ELSEVIER
www.elsevier.com/locate/worlddev

World Development Vol. xx, pp. xxx–xxx, 2013

0305-750X/$ - see front matter

http://dx.doi.org/10.1016/j.worlddev.2013.01.021

Enhancing Nutrition: A New Tool for *Ex-Ante* Comparison of Commodity-based Vouchers and Food Transfers

DAVID RYCKEMBUSCH
WFP, Rome, Italy

ROMEO FREGA
Harvard Business School, Boston, USA

MARCIO GUILHERME SILVA
Accenture, Rio de Janeiro, Brazil

UGO GENTILINI, ISSA SANOGO and NILS GREDE
WFP, Rome, Italy

and

LYNN BROWN [1 *]
World Bank, Washington DC, USA

Summary. — This article presents a new analytical tool for *ex-ante* comparison of the cost-effectiveness of two transfer modalities in pursuing specific nutritional objectives. It does so by introducing a metric to score the nutrient value of a food basket—the Nutrient Value Score (NVS)—and explains how this metric can be combined with full supply chain analysis and costing to generate a new tool, the Omega Value. The use of the Omega Value allows policy-makers who design a program with nutrition objectives to compare direct food transfers and commodity-based food vouchers in terms of both cost efficiency and cost effectiveness.

Key words — transfers, vouchers, food, nutrient access, cost effectiveness, response analysis

1. INTRODUCTION

Traditionally, programs with nutrition objectives have relied on in kind (or direct) food transfers. More recently, both cash and vouchers have been increasingly used in a wide variety of food assistance programs. While having additional options in terms of transfer modality is certainly an advantage, policy makers require decision making tools to guide their modality selection.

This paper contributes to the debate on optimal choice of transfer modalities. However, it does not consider all of those possible modalities, nor does it elaborate on the full range of objectives that those transfers can potentially pursue. More specifically, the paper focuses on the optimal choice between two modalities (direct food transfers and commodity-based food vouchers) in the context of programs with specific nutritional objectives, ensuring in particular access to the full range of essential nutrients by closing nutrient access gaps through food assistance programing.

While not considering cash transfers and programmatic objectives other than nutrition, the paper draws on the broader issues and challenges that shape decision-making on transfer selection and concludes with a discussion of the opportunities and limitations of applying the proposed tool to other transfer modalities such as cash transfers or value-based vouchers.

The paper is structured as follows. The next two sections review the general literature on transfer modalities (Section 2) and tools for response analysis (Section 3). These set the stage for the introduction, construction, and application of the proposed new tool, as presented in detail in Sections 4, 5, and 6. Potential applications and conclusion are offered, respectively, in Sections 7 and 8.

2. LITERATURE REVIEW

Various reviews have captured the evidence base and main empirical and practical quandaries surrounding alternative transfer mechanisms (Bailey & Harvey, 2011; Barrett, 2002, chap 40; Creti & Jaspars, 2006; Gentilini, 2007; Harvey, 2007; Rogers & Coates, 2002). In general, these have found that transfers' comparative performance should be interpreted in the light of context-specific factors, including markets, implementation capacity, beneficiary preferences, and effects

* We thank the WFP Policy and Programme Innovation teams who have been involved in this project, most notably the Cash & Vouchers, Nutrition & HIV/AIDS, Food Security, Economic & Market Analysis, Vulnerability Analysis & Mapping Units. Without their invaluable assistance and insights, this paper would not have been possible. We thank Prof. Martin Bloem, Dr. Saskia de Pee, Pablo Recalde, Lola Castro, Annalisa Conte, Joyce Luma, Margot Vandervelden, Tahir Nour, Silvana Giuffrida, John Prout, Levan Tchatchua, Simon Clements, Barbara Clemens, Margaret Rehm, Laurene Goublet, Oscar Caccavale, Tobias Flaemig, Tareq Abuelhaj, and Calum McGregor for their insightful suggestions. Any shortcomings of the paper are the responsibility of the authors..

Please cite this article in press as: Ryckembusch, D. *et al.* Enhancing Nutrition: A New Tool for *Ex-Ante* Comparison of Commodity-based Vouchers and Food Transfers, *World Development* (2013), http://dx.doi.org/10.1016/j.worlddev.2013.01.021

on social relations. These factors mediate and shape the effectiveness and efficiency of alternative interventions, the performance of which should be interpreted in the light of the objectives they pursue.

The economic analysis of alternative transfers for food consumption objectives is generally based on the neoclassical framework set out by Southworth (1945). According to this theory, if the size of a food transfer (or a voucher) is less than what a household would have consumed without it, then the transfer is considered "inframarginal". This allows the recipient to simply purchase less of the food from their own resources, rendering the in-kind or voucher transfer equivalent to cash. The transfer is "extra-marginal" if its size is greater than the amount the household would have consumed in its absence. If food is not re-sold on the market, resold below the market price or resale entails high transaction costs, then a difference in terms of expected food consumption arises between in-kind/voucher food transfers and an equivalent cash transfer. Indeed, an extra-marginal transfer may have two effects—an income effect and a substitution (or price) effect. Conversely, the effect of an inframarginal ration is equivalent to the income effect only (that is, the value of the income transfer from food), regardless of its resale status.

While the Southworth framework has, in many ways, laid the basis for informing the microeconomics of food policy analysis, it also presents significant limitations. Clearly, the theory envisages a difference between food consumption patterns only at the extensive margin of the household's food purchase possibilities. Field experiments have rejected the assumed equivalence of inframarginal transfers: for example, factors such as intra-household resource allocation dynamics, behavioral effects like mental accounting, incomplete market availability of products have contributed to the so-called "cash-out puzzle"—that is, an observed difference between in-kind and cash transfers even when the transfer is inframarginal (Alderman, 1986; Basu, 1996; Breunig & Dasgupta, 2005; Coate, 1989; Dreze & Sen, 1989; Faminow, 1995; Haddad, Hoddinott, & Alderman, 1997; Senauer & Young, 1986; Thaler, 1990).

For example, Fraker (1990) showed that, in the United States of America, an additional dollar transferred in kind increased food consumption by 17–47%, but for cash the increase was just 5–13%. The effect on nutrient availability was ranged approximately from 2 to 7 times larger for food transfers as opposed to cash. Similarly, Fraker, Martini, and Ohls (1995) showed that the switch from in-kind to cash transfers triggered a reduction in food expenditures of between 18% and 28%. However, there is a dearth of information with respect to the comparative performance of alternative modalities in terms of improving nutritional outcomes. While there is evidence from studies in high and middle-income countries (Barrett, 2002; Case & Deaton, 1998; Manley, Gitter, & Slavchevska, 2012; Skoufias, Tiwari, & Zaman, 2011), more evidence on how choice of modality affects the ability to deliver nutrition outcomes (including diet quality as opposed to purely energy or calories) is required, particularly in lower-income contexts.

One careful study of four programs in Bangladesh, using different transfer mechanisms—rice, rice and cash, cash, and atta flour—found that only one transfer modality, atta flour, had an impact on women's nutritional status. Several factors are likely responsible; atta flour is a fortified product, the transfer was extra-marginal, and household food preferences are for rice such that the intra-household consumption of atta flour is skewed toward women (Ahmed, Quisumbing, Nasreen, Hoddinott, & Bryan, 2009). This study illustrated the complexity of impacts of different modalities. More evidence is needed on how modality choice influences the ability to deliver diet quality (micronutrient) as opposed to purely energy (calories) to beneficiaries.

Markets are a crucial factor to determine the most appropriate transfer modality. In contexts where markets work poorly (e.g., due to structural constraints or temporary disruptions in the food supply chain), food transfers are more likely the more appropriate response. Indeed, in those situations vouchers and cash transfers place the risk of supply failures on beneficiaries and generate or exacerbate inflationary effects. When markets work better, the use of cash and vouchers may be more cost efficient than food transfers.

Generally, markets do not work perfectly and even "competitive" ones may leave scope for very localized and time-bound rent extraction. Therefore, it is important to identify the "degree of imperfection" of markets, rather than adopt binary approach against a hypothetical benchmark. The issue is further complicated by the need to understand not only how markets work in general, but also the extent to which they work for the poor in particular (Donovan, McGlinchy, Staatz, & Tschirley, 2006; WFP, 2008b).

Apart from market analysis, there are many non-market factors that should inform transfer modality selection. Clearly the objective of the transfer program is a key one. Additionally, security, specific nutritional objectives, gender dynamics in the recipient population, cost, implementing agency capacity, and timeliness are also critical in evaluating the feasibility of a food, cash, or voucher intervention (Michelson *et al.*, in press). The ability of various transfers to meet program objectives is highly context dependent (Harvey, Proudlock, Clay, Riley, & Jaspars, 2010; Upton & Lentz, 2011). Besides analysis, donor resources, organizational capacity, compliance requirements, and in some cases, the sheer circumstances of the food security problem also matter (Maxwell, Parker, & Stobaugh, in press).

There are also cases where in-kind food transfers may be more appropriate in reaching specific objectives even when markets work reasonably well. Markets may function, but age adequate, nutritious food for vulnerable groups such as young children may not be readily available. Even if available, beneficiaries may—when given cash or a value-based voucher[2]—not choose the product which addresses their nutritional needs, but instead choose a less nutritious, more preferred one. While in the long term, education of beneficiaries could enable the right choices, program designers and policy makers often cannot wait until education results in the desired behavior.

Implementation capacity also plays a key role in shaping the choice for the appropriate transfer modality. Effective and efficient voucher and cash transfer programing can only be achieved where adequate and accessible financial partner institutions and appropriate monitoring, reporting, and control systems are available. Similarly capacities and expertise are required for implementing food transfers including procurement, storage, and logistics capacity, transport networks, and distribution agents. Importantly, different implementation arrangements imply different configurations of set-up and variable costs, which should be duly reflected in decision-making.

While it is difficult to generalize people's preferences for a certain transfer modality, some general patterns can be discerned. The preference for cash, value, or commodity vouchers or in-kind food aid varies sometimes by location, season, and gender. Households living far from markets tend to prefer in-kind food transfers, while those living close prefer vouchers and cash transfers.[3] There are indications that people prefer in-kind food transfers during the lean season due to higher

Please cite this article in press as: Ryckembusch, D. *et al.* Enhancing Nutrition: A New Tool for *Ex-Ante* Comparison of Commodity-based Vouchers and Food Transfers, *World Development* (2013), http://dx.doi.org/10.1016/j.worlddev.2013.01.021

food prices, while cash is often preferred around the harvest period. Gender issues can be significant. In general, women tend to prefer food, which they are more likely to control, while men may prefer cash transfers. Yet, gender-specific preferences are more complex and contextual than often assumed.[4] New research is also shedding light on intra-community effects of cash-based transfers, some of which are "positive" or empowering, while others may actually generate "negative" and undesired consequences in terms of social relations. For example, in Zimbabwe it was observed that, unlike food, cash transfers were not shared within the community, hence possibly hindering informal support and risk management mechanisms (MacAuslan & Riemenschneider, 2011).

While the evidence base is increasing on the impact of cash transfers (and somewhat less of vouchers) on non-income dimensions of poverty, particularly cognitive development, learning, educational attainments, and other human capital dimensions, the analysis is usually not framed in terms of comparing the efficiency or effectiveness of different transfer (Alderman, 2011). The research is focused on how to enhance conditional cash transfer (CCT) programs (Das, Quy-Toan, & Ozler, 2005; De Janvry, Finan, Sadoulet, & Vakis, 2006; Fiszbein & Schady, 2009) or, more recently, around the comparative effectiveness of conditional and unconditional programs (Baird, McIntosh, & Ozler, 2009; De Brauw & Hoddinott, 2011; Ozler & Ferreira, 2011). In either case, since the vast majority of conditional programs are CCTs, it could be argued that the debate on conditionality has somewhat overshadowed the one on transfer modality.

Given the variety of factors (market, non-market, context specific) affecting the selection of transfer modalities, a number of response analysis tools are being proposed.

3. AN OVERVIEW OF RESPONSE ANALYSIS TOOLS

Response analysis consists of analyzing both primary and secondary sources to assess what transfer modality is most likely to effectively address a food insecurity situation (Barrett, Bell, Lentz, & Maxwell, 2009). Response analysis tools can be used to guide response to sudden or slow-onset food emergencies and help protect households' consumption and assets in areas affected by poverty and chronic food insecurity (Michelson *et al*., 2012).

Several response analysis tools have recently been developed to guide the choice of transfer modality among food, cash, and vouchers. The *Market Information and Food Insecurity Response Analysis* (MIFIRA) framework is a response analysis tool designed to evaluate the feasibility of transfer options given market conditions and household circumstances and preferences (Barrett *et al*., 2009; Mude, Ouma, & Lentz, 2012). MIFIRA focuses primarily on the choice between cash and food aid and the decision to source food aid locally, regionally, or internationally when it is the most appropriate transfer modality. While MIFIRA assesses whether markets are functioning adequately to support a given transfer modality, other non-market factors that will also shape agency and donor decisions are out of MIFIRA's scope.

The *Emergency Market Mapping Assessment* (EMMA) tool is intended to support rapid decision making for a broad range of needs mainly during sudden-onset emergencies (Albu, 2010). The EMMA emphasizes three core components: gap analysis, market analysis, and response analysis. While the tool is widely used by the humanitarian community, a recent review highlighted some practical aspects that can be improved (Sivakumaran, 2011).

Market information is the cornerstone of the decision making process of both MIFIRA and EMMA. EMMA focuses more on the analysis of market conditions while MIFIRA focuses on the decision making process between in-kind and market-based interventions, using market analysis findings. In both cases, the emphasis is on analyzing whether there will be a market supply response to an injection of cash or commodity-based vouchers, or whether it will trigger food price inflation, affecting both beneficiaries and non-beneficiaries. Given the large number of market analysis tools, approaches, and conceptual frameworks, the task of integrating market analysis into assessment practices is often daunting for non-specialist staff (WFP, 2011b).

In addition to market factors, attempts are being made to account for non-market and context specific factors in a broader response analysis process, which starts from situation analysis to the identification of appropriate and feasible response options. The WFP-led response analysis project (RAP) and the FAO-led response analysis framework (RAF) try to bring together the most knowledgeable experts and the most relevant information to drive consensual, appropriate and feasible response options, taking into account factors such as the existing planning frameworks and timelines. Given the RAP and the RAF attempt to capture the whole process of response analysis, they tend to be complex in practice.

The Omega value indicator proposed in this paper complements existing tools in that it refines the decision making process for programs which have dietary quality and nutrition as program objectives, while also increasing the likelihood of achieving them at the lowest possible cost. However, market analysis remains critical in this approach as vouchers still require favorable market conditions. Furthermore, the analysis of cost efficiency and effectiveness is based on market data on the cost of the food basket.

4. EFFICIENCY AND EFFECTIVENESS—CRITERIA FOR TRANSFER MODALITY SELECTION

When policy makers and program designers have a choice of modality, they need to analyze *efficiency* and *effectiveness* for each implementation scenario under consideration in light of the desired objective. For the sake of this paper, we *define cost efficiency as the strict relationship between inputs and outputs of a program*, the cost of a transfer (input) and its value delivered to beneficiaries (output) without extending to program outcomes or impact. When the outcomes are measured in addition to comparing delivery costs, *the relative cost of achieving a desired outcome defines cost effectiveness. Cost effectiveness,* therefore, measures how well outputs are converted to outcomes.

In addition, different modalities may generate different *externalities*. An *externality is an outcome of the program which is beyond the objectives of the program*—it can be positive (such as positive impacts on the economy through local food procurement) or negative (such as an increase in use of fuel inefficient stoves related to the distribution of maize).

Figure 1 gives a graphic illustration of the differences between cost efficiency and cost effectiveness analysis and illustrates the hierarchy of outcomes and externalities.

In a *cost efficiency* analysis, one compares the cost of two or more different transfer scenarios with identical value, so that the different costs involved to make the transfers can be compared. For example, one can compare the cost efficiency of internationally, regionally, or locally procured in-kind food transfers with a commodity-based voucher, which outsources

Please cite this article in press as: Ryckembusch, D. *et al.* Enhancing Nutrition: A New Tool for *Ex-Ante* Comparison of Commodity-based Vouchers and Food Transfers, *World Development* (2013), http://dx.doi.org/10.1016/j.worlddev.2013.01.021

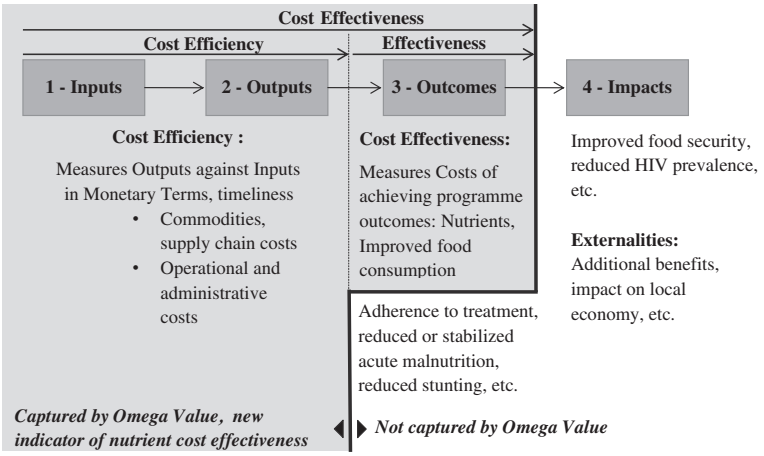

Figure 1. *Cost efficiency and cost effectiveness analysis in modality selection considerations.*

procurement to the local private sector. The analysis needs to compare the cost to procure and deliver the food basket (including the costs required to care for and physically deliver the food basket to the final delivery point) with the cost of a voucher program (including the purchase of the food basket at the recipient's local market and the costs for setting up and operating a voucher program).

However, such an analysis (using average shipping rates and commodity prices) is only useful as a first level indicator; it cannot be used to make more refined programing decisions, as the results of the analysis will differ by transfer location in a specific country. In order to have an adequate estimation of actual cost differences for delivery, a detailed *supply chain analysis* is critical, mapping the supply chain for the various final delivery points. The analysis may show that the local private sector is better at delivering some products to markets in remote areas than a development agency. In addition, direct operational costs such as those of implementing a voucher program as well as other administrative costs have to be taken into consideration in order to have a *full costing,* which enables a transparent comparison of cost efficiency.

As explained above, the cost efficiency analysis is constrained by comparing costs (inputs) with regard to a presumably fixed output (transfer value). However, programing decisions need to consider that the choice of in kind transfers and voucher based transfers often implies a different range of available commodities and hence a different food basket, potentially leading to different outcomes. Vouchers give access to an extended set of commodities, most notably fresh commodities such as dairy products, animal source protein, and fresh produce, often with higher nutritional values. Direct food transfers, on the other hand, provide staple foods and non-perishables with long shelf lives, which are more easily transported, procured in bulk at lower cost and can be tailored to specific needs of implementing agencies. In addition, in many countries without adequate staple food fortification policies or poor enforcement, in kind transfers facilitate the inclusion of fortified staples or specialized nutritional products for specific target groups.

Hence, there is need for analytical decision tools which can accommodate both an efficiency cost comparison at output level as well as an *effectiveness comparison* with regards to the program objectives and desired outcomes. One of the key considerations for nutrition programs is the composition of the food basket and how the choice of modality influences it.

5. TOWARD A METRIC THAT REFLECTS NUTRIENT VALUE

Recent years have seen increased emphasis on nutrition. The role of an adequate, age appropriate diet for growth during the first 1,000 days [5]—from conception to 2 years of age—is now widely recognized. A complete diet includes over 40 nutrients which are required to enable growth, brain development, and a strong immune system (Golden, 2009). Poor nutrition during this critical period can have lifelong consequences affecting future school performance, economic productivity and earning power as an adult, and increase chronic diseases, such as diabetes and cardiovascular disease later in life (Victora *et al.*, 2008).

Many food assistance programs have specific nutritional objectives and identified nutrition outcomes. An adequate diet providing the right nutrients required by the target group is a necessary component of any solution to under-nutrition. Programs need to take the specific nutritional needs of their beneficiaries into consideration, especially when they target vulnerable groups such as mothers, young children or people living with HIV (PLHIV), (De Pee & Semba, 2010). Food baskets must be tailored to provide the nutrients that are missing in a beneficiary's diet. The poor who are at the highest risk of under-nutrition have micronutrient deficient diets. These diets typically lack animal source foods and fortified foods which are important source of micronutrients, macro-minerals, and essential fatty acids required for longitudinal growth early in life.

The food basket design and the resulting nutrient content provided by each transfer modality are key determinants of the potential nutritional outcomes of a program. The different food baskets offered by different modalities, in kind or voucher, can be used as a proxy for an *ex-ante* comparison of nutrients delivered per dollar spent, thereby adding an *effectiveness* consideration to the cost comparison. One of the challenges of the comparison is that two different food baskets have a different nutritional profile, hence they are difficult to compare on a per dollar basis. For this reason, many comparisons simply compare the caloric value of a food basket delivered per dollar. However, the caloric value of a food basket is only one of many criteria to determine adequacy of a food in nutritional terms (Golden, 2010). A *Nutrient Value Score* (NVS) presents a solution that takes a broader set of criteria into account allowing a better assessment of whether a specific food basket can contribute to a desired nutrition outcome.

Please cite this article in press as: Ryckembusch, D. *et al.* Enhancing Nutrition: A New Tool for *Ex-Ante* Comparison of Commodity-based Vouchers and Food Transfers, *World Development* (2013), http://dx.doi.org/10.1016/j.worlddev.2013.01.021

The NVS allows comparing the nutrient value of two or more food baskets delivered using different modalities. Programs such as NUTVAL[6] can be used to easily determine the micro- and macronutrient content of a selected product and hence also of an overall food basket using the nutrient content of selected foods (micro and macronutrients per 100 g edible portion). In order to translate this nutritional content of a basket into a score, it is necessary to compare the value of the food basket to the requirements of the beneficiaries. In addition to the energy provided by protein, carbohydrates and fat, it is important to determine whether the micronutrient content is adequate in light of the program objectives. This is done by calculating the percentage of the micronutrient requirements provided.

In order to establish the required intake for a specific beneficiary, one can use standards of nutrient intake as recommended internationally (FAO/WHO, 2005; UNHCR, UNICEF, WFP, & WHO, 2001) such as percentage of Recommended Nutrient Intake (RNI) noting that nutrient requirements differ by age, gender, health, activity level, and nutritional status. The transfer may complement a beneficiary's diet and may not aim to deliver a full RNI, but to cover the food access shortfall. As an example, while WFP uses an average intake of 2,100 kcal/person/day,[7] the transfer should also provide an appropriate proportion of calories from protein (10–12%) and fat (minimum 17%) and adequate amounts of micronutrients (vitamins and minerals). The formula used to calculate NVS compares the total content of a particular nutrient in the food basket to the nutrient requirement as established and customized for the program. Depending on the percentage requirement met, each nutrient (macro as well as micronutrient) is assigned a discrete score ranging from 0 (for 0% of the requirement met) to 1 (for 100% of the requirement met). The overall nutrient score will correspond to the sum of all the individual nutrient scores, the maximum score being the total number of nutrients being scored.

In summary, the *Nutrient Value Score NVS computation* can be described as a five-step process:

- Step 1: Define scenarios to compare (scenario with fortified commodities under the voucher)
- Step 2: Define nutrients to be included in NVS and target values based on project objectives and targeted beneficiaries needs
- Step 3: Decide how to weigh the different nutrients for specific deficiencies (Iron, Vitamin A, *etc.*)
- Step 4: Calculate NVS of each scenario using NUTVAL or similar program by nutrient
- Step 5: Add up all the scores and express them as a Nutrient Value Score per food basket

As an illustration of how the NVS can be calculated, cost data from a WFP electronic voucher program delivered in Mozambique was used. The program allows PLHIV treated with antiretroviral (ARV) therapy to receive a commodity voucher giving them access to nutritious foods as part of their ARV treatment package. These e-voucher transfers are conditional on ARV therapy adherence. Their goal is to enable treatment uptake and adherence to medication, thereby ultimately improving treatment success rates.

The following tables illustrate the NVS calculation for

- an in-kind food basket (Table 1),
- a commodity voucher for a food basket available at local retail shops (Table 2),
- a commodity voucher for a food basket containing fortified commodities (Table 3).

All three food baskets follow the requirements WFP applies for food assistance targeted at the general population and

Table 1. *Nutrient Value Score for in-kind maize based ration including specialized nutritional food*[a]

	Ration (g/person/day)	Energy (kcal)	Protein (g)	Fat (g)	Calcium (mg)	Iron (mg)	Iodine (μg)	Vit. A (μg RE)	Thiamine (mg)	Riboflavin (mg)	Niacin (mg NE)	Vit. C (mg)
Maize grain, white	400	1,400	40.0	16.0	28	10.8	0	0	1.54	0.80	8.8	0
Beans, dried	60	201	12.0	0.7	86	4.9	0	0	0.30	0.13	3.7	0
Oil, vegetable (WFP specs.)	25	221	0.0	25.0	0	0.0	0	225	0.00	0.00	0.0	0
Corn soy blend (WFP specs.)	50	200	9.0	3.0	90	6.4	1	251	0.22	0.35	5.0	25
Sugar	15	60	0.0	0.0	0	0.0	0	0	0.00	0.00	0.0	0
Salt, iodized (WFP specs.)	5	0	0.0	0.0	0	0.0	300	0	0.00	0.00	0.0	0
Ration total	555	2,082	61.0	44.7	204	22.2	301	476	2.06	1.28	17.5	25
Requirements	2,100	2,100	52.5	40.0	450	22	150	500	0.90	1.40	13.9	28
% Of requirements supplied by ration		99%	116%	112%	45%	101%	201%	95%	229%	92%	126%	88%
% Of energy supplied by protein or fat			11.7%	19.3%								
Nutrient Value Score	9.21		1.00	1.00	0.45	1.00	1.00	0.95	1.00	0.92	1.00	0.88

[a] The variety of CSB formulations available raises a variety of possibilities, the one used here is the Supercereal CSB fortified according to WFP specifications.

Table 2. *Nutrient Value Score for commodity voucher based ration without fortified maize meal*

	Ration (g/person/day)	Energy (kcal)	Protein (g)	Fat (g)	Calcium (mg)	Iron (mg)	Iodine (μg)	Vit. A (μg RE)	Thiamine (mg)	Riboflavin (mg)	Niacin (mg NE)	Vit. C (mg)
Maize meal, white, whole grain	200	720	18.0	7.0	12	4.8	0	0	0.77	0.40	4.0	0
Beans, dried	60	201	12.0	0.7	86	4.9	0	0	0.30	0.13	3.7	0
Oil, vegetable, unfortified	25	223	0.0	25.0	0	0.0	0	0	0.00	0.00	0.0	0
Fish, dried, salted	50	135	23.5	3.8	172	1.4	0	0	0.04	0.06	4.3	0
Sugar	15	60	0.0	0.0	0	0.0	0	0	0.00	0.00	0.0	0
Tomatoes, red, ripe	50	9	0.4	0.1	5	0.1	1	125	0.02	0.01	0.1	6
Rice, polished	200	720	14.0	1.0	18	3.4	0	0	0.20	0.06	11.2	0
Salt	5	0	0.0	0.0	0	0.0	0	0	0.00	0.00	0.0	0
Ration total	605	2,068	67.9	37.6	292	14.6	1	125	1.32	0.66	23.2	6
Requirements	2,100	2,100	52.5	40.0	450	22	150	500	0.90	1.40	13.9	28
% Of requirements supplied by ration		98%	129%	94%	65%	66%	1%	25%	147%	47%	168%	23%
% Of energy supplied by protein or fat			13.1%	16.4%								
Nutrient Value Score	6.23		1.00	0.96	0.65	0.66	0.01	0.25	1.00	0.47	1.00	0.23

Table 3. *Nutrient Value Score for commodity voucher based ration with fortified maize meal*

	Ration (g/person/day)	Energy (kcal)	Protein (g)	Fat (g)	Calcium (mg)	Iron (mg)	Iodine (μg)	Vit. A (μg RE)	Thiamine (mg)	Riboflavin (mg)	Niacin (mg NE)	Vit. C (mg)
Maize meal, fort. (WFP specs.)	200	732	17.0	3.4	220	10.6	0	282	1.66	0.92	11.0	0
Beans, dried	60	201	12.0	0.7	86	4.9	0	0	0.30	0.13	3.7	0
Oil, vegetable, unfortified	25	223	0.0	25.0	0	0.0	0	0	0.00	0.00	0.0	0
Fish, dried, salted	30	81	14.1	2.3	103	0.8	0	0	0.02	0.03	2.6	0
Sugar	15	60	0.0	0.0	0	0.0	0	0	0.00	0.00	0.0	0
Tomatoes, red, ripe	10	2	0.1	0.0	1	0.0	0	25	0.00	0.00	0.0	1
Rice, polished	200	720	14.0	1.0	18	3.4	0	0	0.20	0.06	11.2	0
Salt, iodized	5	0	0.0	0.0	0	0.0	300	0	0.00	0.00	0.0	0
Ration total	545	2,018	57.2	32.4	428	19.8	300	307	2.18	1.15	28.5	1
Requirements	2,100	2,100	52.5	40.0	450	22	150	500	0.90	1.40	13.9	28
% Of requirements supplied by ration		96%	109%	81%	95%	90%	200%	61%	243%	82%	205%	5%
% Of energy supplied by protein or fat			11.3%	14.4%								
Nutrient Value Score	8.18		1.00	0.85	0.95	0.90	1.00	0.61	1.00	0.82	1.00	0.05

provide a total of 2,100 kcal/day. In addition, the three food baskets are optimized based on products available through the specific transfer modality.

- The in-kind food basket shown in Table 1 contains Corn Soy Blend (CSB), a micronutrient-fortified blend of soy flour and maize. In line with WFP policy, the vegetable oil is also fortified with Vitamin A and the salt is iodized.
- The basket delivered through the commodity voucher illustrated in Table 2 includes dried fish and tomatoes which are available in the markets. In this case, the CSB cannot be included, given it is unavailable in retail shops. Even with nutritious foods such as dried fish included, the NVS of the basket in Table 2 comes out almost three points lower than the NVS in Table 1 because the fortified products which are included in the in-kind transfer are missing in the voucher-based food basket.
- Finally, Table 3 shows the food basket associated with the commodity-based voucher which contains iodized salt and fortified maize meal. While it reaches a higher NVS than the food basket in Table 2, which does not include these products, it still scores lower than the in-kind food basket which includes CSB.

The costs of the food baskets at the recipient's local market price for the vouchers (Tables 2 and 3) differ from the cost of the food basket delivered in-kind (Table 1). Delivery costs (direct operational costs and administrative costs) also differ. The full cost of the three food baskets per person and per month is considered when making comparison as illustrated in Table 4.

This comparison illustrates how the modality choice impacts the amount of nutrients which can be delivered to beneficiaries through the three different food baskets, and how this can be made comparable across different food baskets using a scoring system. One could readily assign different weights to different nutrients to tailor the model to their relative importance in any specific context, but for illustrative purposes in the example nutrients are equally weighted.

While the Nutrient Value Score is a good proxy to estimate nutrient content and compare different food baskets in nutri-

Please cite this article in press as: Ryckembusch, D. *et al.* Enhancing Nutrition: A New Tool for *Ex-Ante* Comparison of Commodity-based Vouchers and Food Transfers, *World Development* (2013), http://dx.doi.org/10.1016/j.worlddev.2013.01.021

Table 4. *Illustration of the Omega Value scenarios*

	Food basket comparison		NVS	Cost/p./month	Omega Value calculation	Omega Value	Analysis
Scenario 1	In kind food basket	Table 1	9.21	$19	(9.21/19)/(6.23/16)	1.2	In kind more nutrient cost effective
	Voucher food basket non-fortified	Table 2	6.23	$16			
Scenario 2	In kind food basket	Table 1	9.21	$ 19	(9.21/19)/(8.18/14)	0.8	Voucher more nutrient cost effective
	Voucher food basket fortified	Table 3	8.18	$14			

tional terms, it is important to highlight that as any proxy it is unlikely to be precise. Nutrient content of any product varies by location, season, and variety. In addition, food quality also influences nutrient content. The micronutrient content, especially vitamins, of many products decreases over time and depends on factors such as storage and handling.

Finally, it is also important to mention one additional limitation. Nutrient content is an important consideration, but nutrient absorption determines ultimately whether the body can utilize nutrients adequately. Food may contain certain nutrients, but their bioavailability is influenced by a number of factors which cannot be adequately captured by the Nutrient Value Score.

6. COMBINING THE NUTRIENT VALUE SCORE WITH COST MEASURES: THE OMEGA VALUE

As a next step, after the Nutrient Value Score computation for two or more alternative food baskets, the NVS of each food basket can be combined with the corresponding full cost of delivery, introducing a first-level nutritional effectiveness consideration into the efficiency analysis. The resulting *Omega Value* thus compares *the nutrient cost effectiveness* of two different transfer modalities (in-kind *versus* a commodity-based voucher). It is defined as the ratio of (NVS/full transfer and delivery cost) of an in-kind food basket over that same ratio for a food basket delivered through a commodity-based voucher. See Figure 2 for an illustration of the principle.

This double ratio can be analyzed as follows:

- If Index >1: In-Kind deliveries are potentially more nutrient cost-effective
- If Index <1: Commodity-based vouchers are potentially more nutrient cost-effective

If we go back to the exemplary food baskets in Tables 1–3, we can create two scenarios, first comparing the in-kind food basket of Table 1 to the unfortified commodity voucher food basket in Table 2 (Scenario 1) and then comparing the in-kind food basket of Table 1 to the fortified commodity voucher food basket in Table 3 (Scenario 2).

As illustrated in Table 4, in Scenario 1, the Omega Value is 1.2, meaning that the in-kind food basket is still more cost effective in nutrients per dollar than the voucher. A commodity cost comparison only (disregarding the nutrient value of the respective food baskets) would have concluded that vouchers are more cost efficient. In Scenario 2 however, the Omega Value falls below 1 and the commodity voucher becomes more cost effective in nutrients per dollar than the in-kind transfer. This is because the costs in Tables 2 and 3 are practically the same for the commodities (staple food fortification has negligible cost implications), while Table 3 delivers a lot more value in nutrient terms.

Comparing commodity costs only may lead to the wrong conclusion. If the voucher is more oriented to basic staples then the loss of economies of scale in procurement may favor direct food distribution. However, a voucher enables a more diversified food basket making the nutritional value becomes an important consideration. The comparison of commodities costs is only a subset of the Omega index calculation capturing both the full cost of operations and the nutrients delivered. Comparing the NVS per dollar of two particular food baskets brings more nuances to the trade off between planned nutritional outcomes and costs when selecting a transfer modality. The Omega algorithm takes outcome into consideration by comparing the *ex-ante* cost effectiveness of alternative transfers which might satisfy assessed nutrient needs as a major factor influencing the achievement of the food assistance objectives. The new defined Omega index can be used to support scenario building and sensitivity analysis of nutrients cost effectiveness as the index changes if the levers and cost drivers are changing (commodity prices, seasonality, nutrients content, fortification).

7. POTENTIAL APPLICATIONS OF THE OMEGA VALUE

As illustrated in chapter 6, the Omega Value combines the NVS (Nutrient Value Score) with a cost efficiency analysis

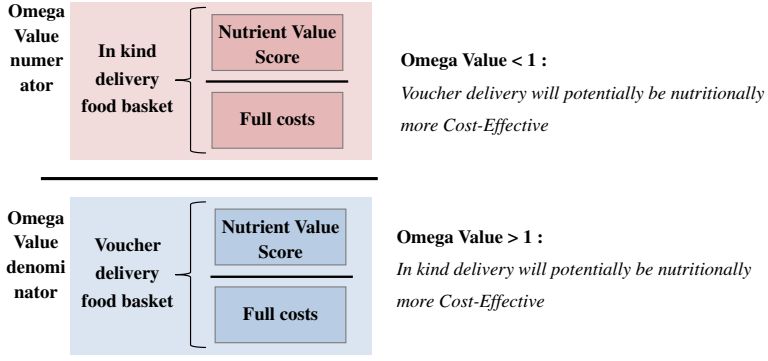

Figure 2. *Illustration of the Omega Value calculation. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)*

(the full supply chain analysis and costing) and therefore, extends the *ex-ante* cost effectiveness analysis to the level of nutritional outcomes as measured by the nutrients contained in two different food baskets (see Figure 1). The example discussed in this paper shows the trade-off between delivering most nutrients through an in-kind food transfer and using a voucher, which can be more cost efficient for some food baskets, because procurement costs are transferred to retailers who may procure at lower cost. This potential cost advantage needs to be weighed, however, against the potential loss of purchasing power when switching from buying at large scale to more fragmented procurement.

This trade-off is a fairly common programing challenge. In many resource-limited settings, fortified or specialized nutritious foods are not available. This is one of the reasons cash or voucher transfers can be a flawed substitute for the specialized food supplements delivered in-kind to meet specific nutritional objectives, such as the treatment of severe and moderate acute under-nutrition or the support for PLHIV through food by prescription programs.

The example also illustrates how the commodity-based voucher modality could be improved in terms of nutrients delivered per dollar, if the commodities available for purchase at the retail level were fortified. When combining the nutrients delivered with the full costs of delivering the baskets (commodity, supply chain and programing costs), the commodity-based voucher with fortified foods comes out as the most cost effective option. This is a typical result. If fortification of staple foods with one or more micronutrients can be achieved and if more specialized nutritious foods such as CSB or specialized foods for infants or PLHIV are available on the shelves of retail outlets in resource limited settings, it increases the ability to use commodity vouchers, also when programs have nutrition objectives. However, at present, these prerequisites are often not met as specialized and fortified foods remain unavailable in many low income contexts. This may also lead policy makers to consider leveraging different transfer modalities for different components of the food basket. For example, a fortified staple or a fortified blended food could be delivered in kind until it is available at the typical retail shop, while other components could be delivered through a voucher.

Obviously, the cost effectiveness information provided by the Omega Value alone is inadequate to judge the overall effectiveness of an intervention in terms of nutritional outcomes, let alone in terms of overall outcomes and externalities. To make an informed decision on the appropriate transfer modality, the Omega Value needs to be combined with other data which may include additional nutritional indicators (dietary diversity, consumption of animal source foods, *etc.*), indicators measuring the likelihood of achieving non-nutritional outcomes as well as with the likelihood of generating positive and negative externalities.

A comprehensive decision framework should consider all these relevant levers which impact the final outcome at the design stage of a program in order to apply a rational and structured decision process to the transfer modality choice. One possibility is the use of a *score card* which rates the likelihood of achieving the project objectives, including a consideration of externalities, i.e., other positive or negative implications that the use of a specific transfer modality may generate (stigma, dignity, acceptance, effect on gender relations, opportunity costs for beneficiaries, *etc.*).

In the scenario above, there has been no discussion of cash transfers or value-based vouchers. These provide data challenges because there is no restriction on how cash is spent and incomplete restriction on how value-based vouchers are spent. This makes them more problematic to assess than a commodity-based food voucher, which provides access to a specific food basket.

The Omega Value could be applied to *cash transfers*, but to do so would require fairly detailed knowledge of household expenditure patterns and specifically the marginal increase in purchase of different foods with increases in income. In most cases, it is hard to predict what percentage of additional income will be spent on food. It is even more difficult to estimate food item-specific income elasticities. Furthermore, both will likely vary by location and over time. If context-specific, detailed household food consumption estimates of the marginal propensity to consume different foods with rising income existed, these could be used to provide indicative ranges of Omega Values to assist transfer modality selection including cash.

While the Omega Value can be more easily applied to *value-based vouchers*, given the restricted food basket available for purchase, its use still has limitations. Potentially it could be used to estimate the worst and best possible food basket purchases, from the range available using the value-based voucher, to give a range of Omega Values. Knowledge of likely household food expenditure patterns, based on existing household surveys, could be used to qualify and potentially narrow down this range of possible Omega Values to assist decision-making. Using such secondary data would add further error to the NVS computations for a cash transfer or a value-based voucher. This error would compound the imprecision discussed above which relates to the inherent difficulty to precisely estimate nutrient content in different products across different locations and over time.

Gender and intra-household resource control and distribution issues are key factors influencing how resources are spent and ultimately the household food consumption. Currently the Omega Value does not take this into account. Given women are often, but not always responsible for all or part of the food provisioning for households transfers of food or vouchers directly linked to food may not change intra-household patterns specific to food. However, considerable evidence indicates that increases in income in the hands of women are more likely to be spent on food than that in the hands of men. Different sets of spending patterns can be included when calculating the Nutrient Value Score for different food baskets. The Nutrient Value Score is based on the intake per person and per day and can therefore be tailored to individual level data within the household incorporating gender/intra-household sensitive spending and consumption patterns. Therefore it would be relevant to include gender dimensions into future work on applying the Omega Value to cash transfers and value-based vouchers transfers. This would mean that information would be required on gender specific spending patterns on food in households as opposed to just the change in food shares linked to household income increases.

8. CONCLUSION

This paper introduces a tool that applies a nutrient per dollar perspective to estimate *ex-ante* the most cost-effective transfer modality for programs with nutritional objectives—the Omega Value. It can be used at the program design stage to transcend mere cost efficiency considerations in predictive models to estimate the likelihood of achieving nutritional outcomes and, therefore, enable more informed decision making. The Omega Value can inform a strategy to minimize costs and

Please cite this article in press as: Ryckembusch, D. *et al.* Enhancing Nutrition: A New Tool for *Ex-Ante* Comparison of Commodity-based Vouchers and Food Transfers, *World Development* (2013), http://dx.doi.org/10.1016/j.worlddev.2013.01.021

maximize benefits, thus enabling policy makers to deliver value for money.

Understanding supply chains and the implications of transfer modality for food basket composition are key considerations at the design stage of programs that address the nutritional needs of vulnerable groups. Very often markets exist for (often unfortified) staples, fruit and vegetables, fish, meat *etc*., but specialized and fortified foods, i.e., those specifically formulated for a certain beneficiary group or fortified with one or more specific micronutrients, are not widely available, particularly in rural areas. The widespread use of vouchers may therefore require more focus not only on the introduction of new, nutritious, inherently more cost effective products into a given market, but also on their market penetration.

Additional research is needed to better understand how the choice of transfer modalities can be better used to deliver nutrition outcomes while taking advantage of the existing market mechanisms. The strength of private sector distribution channels to effectively integrate several partners along the value chain needs to be leveraged while also increasing the availability of affordable fortified and specialized food in local markets. Additional research should also further investigate how the Omega Value could be adapted to assess the cost effectiveness of cash and value-based voucher transfers. This would entail improving the ability to predict the expenditure behavior of households receiving cash or value-based voucher transfers.

NOTES

1. All authors work or worked for WFP. The findings, interpretations, and conclusions expressed in this paper are those of the authors and do not necessarily reflect the views of the World Food Programme or its Executive Board.

2. Value-based voucher refers to a voucher where the beneficiary receives a voucher indicating a specific amount which she or he can spend in a shop, enabling choice within a predefined list of commodities. Commodity-based voucher refers to a voucher which is tied to a specific commodity or a commodity basket (WFP, 2008a, 2011a).

3. Importantly, preferences as shaped by distance form markets should also include analysis on distance from potential food distribution points.

4. In general, very few studies support the unitary model of household behavior. However, it is important to consider endogeneity of leadership variables (e.g., headship, income share, education, and asset ownership) which could potentially bias the results. The use of instrumental variables, structural Estimates, and natural experiments is providing new evidence on intra-household resource allocation dynamics, although few if any are directly comparing the effects of cash versus food transfers (Braido, Olinto, & Perrone, 2012).

5. http://www.thousanddays.org/about/.

6. http://www.nutval.net/.

7. These are the average minimum nutritional requirements established for planning purposes by WHO and adopted by WFP, UNHCR, UNICEF, most other organizations, and the Sphere minimum standards for disaster relief.

REFERENCES

Ahmed, A., Quisumbing, A., Nasreen, M., Hoddinott, J., & Bryan, E. (2009). Comparing food and cash transfers to the ultra poor in Bangladesh. IFPRI, Research Monograph No. 163. Washington DC.

Albu, M. (2010). *The emergency market mapping and analysis toolkit*. Rugby: Practical Action Publishing Ltd..

Alderman, H. (1986). *The effect of food price and income changes on the acquisition of food by low-income households*. Washington, DC: IFPRI.

Alderman, H. (Ed.) (2011). *No small matter: The impact of poverty, shocks, and human capital investments in early childhood development*. Washington, DC: World Bank.

Bailey, S., & Harvey, P. (2011). Cash transfer programming in emergencies. ODI, Good Practice Review No. 11. London.

Baird, S., McIntosh, C., & Ozler, B. (2009). Designing cost-effective cash transfer programs to boost schooling among women in Sub-Saharan Africa. Policy Research Working Paper No. 5090. Washington, DC: World Bank.

Barrett, C. (2002). Food security and food assistance programs. In: B. Gardner, & G. Rausser (Eds.), *Handbook of agricultural economics*, 1st ed. (vol. 2, pp. 2103–2190). Amsterdam: Elsevier.

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

Basu, K. (1996). Relief programs: When it may be better to give food instead of cash. *World Development, 24*(1), 91–96.

Braido, L., Olinto, P., & Perrone, H. (2012). Gender bias in intrahousehold allocation: Evidence from an unintentional experiment. *Review of Economics and Statistics, 94*(2), 552–565.

Breunig, R., & Dasgupta, I. (2005). Do intra-household effects generate the food stamp cash-out puzzle?. *American Journal of Agricultural Economics, 87*(3), 552–568.

Case, A., & Deaton, A. (1998). A large cash transfers to the elderly in South Africa. *Economic Journal, 108*(450), 1330–1361.

Coate, S. (1989). Cash versus direct food relief. *Journal of Development Economics, 30*(2), 199–224.

Creti, P., & Jaspars, S. (2006). *Cash transfer programming in emergencies*. Oxford: Oxfam.

Das, J., Quy-Toan, D., & Ozler, B. (2005). Reassessing conditional cash transfer programs. *World Bank Research Observer, 20*(1), 57–80.

De Brauw, J., & Hoddinott, J. (2011). Must conditional cash transfer programs be conditioned to be effective? The impact of conditioning transfers on school enrollment in Mexico. *Journal of Development Economics, 96*(2), 359–370.

De Janvry, A., Finan, F., Sadoulet, E., & Vakis, R. (2006). Can conditional cash transfer programs serve as safety nets in keeping children at school and from working when exposed to shocks?. *Journal of Development Economics, 79*(2), 349–373.

De Pee, S., & Semba, R. (2010). The role of nutrition in HIV infection: Review of evidence for more effective programming in resource limited settings. *Food and Nutrition Bulletin, 31*(4), S313–S344.

Donovan, C., McGlinchy, M., Staatz, J., & Tschirley, D. (2006). *Emergency needs assessments and the impact of food aid on local markets*. Michigan: Michigan State University.

Dreze, J., & Sen, A. (1989). *Hunger and public action*. Oxford: Clarendon Press.

Faminow, M. (1995). Issues in valuing food aid: The cash or in-kind controversy. *Food Policy, 20*(1), 3–10.

Please cite this article in press as: Ryckembusch, D. *et al.* Enhancing Nutrition: A New Tool for *Ex-Ante* Comparison of Commodity-based Vouchers and Food Transfers, *World Development* (2013), http://dx.doi.org/10.1016/j.worlddev.2013.01.021

FAO/WHO (2005). *Vitamin and mineral requirements in human nutrition* (2nd ed). Geneva: World Health Organization.

Fiszbein, A., & Schady, R. (2009). Conditional cash transfers: Reducing present and future poverty. Policy Research Report. Washington, DC: World Bank.

Fraker, T. (1990). *The effects of food stamps on food consumption: A review of the literature*. Washington, DC: USDA.

Fraker, T., Martini, A., & Ohls, J. (1995). The effects of food stamps cashout on food expenditures: An assessment of the findings from four demonstrations. *Journal of Human Resources, 30*(4), 622–649.

Gentilini, U. (2007). Cash and food transfers: A primer. Occasional Paper No. 18. Rome: WFP.

Golden, M. H. (2009). Proposed recommended nutrient densities for moderately malnourished children. *Food and Nutrition Bulletin, 30*(3), 267–342.

Golden, M. H. (2010). Evolution of nutritional management of acute malnutrition. *Indian Pediatrics, 47*, 667–678.

Haddad, L., Hoddinott, J., & Alderman, H. (1997). *Intrahousehold resource allocation in developing countries: Methods, models, and policy*. Washington, DC: IFPRI.

Harvey, P. (2007). Cash-based responses in emergencies. HPG Report No. 24. London: ODI.

Harvey, P., Proudlock, K., Clay, E., Riley, B., & Jaspars, S. (2010). *Food aid and food assistance in emergency and transitional contexts: A review of current thinking*. London: ODI.

MacAuslan, I., & Riemenschneider, N. (2011). Richer but resented: What do cash transfers do to social relations?. *IDS Bulletin, 42*(6), 60–66.

Manley, J., Gitter, S., & Slavchevska, V. (2012). *How effective are cash transfer programmes at improving nutritional status? A rapid evidence assessment of programmes' effects on anthropometric outcomes*. London: University of London, EPPI-Centre.

Maxwell, D., Parker, J., & Stobaugh, H. (in press). What drives program choice in food security crises? Examining the "Response Analysis" question. *World Development*.

Michelson, H., Lentz, E., Mulwa, R., Morey, M., Cramer, L., & McGlinchy, M., et al. (2012). Cash, food or vouchers in urban and rural Kenya? An application of the market information and food insecurity response analysis framework. *Food Security*.

Mude, A., Ouma, R., & Lentz, E. (2012). Responding to food insecurity: Employing the market information and food insecurity response analysis framework in rural Northern Kenya. *Journal of Development Studies, 48*(12), 1750–1764.

Ozler, B., & Ferreira, F. (2011). *Conditions work! But are they good thing?*. Washington, DC: World Bank.

Rogers, B., & Coates, J. (2002). Food-based safety nets and related programs. Food Policy and Applied Nutrition Discussion Paper No. 12. Medford: Tufts University.

Senauer, B., & Young, N. (1986). The impact of food stamps on food expenditures: Rejection of the traditional model. *American Journal of Agricultural Economics, 68*(1), 37–43.

Sivakumaran, S. (2011). *Market analysis in emergencies*. Oxford: Cash Learning Partnership.

Skoufias, E., Tiwari, S., & Zaman, H. (2011). Can we rely on cash transfers to protect dietary diversity during food crises? Estimates from Indonesia. Policy Research Working Paper No. 5548. Washington, DC: World Bank.

Southworth, H. (1945). The economics of public measures to subsidize food consumption. *Journal of Farm Economics, 27*(1), 28–36.

Thaler, R. (1990). *Quasi rational economics*. New York: Russel Sage Foundation.

UNHCR, UNICEF, WFP, & WHO (2001). *Food and nutrition needs in emergencies*. Geneva, New York and Rome, WHO.

Upton, J., & Lentz, E. (2011). Expanding the food assistance toolbox. In: C. Barrett, B. Binder, & J. Steets (Eds.), Uniting on food assistance: The case for transatlantic cooperation. Routledge.

Victora, C., Adair, L., Fall, C., Hallal, P., Martorell, R., Richter, L., *et al.* (2008). Maternal and child undernutrition: Consequences for adult health and human capital. *The Lancet, 371*(9609), 340–357.

WFP (2008a). Vouchers and cash transfers as food assistance instruments: Opportunities and challenges. EB.2/2008/4-B. Rome.

WFP (2008b). *World hunger series 2008: Hunger and markets*. Rome.

WFP (2011a). Update on the implementation of WFP's policy on vouchers and cash transfers. EB.A/2011/5-A. Rome.

WFP (2011b). *Market analysis framework: Tools and Applications for needs assessments*. Rome.

Please cite this article in press as: Ryckembusch, D. *et al.* Enhancing Nutrition: A New Tool for *Ex-Ante* Comparison of Commodity-based Vouchers and Food Transfers, *World Development* (2013), http://dx.doi.org/10.1016/j.worlddev.2013.01.021