stated in (15), but this decision would be no different for food recipients than for cash recipients.

Case 2: Both transfers extra-marginal

If both transfers are extra-marginal this implies that:

$$c_{1t}^* < q_{1t} + T_{1t} \quad => \quad p_{1t}^* = p_{1t} - \theta_t$$

and

$$c_{2t}^* < T_{2t} \quad => \quad p_{2t}^* = p_{2t} - \theta_t$$

In this case, the shadow prices of both commodities are lower than they would otherwise be—and lower hence for food recipients than for cash recipients. Per H1 and H2, the transfer of T_1 should decrease dietary diversity and the transfer of T_2 should increase dietary diversity (relative to the cash transfer of T_c). The net impact of the food transfer versus cash transfer on dietary diversity is hence ambiguous and depends on a household's relative marginal utilities. In so far as food is excess, a household may choose to sell the commodity with the higher shadow price and substitute toward the cheaper commodity, which would lead to a net negative impact on dietary diversity. However, if the marginal utility of c_2 is higher, the household may consume more c_2, and this would not be the case.

In so far as the food is in excess and the household sells the food good with the highest shadow price (i.e., max$\{p_1\text{-}\theta, p_2\text{-}\theta\}$) in order to purchase x, the transaction cost involved in selling food leads to a corollary hypotheses:

> **H4:** Among households for whom either commodity—but especially both commodities—is extra-marginal, those who receive cash will spend more on non-food needs (x) than food recipients.

Case 3: Good c_1 extra-marginal, good c_2 infra-marginal

This case means that:

$$c_{1t}^* < q_{1t} + T_{1t} \quad => \quad p_{1t}^* = p_{1t} - \theta_t$$

and

$$c_{2t}^* \geq T_{2t} \quad => \quad p_{2t}^* = p_{2t}$$

In this case the household's price of c_2 is greater than its price for c_1, as p_2 is not only initially greater but also not subject to a (negative) transaction cost adjustment. The prediction in this case is merely consistent with H1 and H3, which is to say we expect the dietary diversity impact of T_1

to be lower than that of cash, while provision of T_2 should be the same. Hence the over-all dietary diversity impact of food relative to cash should be *negative.*

Case 4: Good c_1 infra-marginal, good c_2 extra-marginal

This case means that:

$$c_{1t}^* \geq q_{1t} + T_{1t} \quad => \quad p_{1t}^* = p_{1t}$$

and

$$c_{2t}^* < T_{2t} \quad => \quad p_{2t}^* = p_{2t} - \theta_t$$

In this case, consistent with H2, the household would face a lower relative price of c_2 and hence would substitute toward it relative to c_1, leading to a positive dietary diversity impact for transfers of T_2 relative to cash (T_c). Consistent with H3, the impact of T_1 should be the same as that of cash, meaning that food recipients over all experience greater dietary diversity.

Finally, the main driver in each of these is the transaction cost involved in selling an extra-marginal food transfer. This leads to one final hypothesis, that serves as a corollary to H1, H2, and H4 above:

> **H5:** The degree to which the extra-marginality of T_1 (T_2) has a negative (positive) impact on dietary diversity, and the degree to which cash recipients spend more than food recipients on non-food needs when commodities are extra-marginal, will be increasing in the transaction costs associated with selling food.

In summary, the core predictions of this model are that the impact on dietary diversity of providing food in any form is the same as that of providing cash for households for whom that food good in infra-marginal. When a food good is extra-marginal for any given household, however, the impact on dietary diversity relative to cash will be *negative* for a staple grain that the household would otherwise consume (that is likely extra-marginal primarily because it is otherwise produced or acquired), but *positive* for a higher quality good (that is likely extra-

marginal because the household may not otherwise be able to afford it). The extra-marginality of food transfers will also lead to higher purchases of non-food goods for cash recipients, particularly when both food goods are extra-marginal. All of these differential impacts are increasing with the transaction cost associated with selling food.

4. DATA AND ESTIMATION

a. Experimental design and balance

The intervention that serves as the focus of this study was undertaken in response to a Government of Niger (GoN) needs assessment in 2010 that identified 13 sub-districts (communes) of Mirriah as the most vulnerable to malnutrition. This pilot was implemented by the WFP in partnership with the International Food Policy Research Institute (IFPRI). In light of the GoN strategy to promote Cash for Work (CFW) and Food for Work (FFW) programs, the first stage of the project provided transfers conditional on work, whereas the second stage provided unconditional transfers to a subset of recipients (the most vulnerable half within each village).

The first and most important feature of these data is that the form of transfer was randomized. Within the selected sub-districts there were approximately 112 villages (10,900 households). Of these, 79 (6,800 households) were suitable for randomization.[7] Worksites for the first phase of the project were designated by district, and randomization had to occur at the worksite level as it was not feasible to provide different forms of transfer to participants at the same worksite. Randomization was done after first stratifying by livelihood zone as locally defined, agricultural or agro-pastoral. This led to 52 worksites, 29 agricultural and 23 agro-pastoral. While all households could participate in the public works from April to June, the most

[7] Cash transfers were deemed by the WFP to be inappropriate in several villages, and a few others refused to participate in the evaluation. These villages were retained in the program but dropped from the evaluation.

vulnerable half in each village (2,300 households) were selected to receive unconditional transfers—of the same transfer type—from July through September.[8] The first survey round was undertaken after the public works phase in early July, at the height of the lean season with food prices still rising, with a more extensive survey and food consumption model undertaken only with those pre-selected for unconditional transfers. The second survey round followed, with only the unconditional transfer recipients, at the conclusion of the second phase in early October, as the harvest season was underway and food prices were stable or falling. Of the 2268 unconditional transfer recipients interviewed in the first round, we were able to follow up with 2209, an attrition rate of only 2.6%.[9]

Table 2.1 shows un-weighted descriptive statistics for important pre-intervention household and village-level characteristics, first at the household level and then clustered at the randomization unit level.[10] At the clustered level there are no significant differences between cash and food recipients, indicating that the randomization was successfully implemented. At the household level, however, there are a few characteristics that are significantly different. These differences appear to be driven by a chance draw of more Hausa-dominant worksites for food transfers in the randomization, as the primary significant differences are ethnicity and the nature of assets, which would be highly related to each other. That a few characteristics do not balance is not striking, however, as given the sample size and number of covariates we would expect that a subset of characteristic would not balance between groups (Bruhn and McKenzie 2009). The

[8] Participation in public works was virtually 100%; households without labor capacity received unconditional transfers.
[9] The most common causes for attrition were dissolution of households due to marriage or migration, and fictitious households, who claimed transfers in the first round but were discovered to be sub-sets of other households (providing false information) on follow-up. There is little reason to believe that this attrition would lead to bias; analysis of attritors and non-attritors showed only minor significant differences between groups.
[10] Including sampling weights has no significant effect on the results.

primary characteristics that do not balance at the household level, including ethnicity, assets, and some access measures, are controlled for in the analysis.[11]

Table 2.1: T-tests on household and Village characteristics at baseline, by transfer type

	Household Level			Clustered at Worksite Level		
	CASH	FOOD	T-test p-value	CASH	FOOD	T-test p-value
Age of HH Head	48.37	48.47	0.878	47.61	47.87	0.856
Female HH Head	0.22	0.24	0.128	0.23	0.21	0.572
Heads with formal education	0.07	0.07	0.67	0.06	0.06	0.798
Household Size	7.47	7.23	0.081	7.41	7.17	0.447
Polygamous HH	0.15	0.17	0.116	0.15	0.17	0.276
Member of Ethnic Majority	0.91	0.89	0.06	0.91	0.87	0.386
Hausa	0.57	0.66	0	0.54	0.65	0.364
Asset Score (PCA), Baseline	-0.19	0.24	0	-0.15	0.22	0.123
Tropical Livestock Units, Baseline	0.83	1	0.078	1.07	1.17	0.781
Distance from village center (km)	0.45	0.32	0.001	0.37	0.37	0.987
Pastoral	0.42	0.38	0.047	0.44	0.44	0.975
Market in village	0.13	0.12	0.532	0.11	0.09	0.766
Time to reach market, if not in village (min)	56.88	65.42	0	56.16	68.84	0.351
Cereal bank in or near village	0.78	0.6	0	0.79	0.52	0.023
Distance to main road (km)	48	48	0.862	58	53	0.644
Zinder-Village Center distance (km)	58	52	0	58	53	0.395
Cell Phone Network in Village	0.95	0.93	0.082	0.87	0.96	0.24
Observations	1198	1070		27	25	

[11] See Hoddinott et al. 2013 for more detail on the experimental design and balance.

b. Variable construction

i. Outcome variables

The primary outcome of interest is dietary diversity, which we measure using a 7-day recall module on food consumption with 25 food items.[12] From this we first divide foods into appropriate food groups, and then construct the food consumption score (FCS), which is a weighted sum of the number of days that each of eight food groups is consumed, weighted as a function of dietary importance. The FCS as constructed can range between 0 and 112, and the WFP considers an FCS of 35 to be "acceptable" (Weismann et al. 2009). The FCS is very commonly used by the WFP and others to measure food security impacts, and has been found to be a good indicator of dietary diversity and micronutrient intake in several developing countries (Kennedy 2009). Purchases of non-food items were solicited directly across a relatively comprehensive list of items and categories, and were then averaged for each month in order to construct a measure of total monthly non-food expenditure.

ii. Treatment variables

Previous work on these data has utilized as a treatment variable a dummy indicating that a household received food as opposed to cash (Hoddinott et al. 2013). For this analysis I use also the value of the transfer received in each form, either cash, core staples (grains), or other higher quality foods (legumes and oil). The food basket contained either maize or sorghum, vegetable oil, salt, and either lentils, cowpeas, or red beans.

The community level survey solicited the local price in each village for millet and maize only. Millet and sorghum have the same price and price pattern in this region, hence the millet price is applied for the sorghum transfers. The cowpea price was available at a regional, but not a

[12] Households were asked whether or not they consumed an item, and if so for how many days of the past seven. The question was asked separately if the item was consumed as merely as a condiment, and consumption of condiments was not factored into the dietary diversity score.

village, level. As cowpeas are also locally produced and consumed, we expect the price to exhibit a similar spread between villages and dynamic over time as the millet price. I hence construct a regression using village-level fixed effects and household-level distances from villages to project the distribution of cowpea prices. As lentils and red beans are not available locally, I apply the cowpea price, taking into account the different weights of these commodities to convert unit prices to kilogram prices.[13] Prices for salt and oil are the same throughout the region, and are converted from local units to kilograms.[14] The over-all value of the transfer is then calculated using the price at the time of the transfer and the intended ration quantities, hence an intent-to-treat effect.[15]

iii. Other controls and characteristics

Aside the transfer type, a number of other covariates enter into the reduced form equations I am estimating. These include household-level transaction costs, prices and price expectations, interest rates, land, assets and other potentially preference-shifting household characteristics.

I use household-level distances from the center of the village as a proxy for household-level transaction costs. Distance per se has been found to be a relatively imprecise measure of market access, and does not highly correlate with other market access measures. It does potentially capture some important features, however, of not only the physical and time costs of transportation but also the ways in which remoteness more generally may affect household

[13] See Appendix 2.1 for further detail on the price projection procedure, including comparisons with alternative approaches. Estimations were run using each of four candidate cowpea price projections, with no resulting differences in the sign or significance of the final results.

[14] As the only available salt and oil prices were international prices, I utilize a price obtained through key informant interviews.

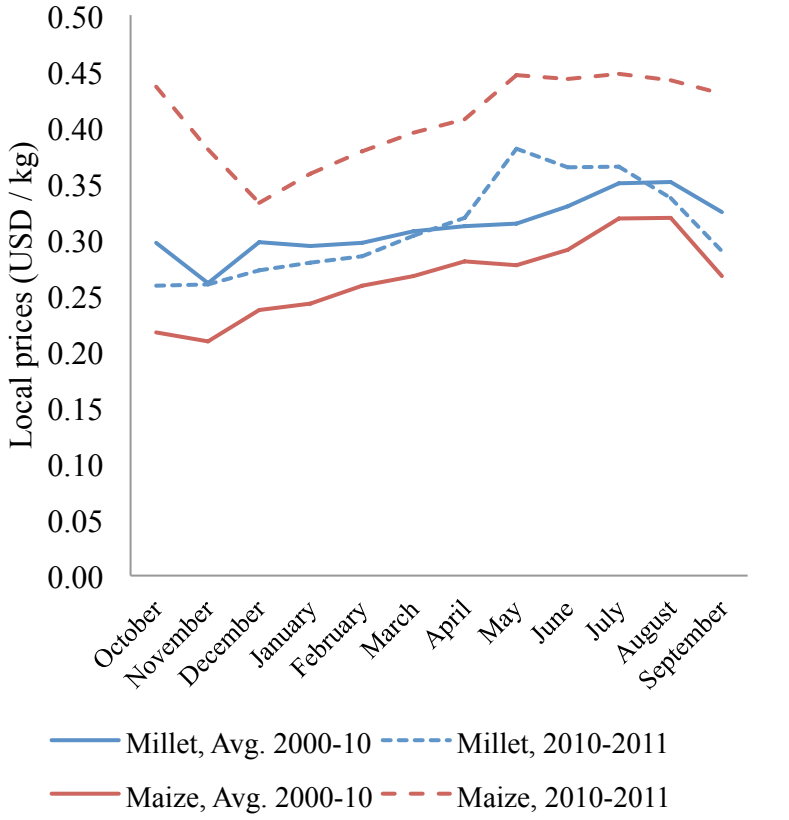
[15] The daily ration was: 3.5 kgs of grain, .72 kgs of legumes, .14 kgs of vegetable oil, and .035 kgs of salt. The monthly ration was based on work-days for the public works, hence was for 25 days per month. Quality data on actual quantities received by households is unavailable, I hence cannot estimate the average treatment effect on the treated.

choices and outcomes (Chamberlin and Jayne 2013). In this case, several aspects of market access are captured at the village or community level, through commune-level fixed effects (which would capture several market characteristics, as markets are generally few and similar within each commune), whether or not there is a market in the village, minutes of travel to the nearest market if there is not one, distance from the village to the main (paved) road, and whether or not there is cell phone service in the village, which has specifically been found to affect agricultural markets and price dispersion in Nigerien agricultural markets (Aker 2010). The specific transaction cost of interest for the model at the household level pertains to its cost in selling food received, and how its particular context might affect its decisions to do so. While imperfect, the household-level distance from the village center may be the best available proxy for these particular transaction costs.[16]

I control for prices using current prices of millet, cowpeas, and livestock (a lactating cow and a young male goat). While it is not straightforward to include price expectations, I include firstly the changes in these prices over the period as a proxy. Food price trends are a known and important phenomenon in the region; Figure 2.2 shows the price trends for millet and maize over the period, relative to the average over ten prior years. The somewhat predictable nature of these seasonal trends gives households reasonable expectations over price changes, and hence the village-level price change over the prior three months would give households a reasonable idea of how prices his year will behave in relation to prior years. Other things that would affect price expectations are factors like production conditions, such as rainfall, and these would not vary more than at the commune-level. I hence include commune-level fixed effects.

[16] See Appendix 2.2 for detail on the construction of the household-level village-center distance, using household-level GPS coordinates and spatial techniques.

Figure 2.2: Harvest-to-harvest grain prices in Zinder (ten-year average & transfer year)



Data Source: National Statistics Office, Niger

The price changes also capture interest rates, due to the features of assets and credit in the local economy. The seasonal food price change serves as an effective interest rate on loans, both due to displaced distortions (Barrett 2007), and due to the fact that loans are often taken out in the form of food and must then be repaid when food prices have fallen. Since livestock are the primary asset, livestock price changes are effectively the interest rates on investment. See Upton et al. (2014) for further detail on local credit markets and interest rates.

Land is measured by area cultivated in this growing season. A scalar measure of total assets is constructed using principal component analysis (PCA) over all durable assets. The other primary asset held by households is livestock, which is measured using tropical livestock units (TLU), a measure constructed using animal weight and associated basal metabolic rate to standardize value across different animals (FAO 2014).[17] Finally, household-level characteristics that might shift preferences include gender, age, and education of household head, household size, whether the household is polygamous, and ethnicity. This set of variables effective captures the right hand side of the reduced form equations, (16) and (17).

iv. Infra- versus extra-marginality of commodities

The model yields predictions in light of the infra- versus extra-marginality of different food types for the population. The extra-marginality of different food items, a result of both available resources and household preferences, cannot be directly observed, so I approximate this in a few different ways for the analysis and hypothesis testing. The food consumption module asks the primary source of each food consumed in the past seven days (e.g., home-produced, purchased, received as a transfer). For most households the reference period fell toward the end of the transfer month, between two weeks and one month after having received the last food transfer. Hence, for food recipients, if a household purchased a food item (or category) that was

[17] Including livestock in other ways, such as by numbers of different separate categories, does not affect the results.

received in the transfer, we can infer that the transfer was infra-marginal. If the food item (or category) was not purchased, whether or not it was consumed, we can infer that the transfer was extra-marginal.[18]

We can consider either two over-lapping groups, just the extra-marginality of each commodity without regard to the other, or four distinct groups, based on the status of each commodity for that household. That is to say that we have either:

Grain (c_1) extra-marginal (legumes (c_2) either infra- or extra-marginal)

Legumes (c_2) extra-marginal (grain (c_1) either infra- or extra-marginal)

OR

Group 1 – Neither grain (c_1) nor legumes (c_2) extra-marginal

Group 2 – Both grain (c_1) and legumes (c_2) extra-marginal

Group 3 – Just grain (c_1) extra-marginal, legumes (c_2) infra-marginal

Group 4 – Just legumes (c_2) extra-marginal, grain (c_1) infra-marginal

While we can hypothesize as to the influence of extra-marginality of a commodity, no clear hypotheses can be drawn over the first two groups given the confounding effect of possible extra-marginality in the other commodity. I hence focus for the predictions and results on the four distinct groups of food recipients.

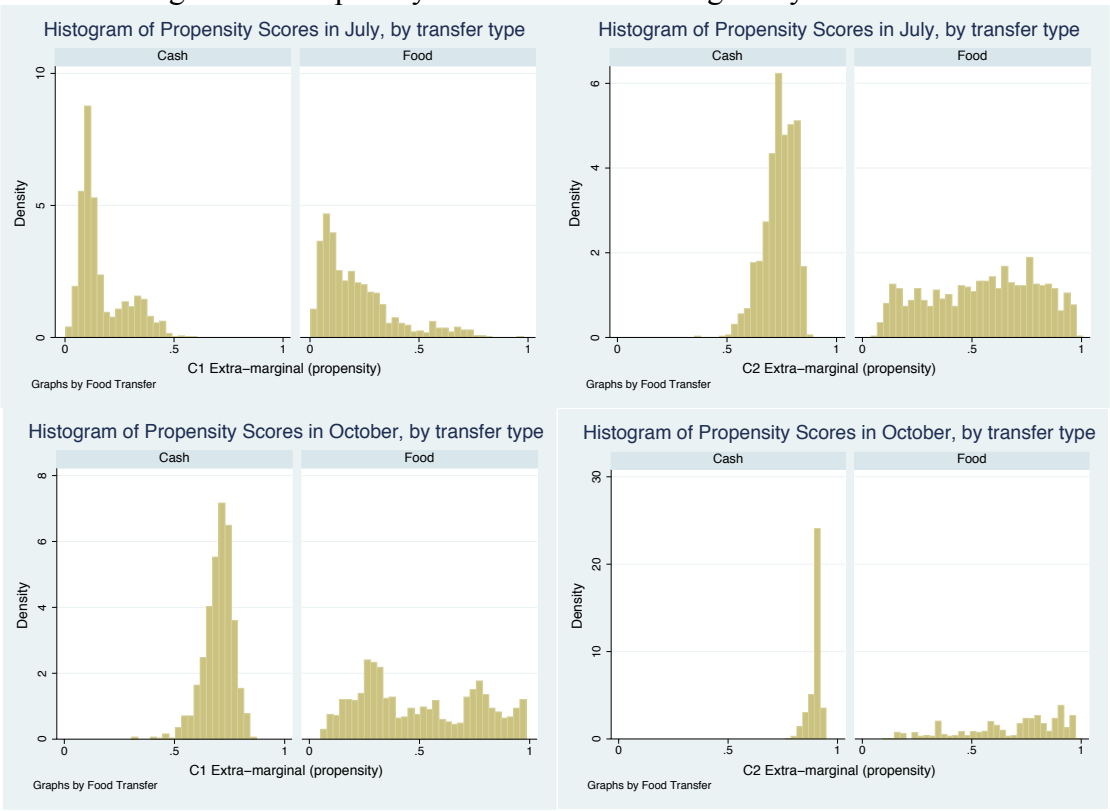
The next issue for the analysis is that I must compare these defined groups of food recipients against all cash recipients. In the absence of a food transfer, I cannot sub-divide cash recipients based on the infra-marginality or extra-marginality of commodities to assess the

[18] For c_1, I consider households who purchased any staple grain (millet, sorghum, maize, or rice) infra-marginal in the grain transfer, taking all staple grains as roughly substitutable with the transferred good. For c_2, I consider all households who purchased any type of legume or non-grain staple food, namely manioc and other tubers, infra-marginal in the legume transfer, taking all of these higher quality (but still staple/semi-storable) foods to be substitutes. Excluding tubers for only legumes and/or only cowpeas results in some differences in the numbers of households that fall into each category, but does not significantly affect the results for each group. More detail on the group construction and results for different configurations is available upon request.

impacts of different transfer types within like groups, as I would ideally do. To attempt to overcome this constraint, I develop a mechanism for approximating the groups of interest using a propensity score method. Following the relatively transparent approach of Dehejia and Wahba (2002), I construct a logit regression of the observed extra-marginality of each commodity among food recipients on a series of characteristics that could affect both the availability of and preferences for foods. I include food production, assets, and accessibility, as well as potential preference-shifters like ethnicity and other household-level characteristics. I then project the results of this regression, among food recipients, across all households. I do this process for each commodity, to obtain two propensity scores, the predicted propensity of being extra-marginal in consumption of c_1, or of c_2, relative to the transfer in that commodity. The histograms shown in Figure 2.3 provide as an example the propensities of being extra-marginal in consumption of each commodity in July and then in October, divided by transfer type.[19]

[19] Further detail on the process of constructing these propensity scores, and comparisons across several versions that are constructed using different estimators and covariates, are provided in Appendix 2.3.

Figure 2.3: Propensity Scores for Extra-Marginality of Transfers



Showing the predicted propensity to be extra-marginal in c1 (left), in July (top) and October (bottom), and separately the predicted propensity to be extra-marginal in c2 (right), in July (top) and October (bottom).
Propensity scores projected on entire sample, using Logit regressions on observed status for food recipients.

c. Estimation procedures

In order to test the hypotheses of the model, I estimate the reduced form equations (16) and (17) on dietary diversity and non-food expenditures, respectively, with the primary focus on the former (equation (16)). These each represent the marginal propensities to consume, either a more diverse diet or non-food goods, given a transfer in the form of a staple-grain, a higher-quality staple, or cash. Because my hypotheses all relate to food or cash transfers otherwise commonly subject to selection effects and other forms of unobserved heterogeneity that might

otherwise bias key parameter estimates, the strength of identification through randomization of the form of transfer is central to the estimation strategy.

First I look at a model over all households that examines the impact of receiving a food transfer on the outcomes of interest, and then divides the food transfer into its component parts to look at the relative impact of receiving T_1 *or* T_2 relative to T_c. For each endogenous choice variable "Y," c_2 or x, and for each time period,[20] we have:

$$Y_i = \alpha + T_{fi}(\beta_f + \rho_f \theta_i) + \rho_0 \theta_i + \delta P_v + \pi A_i + \phi Z_{vi} + \lambda FE + \varepsilon_i \tag{18}$$

Here Pv is a set of prices and price changes, which vary at the village level (v). Transaction cost, θ_i, varies at the household level, and is also examined as it affects the relative impacts of the different transfer types. A household has assets A_i, and the vector Z_{vi} represents several other households and village-level characteristics as described above. Z_{vi} also includes the stratification variable (pastoral / agro-pastoral) to take into account the randomization. FE stands for the commune-level fixed effects, and is an i.i.d. error term that satisfied the necessary assumptions.

In this simplified case, the food transfer, T_f, is the combination of all food goods received and can, as with the cash transfer (T_c), be included either as a dummy variable or as a cash value (in local currency, West Africa Francs (CFA)). Since the transfer received is either in cash or in food, one of these will zero out; I hence include only the food transfer in the specification, and focus in this case on the food transfer coefficient, β_f, the impact of receiving food as opposed to cash (or in value, the impact of an additional 1000 CFA received in food as opposed to in cash).

[20] Time sub-scripts are dropped for the sake of simplicity. All variables reflect time t except prices, which represent price expectations in time t over next period prices.

This specification, however, provides no information on the relative impacts of separate commodities, so with the food transfer divided into the values of the component parts I then estimate:

$$Y_i = \alpha + T_{1i}(\beta_1 + \rho_1\theta_i) + T_{2i}(\beta_2 + \rho_2\theta_i) + \rho_0\theta_i + \delta P_v + \pi A_i + \phi Z_i + \lambda FE + \varepsilon_i \tag{19}$$

In this case, T_c is omitted, T_1 is the value of the food transfer of staple grain, and T_2 is the value of more diverse foods (legumes, oil, and salt). The results for all households, as opposed to for separate groups, can inform the hypotheses in light of the general consumption trends in the population.

I then allow the impacts to vary for each sub-group of recipients, classified based on whether the food basket components were infra- or extra-marginal. First I take the groups as defined among food recipients, and estimate these groups against *all* cash recipients (regardless of their unknown status in each commodity). In this case I effectively estimate equations (18) and (19) separately for each group *j,* where *j* can be either the two over-lapping groups or the four distinct groups as defined above:

$$Y_i = \alpha_j + T_{ci}\left(\beta_{cj} + \rho_{cj}\theta_i\right) + T_{fi}\left(\beta_{fj} + \rho_{fj}\theta_i\right) + \rho_{0j}\theta_i + \delta_j P_v + \pi_j A_i + \phi_j Z_{vi} + \lambda_j FE + \varepsilon_i \tag{20}$$

and

$$Y_i = \alpha_j + T_{1i}\left(\beta_{1j} + \rho_{1j}\theta_i\right) + T_{2i}\left(\beta_{2j} + \rho_{2j}\theta_i\right) + \rho_{0j}\theta_i + \delta_j P_v + \pi_j A_i + \phi_j Z_i + \lambda_j FE + \varepsilon_i \tag{21}$$

Finally, using the propensities to be extra-marginal in each commodity as defined above, I run the combined specification across all households, first for the food treatment variable (versus cash) as a whole and then for each separate commodity, as follows:

$$Y_i = \alpha + T_{fi}\left(\beta_f + \gamma_{f1}\widehat{\Omega}_{1i} + \gamma_{f2}\widehat{\Omega}_{2i} + \rho_f\theta_i + \rho_{f1}\theta_i \times \widehat{\Omega}_{1i} + \rho_{f2}\theta_i \times \widehat{\Omega}_{2i}\right) + \gamma_1\widehat{\Omega}_1 + \gamma_2\widehat{\Omega}_2 + \rho_0\theta_i + \delta P_v + \pi A_i + \phi Z_{vi} + \lambda FE + \varepsilon_i \tag{22}$$

and

$$Y_i = \alpha + T_{1i}\left(\beta_1 + \gamma_{11}\widehat{\Omega}_{1i} + \gamma_{12}\widehat{\Omega}_{2i} + \rho_1\theta_i + \rho_{11}\theta_i \times \widehat{\Omega}_{1i} + \rho_{12}\theta_i \times \widehat{\Omega}_{2i}\right) + T_{2i}\left(\beta_2 + \gamma_{21}\widehat{\Omega}_{1i} + \gamma_{22}\widehat{\Omega}_{2i} + \rho_2\theta_i + \rho_{21}\theta_i \times \widehat{\Omega}_{1i} + \rho_{22}\theta_i \times \widehat{\Omega}_{2i}\right) + \gamma_1\widehat{\Omega}_1 + \gamma_2\widehat{\Omega}_2 + \rho_0\theta_i + \delta P_v + \pi A_i + \phi Z_{vi} + \lambda FE + \varepsilon_i \tag{23}$$

Here $\widehat{\Omega}_{1\mathrm{i}}$ ($\widehat{\Omega}_{2i}$) is the household's predicted propensity to be extra-marginal in consumption of c_1 (c_2) relative to the transfer of T_1 (T_2). These are interacted with the values of each transfer (the over-all transfer in (20), or the values of each in (21)), as well as with the household-level transaction costs. All other variables and controls are the same as in equation (18).

The hypotheses can now be re-stated in terms of the parameters of equations (18)-(23). For each of Hypotheses 1, 2, and 4, the predictions of Hypothesis 5, regarding the additional influence of the household-level transaction costs, can be included as a corollary.

H1: If a transfer T_1 is extra-marginal, households will substitute toward consumption of c_1 relative to c_2. Transfers of T_1 will hence have a *negative* impact on dietary diversity relative to cash transfers (T_c) for households for whom the transfer is extra-marginal. Taking Y_i=c_2^*:

For Equation (19), all households, for the separate transfers of T_1 and T_2 versus T_c (omitted):

$$H_0: \beta_1 = 0 \; [vs. H_A: \beta_1 < 0]$$

H5 corollary:

$$H_0: \rho_1 = 0 \; [vs. H_A: \rho_1 < 0]$$

For Equation (20), by groups, for the combined transfers of T_f versus T_c (omitted):

$$H_0: \beta_{fj} = 0 \; \left[vs. H_A: \beta_{fj} < 0\right]$$

H5 corollary:

$$H_0: \rho_{fj} = 0 \; [vs. H_A: \rho_{fj} < 0]$$

$$for \;\; j = G3 \; (c_1 \; extra - marginal, c_2 \; infra - marginal)$$

For Equation (21), by groups, for the separate transfers of T_1 and T_2 versus T_c (omitted):

$$H_0: \beta_{1j} = 0 \; \left[vs. H_A: \beta_{1j} < 0\right]$$

H5 corollary:

$$H_0: \rho_{1j} = 0 \; [vs. H_A: \rho_{1j} < 0]$$

$$for \; j = G2 \; and \; G3 \; (c_1 \; extra - marginal)$$

For Equation (23), propensity scores on extra-marginality of c_1, for the separate transfers of T_1 and T_2 versus T_c (omitted):

$$H_0: \beta_1 + \gamma_{11} = 0 \; [vs. H_A: \beta_1 + \gamma_{11} < 0]$$

H5 corollary:

$$H_0: \rho_{11} = 0 \; [vs. H_A: \rho_{11} < 0]$$

Note that the H5 corollary hypotheses follow suit in the following, and also as regards H4, in that the corollary is that the impact discussed will be increasing in transaction costs, or the sign on ρ will follow the sign on the beta coefficients of interest. I omit these additions for simplicity.

H2: If a transfer T_2 is extra-marginal, households will substitute toward consumption of c_2 away from c_1. This means that transfers of T_2 will have a *positive* impact on dietary diversity relative to T_c.

Taking Y_i=c_2^*:

For Equation (19), all households, for the separate transfers of T_1 and T_2 versus T_c (omitted):

$$H_0: \beta_2 = 0 \; [vs. H_A: \beta_2 > 0]$$

For Equation (20), by groups, for the combined transfer of T_f versus T_c (omitted):

$$H_0: \beta_{fj} = 0 \left[vs. H_A: \beta_{fj} > 0\right]$$

$$for\ j = G4\ (c_2\ extra - marginal, c_1\ infra - marginal)$$

For Equation (21), by groups, for the separate transfers of T_1 and T_2 versus T_c (omitted):

$$H_0: \beta_{2j} = 0 \left[vs. H_A: \beta_{2j} > 0\right]$$

$$for\ j = G2\ and\ G4\ (c_2\ extra - marginal)$$

For Equation (23), propensity scores on extra-marginality of c_2, for the separate transfers of T_1 and T_2 versus T_c (omitted):

$$H_0: \beta_2 + \gamma_{22} = 0\ [vs. H_A: \beta_2 + \gamma_{22} > 0]$$

H3: If a transfer of either T_1 or T_2 is infra-marginal, the dietary diversity impact of providing that good will be the *same* as that of providing cash (T_c).

Taking Y_i=c_2^*:

For Equation (20), by groups, for the combined transfer of T_f versus T_c (omitted):

$$H_0: \beta_{fj} = 0 \left[vs. H_A: \beta_{fj} \neq 0\right]$$

$$for\ j = G1\ (both\ goods\ infra - marginal)$$

For Equation (21), by groups, for the separate transfers of T_1 and T_2 versus T_c (omitted):

$$H_0: \beta_{1j} = 0\ \left[vs. H_A: \beta_{2j} \neq 0\right]$$

$$for\ j = G1\ and\ G4\ (c_1\ infra - marginal)$$

$$H_0: \beta_{2j} = 0\ \left[vs. H_A: \beta_{2j} \neq 0\right]$$

$$for\ j = G1\ and\ G3\ (c_2\ infra - marginal)$$

For Equation (23), propensity scores on extra-marginality of c_1 and c_2, for the separate transfers of T_1 and T_2 versus T_c (omitted):

$$H_0: \beta_1 = 0 \mid \widehat{\Omega}_1 = 0 \; [vs. H_A: \beta_1 \neq 0 \mid \widehat{\Omega}_1 = 0]$$

$$H_0: \beta_2 = 0 \mid \widehat{\Omega}_2 = 0 \; [vs. H_A: \beta_2 \neq 0 \mid \widehat{\Omega}_2 = 0]$$

H4: Among households for whom a food transfer is extra-marginal, those who receive cash will spend more on non-food needs (x) than food recipients.

Taking Y_i=x*:

For Equations (18) and (19), all households, for the combined transfer of T_f versus T_c (omitted):

$$H_0: \beta_{fj} = 0 \; and \; \beta_1, \beta_2 = 0 \left[vs. H_A: \beta_{fj} < 0, \beta_1, \beta_2 < 0\right]$$

For Equation (20), by groups, for the combined transfer of T_f versus T_c (omitted):

$$H_0: \beta_{fj} = \beta_{cj} \; \left[vs. H_A: \beta_{fj} < \beta_{cj}\right]$$

$$for \; j = G2 \; (both \; commodities \; extra - marginal)$$

For Equation (21), by groups, for the separate transfers of T_1 and T_2 versus T_c (omitted):

$$H_0: \beta_{1j} = 0 \; \left[vs. H_A: \beta_{1j} < 0\right]$$

$$for \; j = G2 \; and \; G4 \; (c_1 extra - marginal)$$

$$H_0: \beta_{2j} = 0 \; \left[vs. H_A: \beta_{2j} < 0\right]$$

$$for \; j = G2 \; and \; G3 \; (c_2 extra - marginal)$$

For Equation (22), propensity scores on extra-marginality of food, for the separate transfers of T_1 and T_2 versus T_c (omitted):

$$H_0: \beta_f + \gamma_{f1} + \gamma_{f2} = 0 \; [vs. H_A: \beta_f + \gamma_{f1} + \gamma_{f2} < 0]$$

For Equation (23), propensity scores on extra-marginality of c_1 and c_2, for the separate transfers of T_1 and T_2 versus T_c (omitted):

$$H_0: \beta_1 + \gamma_{11} = 0 \mid \widehat{\Omega}_1 > 0 \; [vs. H_A: \beta_1 + \gamma_{11} < 0 \mid \widehat{\Omega}_1 > 0]$$

$$H_0: \beta_2 + \gamma_{22} = 0 \,|\widehat{\Omega}_2 > 0 \; [vs. H_A: \beta_2 + \gamma_{22} < 0 \,|\widehat{\Omega}_2 > 0]$$

For simplicity, Table 2.2 summarizes the expected signs on the parameters that would be associated with rejecting the null hypotheses, for the food transfer as a whole as well as for its component parts, and for each sub-group as well as for all households.

Table 2.2: Predicted impacts on dietary diversity for each food type, relative to a cash transfer (by infra-/extra-marginality group)

	Grain (T1)	Legumes (T2)	Food Transfer (Tf)
Group 4-1: Both goods infra-marginal	=	=	=
Group 4-2: Both goods extra-marginal	-	+	~
Group 4-3: Only grain extra-marginal	=	+	+
Group 4-4: Only legume extra-marginal	-	=	-
All Households	≤ 0	≥ 0	~
Propensity to be extra-marginal in grain (c1)	-	~	~
Propensity to be extra-marginal in legume (c2)	~	+	~

+, - , =, and ~ represent positive, negative, equal, an ambiguouspredicted impacts of the food transfer indicated on dietary diversity relative to cash.

5. RESULTS

a. Consumption patterns and characteristics of all households and groups

The first aspect of the results that bears discussion is the implications of examining all households versus the sub-divided groups based on the infra- or extra-marginality of transfers, in light of underlying consumption patterns for cash versus food recipients and the nature of the extra-marginality of transfers between seasons. While the model's predictions can be tested in part by looking at the results for all households, the consumption patterns of the population at large can help us to better understand these results and further inform the predictions. These patterns also reveal difference in the nature and causes of extra-marginality of each transfer type in each season, which informs how we might expect results to differ over time.

Food consumption patterns in each period for the main grains (c_1) and non-grain staples (c_2), separated by period and then by cash and food recipients, are shown in Table 2.3. The numbers under each food type represent first whether or not the food was consumed, and the number of days in the past seven, then the source, or what percentage of households claimed each source as "primary" for that food and period. We see clearly, first of all, that in the absence of a food transfer the primary grain commodity consumed is millet, followed by sorghum and then maize, with 96%, 60%, and 18% (100%, 36%, and 6%) of cash recipients consuming each commodity in July (October), respectively. With respect to non-grain staples, cash-recipient households are likely to consume a mix of cowpeas (60% and 6%, in July and October, respectively) and tubers (31% and 33%, likewise), nearly all of them purchased, and virtually only consume any other bean if it was received as a transfer. When all home-produced food is scarce, then, cash recipients purchase a mix of foods, including cowpeas; however, when home-

produced millet is available, in October, we see that cash recipients substitute toward millet consumption and purchase significantly less of any other food.

These observations can inform us about the degree to which different forms of transferred goods are broadly extra-marginal for this population. Food recipients are nearly as likely (albeit for fewer days on average) to consume millet as cash recipients, even when it is primarily purchased in July. However, they switch from being more likely to consume maize to more likely to consume sorghum between periods, with 41% consuming sorghum and 88% maize in July, versus 88% and 17%, respectively, in October. This trend is consistent with the form of grain transfer received, shown in Table 2.4, which was in the form of maize for roughly half of all households in July, but was in the form of sorghum for over 90% in October. Maize is effectively only consumed if it was received as a transfer, whereas sorghum is consumed significantly more when received as a transfer (in October) but also consumed to some degree when not (in July). Hence both of these commodities are largely extra-marginal, but maize more so. These trends support Cunha's (2014) findings in Mexico of substitution toward extra-marginal commodities away from similar commodities, albeit this happens little in the case of millet, which is purchased and consumed by nearly all households even when it is not transferred. In this case also, however, there is substitution away from relatively dissimilar commodities—in the sense that households are so liquidity constrained that they choose to substitute toward cheaper grain when it is available and away from higher quality foods.

Table 2.3: T-tests on food consumption (and sources) in each round, by Cash vs. Food transfers

	JULY				OCTOBER			
	All HHs	CASH	FOOD	T-test p-value	All HHs	CASH	FOOD	T-test p-value
Millet (any)	95%	96%	94%	0.018	98%	100%	95%	0
No. of Days Consumed	5.6	5.8	5.3	0	5.9	6.2	5.6	0
Purchased	74%	84%	62%	0	16%	23%	9%	0
Home-produced	19%	10%	28%	0	80%	76%	84%	0
Transfer	2%	1%	3%	0.001	0%	0%	1%	0.006
Sorghum (any)	51%	60%	41%	0	60%	36%	88%	0
No. of Days Consumed	2.1	2.5	1.6	0	2.7	1.3	4.2	0
Purchased	39%	53%	23%	0	13%	21%	4%	0
Home-produced	9%	6%	12%	0	10%	14%	6%	0
Transfer	2%	0%	5%	0	36%	0%	77%	0
Maize (any)	51%	18%	88%	0	11%	6%	17%	0
No. of Days Consumed	2.6	0.5	4.9	0	0.3	0.1	0.4	0
Purchased	10%	15%	6%	0	5%	5%	6%	0.913
Home-produced	0%	0%	0%	0.936	0%	0%	0%	0.255
Transfer	39%	2%	81%	0	5%	0%	11%	0
All Grain (any)	100%	100%	100%	0.345	100%	100%	100%	.
No. of Days Consumed	6.9	6.8	6.9	0	6.9	6.9	6.9	0
Purchased	88%	97%	78%	0	60%	70%	50%	0
Home-produced	22%	14%	31%	0	81%	77%	85%	0
Transfer	40%	3%	82%	0	38%	0%	81%	0
T1 Extra-Marginal		N/A	22%			N/A	50%	
Cowpeas (any)	68%	60%	76%	0	35%	6%	68%	0
No. of Days Consumed	1.9	1.5	2.3	0	0.9	0.2	1.8	0
Purchased	35%	52%	16%	0	1%	2%	1%	0.025
Home-produced	6%	6%	5%	0.267	3%	3%	3%	0.627
Transfer	26%	1%	54%	0	30%	1%	63%	0
Other Beans (any)	5%	2%	8%	0	7%	5%	10%	0
No. of Days Consumed	0.2	0.1	0.3	0	0.2	0.1	0.4	0
Purchased	1%	1%	1%	0.799	1%	2%	1%	0.005
Home-produced	0%	0%	0%	0.91	2%	3%	0%	0
Transfer	3%	1%	6%	0	4%	0%	9%	0
Tubers (any)	26%	31%	21%	0	31%	33%	28%	0.026
No. of Days Consumed	0.6	0.7	0.5	0	0.6	0.7	0.5	0.003
Purchased	25%	30%	20%	0	30%	31%	27%	0.049
Home-produced	0%	0%	0%	0.819	1%	1%	0%	0.082
All non-grain staples (any)	76%	71%	83%	0	59%	40%	81%	0
No. of Days Consumed	2.6	2.2	3.0	0	1.7	0.9	2.6	0
Purchased	62%	77%	45%	0	36%	40%	31%	0
Home-produced	6%	7%	6%	0.165	6%	7%	4%	0
Transfer	28%	1%	59%	0	34%	1%	72%	0
T2 Extra-Marginal		N/A	55%			N/A	69%	
Observations	2268	1198	1070		2209	1179	1030	

Table 2.4: Foods Received (percent), by Transfer Period

	July	October
Legume Received:		
Cowpeas	31.31	28.45
Lentils	13.93	23.4
Beans	54.77	48.16
Grain Received:		
Sorghum	56.26	94.17
Maize	43.74	5.83
Number of HHs	1070	1030

The inter-period differences in other food consumption exhibit a rather different pattern. Consumption of cowpeas, other legumes, and tubers by food recipients remains relatively constant between periods, with 76%, 8%, and 21% consuming each (respectively) in July and 68%, 10%, and 28% consuming each (respectively) in October. With respect to legumes, cowpea transfers would appear to be retained and consumed (and additionally purchased by some), whereas other beans, received by about 69% and 72% of households in July and October (respectively), are hardly consumed in either case.

The large degree of increased consumption with the transfer of certain commodities is consistent with a degree of extra-marginality. By this logic, we may suspect that for the population at large, even if grain per se was not extra-marginal, the commodities provided (primarily maize, but for many also sorghum) were extra-marginal for these households.

The legume commodity in any form was also per this evidence extra-marginal, in part because household would in the absence of the food transfer consume almost exclusively less expensive (and otherwise more available, via home production) staple grains. The degree of extra-marginality of legumes was more pronounced in October, when the local grain (millet) was more available due to the harvest.

This leads to the realization that the degree of, and reasons for, extra-marginality for any given household varies between seasons based on seasonal conditions and household characteristics. Table 2.5 shows the transition matrix between groups between periods, including also the average food consumption scores in each period for each group. By looking at the diagonal we see first off that a minority of households—a total of 32.5% across groups—retain the same status between periods. The movement between groups over time, taking into account consumption levels, reflects that the extra-marginality of any given commodity is a function of choices under constrained circumstances, which change inter-seasonally. There may be different implications of being extra-marginal in a commodity under different conditions, i.e. it may be a matter of resorting to an available substitute out of desperation in one period but rather a matter of choosing an available substitute by preference in another. Those for whom the transfer was extra-marginal in both commodities in October (G2, 422 households), and also just in grain (G3, 95 households), have lower FCS scores on average in both periods than those for whom both commodities (G2, 158 households) or just grain (G3, 62 households) were extra-marginal in July. This reflects, in light of the evidence in Table 3, that the extra-marginality of grain in July and October are different in nature; in July, households who do not buy additional grain are likely to be using those resources to purchase a more diverse diet, whereas in October, those households are more likely producing sufficient grain and hence substituting more toward it, leading to a less diverse diet. The bean commodities are extra-marginal (Groups 2 and 4) for the largest number of households in both periods (563 households in July and 711 in October). Putting this together with the descriptive information in Table 2.3, however, we know that this extra-marginality is much more distorting in October, when cash recipients almost all forego legume consumption for that of cheaper (home-produced) grains.

Table 2.5: Transition Matrix of Infra-/Extra-marginality groups between periods
Frequencies in parentheses, with FCS (July; October) for each group below

		October (After unconditional transfers)				
	Group	G1	G2	G3	G4	Total
July (After conditional transfers)	G1	12% (127) 51; 57	12% (119) 44; 44	4% (43) 43; 42	11% (116) 47; 51	39% (405) 47; 51
	G2	2% (22) 43; 52	9% (91) 43; 49	1% (11) 47; 54	3% (34) 46; 59	15% (158) 44; 52
	G3	1% (6) 48; 62	3% (27) 49; 52	0.5% (5) 46; 50	2% (24) 47; 47	6% (62) 48; 51
	G4	7% (69) 45; 59	18% (185) 39; 45	3% (36) 47; 52	11% (115) 46; 53	39% (405) 43; 50
	Total	22% (224) 48; 57	41% (422) 42; 46	9% (95) 45; 50	28% (289) 46; 52	100% (1030) 45; 51

G1 - Both commodities infra-marginal
G2 - Both commodities extra-marginal
G3 - Grain (c1) extra-marginal, legume (c2) infra-marginal
G4 - Legumes (c2) extra-marginal, grain (c1) infra-marginal

These trends would be expected to impact the results of hypothesis tests in each period. In particular, we would expect the extra-marginality of both commodities to make the differential impacts of each food transfer type stronger in October. The effect of providing grain on dietary diversity should be more negative because grain—in particular the sorghum provided—is extra-marginal for more households given the millet harvest. The effect of providing the legume on dietary diversity should be more positive because of the strong tendency otherwise to substitute toward the less-diverse diet of home-produced millet.

b. Testing Hypotheses 1 and 2

Tables 2.6 and 2.7 show the results of equations (18) and (19), for all households, with the outcome variable of FCS. Three versions of the treatment variable are shown: the dummy for receipt of a food (versus cash) transfer, the over-all value of food (versus cash) received, and then the separate values of T_1 and T_2, or grain versus legumes, oil, and salt. For each treatment

Table 2.6: OLS results on the Food Consumption Score, for ALL HOUSEHOLDS in JULY

	Food Dummy				Food Value, Total				Food Value, Separated			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Food Transfer	6.318**	4.921**	4.815**	3.427**								
	(2.558)	(2.165)	(2.013)	(1.428)								
Food X TransCost	0.952	1.215	1.278	0.872								
	(1.502)	(1.165)	(1.174)	(1.036)								
Food Transfer Value (ITT, Proj4)					0.185**	0.146**	0.147**	0.107**				
					(0.084)	(0.068)	(0.063)	(0.045)				
Food Value X TransCost					0.024	0.033	0.035	0.024				
					(0.048)	(0.036)	(0.036)	(0.031)				
Transfer Value, Grain (ITT)									-1.283**	-1.006	-0.661	-0.003
									(0.610)	(0.608)	(0.690)	(0.350)
c1 value X TransCost									-1.084**	-0.643	-0.821*	-0.508***
									(0.457)	(0.435)	(0.426)	(0.187)
Transfer Value, Other Foods (ITT, Proj4)									1.933**	1.518*	1.12	0.235
									(0.752)	(0.756)	(0.846)	(0.454)
c2 value X TransCost									1.412**	0.881	1.089**	0.682***
									(0.566)	(0.551)	(0.528)	(0.235)
Distance from village center (km)	-0.595	-0.293	-0.265	0.347	-0.593	-0.28	-0.233	0.368	-0.578	-0.289	-0.207	0.334
	(0.824)	(0.861)	(0.935)	(0.906)	(0.822)	(0.861)	(0.949)	(0.910)	(0.824)	(0.860)	(0.916)	(0.901)
Pastoral		3.796**	4.041**	1.097		3.955**	4.123**	1.122		2.514	3.265	0.794
		(1.808)	(1.815)	(2.398)		(1.805)	(1.857)	(2.409)		(2.284)	(2.015)	(2.318)
Household-level assets and controls	No	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Village-level prices and transaction costs	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes
Commune FEs	No	No	No	Yes	No	No	No	Yes	No	No	No	Yes
No. of Households	2245	2242	2231	2231	2245	2242	2231	2231	2245	2242	2231	2231
R-Squared	0.047	0.18	0.201	0.313	0.039	0.176	0.199	0.312	0.076	0.195	0.206	0.313

*, **, and *** represent significance at the 10%, 5%, and 1% level, respectively

Household-level assets and controls (not shown) include: age of household head (years), female household head (dummy), head with formal education (dummy), household size, polygamous household, household is member of ethnica majority (dummy), Hausa (dummy), Asset score (PCA), TLU

Village-level prices (in CFA) and transaction costs include: Millet price, Change in millet price (over period), Cowpea price, Change in cowpea price (over period), Price of a cow, Change in price of cow (inter-seasonal), Price of goat, Change in price of goat (inter-seasonal), Market in village (dummy), Time to reach market if not in village (minutes), Cereal bank in or near village (dummy), Distance to main road (km), Cell phone network in village

Table 2.7: OLS results on the Food Consumption Score, for ALL HOUSEHOLDS in OCTOBER

	Food Dummy				Food Value, Total				Food Value, Separated			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Food Transfer	6.398***	5.752***	6.308***	4.856***								
	(2.006)	(1.635)	(1.407)	(1.025)								
Food X TransCost	-0.201	-0.318	-0.38	-0.25								
	(1.261)	(0.909)	(0.744)	(0.723)								
Food Transfer Value (ITT, Proj4)					0.181***	0.160***	0.187***	0.138***				
					(0.062)	(0.050)	(0.046)	(0.032)				
Food Value X TransCost					0	-0.004	-0.007	-0.001				
					(0.041)	(0.028)	(0.023)	(0.022)				
Transfer Value, Grain (ITT)									-1.242***	-1.246***	-1.663***	-1.300***
									(0.463)	(0.316)	(0.482)	(0.405)
c1 value X TransCost									0.447	0.495	0.511	0.742**
									(0.497)	(0.360)	(0.321)	(0.293)
Transfer Value, Other Foods (ITT, Proj4)									1.867***	1.829***	2.297***	1.823***
									(0.533)	(0.377)	(0.552)	(0.479)
c2 value X TransCost									-0.523	-0.584	-0.595	-0.854**
									(0.527)	(0.402)	(0.361)	(0.344)
Distance from village center (km)	1.151	1.565**	2.115***	2.474***	1.072	1.493**	2.041***	2.387***	1.155	1.565**	2.090***	2.506***
	(0.744)	(0.616)	(0.534)	(0.518)	(0.750)	(0.618)	(0.546)	(0.509)	(0.744)	(0.619)	(0.473)	(0.480)
Pastoral		5.314***	4.938**	12.616***		5.187***	4.766**	12.542***		5.537***	5.184***	10.764***
		(1.595)	(1.905)	(2.960)		(1.651)	(1.958)	(2.940)		(1.537)	(1.916)	(3.129)
Household-level assets and controls	No	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Village-level prices and transaction costs	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes
Commune FEs	No	No	No	Yes	No	No	No	Yes	No	No	No	Yes
No. of Households	2076	2076	2055	2055	2076	2076	2055	2055	2076	2076	2055	2055
R-Squared	0.05	0.126	0.165	0.242	0.043	0.12	0.161	0.241	0.066	0.14	0.178	0.249

*, **, and *** represent significance at the 10%, 5%, and 1% level, respectively

See list of included controls in notes of Table 2.6.

variable I show here first the uncontrolled regression results, then those with household controls, then with household and village controls, then with all controls and fixed effects, in order to explore the strength of the randomization and model. Columns (4) hence represent the specifications described in equations (18) and (19), the preferred specification, which I expect to be more precise. The results for July, during the lean period and following the conditional transfers (Table 2.6), and for October, during the early part of the harvest and following the unconditional transfers (Table 2.7), are shown separately.

The results are first off fundamentally consistent with Hoddinott et al. (2013), in that the food transfer on the whole has a greater impact on dietary diversity than the cash transfer. Keeping in mind that the second treatment variable used represents the value of the transfer (in 1000s of CFA) as opposed to the dummy, and the transfer value was roughly 25,000 CFA, these two sets of results are similar in magnitude. The magnitudes represent a 8% (7%) difference in July and a 10% (8%) difference in October, looking at the food as a dummy variable (value), relative to over-all averages in each period.

I begin the tests of Hypotheses 1 and 2 by looking at the transfer separated into its two components. The impact of providing T_1 is broadly negative relative to cash over-all, whereas that of providing T_2 is positive. There is some support for this relationship in July, but the significance disappears with addition of village controls and fixed effects (see the final two columns of Table 2.6). Both outcomes remain significant in October (Table 2.7). The magnitudes are in turn much larger, with a roughly 80% negative difference in FCS for T_1 and a 90% positive difference in FCS for T_2 relative to the October average FCS (of about 47). For all households, hence, I can *reject* hypotheses 1 and 2, the nulls of which state that T_1 and T_2 would have no impact on FCS relative to cash, in favor of the respective one-sided alternatives.

This result is in turn consistent with the assessment of consumption patterns, that within the over-all sample both food transfer types are extra-marginal at all times for many, but had a greater (more distorting) degree of extra-marginality in October than in July. To further explore this claim, I break the transfer values apart by individual commodities, as shown in Table 2.8. In July, there is weak evidence (not robust to inclusion of fixed effects) that both sorghum and maize have negative impacts, and a dominating positive effect of providing cowpeas. In October, however, these impacts are stronger in both directions, as one would suspect give the greater degrees of extra-marginality of each commodity. The impact is strongest for cowpeas in particular, which were consumed by almost no cash recipients, which is consistent with the degree to which most households were extra-marginal in cowpea consumption in October.

In summary, taking into account the general extra-marginality of the commodities provided in this population, I can *reject* the null hypotheses in favor of the alternatives:

$$H1\text{:}\ H_0\text{:}\ \beta_1 = 0\ [vs.\ H_A\text{:}\ \beta_1 < 0]$$

$$and$$

$$H2\text{:}\ H_0\text{:}\ \beta_2 = 0\ [vs.\ H_A\text{:}\ \beta_2 > 0]$$

While I only reject with 95% confidence and without controls and fixed effects in July, I reject with confidence ($p < 0.01$) in October.

Table 2.8: OLS Regression on FCS for ALL households with separated food values

	July				October			
	No Transaction Cost		Transaction Cost		No Transaction Cost		Transaction Cost	
Transfer Value, Sorghum (ITT)	-2.208***	-0.235	-1.969***	-0.113	-1.928*	-3.118***	-1.547	-3.011***
	(0.646)	(0.429)	(0.697)	(0.414)	(0.962)	(0.525)	(0.978)	(0.463)
Sorghum Value X TransCost			-0.919	-0.724*			0.581*	1.195***
			(0.636)	(0.428)			(0.345)	(0.270)
Transfer Value, Maize (ITT)	-1.931***	-0.277	-1.746***	-0.179	-1.937**	-2.758***	-1.741**	-2.723***
	(0.589)	(0.388)	(0.632)	(0.380)	(0.770)	(0.428)	(0.788)	(0.380)
Maize Value X TransCost			-0.792	-0.613			0.832**	1.231***
			(0.682)	(0.468)			(0.394)	(0.293)
Transfer Value, Cowpeas (ITT)	6.161***	5.462**	6.479***	5.072**	6.438	12.720***	4.83	11.615***
	(2.150)	(2.248)	(2.421)	(2.307)	(4.586)	(2.977)	(4.720)	(2.742)
Cowpea Value X TransCost			0.811	2.114			-3.489	-3.854***
			(2.210)	(1.866)			(2.186)	(1.222)
Transfer Value, Other Beans (ITT)	4.925**	2.511	5.071**	1.908	6.227	11.388***	4.887	10.168***
	(2.032)	(1.804)	(2.320)	(1.892)	(4.288)	(2.604)	(4.412)	(2.390)
Other Legume Value X TransCost			1.31	2.744			-3.075	-3.214***
			(2.427)	(1.874)			(2.051)	(1.101)
Transfer Value, Oil	5.514	-1.992	4.092	-1.883	2.549	0.024	2.857	1.459
	(3.973)	(2.226)	(4.587)	(2.296)	(2.903)	(2.434)	(3.119)	(2.193)
Oil Value X TransCost			3.154	0.235			1.001	-1.344
			(3.069)	(1.717)			(1.758)	(1.162)
Distance from village center (km)			-0.595	0.547			1.151	2.504***
			(0.825)	(0.937)			(0.745)	(0.497)
Pastoral		-5.168***		-2.114		9.435***		11.439***
		(1.892)		(3.982)		(2.526)		(3.289)
HH Controls & Assets	No	Yes	No	Yes	No	Yes	No	Yes
Village Prices & Transaction Costs	No	Yes	No	Yes	No	Yes	No	Yes
Commune FEs	No	Yes	No	Yes	No	Yes	No	Yes
No. of Households	2263	2257	2245	2242	2209	2206	2076	2076
R-Squared	0.065	0.322	0.071	0.323	0.067	0.232	0.074	0.252

*, **, and *** represent significance at the 10%, 5%, and 1% level, respectively

See list of included controls in notes of Table 2.6.

Evidence related to the corollary regarding transaction costs, Hypothesis 5, is mixed between seasons. In July, even while the impacts of each commodity are not robust to fixed effects, the degree to which the grain (legume) transfer has a negative (positive) impact on dietary diversity is increasing with a household's distance from the village center. In October, however, the impacts of each food commodity are attenuated by the transaction costs. Hence I *reject* the corollary hypothesis ($p < 0.01$) in July, but fail to reject in October. This finding could reflect implications of remoteness, or other unobservables other than the transaction cost associated with the model, that differ between seasons and are captured by the households' distance from the village center.

I now turn to analysis within separate groups of food recipients based on the extra-marginality of each transfer type. Rejection of hypothesis 1 would imply that we find negative coefficients on the beta parameters for the food transfer over-all among those for whom the grain is extra-marginal and the legume is not, which is group 3 in Tables 2.9 (July) and 2.10 (October). As seen in Columns (5), this coefficient is positive but not significant in July and October. For divided commodities, results are stronger, in that the coefficient on transfers of T_1, in Columns (6), is negative and significant in both periods. In October (Table 2.10) the impact of T_1 is negative and significant for all groups for whom the grain is extra-marginal, and these results are more pronounced than in July as expected.

In looking finally at the propensity scores, Table 2.11, I fail to reject Hypothesis 1 in July (columns (1) and (2)). In October, however, the impact of food generally is negative for those extra-marginal in c_1 (net effect of -0.585, column (3)), but particularly decreasing for transfers of T_1 (net effect of -6.488, column (4)). I can say then on the whole that I *reject* hypothesis 1 in

Table 2.9: OLS results on the Food Consumption Score, by sub-groups, in JULY

	Group 1: Both goods infra-marginal		Group 2: Both goods extra-marginal		Group 3: Only grain extra-marginal		Group 4: Only legume extra-marginal	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Food Transfer Value (ITT, Proj4)	0.159***		0.09		0.158		0.083	
	(0.057)		(0.075)		(0.101)		(0.050)	
Food Value X TransCost	0.058		-0.067		0.153		-0.025	
	(0.037)		(0.050)		(0.100)		(0.034)	
Transfer Value, Grain (ITT)		0.961*		-0.767		-1.358**		-0.989*
		(0.563)		(0.727)		(0.618)		(0.514)
c1 value X TransCost		0.058		-1.55		3.236*		-1.447***
		(0.366)		(1.793)		(1.800)		(0.404)
Transfer Value, Other Foods (ITT, Proj4)		-0.8		1.037		1.873**		1.339**
		(0.677)		(0.908)		(0.846)		(0.625)
c2 value X TransCost		0.055		1.919		-3.375		1.742***
		(0.453)		(2.390)		(2.208)		(0.514)
Distance from village center (km)	0.15	0.125	0.143	0.121	0.097	0.115	0.365	0.32
	(0.849)	(0.855)	(0.834)	(0.819)	(0.794)	(0.796)	(0.886)	(0.856)
Pastoral	20.869***	21.401***	-0.151	-0.166	-5.969	-6.536	-7.059***	-7.712***
	(3.238)	(3.330)	(3.111)	(3.121)	(5.208)	(5.355)	(2.517)	(2.151)
HH Controls & Assets	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Village Controls & Transaction Costs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Commune FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. of Households	1575	1575	1331	1331	1230	1230	1590	1590
R-Squared	0.284	0.286	0.246	0.249	0.254	0.255	0.307	0.314

*, **, and *** represent significance at the 10%, 5%, and 1% level, respectively

See list of included controls in notes of Table 2.6.

Table 2.10: OLS results on the Food Consumption Score, by sub-groups, in OCTOBER

	Group 1: Both goods infra-marginal		Group 2: Both goods extra-marginal		Group 3: Only grain extra-marginal		Group 4: Only legume extra-marginal	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Food Transfer Value (ITT, Proj4)	0.248***		0.058		0.098		0.117**	
	(0.057)		(0.038)		(0.080)		(0.053)	
Food Value X TransCost	0.022		-0.022		-0.15		0.001	
	(0.025)		(0.024)		(0.095)		(0.023)	
Transfer Value, Grain (ITT)		-0.501		-1.487***		-1.572*		-1.956***
		(0.629)		(0.450)		(0.891)		(0.570)
c1 value X TransCost		0.051		0.431*		2.185**		1.216*
		(0.516)		(0.238)		(0.956)		(0.672)
Transfer Value, Other Foods (ITT, Proj4)		1.125		1.888***		2.022*		2.542***
		(0.696)		(0.535)		(1.011)		(0.674)
c2 value X TransCost		-0.019		-0.528**		-2.698**		-1.418*
		(0.591)		(0.245)		(1.090)		(0.790)
Distance from village center (km)	2.208***	2.222***	2.232***	2.323***	2.055***	2.087***	2.282***	2.341***
	(0.495)	(0.479)	(0.427)	(0.405)	(0.419)	(0.406)	(0.514)	(0.485)
Pastoral	10.801***	12.028***	14.005***	14.767***	1.01	0.028	10.338**	5.565
	(3.908)	(3.887)	(3.779)	(3.316)	(3.086)	(3.172)	(4.186)	(5.822)
HH Controls & Assets	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Village Controls & Transaction Costs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Commune FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. of Households	1290	1290	1471	1471	1160	1160	1341	1341
R-Squared	0.271	0.272	0.206	0.213	0.2	0.204	0.245	0.257

*, **, and *** represent significance at the 10%, 5%, and 1% level, respectively

See list of included controls in notes of Table 2.6.

favor of the alternative, that the *T1* transfer has negative impacts on dietary diversity. This evidence is present in both seasons, but more pronounced and consistent in October.

Hypothesis 2 is even more strongly rejected in the sub-groups and propensity score estimations. The impact off food and of T_2 on the sub-groups for whom it is extra-marginal, G2 and G4 (columns (3)-(4) and (7)-(8) of Tables 9 and 10), is positive, although only significant in October for G4 for the food transfer (column (7)), and for the divided commodities. Using the propensity scores (Table 2.11), evidence related to Hypothesis 2 is mixed. There is similar to the above no supporting evidence in July, whereas in October the impact of the food transfer is positive in the propensity to be extra-marginal in c_2 (column (3)). The effect is not shown to be specific to T_2, however (column (4)). Again, while evidence is somewhat mixed, and more definitive in October, I across metrics can *reject* Hypothesis 2 in favor of the alternative that transfers of T_2 have positive impacts on dietary diversity.

That both Hypotheses are more firmly rejected in October is on the whole consistent with the different conditions between seasons (Table 2.3). It is possible also that the propensity score approach is more able to capture the characteristics that drive the extra-marginality of transfers in October, when conditions are less strained so differences between households are more driven by household-level characteristics.

Similar to the case for all households, evidence related to the corollary transaction cost hypothesis is mixed. In July, we see that the transaction cost strengthens the separate impacts of each commodity for groups for whom legumes only are extra-marginal (G4, column (8) of Table 2.9), and these results are significant ($p < 0.01$). In October, however, evidence fails to reject the hypothesis for all groups.

Table 2.11: OLS Regression on FCS for ALL households with extra-marginality propensity scores

	JULY		OCTOBER	
	(1)	(2)	(3)	(4)
Food Transfer Value (ITT, Proj4)	-0.178		-0.778*	
	(0.243)		(0.423)	
Food Value X c1-Extra (pscore)	0.642**		0.193	
	(0.283)		(0.328)	
Food Value X c2-Extra (pscore)	0.223		0.805	
	(0.344)		(0.593)	
Food Value X c1-Extra (pscore) X TransCost	0.455*		-0.199**	
	(0.235)		(0.091)	
Food Value X c2-Extra (pscore) X TransCost	-0.126		0.132**	
	(0.079)		(0.060)	
Transfer Value, Grain (ITT)		0.612		-0.297
		(1.012)		(1.009)
c1 Value X c1-Extra (pscore)		0.763		-6.191***
		(2.470)		(1.783)
c1 Value X c2-Extra (pscore)		-1.69		2.771
		(1.657)		(1.662)
c1 value X TransCost		0.636		-0.186
		(0.839)		(0.910)
c1 Value X c1-Extra (pscore) X TransCost		5.971*		6.257**
		(3.329)		(2.828)
c1 Value X c2-Extra (pscore) X TransCost		-3.086*		-3.555
		(1.841)		(2.504)
Transfer Value, Other Foods (ITT, Proj4)		-1.226		-0.905
		(1.158)		(2.627)
c2 Value X c1-Extra (pscore)		0.392		8.032***
		(2.781)		(2.065)
c2 Value X c2-Extra (pscore)		2.666		-2.228
		(1.809)		(2.768)
c2 value X TransCost		-0.398		0.211
		(0.947)		(1.037)
c2 Value X c1-Extra (pscore) X TransCost		-6.114		-7.598**
		(3.940)		(3.283)
c2 Value X c2-Extra (pscore) X TransCost		3.064		4.314
		(2.212)		(2.916)
C1 Extra-marginal (propensity)	-7.694	-7.26	-13.614	-17.340*
	(7.414)	(7.416)	(9.209)	(8.680)
C2 Extra-marginal (propensity)	-4.798	-5.887	-26.649	-17.289
	(9.520)	(10.294)	(18.512)	(32.235)
Distance from village center (km)	0.405	0.11	2.196***	2.428***
	(0.864)	(0.828)	(0.384)	(0.391)
Pastoral	-6.169*	-5.316*	8.148**	9.560**
	(3.624)	(3.133)	(3.920)	(3.691)
HH Controls & Assets	Yes	Yes	Yes	Yes
Village Controls & Transaction Costs	Yes	Yes	Yes	Yes
Commune FEs	Yes	Yes	Yes	Yes
No. of Households	2081	2081	1891	1891
R-Squared	0.326	0.331	0.251	0.264

*, **, and *** represent significance at the 10%, 5%, and 1% level, respectively

See list of included controls in notes of Table 2.6.

c. Testing Hypothesis 3

A rejection of hypothesis 3 would mean that, across estimation procedures, a transfer has an impact on dietary diversity relative to cash even when that transfer in infra-marginal. A failure to reject, in this case, provides some support for the model's prediction, that food transfers have no impact relative to cash transfers for those for whom they are infra-marginal. In the first instance I test whether for those for whom both goods are infra-marginal, G1, the beta coefficients for food transfers is not equal to zero. As shown in Column (2) of Tables 9 and 10, while the over-all impact of the food transfer is still weakly positive in both periods, in October each separate commodity has no impact of dietary diversity relative to cash; in July the impact of grain is weakly positive, as opposed to negative for all other groups. It is only in the case that both commodities are infra-marginal, G1, however, that I cannot reject the hypothesis, i.e. that there are not definitive impacts of the food transfers on dietary diversity relative to cash. While this does not confirm that the impact of food is identical to that of cash for infra-marginal recipients, it does provide support for the model, especially since the hypothesis is stronger rejected for other groups.

For the propensity score estimation, a rejection is contingent on the impact of food and/or both food commodities being different from cash if the propensity to be extra-marginal is zero, or:

$$H_0: \beta_1 = 0 \mid \Omega_1 = 0 \; [vs. H_A: \beta_1 \neq 0 \mid \widehat{\Omega}_1 = 0]$$

$$H_0: \beta_2 = 0 \mid \Omega_2 = 0 \; [vs. H_A: \beta_2 \neq 0 \mid \widehat{\Omega}_2 = 0]$$

In both periods, we see that including the propensity scores in the regression leads to an insignificant (not distinguishable from zero) impact of each transfer on dietary diversity (columns (2) and (4)), and in July this occurs for the transfer as a whole (column (1)). Here again

I *fail to reject* the hypothesis in support of the alternative, finding some (if weak) support for the model's prediction.

d. Testing Hypothesis 4

The model predicts that, in addition to influencing consumption outcomes, the extra-marginality of both food transfer types could lead to greater expenditure on non-food items for cash than for food recipients. Overall I fail to reject this hypothesis, finding to the contrary that food recipients spend as much or more on non-food expenditures as cash recipients. There are minimal significant differences between cash and food recipients on non-food expenditures in July, and none at all in October. When divided between groups, the impacts of food transfers for some subsets are weakly positive (indicating greater purchases of non-food items by food recipients) in July and weakly negative (indicating greater purchases of non-food items by cash recipients) in October, which is consistent with the findings of Hoddinott et al. (2013) of greater expenditures by those respective groups in certain targeted areas. These effects are however small in magnitude.

Looking at the propensity score estimations shown in Table 2.12, while the food transfer impact is positive (column (1)), indicating greater purchases by food recipients, it is decreasing in the propensities to be extra-marginal, and on net negative for those who are extra-marginal in consumption of c_2. Likewise with the regressions divided by commodity, the degree to which cash recipients purchase more non-food goods is increasing in the degree of extra-marginality of c_2 (3.601-5.556=-1.955, column (2)). On the whole, however, I *fail to reject* Hypothesis 4 in favor of the alternative, that cash recipients would make more non-food purchases when commodities are extra-marginal.

Table 2.12: OLS Regression on Total Non-Food Expenditure for ALL households with extra-marginality propensity scores

	JULY		OCTOBER	
	(1)	(2)	(3)	(4)
Food Transfer Value (ITT, Proj4)	0.522**		0.295	
	(0.198)		(0.426)	
Food Value X c1-Extra (pscore)	-0.343		-0.035	
	(0.301)		(0.378)	
Food Value X c2-Extra (pscore)	-0.641**		-0.361	
	(0.295)		(0.399)	
Food Value X c1-Extra (pscore) X TransCost	-0.151		0.162	
	(0.115)		(0.099)	
Food Value X c2-Extra (pscore) X TransCost	0.084**		-0.086	
	(0.033)		(0.081)	
Transfer Value, Grain (ITT)		-1.953*		-0.886
		(1.152)		(1.267)
c1 Value X c1-Extra (pscore)		-2.722		-1.786
		(1.842)		(1.886)
c1 Value X c2-Extra (pscore)		3.358		0.867
		(2.035)		(2.212)
c1 value X TransCost		0.31		-1.15
		(0.825)		(1.285)
c1 Value X c1-Extra (pscore) X TransCost		3.158		-7.335
		(2.767)		(5.855)
c1 Value X c2-Extra (pscore) X TransCost		-1.658		7.817*
		(1.514)		(4.632)
Transfer Value, Other Foods (ITT, Proj4)		3.601***		3.977
		(1.291)		(2.937)
c2 Value X c1-Extra (pscore)		2.533		2.187
		(2.499)		(2.254)
c2 Value X c2-Extra (pscore)		-5.566**		-4.483
		(2.468)		(3.639)
c2 value X TransCost		-0.426		1.059
		(0.982)		(1.282)
c2 Value X c1-Extra (pscore) X TransCost		-4.133		8.453
		(3.377)		(6.841)
c2 Value X c2-Extra (pscore) X TransCost		2.272		-8.642
		(1.883)		(5.367)
C1 Extra-marginal (propensity)	19.383***	17.974**	1.201	2.26
	(6.468)	(7.077)	(16.131)	(16.646)
C2 Extra-marginal (propensity)	10.093	16.211**	9.525	46.550**
	(7.935)	(7.310)	(14.579)	(22.125)
Distance from village center (km)	-0.845**	-0.731**	0.076	0.341
	(0.356)	(0.355)	(0.350)	(0.291)
Pastoral	-2.998	-2.877	2.544	5.326
	(2.026)	(2.080)	(3.150)	(3.603)
HH Controls & Assets	Yes	Yes	Yes	Yes
Village Controls & Transaction Costs	Yes	Yes	Yes	Yes
Commune FEs	Yes	Yes	Yes	Yes
No. of Households	2085	2085	1891	1891
R-Squared	0.206	0.212	0.295	0.3

*, **, and *** represent significance at the 10%, 5%, and 1% level, respectively

See list of included controls in notes of Table 2.6.

This finding suggests that there are other uses of cash by cash recipients that are not addressed purely by the question of extra-marginality. A key candidate that emerges from the model in this paper is the use of cash for consumption-smoothing behavior, through payment of debts and/or gift-giving. This question is taken up in a companion paper in this dissertation, Upton et al. 2014.

e. Single-adult households

It is often supposed that policy outcomes inconsistent with our theories may be the result of intra-household bargaining dynamics, which can lead to inconsistencies and inefficiencies in behavior. I hence test this supposition by checking to see whether the model's predictions and results hold in the absence of intra-household bargaining, which we would presume to be the case in households with only one adult.

I define single-adult households as those of either gender for whom the spouse is deceased or otherwise absent during the transfer period. In July, this included just one male-headed household (whose wife was absent during that period), but in October it coincided precisely with female-headed households.[21]

The results for the key specifications on the food consumption score, first with food values alone (equations (18) and (19)) and then with the propensity scores (equations (22) and (23)), are shown in Table 2.13 for both periods. The food value has a positive impact on dietary diversity relative to cash, in slightly greater magnitude than for all households. Hypothesis 1 and 2 are in turn rejected in October, as we see negative coefficients on T_1 and positive coefficients on T_2 (columns (6) and (8)). The propensity scores evidence is ambiguous, however, perhaps because the extra-marginality of foods does capture different information for single-adult (primarily female-headed) households. Finally, I can as for all households reject hypothesis 3

[21] The results for just female-headed households are virtually identical.

only in July, as the impacts of food and each food good are indistinguishable from zero when propensity scores are zero (columns (3) and (4)).

When we look at non-food expenditures (not shown), similarly also to the results for all households, food recipient single-adult households have slightly higher non-food expenditures in July, but there are no significant differences at all in October.

While there may be some evidence that there are differences in the nature of the extra-marginality of transfers for single-adult households, I would conclude on the whole that there is very little evidence that household-level bargaining dynamics affect the core predictions of the model.

Table 2.13: OLS Regression on FCS, for single-adult households

	July				October			
	Food Values		Propensity Scores		Food Values		Propensity Scores	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Food Transfer Value	0.142*		0.354		0.181***		-1.167*	
	(0.071)		(0.574)		(0.053)		(0.585)	
Food Value X TransCost	-0.036				0.021			
	(0.071)				(0.033)			
Food Value X c1-Extra (pscore)			0.966**				0.175	
			(0.451)				(0.516)	
Food Value X c2-Extra (pscore)			-0.592				1.25	
			(0.769)				(0.763)	
Food Value X c1-Extra (pscore) X TransCost			0.475				-0.166	
			(0.455)				(0.139)	
Food Value X c2-Extra (pscore) X TransCost			-0.151				0.144*	
			(0.165)				(0.084)	
Transfer Value, Grain (ITT)		-0.865		-2.969		-1.740***		-5.830***
		(0.726)		(2.228)		(0.381)		(1.981)
c1 value X TransCost		0.959*		-7.835		1.581*		14.963*
		(0.543)		(5.632)		(0.824)		(7.703)
c1 Value X c1-Extra (pscore)				12.418**				-5.54
				(5.403)				(3.860)
c1 Value X c2-Extra (pscore)				-0.454				9.662***
				(3.813)				(3.444)
c1 Value X c1-Extra (pscore) X TransCost				20.174***				11.834
				(6.760)				(11.863)
c1 Value X c2-Extra (pscore) X TransCost				0.804				-26.658*
				(6.392)				(14.928)
Transfer Value, Other Foods		1.345		4.028		2.439***		8.712**
		(0.863)		(2.528)		(0.431)		(3.918)
c2 value X TransCost		-1.287*		9.59		-1.762*		-16.586**
		(0.704)		(7.168)		(0.948)		(7.158)
c2 Value X c1-Extra (pscore)				-11.604*				6.604
				(6.023)				(4.959)
c2 Value X c2-Extra (pscore)				-0.619				-13.336***
				(4.403)				(4.805)
c2 Value X c1-Extra (pscore) X TransCost				-24.158***				-12.745
				(8.142)				(11.939)
c2 Value X c2-Extra (pscore) X TransCost				-1.202				29.440**
				(8.105)				(13.501)
C1 Extra-marginal (propensity)			-4.325	0.359			-17.876	-16.036
			(11.415)	(10.738)			(16.326)	(20.109)
C2 Extra-marginal (propensity)			18.688	16.436			-47.152*	28.171
			(21.395)	(21.715)			(23.491)	(35.516)
Distance from village center (km)	1.436	1.319	0.684	0.899	1.617**	1.826**	0.991	1.424*
	(2.024)	(1.975)	(1.988)	(2.075)	(0.756)	(0.816)	(0.939)	(0.845)
Pastoral	4.129	0.753	-13.003	-17.938**	15.311***	8.566	4.576	10.087
	(4.670)	(5.272)	(8.904)	(7.477)	(4.241)	(7.152)	(6.495)	(8.079)
HH Controls & Assets	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Village Controls & Trans Costs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Commune FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. of Households	473	473	394	394	434	434	343	343
R-Squared	0.334	0.34	0.355	0.378	0.287	0.305	0.324	0.355

*, **, and *** represent significance at the 10%, 5%, and 1% level, respectively

Single-adult households are defined as female-headed households with no other adult women (co-spouses) present, and households with the head absent during the transfer period.

See list of included controls in notes of Table 2.6.

6. SUMMARY AND CONCLUSIONS

In this paper I take on a puzzle that has been with economists, and the community of scholars concerned with food security and food assistance policy, for years: the so-called "cash-out" puzzle, or degree to which in-kind transfers lead to different decisions and outcomes than cash transfers, even with the in-kind transfer is infra-marginal. In particular, I attempt to shed light on the mechanisms behind differential impacts of cash versus food transfers, and in this case the conditional superiority of food transfers, for dietary diversity objectives. While this question has been examined repeatedly and in many contexts, I take a novel approach that builds on development microeconomic theory, and evaluate it in the challenging and important context of rural Niger.

The model I construct in this paper includes a minor extension on a dynamic household decision model, in order to generate predictions on the impacts of cash versus food transfers for dietary diversity outcomes. The model predicts that, due to transaction costs involved in selling food, household will substitute toward consumption of extra-marginal transferred commodities. This substitution leads to negative impacts on dietary diversity relative to cash if the extra-marginal commodity is a cheap, staple grain, but positive impacts on dietary diversity relative to cash if the extra-marginal commodity is a higher quality food. The model yields additional predictions related to other uses of cash, in particular with respect to consumption-smoothing behavior, that are taken up in a companion paper (Upton et al. 2014).

The Niger context and particular sample of households in which I test this model's predictions is intriguing. I show that, for all households in the sample, both commodities provided in the transfer are largely extra-marginal. But the status of each good is dynamic, and the reasons for the extra-marginality are different between lean and harvest seasons. In the lean

season, the grain transfer is largely infra-marginal in terms of grain consumption, but the specific commodities provided are still extra-marginal, and I find support for the model's prediction in a slightly negative impact of grain transfers relative to cash on the food consumption score. During the harvest, however, the commodities provided are still extra-marginal and the extra-marginality of grain over all increases due to local availability of millet. In turn, we see as the model predicts pronounced negative impacts on dietary diversity relative to cash. The other, higher quality good provided is a legume, which is extra-marginal for many households in both periods but primarily because households choose to substitute toward consumption of cheaper grains, especially during the harvest when home-produced grain is available. The model's predictions are supported here as well, with a pronounced positive impact of the legume good provided on dietary diversity relative to cash, particularly during the harvest.

I then divide households into groups based on the extra-marginality of each commodity, and construct propensity scores, to confirm that these impacts vary within the population as a function of the extra-marginality of foods. While this task is challenging and somewhat imprecise, I find some additional support for the model through these methods, in particular that during the harvest period the negative (positive) impact of the grain (legume) transfer is (decreasing) increasing in the propensity for it to be extra-marginal. While the impact of food generally is still positive relative to cash for those for whom transfers are infra-marginal, the impacts of the separated commodities among these households is negligible.

I examine all results within the sub-sample of single-adult households to assess the influence of intra-household bargaining dynamics, and find that very similar results. This is to say that intra-household bargaining does not have an important effect on the degree to which the extra-marginality of transferred commodities influences their impacts.

These results, and the validation of this model, go a long way toward solving the puzzle of the conditional superiority of food transfers for dietary diversity outcomes in this context. There are some gaps in the results, however—such as in that the over-all food transfer has positive impacts in July, but this does not seem to be explained by the relative status of each commodity. In turn, the food transfer over-all still has positive impacts relative to cash for all households and all infra- or extra-marginality groupings. The model also predicts that cash recipients should purchase more non-food items than food recipients when food commodities are extra-marginal, but this prediction is not supported by the evidence. These gaps suggest that additional mechanisms remain to be explained by other dynamics, including the relative use of cash versus food for debts and gift-giving to smooth consumption over time.

While these specific results are unique to the context of Niger—characterized by extreme poverty and extraordinarily limited dietary diversity—the model, its principles, and predictions could be usefully applied elsewhere to examine the impacts of food versus cash transfers, and the importance of the content of the food basket, for differential impacts on consumption behavior.

The contribution of this paper is hence two-fold. First, it uses economic theory to build intuition on an important economic question. This is a theoretical contribution from the perspective of development microeconomics, and especially for the study of food security and food assistance. These results could also be used toward better design of food assistance programs. In particular, the results in Niger, while not applicable everywhere, can show us conditions under which food transfers—especially when providing a good of higher quality than poor recipients would otherwise consume—may have positive impacts on dietary diversity relative to cash. They also show the more generalizable result that providing a staple grain,

especially one that is extra-marginal, will perform worse relative to cash toward dietary diversity outcomes.

There are key implications to be drawn from these findings for food aid quality and commodity choice. The findings show that for the goal of improving dietary diversity providing an inexpensive grain is less effective than providing cash, while providing a higher quality food is better than providing cash. Hence with this particular goal in mind, cash is preferred to a low quality food and a high quality food is a still better choice. This finding raises question of paternalism in food assistance, however, and whether or not it is appropriate for policy makers to restrict recipients' flexibility in order to achieve their desired objectives. A key point of discussion in the transition toward cash transfers has centered around providing cash in order to better meet recipients' preferences through greater flexibility.

The case of Niger raises additional questions related to recipient choice, however, in that assuming that more flexibility is necessarily better for recipients is also imposing certain assumptions about recipients' preferences and needs. Recipients in this case expressed strong preferences for food transfers, in spite of the lack of flexibility. This food preference may be linked to the outcomes we observe, in that cash recipients may have substituted toward cheaper commodities due to certain pressures but would have in fact preferred to receive food as a kind of commitment device for achieving greater dietary diversity. Better meeting recipients' needs and preferences should hence begin with the choice of transfer type, and not be assumed to be better achieved with cash transfers (Gentilini 2014). More research should also be done to assess the links between transfer preferences and outcomes, in particular the degree to which recipients' stated preferences provide information about likely outcomes they will experience from different transfer types.

While these results are powerful and have pertinent implications, one should exercise caution in applying them in contexts too different from the poor, rural, Sahelian region of southern Niger. The predictions of this model should hence be tested in other contexts, with different food commodity choices and levels of poverty, in order to apply their intuition toward the decision to provide cash versus food and/or what foods to provide, particularly in light of dietary diversity objectives.

REFERENCES

Adams, L. and R. Winahyu (2006).Learning from cash responses to the Tsunami: Case Studies, Humanitarian Policy Group.

Aker, Jenny, Rachid Boumnijel, Amanda McClelland, and Niall Tierney (2013). How do electronic transfers compare? Evidence from a mobile money cash transfer experiment in Niger. In submission. Available on line at: http://sites.tufts.edu/jennyaker/files/2010/02/Zap-it-to-Me_12sept2013_No-Appendices.pdf

Aker, Jenny (2010). Information from markets near and far: the impact of mobile phones on grain markets in Niger. *American Economic Journal: Applied Economics, Vol. 2*: 46-59.

Arnould, E. J. (1985). "Evaluating Regional Economic Development: Results of a Marketing Systems Analysis in Zinder Province, Niger Republic." *Journal of Developing Areas* **19**(2): 209-244.

Azarya, V., A. Breedveld, M. Bruijn, and H Van Dijk (1999). Pastoralists Under Pressure? Fulbe Societies Confronting Change in West Africa. Leiden, Boston, Köln: Brill, 1999.

Barrett, Christopher B. and Michael Carter (2013). The economics of poverty traps and persistent poverty: policy and empirical implications. *Journal of Development Studies, 49*(7): 976-990.

Barrett, Christopher B., Andrea Binder and Julia Steets (2012). Uniting on food assistance: the case for transatlantic cooperation. Chapter in Barrett, Christopher B., Andrea Binder and Julia Steets (Eds). Uniting on food assistance: the case for transatlantic cooperation. London, New York: Routledge 2012.

Barrett, Christopher B. (2010). Food systems and the escape from poverty and hunger traps in sub-Saharan Africa. In Pinstrup-Andersen, Per (Ed.). The African food system and its interactions human health and nutrition. Ithaca, NY: Cornell University Press, 2010.

Barrett, Christopher B. (2007). "Displaced Distortions: Financial Market Failures and Seemingly Inefficient Resource Allocation in Low-Income Rural Communities," in E. Bulte and R. Ruben, eds., Development Economics: Between Markets and Institutions: Incentives for growth, food security and sustainable use of the environment (Wageningen: Wageningen Academic Publishers).

Barrett, Christopher B. (2002). Chapter 40: Food security and food assistance programs. *Handbook of Agricultural Economics, 2*(Part B): 2103-2190.

Barrett, Christopher B. (1996). Urban bias in price risk: The geography of food price distributions in low-income countries. *Journal of Development Studies 32*(6): 830-849.

Ben Mohamed, A., N. Van Duivenbooden, and S. Abdoussallam (2002). Impact of climate change on agricultural production in the Sahel–Part 1. Methodological approach and case study for millet in Niger. *Climatic Change* 54(3): 327-348.

Behrman, Jere R., Andrew Foster and Mark R. Rosenzweig (1997). Dynamic savings decisions in agricultural environments with incomplete markets. *Journal of Business & Economic Statistics, 15*(2): 282-292.

Besley, Timothy (1995). Nonmarket institutions for credit and risk-sharing in low-income countries. *Journal of Economic Perspectives, 9*(3): 115-127.

Breunig, Robert and Indraneel Dasgupta (2005). Do intra-household effects generate the food stamp cash-out puzzle? *American Journal of Agricultural Economics, 87*(3):552-568.

Bruhn, M. and D. McKenzie (2009). In Pursuit of Balance: Randomization in Practice in Development Field Experiments. *American Economic Journal: Applied Economics*, 1(4): 200-232.

Chamberlin, Jordan and T.S. Jayne (2013). Unpacking the meaning of 'market access': Evidence from rural Kenya. *World Development 41*: 245-264.

Chen, Y. and Zhou L.A. (2007). The long-term health and economic consequences of the 1959-1961 famine in China. *Health Economics 26*: 659-681.

Cunha, Jesse M. (2014). Testing paternalism: cash versus in-kind transfers. *American Economic Journal: Applied Economics 6*(2): 195-230

de Janvry, A., M. Fafchamps and E. Sadoulet (1991). Peasant Household Behavior with Missing Markets: Some Paradoxes Explained. *Economic Journal,* Vol. 101 (409): 1400-1417.

Deaton, Angus (1991). Saving and Liquidity Constraints. *Econometrica, 59*(5): 1221-1248.

Dehejia, Rajeev H. and Sadek Wahba (2002). Propensity score-matching methods for nonexperimental causal studies. *Review of Economics and Statistics, 84*(1): 151-161.

Devereux, S., J. Marshall, J. MacAskill, and L. Pelham (2005). Making Cash Count: Lessons from cash transfer schemes in east and southern Africa for supporting the most vulnerable children and households. Brighton, Sussex, Save the Children UK, HelpAge International and Institute of Development Studies.

Eilerts, G. (2006). Niger 2005: Not a famine, but something much worse. Humanitarian Exchange Magazine, Issue 33, April 2006.

Famine Early Warning System (2014). Niger Food Security Brief. Available on line at: http://www.fews.net/west-africa/niger/food-security-brief/tue-2014-05-20 (accessed June 5, 2014).

Food and Agriculture Organization (2014). Tropical Livestock Units. Available on line at: http://www.fao.org/ag/againfo/programmes/en/lead/toolbox/Mixed1/TLU.htm (accessed March 22, 2014).

Fraker, T.M. (1990). The effects of food stamps on food consumption: A review of the literature. U.S. Department of Agriculture Food and Nutrition Service, Washington.

Gentilini, Ugo (2014). Our daily bread: What is the evidence on comparing cash versus food transfers? World Bank Social Protection and Labor Discussion Paper No. 1420.

Gilligan, D. J. Hoddinott and A. Taffesse (2008). The impact of Ethiopia's Productive Safety Net Programme and its linkages. IFPRI Discussion Paper 839. Washington, D.C.: IFPRI.

Grober-Tanner, C. (2006). Understanding nutrition data and the causes of malnutrition in Niger: A special report by the Famine Early Warning Systems Network. USAID / FEWS, 2006.

Haddad, L. J. Hoddinott and H. Alderman (1997). Intrahousehold resource allocation in developing countries: models, methods, and policy. Baltimore, MD, USA: Johns Hopkins University Press.

Hetzel, B.S. (1990). Iodine deficiency: an international public health problem. In Brown, M.L. (Ed.), Present Knowledge in Nutrition. Washington, D.C.: International Life Sciences Institute, Nutrition Foundation, 1990.

Hidrobo, Melissa, John Hoddinott, Amber Peterman, Amy Margolies, and Vennessa Moreira (2012). Cash, food, or vouchers? Evidence from a randomized experiment in Northern Ecuador. IFPRI Discussion Paper 01234.

Hoddinott, John, Susanna Sandstrom and Joanna Upton (2013). The impact of cash and food transfers: Evidence from a randomized intervention in Niger. Under revision for *American Journal of Agricultural Economics.*

Kennedy, Gina L. (2009). Evaluation of dietary diversity scores for assessment of micronutrient intake and food security in developing countries. Thesis, Wageningen University, The Netherlands. Available on line at: http://library.wur.nl/WebQuery/edepot/14551 (accessed May 31, 2014)

Key, Nigel, Elisabeth Sadouet and Alain de Janvry (2000). Transaction costs and agriculture household supply response. *American Journal of Agricultural Economics, 82*(2): 245-259.

Khogali, H. and P. Takhar (2001). Empowering women through cash relief in humanitarian contexts. *Gender & Development* 9(3): 40-49.

Lentz, E.C., S. Passarelli, and C.B. Barrett, (2013). The Timeliness and Cost Effectiveness of the Local and Regional Procurement of Food Aid. *World Development*.

Michelson, Hope, Erin Lentz, Richard Mulwa, Mitchell Morey, Laura Cramer, Megan McGlinchy, and Christopher B. Barrett (2012). Cash, Food or Vouchers in Urban and Rural Kenya? An Application of the Market Information and Food Insecurity Response Analysis Framework. *Food Security, 4*(3): 455-469.

Miles, (1994). Hausaland Divided. Ithaca, London: Cornell University Press.

Moursi, Mourad M., Mary Arimond, Kathryn G. Dewey, Serge Treche, Marie T. Ruel, and Francis Delpeuch (2008). Dietary diversity is a good predictor of the micronutrient density of the diet of 6- to 23-month-old children in Madagascar. *Journal of Nutrition 138*(12):2448-2453.

Reza, A., B. Tomczyk, V. Aguayo, N. Zagré, K. Goumbi, C. Blanton, and L. Talley (2008). Retrospective Determination of Whether Famine Existed in Niger, 2005: Two State Cluster Survey. *BMJ* 337:a1622.

Schofield, Heather (2014). The economic cost of low caloric intake: evidence from India. Job Market Paper, Harvard University. Available on line at: http://scholar.harvard.edu/hschofield/research.

Schwab, Benjamin (2013). In the form of bread? A randomized comparison of cash and food transfers in Yemen. IFPRI. Selected Paper prepared for presentation at the Agricultural and Applied Economics Association's 2013 AAEA & CAES Joint Annual Meeting, Washington, D.C., August 4-6 2013.

Shapiro, Jesse M. (2005). Is there a daily discount rate? Evidence from the food stamp nutrition cycle. *Journal of Public Economics, 89*(2): 303-325.

Southworth, H.M. (1945). The economics of public measures to subsidize food consumption. *Journal of Farm Economics,* 27: 38-66.

Stephens, E. C. and C. B. Barrett (2011). "Incomplete credit markets and commodity marketing behaviour." *Journal of Agricultural Economics* 62(1): 1-24.

Steyn, N.P., J.H. Nel, G. Nantel, G. Kennedy and D. Labadarios (2006). Food variety and dietary diversity scores in children: are they good indicators of dietary adequacy? *Public Health Nutrition, 9*: 644-650.

Udry, Christopher (1996). Gender, agricultural production, and the theory of the household. *Journal of Political Economy, 104*(5): 1010-1046.

Upton, Joanna, Susanna Sandstrom and John Hoddinott (2014). The impact of cash versus in-kind transfers on debt and transfer behavior in rural Niger. Working Paper.

Upton, J. and E. Lentz (2011). Expanding the food assistance toolbox. Chapter 5 in Barrett, C.B., A. Binder and J. Steets (Eds). Uniting on Food Assistance: The case for transatlantic policy convergence. London, Routledge.

Victoria, C.G., L. Adair, C. Fall, P.C. Hallal, R. Martorell, L. Richter, H.S. Sachdev (2008). Maternal and child undernutrition: consequences for adult health and human capital. *Lancet 371*: 340-357.

Walsh, M. (1998). Women in Food Aid Interventions: Impacts and Issues. Time for Change: Food Aid and Development. IDS. Rome, Italy.

Wiesmann, D. L. Bassett., T. Benson, and J. Hoddinott (2009). Validation of the World Food Programme's Food Consumption Score and Alternative Indicators of Household Food Security. IFPRI Discussion Paper 00870. International Food Policy Research Institute.

World Food Programme (2011a). Spanish Trust Fund Proposal: Niger.

World Food Programm (2011b). Integrated Food Aid Information System. On line at : www.wfp\interfais.org

World Food Programme (2010). Draft Terms of Reference: EMOP 200170: Saving Lives and Improving Nutrition in Niger. Evaluation and Quality Assurance System, WFP, 5 November 2010.

World Health Organization (2009). Global prevalence of vitamin A deficiency in population at risk 1995-2005: WHO global database on vitamin A deficiency. Geneva: World Health Organization, 2009.

APPENDIX 2.1

Cowpea Price Projection

For the purposes of testing the model in this paper, it was necessary to estimate local values for the food basket distributed to food recipients. While millet prices were solicited at the community level, the survey did not do so for cowpeas, the other primary (and locally available) commodity distributed. Given that local production and trade patterns with respect to millet and cowpeas are similar, we could expect that the two prices have similar patterns across time and villages.

The way that we construct this projection depends on what we consider to be the primary drivers of price variation. One supposition is that the drivers are a direct function of distance, from primary cities and towns, the main road, and/or the nearest market. They might also, however, be a function of other village-level characteristics, such as production patterns, numbers of households, and other aspects of accessibility not captured by distance.

I hence consider a few options for this price projection, based on available data. In all cases, I am regressing the village-level millet price across time, against the price at the regional capitol (Zinder) and a number of other covariates. I then retain the parameters, and project a village-level cowpea price using the regional price available. I executed and compared four possible regression projections. In the first efforts, I assess the degree to which distance and available accessibility characteristics sufficiently capture the variation in price, and the degree to which additional covariates and/or interactions changes the price projection. I then explore addition of fixed effects, with and without additional household-level distance variables.

The first projection proceeds as follows:

Projection (1):

$$P_{ti}^{m} = \alpha_{it} + \beta_{1it}P_t^m \times Zinder_i + \beta_{2it}P_t^m \times Market_i + \beta_{3it}RN1_i + \beta_{4it}RoadQ_i$$
$$+ \beta_{5it}TwoRoads_i + \beta_{6it}TCost_i + \beta_{7it}HHs_i + \varepsilon_{it}$$

Here, P_{ti}^{m} is the millet price that varies by village (i) over time (t). I then interact the Zinder price, P_t^m, which varies only between periods, with the distance from each village to Zinder ($Zinder_i$), as well as with the distance from each village to the nearest market ($Market_i$). I also include the distance from each village to the main highway, Route Nationale No. 1 ($RN1_i$), the quality of the road in the village ($RoadQ_i$), whether or not there is a second road from the village ($TwoRoads_i$), the cost of transporting 100kg bag of grain to the nearest market ($TCost_i$), and the number of households in the village (HHs_i). We have finally the error term, ε_{it}.

The second projection is largely similar, but with every term interacted with the regional price.

Projection (2):

$$P_{ti}^{m} = \alpha_{it} + \beta_{1it}P_t^m \times Zinder_i + \beta_{2it}P_t^m \times Market_i + \beta_{3it}P_t^m \times RN1_i + \beta_{4it}P_t^m \times RoadQ_i$$
$$+ \beta_{5it}P_t^m \times TwoRoads_i + \beta_{6it}P_t^m \times TCost_i + \beta_{7it}P_t^m \times HHs_i + \varepsilon_{it}$$

After examining these projections, it appeared that a large degree of the variation in millet price was not being captured by these covariates. This is possibly due to various unobserved or unobservable village conditions and characteristics that influence how the price varies over space and over time. I hence included village-level fixed effects, first without and then with household-level distances from the village center (see Appendix 2.2) also included to introduce household-level variation:

Projection (3):

$$P_{ti}^{m} = \alpha_{it} + \beta_{1it}P_{t}^{m} + \gamma_{it}Villages + \varepsilon_{it}$$

Projection (4):

$$P_{ti}^{m} = \alpha_{it} + \beta_{1it}P_{t}^{m} + \beta_{2it}P_{t}^{m} \times MarketHH_{j} + \gamma_{itv}Villages + \varepsilon_{it}$$

Here, the right hand side includes only the Zinder price and village-level fixed effects (*Villages*), both of which vary over time. In Projection (4), $MarketHH_j$ represents the household-level distance, which introduces more nuance to the price projection and also assists with problems of collinearity between the final treatment variables.

I then save the parameters in these regressions and project the village-level cowpea price, P_{ti}^{c}, plugging in the Zinder price of cowpeas in place of the Zinder price of millet.

Table A1 shows the four price projections, as compared against the millet price, with averages and standard deviations across villages for each month of the transfer period. I favor projection (4), the fixed effects projection with household-level market distances. While the second projection performs well in terms of being similarly distributed to the millet price, the price level is very close to that of millet, which is not reflective of what is shown in national-level price data and at the regional level here. The third and fourth projections reflect more appropriate price levels. In turn, the fourth projection introduces a level of unique household-level variation that is useful for the analysis.

In order to confirm that the results aren't sensitive to the exact nature of the cowpea price projection, I run a set of regressions showing results across all four projections (Table A2.1.2). These results, for all households in October, show the treatment variable as the value of all commodities and then the divided commodities. As is clear from the results, the nature of the projection does not affect the outcomes of interest; the outcomes are slightly different in

magnitude for projections (3) and (4) than for projections (1) and (2), but do not change in sign or significance.

Table A2.1.1: Cowpea Price Projection Summary, transfer period (April-September 2011)
Prices per kilogram (Average / SD)

	Millet Price		Cowpea Price and Price Projections				
	Zinder	Villages	Zinder	Proj 1	Proj 2	Proj 3	Proj 4
April	173	180	252	177	175	265	265
	0	25.37	0	6.08	26.18	25.37	25.39
May	174	183	253	184	188	270	270
	0	28.64	0	5.53	29.56	28.64	28.67
June	179	187	253	189	197	264	264
	0	26.5	0	7.76	27.82	26.5	26.5
July	176	185	212	187	190	221	221
	0	28.69	0	9.89	29.52	28.69	28.71
August	173	187	213	190	192	233	234
	0	30.11	0	12.79	31.15	30.11	30.11
September	168	189	222	193	195	244	244
	0	30.31	0	12.87	31.82	30.31	30.31

Table A2.1.2: Regression on FCS, for all cowpea price projections (Total transfer value and divided values, October)

	Projection 1		Projection 2		Projection 3		Projection 4	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Food Transfer Value	0.143***		0.142***		0.138***		0.138***	
	(0.032)		(0.032)		(0.031)		(0.031)	
Transfer Value, Grain (ITT)		-0.950**		-1.328***		-1.232***		-1.232***
		(0.383)		(0.457)		(0.446)		(0.446)
Transfer Value, Other Foods		1.448***		1.915***		1.681***		1.681***
		(0.488)		(0.582)		(0.532)		(0.532)
Distance from village center (km)	2.378***	9.379***	2.376***	9.414***	2.377***	9.417***	2.377***	9.417***
	(0.399)	(2.713)	(0.400)	(2.668)	(0.400)	(2.684)	(0.400)	(2.684)
Pastoral	12.612***	0.027	12.561***	0.027	12.578***	0.027	12.578***	0.027
	(2.852)	(0.023)	(2.855)	(0.023)	(2.854)	(0.023)	(2.854)	(0.023)
Age of HH Head	0.019	0.818	0.019	0.819	0.019	0.825	0.019	0.825
	(0.026)	(0.677)	(0.026)	(0.678)	(0.026)	(0.677)	(0.026)	(0.677)
Female HH Head	1.052	-0.007	1.05	0.009	1.051	0.006	1.051	0.006
	(0.685)	(1.079)	(0.684)	(1.077)	(0.684)	(1.076)	(0.684)	(1.076)
Heads with formal education	-0.414	-0.340**	-0.419	-0.340**	-0.417	-0.340**	-0.417	-0.340**
	(1.207)	(0.145)	(1.208)	(0.145)	(1.207)	(0.145)	(1.207)	(0.145)
Household Size	-0.347**	1.47	-0.347**	1.481	-0.347**	1.483	-0.347**	1.483
	(0.144)	(1.243)	(0.144)	(1.244)	(0.144)	(1.243)	(0.144)	(1.243)
Polygamous HH	1.6	-2.032	1.604	-1.995	1.603	-2.003	1.603	-2.003
	(1.334)	(1.229)	(1.334)	(1.223)	(1.334)	(1.223)	(1.334)	(1.223)
Member of Ethnic Majority	-1.844	-1.736	-1.845	-1.684	-1.844	-1.672	-1.844	-1.672
	(1.180)	(1.104)	(1.181)	(1.108)	(1.180)	(1.111)	(1.180)	(1.111)
Hausa	-1.758	1.011***	-1.755	1.010***	-1.753	1.012***	-1.753	1.012***
	(1.093)	(0.176)	(1.093)	(0.175)	(1.093)	(0.176)	(1.093)	(0.176)
Asset Score (PCA), Baseline	0.982***	0.086	0.982***	0.084	0.982***	0.085	0.982***	0.085
	(0.173)	(0.205)	(0.173)	(0.206)	(0.173)	(0.207)	(0.173)	(0.207)
Tropical Livestock Units, Baseline	0.071	-0.006	0.072	-0.006	0.071	-0.007	0.071	-0.007
	(0.176)	(0.011)	(0.176)	(0.011)	(0.176)	(0.011)	(0.176)	(0.011)
Millet Price (CFA)	-0.013	0.008	-0.013	0.009	-0.013	0.009	-0.013	0.009
	(0.012)	(0.008)	(0.012)	(0.008)	(0.012)	(0.008)	(0.012)	(0.008)
Change in millet price (CFA)	0.015	0.035	0.015	0.032	0.015	0.031	0.015	0.031
	(0.009)	(0.029)	(0.009)	(0.027)	(0.009)	(0.027)	(0.009)	(0.027)
Market in village	-2.1	-1.414	-2.089	-1.448	-2.093	-1.445	-2.093	-1.445
	(1.543)	(1.703)	(1.543)	(1.682)	(1.542)	(1.677)	(1.542)	(1.677)
Time to reach market, if not in village (min)	-0.004	0.002	-0.004	0.002	-0.004	0.001	-0.004	0.001
	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)
Cereal bank in or near village	-2.402	-3.515**	-2.417*	-3.384**	-2.409	-3.398**	-2.409	-3.398**
	(1.446)	(1.607)	(1.441)	(1.626)	(1.444)	(1.628)	(1.444)	(1.628)
Distance to main road (km)	-0.018	-0.045*	-0.017	-0.046*	-0.017	-0.046*	-0.017	-0.046*
	(0.029)	(0.023)	(0.029)	(0.023)	(0.029)	(0.023)	(0.029)	(0.023)
Cell Phone Network in Village	1.186	0.594	1.227	0.543	1.214	0.578	1.214	0.578
	(1.564)	(1.698)	(1.569)	(1.651)	(1.566)	(1.664)	(1.566)	(1.664)
Commune FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. of Households	2055	2185	2055	2185	2055	2185	2055	2185
R-Squared	0.241	0.229	0.241	0.231	0.241	0.23	0.241	0.23

*, **, and *** represent significance at the 10%, 5%, and 1% levels, respectively

Prices, in CFA, are also included but not shown for the sake of space. These include: Cowpea price, Change in cowpea price, Price of Goat, Change in price of Goat, Price of Cow, Change in price of cow

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APPENDIX 2.2

Construction of Household-level Distances from the Village Center

Transaction costs faced by households emerge as a key variable of importance in the household model. Their importance has to do with the travel and other costs associated with selling a food commodity received as a transfer, in the case that it is extra-marginal and hence unwanted. This led me to want to understand households' distance not only to markets but to village centers, where many exchanges and other transactions take place.

The community survey collected village-level GPS coordinates. These suffered, unfortunately from several issues. For one there were several missing, meaning the loss of a large number of households if I were to use those coordinates. Even for those not missing, there were several issues that make these coordinates less than ideal as measures of the center of the village. I will describe how I handle each of these cases.

The first issue is that many coordinates were not systematically collected at a point actually central to each village, in terms of either space or a conceptual or cultural center. While in some cases a market or central meeting place might not be at the true Euclidean center of the village, the enumerators were not only not collecting coordinates at a spatial center but did not systematically seek out main meeting places or hubs. On examination, we see that many of these coordinates are at some distance from the majority of households in a given village, even when households were otherwise relatively clustered in a given location, which reflects neither a cultural or spatial center. An example of this is shown in Case 1, below.

In turn, the distribution of households in some villages is not very straightforward, which is to say that households are not all located in one clustered location. As land quality has been degrading, households have to travel further and/or seek to cultivate larger plots of land. As these

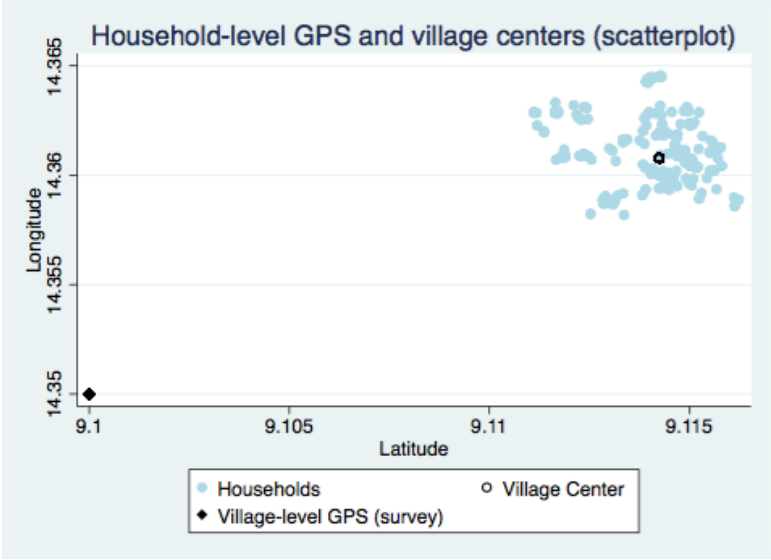
land plot sizes increase, households (or some part of them) frequently displace themselves to be closer to the fields, particularly during heavy field work times. Some of these sub-locations, originally just seasonal camps, have become increasingly permanent.

This phenomenon has led to two different common village layouts. One, Case 2, is to have a central location, and then long line of households settled along the length of the fields. Another, Case 3, is to develop several small clusters, with generally one location and cluster of residences considered primary, at the historic location of the village, and one or more other quasi-permanent satellite villages that still identify with the main village. The distance that best reflects, then, a household's distance from the center of the village is actually its distance from the primary cluster, where the bulk of all transactions take place. These primary clusters are always the site of the majority of households in the village.

I deemed it necessary, hence to examine each village and determine the location of the main cluster and then the center of that cluster, in order to then construct household-level distance from the 'true' village centers. I use a spatial method, whereby I physically plot each village by plotting household-level locations. I then visually identify the largest cluster, and confirm that it contains a larger number of households than any other visible cluster. I also re-define village centers in light of errors in the initial data collection.

Figure A2.2.1 shows an example of Case 1, in which the village has a relatively straight-forward layout but the GPS collected at the community level was for some reason significantly off center. In the case shown, the village of Baboul (in the commune of Wame), the original GPS collected (represented with a diamond) is nearly two kilometers from the point I identify as the village center using the medians of the clustered household locations.

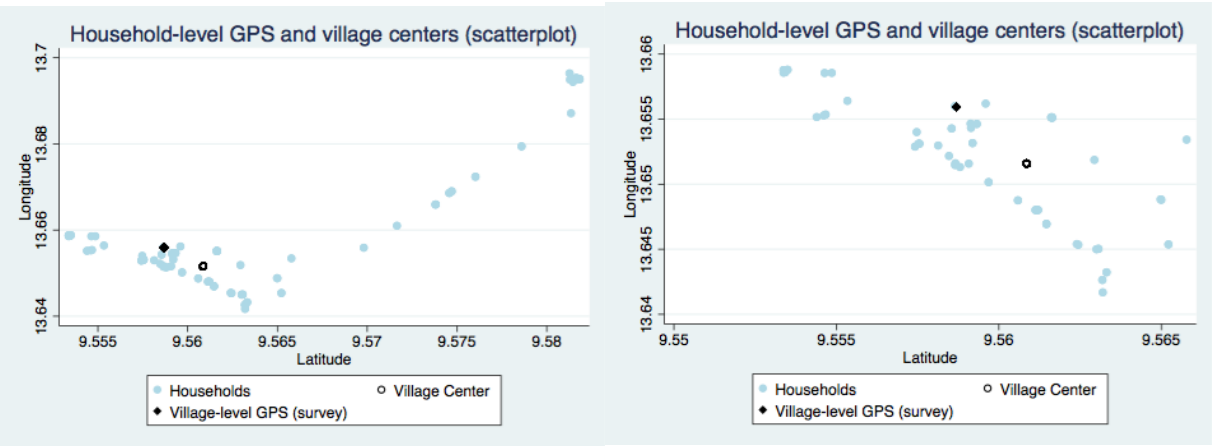
Figure A2.2.1: Case 1, the village of Baboul, Wame



The second case is shown in Figure A2.2.2, with the village of Ridal Hardo (in the commune of Guidimouni). In this case there is a clear cluster at the lower left, and a chain of households settled along the perimeter of the fields. The right side of the figure shows a close-up on the cluster, where my village center adjustment made only a minor change relative to the collected GPS in order to place the center at the medians of the largest cluster.

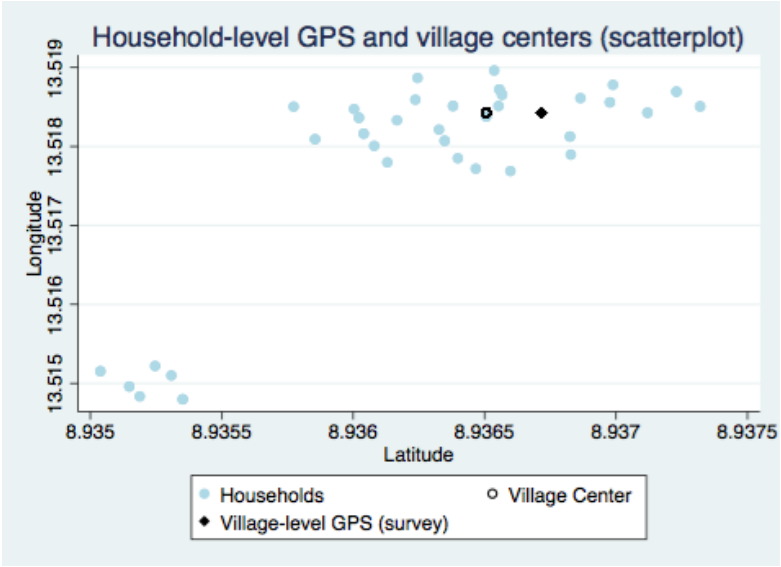
Figure A2.2.2: Case 2, the village of Ridal Hardo, Guidimouni

Overview (left), then close-up of cluster (right)



Finally, a very common case (Case 3) is for there to be two or more village clusters. In this case, I simply identify the primary cluster (by size) and select the center to be its median. This in some cases aligned with the GPS collected and in others not. Figure A2.2.3 show one such case, for the village of Angoual Sala (commune of Dogo).

Figure A2.2.3: Case 3, the village of Angoual Sala, Dogo



Household-level distances to the village center are designated in kilometers using the *Vincenty* command in Stata.

APPENDIX 2.3

Propensity scores on the extra-marginality of commodities

The reason for constructing propensity scores on the extra-marginality of different commodities follows the basic rationale of the propensity score: to facilitate the ability to compare outcomes of individuals who have a certain 'treatment' to similar individuals who do not (Angrist and Pischke 2009). The unique element of this case is that the 'treatment' is not even remotely exogenous, but is instead a category based on only a partly observable characteristic in the population, the extra-marginality for that population of a given food commodity. Additionally, we are then using this propensity to compare an actual treatment effect—the receipt of that food versus cash—between populations. Hence, the propensity score in this case is not being relied upon to identify a treatment effect, but instead to examine a treatment effect (that was randomized) within an appropriate comparison group (upon which randomization could not be and was not stratified).

The treatment variable then used is the extra-marginality of each commodity within the food recipient population, as defined by the lack of purchase of that commodity (whether or not it is consumed) in the final week of the transfer period. I choose to then roughly follow the straightforward approach put forward by Dehejia and Wahba (2002), to estimate and then assess the performance of the propensity score. While the Logit estimator is common and recommended for this purpose, I examine also the results with a Probit estimator and a Linear Probability Model, to see if there are significant differences in the results among binary response estimators.

Taking *F(x)* to be the probability of falling into one of the defined groups contingent on a vector of explanatory variables *x,* the *logit* is defined as the inverse of the logistic function, or:

$$F(x) = \frac{1}{1 + e^{-(\beta_0 + \beta_1 x_1 + \cdots)}}$$

I begin by selecting for *x* a rather parsimonious set of variables that I consider to be likely predictors of being extra-marginal in a given food commodity, which would be both supply-side (availability and access related) and demand-side (needs and preferences) characteristics. These include first household head characteristics, including: age, gender, presence of a handicap, and level of schooling. Then a number of household level characteristics, including whether or not the household is polygamous, ethnicity variables, the household size, number of children, dependency ratio, whether or not the household cultivates land, and the number of hectares cultivated. I then include village-level availability and access characteristics, including: the presence of a market, distance to market otherwise, whether or not there is a cereal bank in the village, the number of households in the village, distance to the main road, and whether or not there is cell phone service. Alternatively, I restrict this to the household-level characteristics only and use village-level fixed effects, which has advantages in capturing a number of unobservables at the village level that may affect the status of each commodity. Alternative approaches suggest using a series of interactions (e.g., squares of the outcome variables), an approach more concerned about fit than about the conceptual justification of the covariates.

After running the regression on this set of characteristics on only food recipients for whom we observe the outcome of interest, I then predict the outcome over the entire set of households to obtain the propensity score. I then assess the performance of this propensity score in leading to comparable groups, and in representing the likelihood of being extra-marginal within the estimation sample. I run this procedure first using different estimators, and then different sets of covariates and/or squares, to compare performance.

First, using the core set of household characteristics and village-level fixed effects, I compare estimators (logit, probit, or LPM). Table A2.3.1 shows t-tests of each of the propensity

score estimates, on the observed extra-marginality of each commodity, in each period. The predicted averages are virtually identical between estimators. The histogram version of this information, for just the propensity to be extra-marginal in consumption of c2, is shown in Figure A2.3.1.

Table A2.3.1: Ttests of each propensity score estimator on the original variable, for food recipients only

		July			October		
		Var=0	Var=1	P-value	Var=0	Var=1	P-value
C1 Extra-marginal	**Logit**	**0.18**	**0.35**	**0.00**	**0.36**	**0.63**	**0.00**
	Probit	0.18	0.35	0.00	0.36	0.63	0.00
	LPM	0.17	0.34	0.00	0.36	0.63	0.00
Observations		839	231		513	517	
C2 Extra-marginal	**Logit**	**0.42**	**0.66**	**0.00**	**0.53**	**0.76**	**0.00**
	Probit	0.42	0.66	0.00	0.53	0.76	0.00
	LPM	0.42	0.66	0.00	0.53	0.76	0.00
Observations		477	593		319	711	

Figure A2.3.1: Propensity on Extra-marginality of C2, by the treatment variable

In keeping with the established literature (Dehejia and Wahba 2002), I continue with the logit estimator. I then attempt different sets of covariates, firstly with and without fixed effects, then with all terms interacted. Table A3.2 shows the comparisons as above but for just the scores

derived using the logit, and across these various sets of controls and covariates. For each period, the mean of the propensity score is shown for where the 'true value' among food recipients, the extra-marginality of each commodity based on purchasing behavior, is equal to 0 (Var=0) and equal to 1 (Var=1). We see from this that the estimator performs better, in the sense of there being a stronger relationship between the propensity score and the treatment variable, with fixed effects, in that the values for those who are actually extra-marginal are higher, and those for who are not are lower. There otherwise is not much difference between them based on the number of covariates included, nor with the inclusion of the interaction terms. I hence, again in keeping with the literature, keep with the more parsimonious regression specification, indicated in bold in Table A2.3.2.

Table A2.3.2: Comparison of Propensity Scores, preferred estimator with different covariates

	July			October		
	Var=0	Var=1	P-value	Var=0	Var=1	P-value
C1 Extra-marginal						
HH & Village Controls	0.2	0.25	0.00	0.4	0.59	0.00
HH Controls, Village FEs	**0.18**	**0.35**	**0.00**	**0.36**	**0.64**	**0.00**
HH & Village Controls, Village FEs	0.18	0.35	0.00	0.36	0.64	0.00
HH Controls w/ Squares	0.2	0.23	0.00	0.45	0.54	0.00
HH Controls w/ squares, Village FEs	0.18	0.35	0.00	0.36	0.64	0.00
Observations	839	231		513	517	
C2 Extra-marginal						
HH & Village Controls	0.48	0.6	0.00	0.61	0.72	0.00
HH Controls, Village FEs	**0.42**	**0.66**	**0.00**	**0.53**	**0.76**	**0.00**
HH & Village Controls, Village FEs	0.42	0.66	0.00	0.53	0.76	0.00
HH Controls w/ Squares	0.51	0.58	0.00	0.67	0.7	0.00
HH Controls w/ squares, Village FEs	0.41	0.66	0.00	0.53	0.76	0.00
Observations	477	593		319	711	

I now proceed, per Dehejia and Wahba (2002), to assess the balance of covariates across quintiles of the propensity score. As shown in Table A2.3.3, the core household-level covariates used in the model balance across these groups within quintiles.

In this special case, however, this is not the balance that we particularly care about, but more the balance between cash and food recipients along quintiles of the propensity scores,

which is a different matter. While this is the conventional manner in which one can test the propensity score, and the test passes in this case, as I am not using it for identification at this level the test is not as necessary or interesting. What is more important for the model is the degree to which there is balance between cash and food recipients across quintiles of the propensity score. For the sake of examination, I look at this as well, in Table A3.4. While not perfectly balanced, the subsets balance similarly to the overall sample, with the fewest groups balanced across ethnicity variables but most groups balanced across other key covariates.

Table A2.3.3: Balance on covariates, by quintiles of the P-Score; Ttests by Treatment Variable

	Quintile 1			Quintile 2			Quintile 3			Quintile 4			Quintile 5		
Extra-marginality of C1	T=0	T=1	P-value	T=0	T=1	P-value	T=0	T=1	P-value	T=0	T=1	P-value	T=0	T=1	P-value
Pastoral	0.3	0.3	0.604	0.4	0.5	0.645	0.3	0.5	0.192	0.5	0.5	0.715	0.5	0.3	0.002
Age of HH Head	48.1	49.9	0.611	49.8	49.6	0.964	46.6	50.4	0.284	46.2	42.7	0.102	47.3	50.7	0.083
Female HH Head	0.2	0.3	0.234	0.3	0.2	0.428	0.3	0.4	0.515	0.2	0.2	0.758	0.2	0.2	0.942
Heads with education	0.1	0	0.428	0.1	0.2	0.018	0.1	0.1	0.821	0.1	0.1	0.748	0.1	0.1	0.824
Household Size	7.2	8.3	0.226	7.1	7.5	0.605	7.1	6.2	0.203	7.6	8	0.441	8.1	7.6	0.237
Polygamous HH	0.1	0.1	0.848	0.1	0.2	0.752	0.1	0.1	0.365	0.3	0.2	0.633	0.2	0.3	0.266
Ethnic Majority member	0.8	1	0.099	0.8	0.8	0.748	0.9	0.8	0.378	0.9	0.9	0.757	0.9	1	0.699
Hausa	0.7	0.7	0.842	0.5	0.6	0.627	0.6	0.5	0.519	0.6	0.6	0.733	0.8	0.8	0.304
PCA, Basline	0.2	0.7	0.538	0.5	0.5	0.992	0.1	0.5	0.576	0.3	0	0.415	0.7	0.6	0.618
TLU, Baseline	1	0.8	0.775	1	1.2	0.724	0.7	0.9	0.556	0.9	1.3	0.057	1.2	1.6	0.407
Observations	219	12		114	13		116	17		200	61		119	106	
Extra-marginality of C2	T=0	T=1	P-value	T=0	T=1	P-value	T=0	T=1	P-value	T=0	T=1	P-value	T=0	T=1	P-value
Pastoral	0.5	0.5	0.415	0.4	0.4	0.573	0.5	0.6	0.685	0.4	0.5	0.764	0.1	0	0.162
Age of HH Head	48	48.5	0.769	48.6	49.5	0.679	53.1	44.8	0.028	47.6	46.2	0.645	42.2	44.6	0.464
Female HH Head	0.2	0.2	0.322	0.3	0.3	0.68	0.1	0.2	0.651	0.2	0.1	0.069	0.4	0.2	0.027
Heads with education	0.1	0.2	0.052	0.1	0.1	0.635	0	0.1	0.225	0	0	0.883	0	0	0.709
Household Size	7.5	7.4	0.723	7.6	7.7	0.901	8	7.3	0.385	7	7.9	0.269	6.1	7.1	0.176
Polygamous HH	0.2	0.1	0.568	0.2	0.2	0.538	0.2	0.2	0.771	0.1	0.2	0.48	0.2	0.3	0.822
Ethnic Majority Member	0.9	0.8	0.468	0.9	0.9	0.153	1	0.9	0.131	0.9	1	0.039	1	0.9	0.474
Hausa	0.6	0.6	0.706	0.7	0.8	0.244	0.9	0.9	0.889	0.8	0.9	0.097	0.6	0.5	0.348
PCA, Baseline	0.5	0.4	0.655	0.8	0.5	0.354	0.4	0.3	0.854	-0.1	0.3	0.428	0.2	-0.3	0.138
TLU, Baseline	1.1	1.2	0.708	0.9	1	0.498	1.1	1	0.814	1.1	1.8	0.58	0.7	0.8	0.456
Observations	300	126		85	146		20	56		28	67		21	157	

Table A2.3.4: Balance on covariates, by quintiles of the P-Score; Ttests by transfer type

	Quintile 1			Quintile 2			Quintile 3			Quintile 4			Quintile 5		
Extra-marginality of C1	CASH	FOOD	P-value	CASH	FOOD	P-value	CASH	FOOD	P-value	CASH	FOOD	P-value	CASH	FOOD	P-value
Pastoral	0.3	0.3	0.955	0.3	0.4	0.002	0.3	0.3	0.168	0.6	0.5	0.012	0.9	0.4	0
Age of HH Head	48.7	48.2	0.681	49	49.8	0.573	46.3	47.1	0.577	51.4	45.4	0	44.7	48.9	0.003
Female HH Head	0.1	0.2	0.059	0.1	0.2	0	0.3	0.3	0.721	0.1	0.2	0.07	0.4	0.2	0
Heads with education	0	0	0.248	0	0.1	0.257	0.1	0.1	0.529	0.1	0.1	0.793	0.1	0.1	0.26
Household Size	7.9	7.3	0.051	7.8	7.1	0.034	7.4	7	0.302	8.1	7.7	0.208	7	7.8	0.011
Polygamous HH	0.1	0.1	0.877	0.1	0.1	0.091	0.2	0.1	0.042	0.2	0.3	0.593	0.2	0.2	0.056
Ethnic Majority Member	0.8	0.8	0.504	1	0.8	0	1	0.9	0	0.8	0.9	0	1	0.9	0.38
Hausa	0.6	0.7	0.006	0.9	0.6	0	0.8	0.6	0	0.2	0.6	0	0	0.8	0
PCA, Baseline	-0.3	0.2	0.088	-0.3	0.5	0	0	0.2	0.452	0.1	0.2	0.725	-0.3	0.7	0
TLU, Baseline	1.3	1	0.516	0.6	1	0.006	0.9	0.8	0.264	1	1	0.668	0.6	1.4	0.003
Observations	192	231		295	127		290	133		161	261		197	225	
Extra-marginality of C2	CASH	FOOD	P-value	CASH	FOOD	P-value	CASH	FOOD	P-value	CASH	FOOD	P-value	CASH	FOOD	P-value
Pastoral	0.7	0.5	0.496	0.4	0.4	0.752	0.5	0.5	0.194	0.4	0.5	0.766	0.3	0	0
Age of HH Head	50	48.2	0.808	47	49.2	0.118	48.3	46.9	0.399	48.6	46.6	0.223	46.8	44.3	0.084
Female HH Head	0.3	0.2	0.513	0.1	0.3	0	0.1	0.2	0.054	0.2	0.1	0.14	0.4	0.2	0.002
Heads with education	0	0.1	0.538	0.3	0.1	0	0	0.1	0.102	0	0	0.646	0	0	0.003
Household Size	18.7	7.5	0	9	7.7	0.001	8.2	7.5	0.074	7.3	7.6	0.283	6.1	7	0.001
Polygamous HH	0.3	0.2	0.379	0.2	0.2	0.695	0.2	0.2	0.119	0.2	0.1	0.89	0.1	0.3	0.001
Ethnic Majority Member	0.3	0.8	0.016	0.8	0.9	0	0.9	0.9	0.81	0.9	0.9	0.565	1	0.9	0
Hausa	0.3	0.6	0.395	0.3	0.7	0	0.5	0.9	0	0.6	0.9	0	0.8	0.5	0
PCA, Baseline	2.3	0.5	0.31	0.4	0.6	0.448	-0.1	0.4	0.129	-0.2	0.2	0.104	-0.7	-0.3	0.021
TLU, Baseline	0.3	1.1	0.51	1.2	1	0.102	1	1.1	0.956	0.7	1.6	0.008	0.5	0.8	0.001
Observations	3	426		197	231		352	76		333	95		250	178	

REFERENCES

Agrist, Joshua and Jorn-Stefeen Pischke (2009). Mostly Harmless Econometrics: An Empiricist's Companion. Princeton: Princeton University Press, 2009.

Dehejia, Rajeev H. and Sadek Wahba (2002). Propensity score-matching methods for nonexperimental causal studies. *Review of Economics and Statistics, 84*(1): 151-1

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THE IMPACT OF CASH VERSUS IN-KIND TRANSFERS ON DEBT AND TRANSFER BEHAVIOR IN RURAL NIGER

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ABSTRACT

Discussions of the impact of public transfers or private consumption smoothing behaviors typically abstract from the form of these transfers. In this paper, we extend a standard agricultural household model to address this issue. The model predicts that, due both to food price expectations and transaction costs involved in selling food transfers, recipients of cash transfers will repay more debts and/or make more transfers in cash than will recipients of food; further, these differences will be more pronounced during periods of rising food prices. We test these predictions empirically using household-level survey data from a randomized cash/food intervention in south-central Niger. We find that cash recipients are more likely to repay debts and give gifts in the form of cash, while food recipients are more likely to give only gifts in food and of smaller average values. These impacts are more pronounced in the lean season, when food prices are rising.

Keywords: cash transfers, food assistance, informal credit, household model, Niger

I. INTRODUCTION

Informal social insurance mechanisms can be very important for the rural poor as devices for smoothing consumption over time and protecting against shocks, especially in the absence of formal credit markets (Morduch 1995). These mechanisms take diverse forms, including informal borrowing and lending and inter-household gift-giving. Some informal loans have repayment terms that depend on the realization of shocks by both borrower and lender, and so may morph into private transfers that do not necessarily need to be repaid (Udry1994). These different mechanisms can be substitutable, with gift-giving, for example, engaged in to serve the same ends as credit and/or savings (Behrman et al. 1997). While households may have mechanisms for addressing covariate risks that affect an entire village, including migration and remittances from non-resident household members, an important component of this phenomenon deals with idiosyncratic risks and the tendency to smooth consumption at the village level (Deaton 1997; Townsend 1994).

Given the importance of social insurance mechanisms for household welfare and food security, especially in environments where livelihoods are fraught with high levels of risk and uncertainty (Besley 1995), understanding how external transfers may affect informal consumption pooling and/or smoothing mechanisms is valuable. Some highlight the concern that public transfers might "crowd out" informal mechanisms, neutralizing the effect of public policies (e.g., Barro1974; Becker1974; Rosenzweig and Wolpin 1994; Cox et al. 1998; Jensen 2003; Albarran and Attanasio 2003). Others suggest that crowding out is not a significant concern, or even that injections of resources into rural economies could reinforce these mechanisms by providing the lubrication from added liquidity or social connections (David and Menchik 1985; Cox and Jacubson 1995; Cox et al. 2004; Chantarat and Barrett 2012). In this

literature, how private transfers respond to public policies is largely driven by the dominant motive behind private transfers. If transfers are altruistically motivated or they mitigate risk, crowding-out may accrue. If transfers are payments in exchange, they could react in either direction to increases in household resources (Cox 1987). Social pressures to share income with kin are likely to increase private transfers as public transfers are being "taxed" by relatives (Jakiela and Ozier 2012).

A limitation of this work lies in the assumption that the extent to which crowding out occurs, or does not occur, is independent of the form of transfer– that is, whether it is provided in-kind or as cash. While a few studies examine the crowding-out effect of food aid (Dercon and Krishnan 2003; Lentz and Barrett 2005; Sulaiman 2011), the implications of the form of transfer provided—cash or in-kind—for these impacts has not been considered. In the case of food assistance in particular, it is unclear whether cash versus food transfers perform differently with respect to crowding out, or reinforcing, these informal transfer mechanisms. In addition, do cash and food have differential impacts on households' choices to prioritize longer-term food security over short-term consumption and dietary diversity by repaying debts and/or giving transfers, and in doing so sacrificing today's consumption to expand the household's future budget set?

In this paper, we develop a theoretical household model to build intuition and predictions for how cash and food transfers might be used differently, given the trade-offs between current and future consumption. The model is typical for the literature, building on the classic non-separable model with transaction costs put forward by de Janvry et al. (1991). We integrate two key features that allow us to focus on the question of the use of cash versus food transfers for consumption smoothing. First, as part of the standard inter-temporal asset constraint, we allow for the ceiling on future borrowing (and/or, equivalently, likelihood of receiving transfers in the

future) to be an increasing function of current debt repayment (and/or, equivalently, transfers given to other households). The more a household pays back (or gives away) today, the more access it will have to borrowing (or likely it will be to receive gifts) later. Second, households receive public transfers either in cash or in food. While households can sell the food transfer, this is subject to a transaction cost that reduces their net proceeds.

This model generates several empirical predictions. Consistent with the precautionary savings principle (Barrett 2002), sacrificing today's consumption (even at very low levels) to give transfers and/or pay debts can be a rational strategy for improving consumption prospects (through reciprocal transfers and/or a higher borrowing ceiling) in the future. The transaction cost involved in selling food and expectations over future prices are the main drivers of differences between cash and food transfers. While it may make sense to give away food transfers (or to use them to pay debts) in order to improve the likelihood of receiving transfers in the future (or to increase future borrowing limits), in so far as most debts need to be repaid in cash one would have to sell food in order to pay back debts. Given the transactions costs involved in selling food, debt repayment is more efficient with cash, as well as more easily used to manage covariate risk through payment to networks outside of the village. Food prices and food price expectations are also important, as rising food prices decrease the value of cash (relative to food) in terms of future food consumption.

The empirical evidence at the household level shows that cash recipients are more likely to pay back debts, and pay larger amounts on average, than food recipients, particularly when food prices are rising during the lean season. Food recipients are more likely to give food gifts (within the village), on average of smaller values than cash repayments. This pattern is linked to food consumption, in that while cash recipients are more likely to repay debts they also

experience lower impacts on dietary diversity than do food recipients (Hoddinott et al. 2013). Cash recipients are in turn more likely than food recipients to take out loans to meet food needs in the leanest season, whereas food recipients take out more loans during the harvest season to meet other needs, reflecting the shift in relative scarcities between seasons.

We begin with our theoretical model and its predictions on the use of cash versus food transfers. We then present some background in Section III on the context, the intervention, the randomization, balance across control and treatment groups, and outcome variables. Section IV presents our estimation strategy, and Section V the results. Section VI summarizes and concludes.

II. THEORETICAL MODEL

A model of household behavior appropriate for poor settings characterized by food insecurity and considerable income risk must recognize trade-offs between food and other essential needs, such as education, care giving, and health care. It must also take into account the desire to smooth consumption over time, and integrate an understanding of risk and uncertainty, in food production, prices, transfers, and effectively all 'inputs' into the household's food availability function (Barrett 2002). Here we develop a non-separable household model that addresses the question of assuring food security while building on the long-standing work of Singh et al. (1986). We assume a unitary household model, which is to say that all decision-makers have the same preferences (over the consumption of food and other goods, as well as over debt repayment/initiation and asset investment), and that all resources are pooled within the household. The decision process is dynamic, such that today's choices are affected by expectations over future income and prices:

$$\max_{c_t, x_t, l_t^l, l_t^q, b_t, h_t a_t} E\left[\sum_{t=0}^{\infty} \beta^t u(c_t, x_t, l_t^l | Z)\right] \tag{1}$$

where the household derives utility over food goods, c_t, as well as other market goods, x_t, and leisure, l_t^l. Z is a vector of household and/or community-specific characteristics, and $1 \geq \beta > 0$ is a time discount preference parameter. The utility function satisfies the usual concavity, Inada and local non-satiation assumptions.

Each household produces a food consumption good, q_t. We assume also that wage labor and other agricultural inputs are not available, so households use only home-labor (l_t^q) for production, along with a fixed initial amount of land and productive capital, K.[1] Consequently, our production function takes the form;

$$q_t = g(l_t^q; K) \tag{2}$$

Income for purchases comes from sales of the produced good (q_t), public transfers in the form of food (T_t^c) or cash (T_t^x), and the sales value of the current asset stock (A_t), taking into account each period's net savings (s_t). This gives the budget constraint:

$$p_t^{c*} c_t + p_t^x x_t + s_t \leq p_t^{c*}(q_t + T_t^c) + T_t^x + A_t \tag{3}$$

Following Behrman et al. (1997), we assume that different forms of consumption smoothing behavior, including savings and investment as well as informal credit and gift exchange, are functionally substitutes. We hence model net savings as composed as follows:

$$s_t = h_t - b_t + a_t \tag{4}$$

[1] We make this assumption for simplicity; relaxing it so as to include other inputs in the production function does not change the predictions we derive.

where h_t is debt repayment and/or gifts given to other households, b_t is debts taken out and/or gifts received from other households, and a_t is other forms of formal and informal savings including investment in livestock and other assets. We assume that b_t is denominated in cash; that is, we assume that households do not borrow or transfer in-kind goods. This may seem like a strong assumption; we re-visit it at several points in the paper.

Substituting equation (4) into (3) yields:

$$p_t^{c*}c_t + p_t^x x_t + a_t + h_t \leq p_t^{c*}(q_t + T_t^c) + T_t^x + b_t + A_t \tag{5}$$

Following de Janvry et al (1991), we express food prices found in equation (5), p_t^{c*}, as a price function. Households can purchase food at the market price, but are subject to θ_t, a household-specific, variable transaction cost, when they sell food.[2] This is defined by the function:

$$\begin{aligned} p_t^{c*} &= p_t^c && if\ c_t \geq q_t + T_t^c \\ & p_t^c - \theta_t && if\ c_t < q_t + T_t^c \end{aligned} \tag{6}$$

This one-sided transaction cost reflects a number of conditions found in rural Niger and indeed across much of Africa. First, markets are generally in close proximity, and are culturally-embedded institutions in which households have numerous reasons to participate, thus the marginal cost of travel to market associated with any given purchase of food is negligible. Second, merchants present at markets will sell goods in all periods, but only purchase goods in certain periods. They also pay a lower price to purchase goods than the retail price of selling them. Hence θ_t represents the additional travel cost to find a buyer and/or the margin by which the selling price for households is lower than their buying price. In areas where markets are

[2] Key et al. (2000) use a transaction cost with both a fixed and a variable component. Adding a fixed cost to our model would mean subtracting a constant term from the right hand side of (6) which would be multiplied by one if the household sells, zero otherwise. This has no meaningful impact on our core results so we assume only fixed costs, in the interest of clarity and parsimony.

further, itinerant merchants travel from village to village (and even household to household) to sell –but not to purchase – key staples, in which case θ_t for such households would be even larger. Finally, information about markets and market prices, and hence prices received, may also vary by household.

Asset stocks (A_t) evolve according to:

$$A_{t+1} = (1 + r_t)(\delta A_t + s_t) \tag{7}$$

where r_t is the interest rate, δ is a depreciation rate, and s_t is net savings as defined in (5) above, in time t. A unique feature in this model, however, is the nature of the borrowing constraint, B^{max}. The amount that an individual can borrow in any given period is bounded above by:

$$b_t \leq B^{max}(A_t, H(h_t)) \tag{8}$$

where $H(h_t)$ is a prior debt repayment or inter-household gift-giving history function. The household can borrow more in each period the greater the value of either A_t, reflecting stock of collateral, or of $H(h_t)$, its history of repayments and generosity, which is strictly increasing in each period's repayments or gifts:

$$\frac{\partial B^{max}}{\partial A_t}, \frac{\partial B^{max}}{\partial H(h_t)}, \frac{\partial H(h_t)}{\partial h_t} > 0 \; \forall \; t \tag{9}$$

These assumptions reflect the idea that a household's ability to smooth consumption partly relies on access to credit and inter-household transfers. Creditors' willingness to lend, and other households' willingness to give, is a function of a prospective borrower or recipient's current collateral but also its repayment reliability and prior generosity. Note too that a households' existing stock of debt does not appear in equation (8). In our study area, households can borrow from lenders within and outside their village and can give and receive transfers from

individuals in their village and migrants outside it. Consequently, the recipient's total debt stock is not knowable by creditors. Thus, it is the household's prior debt repayment or inter-household gift-giving history function that affects borrowing and not the over-all debt stock.

Finally, the household faces a time constraint:

$$l_t^l + l_t^q = L_t \tag{10}$$

We solve the household's constrained maximization problem by recovering the first order necessary conditions (FONCs) from the discrete time present value Hamiltonian. Assuming that the utility function has the necessary properties of concavity and local non-satiation, all constraints bind with equality. The present value Hamiltonian is given by:

$$H = E\left[\sum_{t=0}^{\infty} \beta^t [u(c_t, x_t, l_t^l | Z)] + \beta\lambda_{t+1}[p_t^{c*}(g[(L - l_t^l), K] + T_t^c - c_t) - p_t^x x_t + T_t^x + b_t - h_t + A_t - a_t] - \beta\mu_{t+1}[(1 + r_t)(\delta A_t + h_t - b_t + a_t) - A_{t+1}]\right] \tag{11}$$

Denoting the partial derivative of a function "f" with respect to variable "y" as $f_y(\bullet)$, the FONCs over consumption goods imply:

$$\frac{\partial L}{\partial c_t} = E[\partial u_c(\bullet)] - \beta\lambda_{t+1}E[p_t^{c*}] = 0 \tag{12}$$

$$\frac{\partial L}{\partial x_t} = E[\partial u_x(\bullet)] - \beta\lambda_{t+1}E[p_t^x] = 0 \tag{13}$$

These imply that:

$$\frac{E[\partial u_c(\bullet)]}{E[p_t^{c*}]} = \frac{E[\partial u_x(\bullet)]}{E[p_t^x]} \tag{14}$$

Households equate the marginal utilities of consumption of each good, as weighted by within-period prices. The household's realization of p_t^{c*} depends on its own production, as well as on whether the food transfer received is infra-marginal, such that $c_t* \geq q_t* + T_t^c$, or extra-marginal, such that $c_t* < q_t* + T_t^c$.

Looking at the components of savings, or debt and gift behavior, additional FONCs include:

$$\frac{\partial L}{\partial b_t} = \lambda_{t+1} + \mu_{t+1}(1 + E[r_t]) = 0 \tag{15}$$

$$\frac{\partial L}{\partial h_t} = -\lambda_{t+1} - \mu_{t+1}(1 + E[r_t]) = 0 \tag{16}$$

or

$$\lambda_{t+1} = -\mu_{t+1}(1 + E[r_t]) \tag{17}$$

λ_t is the shadow-value of consumption, or of relaxing the budget constraint. μ_t can be thought of as the shadow value of asset investment, this condition implies that households balance the utility derived from consumption against the disutility of forgoing that consumption now to increase future consumption, by accumulating financial or social capital today, taking into account the interest rate. Otherwise stated, debt repayment or gift-giving is a means of balancing current and future consumption; consumers balance the marginal utility of current consumption of goods (weighted by price) against investment in informal savings through debts or gifts (weighted by the interest rate). Debt repayment or gift-giving relaxes the future borrowing constraint or likelihood of receiving gifts, which translates into greater future consumption. Debt repayment may thereby offer a strategy for smoothing consumption of food and other goods over time, inducing current debt repayment even when consumption is relatively low. Similarly, it

may be rational, even for poor households with limited food consumption, to give transfers to other households and/or pay debts, sacrificing current consumption in order to ensure future consumption. The choice to do this depends not only on marginal utilities, which we cannot directly observe, but on todays' income and assets as well as expectations over tomorrow's incomes and assets, and therefore also prices. Mindful of this, we can write the reduced form demand functions for the choice variables b_t and h_t, or debt initiation / receipt of gifts, and debt repayment / gift-giving, respectively:

$$b_t^* = b(p_t^c, p_{t+1}^c, p_t^x, E[p_{t+1}^x], \theta_t, r_t, T_t^c, T_t^x, A_t, K, H(h_t), Z) \tag{18}$$

$$h_t^* = h(p_t^c, p_{t+1}^c, p_t^x, E[p_{t+1}^x], \theta_t, r_t, T_t^c, T_t^x, A_t, K, H(h_t), Z) \tag{19}$$

Note that public transfers in the form of food (T_t^c) or cash (T_t^x) appear as separate arguments in these reduced form demand functions. Differences in the magnitude of their impacts could reflect several factors. First recall our assumption that debts are made in cash and not in-kind. To repay a debt, therefore, a households receiving a food transfer must first convert this food into cash. In doing so, it faces the transaction cost θ_t. This raises the cost of making a cash transfer (or repaying a cash debt) compared to a household that received a public cash transfer. *Ceteris paribus*, this implies that food recipients will be less likely to repay debts compared to cash recipients. Second, consider households residing in localities at a point in time where food prices are expected to rise. Households receiving a cash transfer can use some of this to repay a debt or make a private transfer. The expected price rise risks eroding the purchasing value of the cash transfer and so it is relatively less costly (in terms of foregone future consumption) to repay debts or make private transfers if the public transfer is received in cash rather than in food. This implies that the magnitudes of the difference in the impacts of public

cash and public food transfers will be smaller when food prices are stable or falling because only the first prediction, but not the second, affects these impacts.

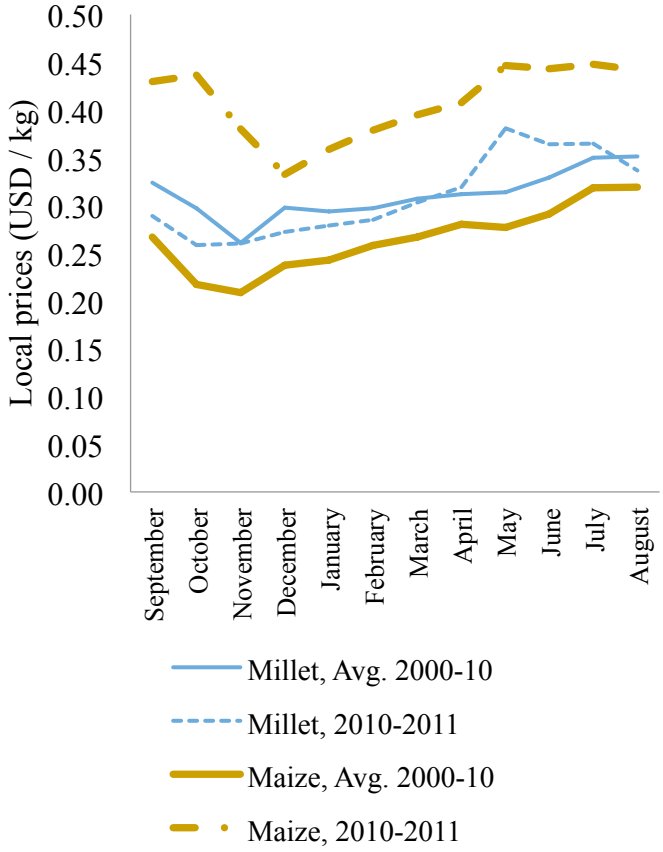
III. BACKGROUND AND DATA

a. Survey site and data overview

Between April and September 2011, the World Food Programme (WFP) implemented a randomized cash-food pilot project to assess the impact of alternatives to cash transfers on household food security in the Zinder region of Niger. Zinder is located in the southern part of the country. It receives more rain than the arid north. Livelihoods are a mix of sedentarism and agro-pastoralism. Zinder is also a key commercial hub, in part due to its proximity and close cultural ties to Nigeria (Eilerts 2006). The main staple consumed by rural households is millet which is produced locally as a subsistence crop but also sold to meet household cash needs. Maize serves as an alternate grain. Cowpeas are produced locally primarily as a cash crop but also consumed as a source of protein (FEWS 2014). There is one main harvest season, which begins in October and last approximately three months. The lean season typically begins in March and peaks in August or September prior to the start of the following harvest. As is common in poor rural settings, households switch from being net sellers of grain at harvest to net buyers in the lean season, with hence seasonal flow reversals in the market and off-site storage of locally produced grain (Barrett 1996). This tendency to sell low and buy high is driven more by liquidity constraints than by availability of storage locally, as dry conditions and elevated grain silos make storage practically feasible for most households (Udry 1991). During the lean season, food is sourced principally through imports. This leads to fairly predictable inter-seasonal price fluctuation for staple goods, which are cheapest right at the harvest in October, stable for much of the year, then begin to rise precipitously throughout the lean season, falling again at the

harvest. The annual pattern for the millet price is shown in Figure 3.1, with average prices for 2000-2010 graphed against the prices observed from the previous harvest season in 2010 through the end of our study in 2011.

Figure 3.1: Harvest-to-harvest grain prices in Zinder (ten-year average & transfer year)



Data Source: National Statistics Office, Niger

The pilot was implemented in two phases. Phase 1 involved public works activities that took place from April to June with all households guaranteed 75 day's work. While participation in public works was voluntary, almost all households took part (98 percent in the food transfer zone and 95 percent in the cash transfer zone). Food payments were provided in the form of a food basket of commodities similar to those typically eaten in the region. A day payment provided a full ration of food for the average household size of seven people, including 3.5 kg of grain (maize or sorghum), 0.72 kg of pulses (cowpeas, red beans, or lentils), 0.14 kg of vegetable oil, and 0.035 kg of salt. Based on the average monthly prices of these commodities between April and September 2008-2010, the average monthly cost of this food basket to recipients was 24000 FCFA. In cash villages, each household received 1000 FCFA (roughly 2 USD) per day worked to a maximum of 25000 FCFA per month. Based on information indicating that it would cost approximately 800 FCFA per month to markets to buy food in local markets making the value of the food basket and the cash transfer roughly equivalent. Based on monthly food price data on millet and cowpeas collected during the study and estimated values for vegetable oil and salt, the value of the monthly cash transfer (excluding transport costs incurred by beneficiaries receiving food transfers) ranged from 85 to 98 percent of the food basket. During the second phase, from July through September, 50 percent of households in each village were selected to continue to receive the same transfer without having to fulfill a work requirement. Targeting of unconditional transfer recipients was left in part to the implementing partners, with guidance from the WFP. A locality selected to receive cash(food) used cash(food) for both public works and unconditional transfer payments.[3]

The WFP in collaboration with the Government of Niger identified 126 villages within Mirriah that required assistance during the hungry season and suitable for the public works

[3] See Hoddinott et al. (2013) for further detail on the implementation and logistics of the intervention.

envisaged as part of this intervention. Some villages were subsequently dropped from the evaluation either because another organization was planning to provide food assistance to them, because the villages themselves declined to participate, or because they had poor market access (these villages received transfers but were not included in the surveys). Implementing parties deemed that it would be too complicated and/or lead to tension if proximate villages—especially that shared a worksite during the public works phase—received different forms of transfer. Hence randomization was done at the worksite level. This led to 52 village or village cluster randomization units. Prior to randomizing, we had information on whether these worksites were located in a sedentary agriculture or agro-pastoralist livelihood zone and the number of households in each worksite. We stratified by livelihood zone (agricultural and agro-pastoral), then ranked worksites from smallest to largest in terms of population. We then randomized through a procedure that assured an approximately equal distribution of villages/worksites by zone and size receiving each transfer.

The first survey was implemented in July, at the conclusion of the public works intervention but before the roll-out of the unconditional transfer.[4] All households in all villages were administered a basic questionnaire. A randomly selected sample of 2268 households who had been targeted for the unconditional transfers was interviewed in greater depth. A follow up survey was then administered to the sampled households at the conclusion of the unconditional transfers, with 2209 being successfully traced and interviewed.[5] The household survey

[4] We had planned a baseline survey but security considerations in the intervention region at the start of 2011 prevented us from accessing the intervention sites These security issues – a dramatically heightened risk of kidnapping of foreign nationals – prevented us from even pilot testing the survey instruments before June 2011. However, as these were directed at foreigners, not nationals, it was possible for the intervention to start in April 2011.

[5] The attrition rate is 2.6 percent. Analysis of the difference between the attritted households and the October sample shows that, among the attritted, fewer female household heads (44 versus 49 percent), were more likely to have formal education (15 versus 7 percent), and were less likely to be Hausa (34 versus 62 percent) than Touareg (31 versus 8 percent). There were no statistically significant differences that would be likely to affect outcomes.

instruments included questions on demographic characteristics, assets, livestock and agriculture, household food security, debt, inter-household transfers and public works participation. Pre-intervention characteristics including household composition, asset ownership and indebtedness were retrospectively assessed as part of July survey. A community survey was also fielded.

Table 3.1 provides selected pre-intervention descriptive statistics and balancing tests. Following Bruhn and McKenzie (2009, p.28), we focus on those characteristics that we believe *a priori* are correlated with the debt payments and private transfers that we will consider. Results presented in the first two rows are derived from data collected by WFP in late 2010; the remainder are drawn from the retrospective components of the community and household survey instruments.[6]

At the worksite level, there is no statistically significant difference in household size or residence by agro-ecological zone, the two characteristics we could observe before randomizing. When we look at a wide range of household demographic, asset, or livelihood characteristics, there are no statistically significant differences between food and cash localities across most variables that we consider; further, the magnitudes of the differences are small. About two-thirds of villages are accessible by road. It typically takes just under one hour to reach a road and about the same time to access a market. There are relatively few food markets in these villages. Nearly all have cell phone coverage.

Next, we consider household characteristics that affect debt payments and private transfers: demographic, wealth and food production. About 15 percent of all households are polygamous and about 20 percent are headed by women. Fewer than 10 percent of heads have

[6] We provide unweighted statistics. Using sampling weights that reflect the inclusion probability of the households in the sample has a minor impact on the results.

any formal schooling.[7] The vast majority of households own little in the way of productive assets or consumer durables. We summarize these in the form of an asset index.[8] Around 30 percent of households report that they own no livestock and another 12 percent own only chickens or one ruminant. Households own, on average, one Tropical Livestock Unit (TLU).[9]

Table 3.1: Household and Village characteristics (by transfer modality), and balancing tests

	Worksites			Housholds		
	CASH	FOOD	Ttest P-Value	CASH	FOOD	Ttest P-Value
Characteristics known prior to the intervention						
Pastoral Zone	44.4	44.0	1	42.2	38.1	0.047
Household Size	7.4	7.2	0.447	7.5	7.2	0.081
Household-Level						
Age of HH Head	47.6	47.9	0.856	48.4	48.5	0.878
Female HH Head	23.1	20.9	0.572	21.8	24.5	0.128
Heads with formal education	6.0	5.6	0.798	7.0	7.5	0.67
Polygamous HH	14.6	17.4	0.276	14.7	17.1	0.116
Member of Ethnic Majority	90.7	86.9	0.386	91.0	88.6	0.06
Hausa	54.2	64.7	0.364	57.4	66.2	0
Asset Score (PCA), Baseline	-0.15	0.22	0.12	-0.19	0.24	0
Tropical Livestock Units, Baseline	1.07	1.17	0.78	0.83	1.00	0.078
Distance from HH to closest market (km)	14.4	11.6	0.377	13.7	10.3	0
Village-Level						
Market in village	11.1	8.7	0.766	13.0	12.2	0.532
Time to reach market, if not in village (min)	56.2	68.8	0.351	56.9	65.4	0
Cereal bank in or near village	79.3	52.2	0.023	78.5	60.2	0
Distance to main road (km)	57.6	52.9	0.644	48.1	47.8	0.862
Zinder-Village Center distance (km)	58.1	52.8	0.395	58.0	51.9	0
Cell Phone Network in Village	86.9	96.0	0.24	94.6	92.8	0.082
Observations	27	25		1198	1070	

Household-level results are unweighted. Introducing sampling weights does not signficantly change the results.

[7] Formal education refers to the completion of at least one year of primary schooling. We exclude attendance at Koranic schools because individuals attending these do not necessarily learn to read and write.
[8] We construct the index using principle components analysis (PCA) across all durable assets owned by households at the start of the first transfer period.
[9] The TLU is measure constructed using animal weight and associated basal metabolic rate to standardize value across different animals (FAO 2014).

At the household level, given the large sample size (2256 observations in the July survey round), even small deviations from the null are likely to lead to rejection of the balanced sample hypothesis. We reject the null of equality between households residing in localities randomized to receive food and those randomized to receive cash across just a few covariates, but the magnitudes of these differences are small.

b. Data on credit

Credit transactions in Mirrah are widespread, heterogeneous and informal.[10] Households borrow from other family members, from other households in the same village, from itinerant merchants and traders and from lenders located outside the village. There are no written loan agreements; instead credit transactions are based on oral agreements and handshakes. The date on which the loan is to be repaid is rarely stipulated and, in keeping with Islamic practice, no interest rate is set. There is little use of formal sector sources such as banks or microfinance institutions.

During the first survey round, respondents were asked about debt stock as of the start of the intervention ("before the beginning of the public works") and the number of debts initiated between April and July, 2011. During the second round, they were asked about debts initiated between July and September 2011 ("since the last survey"). Survey respondents were then asked to provide details on the five loans they perceived to be most important.[11] These included who in the household took out the debt (the household head, his spouse, another man, or another woman), when (month), from where (in the village, a neighboring village, a village outside the

[10] Christopher Udry's (1991; 1994) work in Northern Nigeria provides insight into the savings and credit system, as the region of focus shares the Hausa ethnic group and strong cultural, religious, and historical ties. See Miles (1995) for a treatise on the similarities and differences between Hausa villages in Niger and Nigeria.

[11] Only two households reported that they had initiated more than five debts prior to the public works, only one household during, and none during the unconditional transfers. The majority (80-82 percent) reported only one major debt, and less than 1 percent of households reported all five.

region, the capital city, or another specific city), from whom (a family member, neighbor/friend, lender, public or private organization, etc.), the reason for taking out the debt, its form (cash, grain, other food, etc.), its value in cash, and the percentage of the debt still unpaid at the time of the interview. From these details we constructed variables for the initiation of debt, the total number of debts initiated, the total value of the largest five debts initiated, and the value of current outstanding debt.

44 percent of households had at least one debt outstanding at the beginning of the intervention. As Table 3.2 shows, during the implementation of the public works, 22 percent borrowed at least once; the mean value of all debts initiated during this period is 4,100 CFA which is equivalent to just over four days employment on public works. This rises to 36 percent as the hungry season takes hold between July and September and the mean value of these newly initiated debts rises to 7,480 CFA. In both periods, most of these debts are initiated by the household head and are in cash; a much smaller fraction are initiated by spouses of the head or were in the form of food. The mean value of cash loans is considerably higher than those taken out as food. Note however that debts taken out as grain are, for repayment purposes, denominated in cash terms. To understand the implications of this, suppose that a household borrows a 100kg bag of millet from an itinerant trader during the lean season when the price of millet is 20,000 CFA per bag. At harvest time, suppose that prices have fallen to 13,000 CFA per bag. However, the household must repay the cash value of the original transaction (20,000 CFA) – in effect, repaying 1.5 bags to the lender. Merchants in this way extract a high return on their loans without actually charging a formal interest rate.[12]

[12] This phenomenon is very similar to the displaced distortions as described by Barrett (2007), in that missing formal credit markets lead to distortions in behavior whereby poor households pay extraordinarily high effective interest rates on loans that are driven predictable seasonal price variation, from which others (merchants or lenders) profit.

Table 3.2: Debt, descriptive statistics and t-tests by form of transfer (both periods)

	April - June				July - September			
	All HHs	Cash	Food	P-value	All HHs	Cash	Food	P-value
New Debts								
Initiated Any Debts (%)	22%	27%	17%	0	36%	33%	40%	0
Total Debts Initiated (CFA, 1000s)	4.1	5.35	2.69	0	7.48	6.75	8.33	0.037
Source of Credit								
Debts initiated with family/neighbors (%)	13%	17%	10%	0	24%	22%	27%	0.002
Debts initiated with merchants/lenders (%)	8%	10%	6%	0.001	9%	8%	10%	0.023
Food debts initiated with merchants/lenders (%)	4%	5%	2%	0	2%	3%	2%	0.216
Debts initiated from within village (%)	18%	21%	14%	0	27%	23%	32%	0
Debts initiated from outside the village (%)	5%	7%	3%	0	10%	11%	9%	0.087
Form of Credit								
Debts initiated in cash (%)	16%	19%	12%	0	31%	27%	35%	0
Debts initiated in cash (CFA, 1000s)	2.84	3.57	2.02	0.001	6.29	5.36	7.36	0.005
Debts initiated in form of food (%)	8%	10%	0.05	0	7%	8%	5%	0.014
Debts initiated in form of food (CFA, 1000s)	4%	4%	0.04	0.99	12%	10%	15%	0.473
Debts initiated in form of food (in KGs)	2.53	3.69	1.22	0	2.86	3.43	2.19	0.105
Debts initiated from within the village, in cash (%)	13%	15%	10%	0.001	23%	19%	29%	0
Debts initiated from within the village, in food (%)	6%	8%	4%	0.001	5%	5%	4%	0.242
Debts initiated from outside of village, in cash (%)	3%	4%	2%	0.001	9%	9%	8%	0.35
Debts initiated from outside of village, in food (%)	2%	3%	1%	0.001	2%	3%	1%	0.009
Initator of credit (with form)								
Debts initiated by household heads (%)	17%	20%	13%	0	31%	28%	35%	0
Cash debts initiated by household heads (%)	12%	14%	10%	0.003	26%	22%	31%	0
Food debts initiated by household heads (%)	6%	8%	4%	0	6%	7%	5%	0.033
Debts initiated by spouse (%)	5%	7%	3%	0	5%	5%	5%	0.942
Cash debts initiated by spouse (%)	4%	5%	2%	0.001	4%	4%	4%	0.95
Food debts initiated by spouse (%)	2%	2%	1%	0.028	1%	1%	1%	0.391

Table 3.2 (*continuted*): Debt, descriptive statistics and t-tests by form of transfer (both periods)

	April - June				July - September			
	All HHs	Cash HHs	Food HHs	P-value	All HHs	Cash HHs	Food HHs	P-value
Reasons debt taken (conditional on taking debt)								
Debts initiated for food needs (%)	83%	90%	71%	0	58%	69%	48%	0
Debts initiated for non-food needs (%)	20%	14%	30%	0	48%	36%	59%	0
Debts initated for medical/veterinary needs (%)	8%	6%	10%	0.204	11%	8%	13%	0.008
Debts initiated for productive purposes	3%	3%	4%	0.604	9%	6%	12%	0.003
Debts initiated for transportation (%)	2%	2%	1%	0.41	3%	3%	4%	0.529
Debts initiated to pay other debts (%)	0%	1%	0%	0.297	0%	1%	0%	0.948
Debts initiated for ceremonies/festivities (%)	8%	4%	17%	0	15%	11%	19%	0.002
Debts inititaed to pay fetishers (%)	0%	0%	0%	.	14%	10%	17%	0.003
Debt Repayment								
Paid Back Any Debt	13%	18%	7%	0	--			
Total Debt Paid Back (CFA, 1000s)	1.59	2.52	0.56	0				
Loans made to other households								
Made a loan to another HH	10%	9%	11%	0.037	10%	9%	10%	0.163
Of these: loan in cash, >= 1,000 CFA	68%	70%	66%	0.519	74%	80%	69%	0.092
Of these: loan in cash, >= 25,000 CFA	26%	25%	27%	0.81	16%	15%	17%	0.676
Of these: loan in kind, >= 50kg of grain	13%	9%	17%	0.08	8%	9%	6%	0.538
Of these: loan in kind, >= a goat	8%	7%	9%	0.519	3%	1%	6%	0.064
Observations	2268	1198	1070		2209	1179	1030	

Table 3.3: Gifts and transfers, descriptive statistics and t-tests by form of transfer (both periods)

	April - June				July - September			
	All HHs	Cash	Food	P-value	All HHs	Cash	Food	P-value
Receipt of gifts / private transfers								
Received Gift, Any Resource	10%	9%	11%	0.051	14%	14%	14%	0.897
Total Gifts Received, Any Resource (CFA, 1000s)	2.52	1.45	3.71	0.209	1.81	1.6	2.04	0.245
Form of gifts received								
Received Gift in Cash	7%	6%	8%	0.139	7%	6%	7%	0.388
Total Cash Received (CFA, 1000s)	2.2	1.19	3.34	0.232	1.36	1.17	1.58	0.248
Received Gift in Food	1%	1%	1%	0.88	6%	7%	5%	0.138
Total Food Received (CFA, 1000s)	0.13	0.15	0.11	0.544	0.21	0.25	0.16	0.159
Total Food Received (in KGs)	0.75	0.59	0.92	0.363	0.75	0.75	0.75	0.976
Source of gifts received								
Received Gift from within village	1%	1%	2%	0.061	5%	5%	4%	0.541
Total Received from within village (CFA, 1000s)	0.12	0.06	0.19	0.052	0.17	0.14	0.21	0.205
Received Gift from outside of village	2%	2%	3%	0.203	2%	3%	2%	0.86
Total Received from outside of village (CFA, 1000s)	0.19	0.11	0.27	0.098	0.14	0.17	0.11	0.25
Giving of gifts / private transfers								
Gave, Any Resource	9%	7%	12%	0	26%	24%	30%	0.002
Total Given, Any Resource (CFA, 1000s)	1.24	0.44	2.13	0.205	2.07	2.22	1.89	0.297
Form of gift given								
Gave Cash	4%	4%	4%	0.952	11%	15%	6%	0
Total Cash Given (CFA, 1000s)	1.03	0.3	1.86	0.24	1.19	1.77	0.53	0
Gave Food	4%	2%	7%	0	18%	10%	26%	0
Total Food Given (CFA, 1000s)	0.15	0.1	0.2	0.032	0.82	0.4	1.31	0
Total Food Given (in KGs)	35%	20%	53%	0.028	485%	265%	737%	0
Destination of gift given								
Gave to someone within village	4%	3%	6%	0.001	21%	18%	24%	0.001
Total Given to people within village (CFA, 1000s)	0.4	0.22	0.6	0.178	1.57	1.7	1.42	0.291
Gave to someone outside of village	4%	3%	6%	0	8%	7%	9%	0.212
Total Given to people outside of village (CFA, 1000s)	0.63	0.18	1.14	0.227	0.39	0.47	0.31	0.221
Observations	2268	1198	1070		2209	1179	1030	

While the majority of loans are taken out within the village that the household resides in, households do borrow from sources outside their own village especially during the hungry season; such loans are nearly always in cash. The reasons for taking loans varies over time. In the first period, loans for the purposes of meeting food needs dominate. During the hungry season, many households do take loans for food needs but loans to assist in meeting non-food needs become much more prominent. As this season comes to an end with the first harvests, loans to meet expenses associated with ceremonies and festivities and the need to pay the spiritual guides who lead these (known locally as *fetishers*) also become important.

Table 3.2 disaggregates these descriptive statistics by treatment status. Between April and June, households receiving cash transfers were more likely to borrow and, on average, borrowed larger amounts. This pattern is reversed during July to September. During this period, households that were in localities randomized to receive food were especially likely to borrow to meet cash needs associated with non-food expenditures. The percentage of these households borrowing cash rises from 12 to 35 percent while the mean value of these cash loans rises from 2,020 CFA to 7,360 CFA.

Two other findings are of note. First, consistent with the informality of these loan transactions, we see virtually no households borrowing to repay a loan that has been called. Second, in the first survey round, we also asked about loan repayments. As Table 3.2 shows, households randomized in localities receiving cash are much more likely to do so (18 percent versus seven percent for households in food localities) and repaid much larger amounts (2,520 CFA versus 560 CFA).

Lastly, we collected minimal information about loans given by respondents to other households. We asked if such a loan had been provided that was still outstanding at the time of

the interview and if the value exceeded 1,000 or 25,000 CFA in cash, in food exceeded the value of a 50-kg bag of grain, or in the form of an animal exceeded the value of a goat. Only few, roughly 10%, of households claimed having provided any such loan to another household. Of these the majority were cash loans under 25,000 CFA. There are no significant differences in loaning behavior between cash and food recipients, with the exception of large loans in the form of food in July; 17% of food recipients (of the 10% providing any loan) loaned out more than the value of 50-kg bag of grain, versus 9% of cash recipients.

c. Data on transfers

To assess the transfer behavior of households, information was collected on transfers given to other households and transfers received from other households. In the first survey round, households were asked about transfers given and received during the months before and during the first phase of the intervention. In the second survey round they were asked about transfers during the second part of the intervention. As a result we have monthly transfer data from January to September during the intervention year. Households were asked to give details about the five most important gifts including their type (cereals, other food items, non-food items, and cash), the relationship to the person giving or receiving the transfers, the location of this person, and details about the amount of each transfer and its value in cash. Households were also asked to indicate who in the household gave or received the gift and if the households had exchanged gifts with the same person or household before.

Gift giving and receiving is similar, but more common between households and family members, and can take place in both directions in forms other than cash. Households somewhat more commonly give and receive foods and other items (50-60% of transfers, depending on the period) than cash (40-50% of transfers). Reciprocity is assumed, and is a function of needs and

circumstances. Food gifts are in many cases considered an obligation by those who have food when others do not; one woman in a focus group discussion expressed that she would share food even when she herself did not have enough to last, because it would be shameful to allow her cousin or neighbor to go off for a day's work in the field hungry if she had even one meal at home to provide him. In looking at the descriptive statistics in Table 3.3, it is helpful to bear three things in mind. First, all households are receiving some form of transfer so this table does not capture possible crowding out or crowding in behaviors. Second, civil unrest in neighboring Libya had led to the return of Nigeriens from that country and this may have depressed the receipt of transfers. Third, the end of Ramadan fell in late August and this may have increased gift giving as reported during the second survey round.

About 10 percent of household gave transfers in the three months leading up to the first survey in July and a similar percentage received transfers. Giving gifts and transfers was considerably higher during the second period (26 percent). Households in villages receiving food transfers are especially likely to give gifts, though there was no difference in the level of transfers given by households in food and cash localities. Households receiving cash(food) were more likely to give cash(food) and to do so in larger amounts. Most transfers are given to someone else in the same village.

IV. EMPIRICAL STRATEGY AND VARIABLES

We now turn to developing estimable versions of equations (18) and (19). Given the outcome variable y_{ivt} of either b_{ivt} or h_{ivt}, we write:

$$y_{ivt} = \alpha + \beta foodvillage_{ivt} + \psi y_{ivw(t-1)} + \varphi p_{vt} + \rho\theta_{ivt} + \gamma A_{ivt} + \sigma Z_{iv} + \pi FE_v + \mu stratum_{iw} + \varepsilon_{ivt} \quad (20)$$

where y_{ivt} is the outcome of interest for household i in village v at time t, $foodvillage_{iv}$ is a dummy variable equal to one if a household lives in a village receiving food (T_t^c), and 0 if a household lives in a village receiving cash (T_t^x), p_{vt} is a vector of prices and price changes, θ_{ivt} is a vector of transaction costs including village-level market access and household-level market distance, A_{ivt} is the vector of household-level asset variables, *FEv* is a vector of commune or market-level fixed effects, and Z_{iv} is a vector of household characteristics. To control for payment history ($H(h_t)$), we also include the lag of the dependent variable, $y_{ivw(t-1)}$. Lastly there is the error term, ε_{ivt}, which is i.i.d. and satisfies the usual assumptions. We estimate (20) separately for the three months of the lean season leading up to the time when households begin planting (the July survey round) and the height of the lean season during cultivation up to the early part of the harvest season (October).

We include village-level prices for each period for millet, maize, and livestock. We control for price expectations in two ways. First, we include the price change over the period in question for each of these prices, which would provide households with a fair amount of information as to how the price pattern is likely going to play out relative to prior years. Other factors that would inform expectations would be observations about production, such as rainfall levels and the health of millet stocks, and knowledge of trade dynamics and/or sociopolitical conditions. All of these would be common within each district or commune, and/or among all

households that frequent any given market. We hence include a commune-level fixed effect, and as a robustness check include alternatively a fixed-effect for the market frequented by each village.[13]

Given the nature of debt and debt repayment as described above, food price changes provide a good proxy for interest rates. The primary asset held by households is in turn livestock, so livestock price changes serve as good proxies for interest rates on assets. We control for household-level transaction costs (θ_t) using household-level distances to markets. The remainder of the necessary transaction cost and market access information is captured at the village level with whether or not there is a market and/or cereal bank in the village, the distance from the village to the main (paved) road, and whether or not there is cell phone service, as cell phone access has been found specifically to impact markets and price dispersion in Niger's agricultural markets (Aker 2010). Our measures of assets (A_t) include the asset score described earlier, livestock as measured in TLU, an indicator for whether or not the household head has formal education.[14] For land K we control for the number of hectares cultivated this season by each household. Gender and ethnicity are the primary feature that may shift preferences, so we include whether or not the household-head is female, the ethnic group of the household and whether or not it is a member of the majority group in the village. We also include household size and whether or not a household is polygamous, as these features would affect preferences and bargaining dynamics. Following Bruhn and McKenzie (2009), we include the stratification

[13] There are between one and four markets per commune; there are 13 communes, 26 markets identified in community surveys as that most frequented by households in that village, and 14 markets identified by the World Food Programme as key markets for these villages. Hence several, but not all, markets are frequented by households from more than one village in the sample. In many cases, however, due to the clustering of worksites, there was no variation in transfer type received within a single market district, meaning that using market-level fixed effects effectively loses many observations. We hence prefer and report results using commune-level fixed effects. The results using fixed-effects at each of the different market levels are shown in Appendix 1.

[14] Those with any formal education include only 7% of all household heads, hence a more refined measure carries little meaning and does not affect the results.

variable, or whether the village is classified as pastoral or agro-pastoral, indicated as $\mu stratum_{iw}$. Since we randomize at the worksite level, we allow for the error terms to be correlated by clustering at the worksite level.

Lastly, the two key outcomes variables have four components: debts initiated and/or gifts received (b_t), and debts paid and/or gifts given to other households (h_t). While there are differences between debts and private transfers as described above, they are part of a similar consumption smoothing strategy and it is also possible that many respondents may not always have clearly distinguished between the two when answering questions. In Udry's (1994) work in northern Nigeria – in a setting and with ethnic groups not dissimilar to ours - terms of debt repayment were state-contingent; sometimes debts become effectively transfers and need not be repaid, in response to shocks experienced by those taking them out. Given this, in our analysis we combine debt initiation and transfer receipt as one outcome variable, combine debt repayment and transfers given as a second outcome variable, and additionally report on each of these separately.

V. RESULTS

The parameter β is the parameter of primary interest. An explicit prediction of our model is that β is negative when the outcome involves giving cash transfers or paying cash debts (and positive for gifts or payments in food), and that these estimates are larger in the first period when food prices are rising than in the second when they are leveling off.

We first examine these trends, along with the direct predictions of the model, by looking at the impact of cash versus food transfers on payment of debt and/or giving gifts in each period, shown in Table 3.4. We first treat debt and private transfers as interchangeable, so these tables present results on *any of either activity* and the *total of both*. In July, the lean season during

which prices are rising, cash recipients are more likely, by an estimated 9%, to pay debts and/or gifts over all, and also to pay or give more on average by an estimated average of 5,000 CFA (column (1)).[15] When separated by form, in cash or in food, we see that as the model predicts this difference is driven by payments in cash; cash recipients are an estimated 11% more likely to pay debt in cash, and pay an estimated average of 8,000 CFA more (column (3)). In fact, food recipients are somewhat more likely to give or pay debts in the form of food, albeit not by much in likelihood or amount (5% more likely, by about 500 CFA, column (5)).

Table 3.4: Marginal effect of food transfers on debt repayment and gift-giving, by form (cash/food) and round

	Any debt paid / gift given					
	Any Resource		Cash		Food	
	July	October	July	October	July	October
	(1)	(2)	(3)	(4)	(5)	(6)
Food Transfer	-0.089***	0.060**	-0.112***	-0.099***	0.045***	0.139***
	(0.025)	(0.027)	(0.017)	(0.019)	(0.014)	(0.025)
	Total value of debts paid / gifts given, 1000s CFA					
	July	October	July	October	July	October
Food Transfer	-4.655**	0.431	-8.257***	-1.566***	0.496***	1.085***
	(1.921)	(0.347)	(3.194)	(0.284)	(0.167)	(0.395)
No. of Households	2153	2105	2153	2105	2153	2105

*, **, and *** represent significance at the 10%, 5%, and 1% levels, respectively
Dummy variables estimated using a Probit, showing marginal effects;
Values estimated using a Tobit, showing marginal effect conditional on being uncensored.
All covariates (as previously described), and commune-level fixed effects, are included
Standard errors clustered at the worksite (randomization unit) level

[15] 5,000 FCFA represents roughly $10, and was payment for five days' work during the public works phase.

The model predicts that, while the same transaction cost mechanism is in place in both seasons, the relative scarcity of cash and falling food price in October would make the difference in impact less pronounced. We find that in October there is little difference in debt repayment between cash and food households over-all; food recipients are an estimated 6% more likely to pay back debt or give any gifts, and there is no significant over all difference in levels of payment and gift-giving (column (2)). When divided by form, however, the results are similar to July in sign and statistical significance but, as the model predicts, are of lesser magnitude. Cash recipients are 10% more likely to give or pay cash, but by only a small relative amount, 1,500 CFA (column (4)), and food recipients are as much as 13% more likely to give or pay food, but by relatively small amounts of an average of 1,000 CFA (column (6)).

In light of both the model and the nature of informal credit and gift exchange as described above, we also separate out resources reported as debts from those reported as gifts, shown in Table 3.5 for the July round. As discussed, debts are repaid in cash, so unsurprisingly the frequency of debt repaid in food is too low to estimate separately. We compare, however, all debts paid versus transfers given, as well as gifts given in both cash and food, and debt paid in cash. In the basic divide between all debts and all private transfers, we see that cash recipients are more likely to repay debts by about 14%, and pay on average 4,000 CFA more (column (2)), whereas there is more over-all gift giving among food recipients by about 4% and 3,000 CFA (column (3)). We see also, however, that the form (cash versus food) matters more than the type of activity (debt versus gifts). Cash recipients are more likely to pay and give cash and in higher values, and food recipients are more likely to give food and in higher values (columns (4)-(8)).

Table 3.5: Marginal effects of food trasnfer on debt repayment OR gift-giving, by form (cash/food), in first round only

	Any debt paid / gift given							
	Any Resource			Cash			Food	
	Either	Debt	Transfer	Either	Debt	Transfer	Either	Transfer
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Food Transfer	-0.089***	-0.142***	0.042**	-0.112***	-0.115***	-0.018	0.045***	0.047***
	(0.025)	(0.022)	(0.018)	(0.017)	(0.016)	(0.013)	(0.014)	(0.014)
	Total value of debt paid / gifts given, 1000s CFA							
	Both	Debts	Transfers	Both	Debts	Transfers	Both	Transfers
Food Transfer	-4.655**	-4.163***	2.994**	-8.257***	-4.419***	-2.675***	0.496***	0.548***
	(1.921)	(1.168)	(1.281)	(3.194)	(1.361)	(0.281)	(0.167)	(0.176)
No. of Households	2153	2153	2153	2153	2153	1870	2153	2153

*, **, and *** represent significance at the 10%, 5%, and 1% levels, respectively

Dummy variables estimated using a Probit, showing marginal effects;

Values estimated using a Tobit, showing marginal effect conditional on being uncensored.

All covariates (as previously described), and commune-level fixed effects, are included

Standard errors clustered at the worksite (randomization unit) level

These results are consistent with both model's predictions and the nature of the context previously described. Since debt is denominated in cash, and sales of food subject to a transaction cost, cash recipients are more likely to pay debts and in higher values. This difference is more pronounced when prices are rising, as the expected increase in food prices erodes the value of cash in terms of future consumption and lowers the effective cost of paying debt. As the model shows, however, consumption smoothing (through debt or gifts) is a rational choice for all households, and food recipients utilize transfers in this manner as well by giving food gifts. The magnitudes and frequency of these gifts are lower in part because most transactions are denominated in cash, and possibly also in part because of the strain on gift-giving at the time of the study due to returning migrants from Libya.

The model does not yield precise predictions regarding the impact of cash versus food on debt initiation or receipt of gifts. Examining these results, however, further highlights the relative scarcity of cash versus food, and change in shadow price of cash relative to food, between periods. Table 3.6 shows results for any initiation of debt or receipt of gifts, and Table 3.7 for the values thereof. We see that while cash recipients are more likely to pay debts in July, they are also significantly more likely to initiate debt. Cash recipients are about 10% more likely than food recipients to initiate any debt in July (column (1)). They also initiate an estimated 5,000 CFA more debt over-all and in cash (Table 3.7, column (1)).[16]

Further analysis, shown in Table 3.8, reveals that the majority of these debts are reported to be taken out to meet food needs. Cash recipients are roughly 14% more likely to take out debt for food needs, and of nearly 4,000 CFA more on average (row (1)). For non-food needs, there is no difference in frequency and the average value taken out is slightly larger for food recipients.

[16] If we look separately at debt initiated in cash versus in the form of food, nearly all impacts relate to debt in the form of cash. This is consistent with the fact that debt is generally denominated in (and taken out in) cash.

Table 3.6: Marginal effect of food transfer on initiation of new debt or receipt of private transfers by survey round

	Any debt initiated or private transfer rec'd		Any debt initiated		Any private transfer received	
	July	October	July	October	July	October
	(1)	(2)	(3)	(4)	(5)	(6)
Food Transfer	-0.098***	0.035	-0.120***	0.059**	0.008	0.002
	(0.027)	(0.030)	(0.030)	(0.029)	(0.016)	(0.023)
Lag of Dependent Variable	-0.001	0.064***	-0.009	0.065***	0.059***	0.073***
	(0.027)	(0.021)	(0.023)	(0.022)	(0.017)	(0.022)
Millet Price (CFA)	0	0.019**	0	0.021***	-0.002	0.002
	(0.007)	(0.009)	(0.007)	(0.008)	(0.003)	(0.006)
Price of a cow (CFA)	0.001*	0	0.001**	0	0	0
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Price of a goat (CFA)	-0.002	0	0.002	0.001	-0.003**	0
	(0.004)	(0.005)	(0.004)	(0.004)	(0.001)	(0.004)
Change in millet price (CFA)	0.002	-0.018***	0.005	-0.020***	-0.001	-0.002
	(0.007)	(0.005)	(0.006)	(0.005)	(0.003)	(0.004)
Change in price of a cow (CFA)	-0.001*	0	-0.001**	0	0	0
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Change in price of a goat (CFA)	0.006	-0.002	0.004	-0.003	0.003	0
	(0.004)	(0.003)	(0.004)	(0.002)	(0.002)	(0.002)
Market in village	0.045	0.021	0.044	-0.037	0.022	-0.006
	(0.036)	(0.029)	(0.036)	(0.023)	(0.022)	(0.025)
Cereal bank in or near village	-0.02	0.044	-0.03	0.052	-0.016	-0.002
	(0.037)	(0.039)	(0.034)	(0.034)	(0.025)	(0.031)
Distance to main road (km)	0	-0.001	0	-0.001**	0	0
	(0.001)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)
Cell Phone Network in Village	0.053	0.044	0.003	-0.025	0.064	0.016
	(0.062)	(0.043)	(0.051)	(0.038)	(0.048)	(0.025)
Distance from HH to market (km)	0.001	0	0	-0.001	0.001**	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)
Heads with formal education	0.044	-0.076*	0.043	-0.058	0.03	-0.004
	(0.037)	(0.042)	(0.030)	(0.040)	(0.024)	(0.035)
Asset Score (PCA), Baseline	0.020***	0	0.002	-0.010**	0.016***	0.008**
	(0.006)	(0.005)	(0.006)	(0.004)	(0.003)	(0.004)
TLU, Baseline	0.002	-0.004	-0.003	-0.004	0.002	-0.003
	(0.004)	(0.006)	(0.005)	(0.006)	(0.002)	(0.003)
Age of HH Head	-0.002***	-0.001	-0.003***	-0.001*	0	0
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)
Female HH Head	0.070***	-0.039	0.017	-0.074***	0.056***	0.02
	(0.026)	(0.025)	(0.023)	(0.027)	(0.015)	(0.017)
Household Size	0.003	0.020***	0.009**	0.018***	-0.005**	0.006
	(0.004)	(0.004)	(0.004)	(0.004)	(0.002)	(0.004)
Polygamous HH	-0.048*	-0.022	-0.051*	-0.011	-0.013	-0.042
	(0.029)	(0.027)	(0.026)	(0.030)	(0.022)	(0.028)
Member of Ethnic Majority	-0.014	-0.018	-0.037	-0.03	0.009	-0.011
	(0.033)	(0.045)	(0.033)	(0.039)	(0.017)	(0.033)
Hausa	-0.026	0.002	-0.021	0.024	0	-0.011
	(0.025)	(0.040)	(0.028)	(0.030)	(0.018)	(0.031)
Area Cultivated (ha)	-0.002	0.001	-0.005**	0.002	0.002*	-0.001
	(0.002)	(0.003)	(0.002)	(0.003)	(0.001)	(0.002)
Pastoral	0.151*	-0.023	0.139**	-0.013	0.534***	0.412***
	(0.081)	(0.087)	(0.070)	(0.078)	(0.072)	(0.091)
No. of Households	2153	2105	2153	2105	2153	2105

*, **, and *** represent significance at the 10%, 5%, and 1% levels, respectively

Dummy variables estimated using a Probit, showing marginal effects

Standard errors clustered at the worksite (randomization unit) level

Cash recipients, hence, are more likely to use more of their transfers to pay debts, but then are also more likely to fall short on food and take out loans to meet food needs. On the whole cash recipients are sacrificing their dietary diversity, as shown in the prior analysis of Hoddinott et al. (2013), in order to help assure future consumption.

The division of debt initiated by source and reason reveals a few other interesting differences. There are no significant differences by gender of household head (rows (5) and (6)), as both genders are equally more likely to initiate more debt, and in similar amounts, when they receive cash transfers than when they receive food transfers. Debts are for cash recipients more likely to be from within the village and from friends and neighbors, but are in higher total average values from outside of the village (rows (7)-(9)). Dividing these out between debts initiated and gifts received, shown in Table 8, shows that cash recipients do not receive more gifts than food recipients; the results are driven entirely by loans classified as such.

Table 3.7: Marginal effect of food transfer on levels of new debt or receipt of private transfers, by round

	Value of loans initiated and private transfers received		Value of loans initiated		Value of private transfers received	
	July	October	July	October	July	October
	(1)	(2)	(3)	(4)	(5)	(6)
Food Transfer	-4.947**	1.577	-3.243***	1.793	0.61	0.18
	(2.331)	(1.086)	(0.848)	(1.132)	(0.669)	(0.190)
No. of Households	2153	2105	2153	2105	2153	2105

*, **, and *** represent significance at the 10%, 5%, and 1% levels, respectively
Values estimated using a Tobit, showing marginal effect conditional on being uncensored.
All covariates (as previously described), and commune-level fixed effects, are included
Standard errors clustered at the worksite (randomization unit) level

Table 3.8: Impacts of Food Transfer (relative to cash) on Debt Initiation, by categories and survey round

	July		October	
	Any	Total	Any	Total
(1) for Food Needs	-0.136***	-3.724***	-0.026	-0.68
	(0.028)	(0.934)	(0.023)	(0.622)
(2) for Other Needs	0.006	0.565*	0.090***	3.871***
	(0.010)	(0.306)	(0.021)	(1.190)
(3) for Productive Purposes	-0.006	-1.059***	0.044***	5.135***
	(0.004)	(0.198)	(0.015)	(1.714)
(4) for Ceremonies/Holidays	0.046***	5.793***	0.017	1.051***
	(0.013)	(1.720)	(0.011)	(0.399)
(5) by Household Heads	-0.075***	-2.501***	0.061*	2.046*
	(0.020)	(0.742)	(0.031)	(1.206)
(6) by Spouses	-0.044***	-2.216***	-0.001	-0.245***
	(0.014)	(0.339)	(0.013)	(0.054)
(7) from Within the Village	-0.088***	-1.942***	0.076***	2.115**
	(0.024)	(0.530)	(0.024)	(0.854)
(8) from Outside of the Village	-0.032**	-3.373***	-0.021	-0.767
	(0.014)	(0.499)	(0.018)	(0.936)
(9) from Family or Neighbors	-0.094***	-2.389***	0.031	1.093
	(0.017)	(0.458)	(0.028)	(0.985)
(10) from Merchants or Lenders	-0.016	-1.224	0.039***	1.762***
	(0.018)	(0.981)	(0.013)	(0.390)
No. of Households	2267	2268	2209	2209

*, **, and *** represent significance at the 10%, 5%, and 1% levels, respectively
All covariates (as previously described), and commune-level fixed effects, are included
Standard errors clustered at the worksite (randomization unit) level

This trend changes to a fair degree, however, in October when the harvest is starting. From the descriptive information above (Table 3.2) we see that all households are on average more likely to take out loans in October. The impact estimates show that this increase is more pronounced for food recipients, for as cash becomes more relatively scarce during the harvest, it is food recipients who are more likely to borrow resources, as seen in Table 3.6. Food recipients are about 6% more likely to initiate loans in October (column (6)). Looking at debts by source and reason in Table 3.8 shows that this is not for food needs (row (1)), but rather for productive uses and for festivities (rows (3) and (4)). This latter is not surprising, as in this particular case Ramadan fell just prior to the harvest, at the end of August. Households typically have significant cash needs related to Ramadan celebrations, including meat and other foods for a feast and the purchase of new formal attire for the prayers. Hence the scarcity of cash relative to food during this particular harvest would have been exacerbated. Having received food, food recipients needed to borrow more cash to meet other needs. These impacts are likewise driven by debt and not the receipt of gifts, as the form of transfer has no direct implications for gifts received (Tables 3.6 and 3.7).

VI. SUMMARY AND CONCLUSIONS

Development economists have paid a great deal of attention to the importance of, and different mechanisms for, consumption smoothing at both the household and village levels in poor contexts, and to the influence of public transfers on these mechanisms. This is to the best of our knowledge the first empirical examination of the different implications of different forms of transfer, cash versus in-kind, for these activities, particularly in a developing country context. We develop a theoretical household model that gives us predictions as to how food versus cash transfers could differently impact household-level consumption smoothing choices. Through a

previously tested extension of the asset-evolution constraint, which allows it to include different consumption smoothing mechanisms (Behrman et al. 1997), and the introduction of a transaction cost on the sales of food transfers, we predict that cash transfers will lead to more debt repayment and cash gifts, potentially at the expense of food consumption and dietary diversity. We find in turn that these difference will be accentuated in an environment of rising food prices because the expectation of rising food prices erodes the value of cash in terms of future consumption.

We test this model using a rich data set that results from a randomized cash/food distribution in Eastern Niger. We find support for the model, in that cash recipients pay more debt and give more gifts in cash, while food recipients give gifts in food (in lower average quantities). Cash recipients pay more debt and give more cash gifts even at the expense of their food consumption and dietary diversity, and even though they must then take out more debt to meet food needs.

The model in turn predicts that these impacts would be more pronounced when food prices are rising, because the rising price lowers the current shadow price of cash in terms of future consumption. Our findings firmly confirm these predictions. Cash recipients continue to be more likely than food recipients to pay cash debts, due to the transactions cost involved in selling food and the more common use of cash for debt repayment, but the magnitudes of these differences are much smaller. There is also no difference in debt repayment or gift giving over-all between cash and food recipients, because food recipients give more gifts in the form of food. In turn, as cash is relatively more valuable during the harvest, we see that food recipients take out more cash debts to ease liquidity constraints.

We have contributed in this study a novel application of the dynamic household model to the question of the use of cash versus food transfers. Our approach extends the conventional understanding of in the food assistance literature, by taking a theoretical approach that deepens our intuition about the mechanism behind differential impacts of different forms of transfer. We also take on the little explored question of the relative impacts of different forms of transfer on informal credit and transfer behavior. Using this approach we find that the form of transfer does indeed matter, due to dynamic circumstances (changing prices) and frictions (transaction costs).

Our findings in turn have policy implications, particularly for food assistance and public transfer policies. We have shown that public transfers can indeed "grease the wheels" of, rather than crowd out, private transfers—and that cash transfers do so more than food transfers—in an environment characterized by both resource scarcity and a culture of reciprocity.

These findings have important implications for the delivery of cash versus food transfers. The predicted outcome from each is clearly a function of timing and circumstances; and recipients are making dynamic, not static, consumption choices. The form of transfer provided should hence take into account the dynamic circumstances, and provide the good that is relatively more scarce. One specific implication could be that it is more beneficial in terms of food consumption to provide food when food prices are rising, and to provide cash when food is being locally harvested and food prices are stable or falling. While meeting dynamic needs is natural and can be effective, there are trade-offs to doing so, and one such trade-off might as in this case be in the diversity of current food consumption. How these trade-offs inform policy choices depends on the immediate goals of the policy, and the implications of dynamic household choices may be cause for concern if the policy has as its goal the immediate improvement of food consumption outcomes for targeted recipients.

REFERENCES

Aker, Jenny (2010). Information from markets near and far: the impact of mobile phones on grain markets in Niger. *American Economic Journal: Applied Economics, Vol. 2*: 46-59.

Albarran, Pedro and Orazio P. Attanasio (2003). Limited commitment and crowding out of private transfers: Evidence from a randomized experiment. *Economic Journal, 113:* C77-C85.

Barrett, C.B. (2007). "Displaced Distortions: Financial Market Failures and Seemingly Inefficient Resource Allocation in Low-Income Rural Communities," in E. Bulte and R. Ruben, eds., *Development Economics: Between Markets and Institutions: Incentives for growth, food security and sustainable use of the environment* (Wageningen: Wageningen Academic Publishers).

Barrett, Christopher B. (2002). Food security and food assistance programs. *Handbook of Agricultural Economics, 2*(B), Chapter 40: pp. 2103-2190.

Barrett, Christopher B. (1996). Urban bias in price risk: The geography of food price distributions in low-income countries. *Journal of Development Studies 32*(6): 830-849.

Barro, R.J.(1974). Are government bonds net wealth?. *Journal of Political Economy*. (82): 1095–1117.

Becker, G.S. (1974). A theory of social interactions. *Journal of Political Economy*.(82): 1063–1094.

Behrman, Jere R., Andrew Foster and Mark R. Rosenzweig (1997). Dynamic savings decisions in agricultural environments with incomplete markets. *Journal of Business & Economic Statistics, 15*(2): 282-292.

Besley, Timothy (1995). Nonmarket institutions for credit and risk sharing in low-income countries. *Journal of Economic Perspectives, 9*(3): 115-127

Bruhn, M. and D. McKenzie (2009). In Pursuit of Balance: Randomization in Practice in Development Field Experiments. *American Economic Journal: Applied Economics*, 1(4): 200-232.

Chantarat, Sommarat and Christopher B. Barrett (2012). Social network capital, economic mobility and poverty traps. *Journal of Economic Inequality, 10*:299-342.

Cox, Donald, Bruce E. Hansen and Emmanuel Jiminez (2004). How responsive are private transfers to income? Evidence from a laissez-faire economy. *Journal of Public Economics, 88*: 2193-2219.

Cox Donald, Zekeriya Eser and Emmanuel Jimenez (1998). Motives for private transfers over the life cycle: An analytical framework and evidence for Peru. *Journal of Development Economics* 55:57-80.

Cox, Donald and George Jakubson (1995). The connection between public transfers and private interfamily transfers. *Journal of Public Economics,* 57: 129– 167.

Cox, Donald (1987). Motives for private income transfers. *Journal of Political Economy,* 95 (3): 508– 546.

David M. and P. Menchik (1985). The Effect of Social Security on Lifetime Wealth Accumulation and Bequests. *Economica,* 52(208): 421-434.

de Janvry, A., M. Fafchamps and E. Sadoulet (1991). Peasant Household Behavior with Missing Markets: Some Paradoxes Explained. *Economic Journal,* Vol. 101 (409): 1400-1417.

Deaton, Angus (1997). *The Analysis of Household Surveys*. Baltimore: Johns Hopkins University Press, 1997.

Dercon, S. and P. Krishnan, (2003). Food Aid and Informal Insurance. Working Paper Series UNU-WIDER Research Paper, World Institute for Development Economic Research (UNU-WIDER).

Famine Early Warning System (2014). Price Bulletin, March 2014. Available on line at : http://www.fews.net/west-africa/niger/price-bulletin/wed-2014-03-12.

Food and Agriculture Organization (2014). Tropical Livestock Units. Available on line at: http://www.fao.org/ag/againfo/programmes/en/lead/toolbox/Mixed1/TLU.htm (accessed March 22, 2014).

Hoddinott, J., S. Sandström and J. Upton (2013). The impact of cash and food transfers: Evidence from a randomized intervention in Niger. SSRN working paper (under revisions for the *American Journal of Agricultural Economics*).

Jakiela P. and Ozier O. (2012) Does Africa need a rotten kin theorem? Experimental evidence form village economies.

Jensen, Robert T. (2003), Do private transfers 'displace' the benefit of public transfers? Evidence from South Africa. *Journal of Public Economics,* 88: 89-112.

Key, Nigel, Elisabeth Sadoulet and Alain de Janvry (2000). Transaction costs and agricultural household supply response. *American Journal of Agricultural Economics, 82:* 245-259.

Lentz E. and Barrett C. (2005). Food Aid Targeting, Shocks and Private Transfers Among East African Pastoralists. Cornell University Working Paper.

Miles, William F. (1995). Hausaland Divided. Ithaca, London: Cornell University Press.

Morduch, Jonathan (1995). Income Smoothing and Consumption Smoothing. *The Journal of Economic Perspectives,* 9(3): 103-114.

Rosenzweig, Mark R., and Kenneth I. Wolpin (1994). Parental and Public Transfers to Young Women and their Children. *American Economic Review,* 84(5): 1195-1212.

Singh, I., L. Squire and J. Strauss. 1986. *Agricultural household models: Extension, application and policy*. Baltimore Johns Hopkins University Press.

Sulaiman M. (2011). Incentive and crowding out effects of food assistance:
Evidence from randomized evaluation of food-for-training project in Southern Sudan.

Townsend, Robert M. (1994). Risk and insurance in village India. *Econometrica, 62*(3): 539-591.

Udry, Christopher (1994). Risk and insurance in a rural credit market: An empirical investigation in Northern Nigeria. *Review of Economic Studies, 61*: 495-526.

Udry, Christopher (1991). Rural credit in Northern Nigeria. Dissertation, Yale University.

APPENDIX 3

Robustness Check using Market-level Fixed Effects

We posit in Section IV above that factors that affect price expectations would be captured using either commune- or market-level fixed effects. Commune-level fixed effects capture slightly larger units, within all of which we have variation in our treatment variable at the fixed-effect level. This is not the case for market-level fixed effects, which are smaller. In many cases, any given market area received only one form of transfer, and hence we effectively lose the impact on those observations using these effects. For the sake of robustness, however, we examine these fixed effects to observe any significant change in results.

The results in Table A3.1 show impacts on the combined variable of debts paid and gifts given, first any paid or given, then the values. There are only minimal changes in this case to either the magnitude or significance of the results. In July, the negative impact on the value of debt paid loses significance with inclusion of the closest market fixed effect; whereas in October, the positive impact on this gains significance. The sign, and hence interpretation, however, does not change.

Table A3.2 then shows the impacts on debts initiated and gifts received, first any and then the average values. Here again differences between different fixed effects are minimal; the degree to which cash are more likely to pay debt varies between 8 and 12% in July, and the value of difference stays around 5,000 CFA, albeit (as with the results in Table A3.1) loses significance with the inclusion of closest-market fixed effects. In October, however, the impact estimate on this combined variable gains significance with inclusion of the closest-market fixed effects, but is again the same in sign and fundamental interpretation.

These changes are within the range of what one might expect for the sample restrictions involved in using lower-level fixed effects. We prefer as such the commune-level, and find that each of the three are sufficient with respect to capturing the unobservables potentially associated with price expectations.

Table A3.1: Marginal effects on debt paid and gifts given, by differing fixed effects and round

	Any debt paid / gift given					
	July			October		
	Commune	Closest Market	VAM Market	Commune	Closest Market	VAM Market
	(1)	(2)	(3)	(4)	(5)	(6)
Food Transfer	-0.089***	-0.043*	-0.093***	0.060**	0.112***	0.050*
	(0.025)	(0.026)	(0.026)	(0.027)	(0.043)	(0.026)
	Total value of debts paid / gifts given, 1000s CFA					
	Commune	Closest Market	VAM Market	Commune	Closest Market	VAM Market
Food Transfer	-4.655**	-2.866	-5.075**	0.431	1.103***	1.103***
	(1.921)	(1.768)	(2.103)	(0.347)	(0.353)	(0.353)
No. of Households	2153	2153	2153	2105	2105	2105

*, **, and *** represent significance at the 10%, 5%, and 1% levels, respectively

Dummy variables estimated using a Probit, showing marginal effects;

Values estimated using a Tobit, showing marginal effect conditional on being uncensored.

All covariates (as previously described), and commune-level fixed effects, are included

Standard errors clustered at the worksite (randomization unit) level

Table A3.2: Marginal effects on debt initiated and gifts received, by differing fixed effects and round

	Any debt initiated / gift received					
	July			October		
	Commune	Closest Market	VAM Market	Commune	Closest Market	VAM Market
	(1)	(2)	(3)	(4)	(5)	(6)
Food Transfer	-0.098***	-0.081***	-0.119***	0.035	0.131***	0.03
	(0.027)	(0.025)	(0.029)	(0.030)	(0.048)	(0.031)
	Total value of debts initiated / gifts received, 1000s CFA					
	Commune	Closest Market	VAM Market	Commune	Closest Market	VAM Market
Food Transfer	-4.947**	-4.269	-5.917**	1.577	3.403**	1.472
	(2.331)	(2.644)	(2.674)	(1.086)	(1.574)	(1.104)
No. of Households	2153	2153	2153	2105	2105	2105

*, **, and *** represent significance at the 10%, 5%, and 1% levels, respectively

Dummy variables estimated using a Probit, showing marginal effects;

Values estimated using a Tobit, showing marginal effect conditional on being uncensored.

All covariates (as previously described), and commune-level fixed effects, are included

Standard errors clustered at the worksite (randomization unit) level