The Value of Quality Certification for Infant Foods: Results from a Market Experiment in Mali

by

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and

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Summary

This paper uses an experimental-economics technique to measure the potential impact of introducing quality certification to the market for infant foods in Mali, where malnutrition is widespread. We find that certification could substantially lower food costs, generating a total net economic benefit on the order of US$1 million annually, or approximately US$20 per infant, per year. The study shows that mothers' demand for quality information rises with their education and income level, but is higher than the estimated cost of certification even among the very poor and the uneducated.

Key words: Asymmetric information; preschool children nutrition; complementary foods.

Selected paper: American agricultural Economics Association Annual meeting in Long Beach, Ca, July 28-31, 2002

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1. Introduction

In the developing world, an estimated 33% of preschool children are stunted, and over half of child deaths are associated with malnutrition (UN and IFPRI 2000). Nutritional deficits are most severe between six months and two years of age (Martorell and Habicht 1986, Lutter 2000), in part due to the difficulty of the transition from breastmilk to a family diet, when foods of exceptionally high density must be introduced for children to obtain adequate nutrition from their limited digestive capacity (Brown et al. 1998).[2]

The high-density food products needed to complement breast-milk are relatively more difficult to produce than the foods normally used in a family diet. Home preparation is laborious and requires appropriate ingredients (Bauer et al. 1997, Onofiok and Nnanyelugo 1998). Public health authorities have succeeded in producing industrially-processed products at relatively low cost (Lutter and Huffman 2000), and when these foods are given to children in nutritional trials or feeding programs they improve child health significantly and generate lifelong benefits (Martorell 1995, Caulfield, Huffman and Piwoz 1999). But such low-cost infant foods attract little effective demand in the marketplace, and their introduction has had limited impact on the children at greatest risk (UN and IFPRI 2000). Even in the poorest countries, commercial markets remain dominated by heavily-advertised brands such as Nestlé's Cérélac, which sell at prices far above the cost of production (Dijkuizen 2000), and consequently are purchased in quantities that are too small to meet childrens' nutritional needs.

This paper reports the results of a market experiment in West Africa, whose results suggest that much of the very high price premium currently being paid for Cérélac is due to consumer demand for quality information embodied in the brand name. An independent sampling and testing service could provide that same quality information for other products at

[2] Many other factors also contribute to the severity of malnutrition among infants aged 6-24 months, including exposure to disease, micronutrient needs, and care practices (Smith and Haddad 2000a,b).

much lower cost. Easier access to a common quality certification "brand" would help 'artisanal' and industrial producers to enter the market using local ingredients, lowering product prices and helping parents meet more of their children's nutritional needs. We find that the demand for quality certification is greatest among mothers at higher income and education levels, but that even the very poor and uneducated would benefit from the introduction of a certification program.

Any intervention in child feeding is complex and potentially controversial. In keeping with the International Code of Marketing of Breast-Milk Substitutes (WHO 1981), foods intended to complement breast-milk should not be advertised or marketed for infants below 6 months of age, and they should be accompanied by messages regarding the importance of continued breastfeeding beyond that age (Lutter 2002). Given those guidelines, improving the quality and reducing the cost of complementary foods is a key element of the WHO/UNICEF Global Strategy on Infant and Young Child Feeding (WHO 2002), and quality certification for privately-produced products could be an important step in that direction.

2. Quality information and the market for infant foods

The level of nutrient density needed by infants is not directly observable by consumers. Nutrient density is not apparent to the taste, and its effect on health is confounded by many other intervening factors. A child whose growth falters may have suffered from diarrheal disease or intestinal parasites as well as from inadequate food intake. It is only over a relatively large sample of children, controlling for disease and genetic potential, that appropriate levels of nutrient density can be determined.

Traditional infant-feeding practices take account of the special needs of infants. Grains are often germinated, fermented, processed and cooked in various ways to improve digestibility, and mixed with oilseeds or animal products according to the availability of each ingredient (Haïdara 1989, 1990). Even so, nutrient densities of typical home-prepared infant foods recently sampled in Africa are only 35-45 kcal/100 g. of dry matter (Bauer et al. 1997, Gerbouin-Rerolle and Chauliac 1996). This is about one-tenth the density of Cérélac, and far less than what would be needed to avoid a nutritional constraint on child growth under any circumstances (Brown et al. 1998, USDA 1998).

Using industrial techniques it is possible to produce appropriately high-density foods at extremely low cost, from cereal grains, oilseeds and sugar plus fortification with vitamins and minerals. One of the most famous such products, is Incaparina, introduced in Guatemala in 1961 (Scrimshaw 1980, Tartanac 2000). Numerous similar initiatives have been undertaken around the world and across Africa (e.g. ICRISAT 1990, 1992; Porter and Shafritz 1999).

In Mali, the Laboratoire de Technologies Alimentaire (LTA) of the Institut d'Economie Rurale (IER) developed a recipe they called MILEG, whose manufacture under license to a local firm began in February 1995. Although the product was placed in retail outlets, almost all sales were to government or donor-funded nutrition programs. Three studies were commissioned to analyze the cause of limited market demand, (CECI 1996, Keita 1996, Gerbouin-Rerolle and Chauliac 1996), finding among other things that the original recipe was no longer being followed. Production stopped in May 1997.

Meanwhile, a French NGO (the Association MISOLA) had begun operations in Mali, organizing groups of women for artisanal production using local ingredients (Bauer et al. 1997). And in 1997, a new food-processing firm (UCODAL) introduced a series of infant foods (Mariko 1999). During 1999 and 2000, both UCODAL products and MISOLA were available for retail sale in at least on supermarket and one pharmacy respectively, but as with MILEG almost all actual sales were to government or donor nutrition programs.

Despite their much higher costs, imported brands continue to dominate retail markets. Table 1 lists the products and prices observed in Mali, by type of retail outlet. Only the standard type of Nestlé's Cérélac is available in open markets where prices are lowest. Enclosed stores and pharmacies, which provide more services and charge higher mark-ups, sell other infant foods – but there are only two other brands, one European and one from Cote d'Ivoire, both of which are about as expensive as Nestlé's. The two low-price local products, MISOLA and UCODAL, attract very few buyers.

The dominance of high-price branded goods, even though generic substitutes are technically feasible and occasionally available, is a common feature of markets for goods whose quality cannot be observed before purchase (Nelson 1970). The extreme case of infant foods, whose quality may not be known even after purchase, is known as "credence" good (Darby and

Karni 1973). The value of such products must be taken on trust, and their quality is typically signaled by high prices, extensive advertising, or both together (Milgrom and Roberts 1986).

Brand identity communicates quality, but at the cost of high prices and low volumes. Akerlof (1970) noted that such market failures could be remedied by quality certification, using an independent laboratory to test the product and issue a certificate assuring consumers that the product will meet their needs. Observing quality in this way is not costless, but if a testing fee is charged to producers, they can recover it in a higher product price from consumers, and still leave consumers better off than when their only source of quality information was brand identity. Established firms would lose some of the premium they are now earning from brand identity, as they and other firms would have an incentive to pay the fee, seek certification, and compete to provide the given quality most effectively (Crespi and Marette 2000). In effect, the existence of independent certification permits the emergence of a more competitive market to provide the certified product. Examples of such certification services include the work of the International Standards Organization (ISO) or the Underwriters' Laboratory (UL) in the United States.

Although certification is a useful remedy for many market failures, establishing the certification "brand" involves substantial scale economies, so it is more cost-effective in larger markets (Auriol and Schillizi 2000). To determine whether certification would be feasible and desirable, one must determine the premium consumers are willing to pay for quality information, and compare it to the costs of sampling, testing, and assuring consumers about product quality.

3. Consumer demand for quality certification in Mali

This paper provides an experimental measure of Malian mothers' willingness to pay for quality certification, a service which is not yet available in Mali. We begin by establishing the feasibility and approximate cost of a suitable certification program. In fact, the basic infrastructure needed for certification is already present. Two public agencies have food laboratories equipped and staffed for testing nutrient density, one in the agricultural research service and one in the Ministry of Health, and there is a legal basis for using those laboratories in a certification program.[3]

[3] The laboratories are the Laboratoire de Technologies Alimentaires of the Institut d'Economie Rurale, and the Laboratoire Nationale de la Santé. The relevant legislation is law Nº 92 – 013/AN-RM adopted by Mali's National

The certification scheme we propose is based on a minimalist testing program, focusing on whether the food's density of total protein, total energy and total fats meets a standard similar to the levels in Cérélac. Tests for selected vitamins and minerals could be added if the local technical committee judged them necessary. Qualities other than nutrient density, such as contamination or palatability can be judged by consumers, based on observable characteristics such as product color, texture, taste, packaging, retailer reputation and price. If demand for testing proves sufficient, a certification program can operate on a voluntary fee-for-service basis, as long as it is offered to all potential producers (Crespi and Marette 2000).

There is a long literature on the measurement and analysis of consumer demand for food quality and quality information (e.g. Wessels and Anderson 1995, Caswell 1995, Henson 1997, Unnevehr and Villamil 1999). We follow the standard approach, based on the Lancaster (1966) model that treats each product as a bundle of distinct attributes, such as nutrients, flavor, safety and convenience. Consumers' demand for a change in product attributes can be elicited from market data, if there is enough variety in the attributes of products on the market, using "hedonic" regressions such as Van Ravenswaay and Hoehn (1991). In our setting, certification is not yet being provided, so we use a market experiment to elicit preferences, as in Hayes et al. (1995).

For an experiment to elicit choices similar to those made in an actual market, it is necessary to offer similar incentives. The dominant approach uses a type of auction proposed by Vickrey (1961), in which a respondent's bid determines whether or not they receive the product, but the price they must pay is determined by other respondents or by the researcher. Such a design replicates consumer choices in competitive markets, where a consumer's willingness to pay determines what she buys, but the price she pays is determined by other consumers' demand and the cost of production. A typical auction design asks the highest bidder to pay the second-highest bid (e.g. Melton et al. 1996), but other designs are possible (e.g. INSEAD 2000). The Vickrey concept is relatively complex, however, and requires detailed explanations and practice

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Assembly in August 1992, and order-in-council N^{o} 92 – 235/P-RM signed by the government in December 1992. These directives established a Conseil National de Normalisation et de Contrôle de Qualité (CNNCQ), with a secretariat office in the Direction Nationale des Industries (DNI), and various technical committees. Current food safety controls are limited to large investment projects, which are reviewed before production begins with no provision for subsequent product testing, but officials and some consumers are aware that periodic random sampling of more products might be a good thing.

for respondents to learn how to place bids they will not regret. To construct a simpler kind of market experiment, which uses exchange among products instead of product for money, we follow Binswanger (1980) and ask a sample of Malian mothers to choose among a range of infant foods with different attributes.

4. A market experiment to elicit demand for certification

The survey was conducted in Bamako in June-July 2000, at ten open-air markets randomly selected from the city's shopping areas. The sites were chosen by dividing the city into five similar-sized zones, and choosing two markets from each zone. (Each zone had four or five significant open-air markets from which to choose.) At each market, twenty-five mothers with young children were randomly selected from the shopping population, based on their time of arrival at the survey site. Interactions with them were conducted in Bambara, the region's home language. Ten of the selected mothers failed to complete the entire questionnaire, for a final sample size of 240.

Mothers in the survey were asked to choose between a standard 400g can of Nestlé's Cérélac, two locally-processed products, and the raw ingredients needed to prepare similar foods at home. The locally-processed food was a UCODAL product, repackaged in sealed plastic bags with a printed label marked 'Certilac' and figuring a healthy baby as a mark of certification. The second local product was MISOLA, packed in unsealed bags with no label, which we called an "anonymous" or uncertified product. The raw ingredients were cereal grains (millet, maize), legumes (cowpea, peanut) and sugar, in the fixed proportions recommended by Trèche (1999). These choices differ only in the attributes of interest: the difference between Cérélac and Certilac is what is proprietary to Nestlé's; the difference between Certilac and the anonymous product is quality certification, and the difference between the anonymous product and the raw ingredients is processing.

Potential participants were given a brief explanation of the survey and its objective, and those who were to participate were seated at a table away from the crowd. The interview[4] started with a short questionnaire on socio-demographic information, and then to elicit their infant-food

[4] All interviews were conducted by the first author, assisted by two experienced enumerators employed by the national agricultural research agency, IER.

preferences respondents were given the 400 g. can of Cérélac and offered increasing quantities of the Certilac in exchange. The offers were made in 100 g. increments. So the first choice was between 400 g. of Cérélac vs. 400 g. of Certilac, then 400 g. vs. 500 g., followed by 400 g. vs. 600 g., and so forth, up to a maximum of 900 g. of Certilac. Each choice was recorded on the survey sheet. As soon as the respondent accepted the Certilac, they were offered that same quantity of the anonymous product in exchange for it, followed by increasing quantities again in 100 g. increments, with a maximum of four increments. Then as soon as the anonymous product was accepted, the respondent was offered increasing quantities of the raw ingredients, from 4 kg up to 8 kg, a quantity whose market price was approximately equal to market price of the original can of Cérélac. At the end of the experiment, the respondent took one of the choices they had made, by drawing it at random from a box. Thus each choice was equally likely to determine what the participant would take home, either a can of Cérélac or something else of similar value.

In effect, the experiment sets up an auction in which the respondent trades their Cérélac for increasing quantities of the other goods. The data needed to calculate willingness to pay for each good is only the quantity of it that was needed to induce the consumer to switch. Using that quantity, and the market price and quantity of Cérélac, we could solve for the respondent's willingness to pay for each successive product, from the (approximate) indifference revealed by the consumer's willingness to switch. Where the first good has known price and quantity (p, q), we use the quantity of the other good accepted in exchange (q^*) to solve for its implied price (p^*). If the two bundles have equal value to that consumer,

$$p\ q = p^*\ q^* \qquad (1)$$

then the consumer's implied price for the new good is:

$$p^* = p\ q/q^* \qquad (2)$$

and we can derive each respondent's willingness to pay for each good from the common starting point of Cérélac's well-known price (FCFA 1500) and quantity (400 g.). Since the goods differ only in particular characteristics, we use the difference between the two values ($p^* - p$) to determine willingness-to-pay for those characteristics.

Our "auction" design is based on in-kind exchanges, which makes the experiment far simpler to explain and quicker to implement than Vickrey-type mechanisms. And the products

involved are used almost exclusively for feeding infants, so the experiment is largely self-targeting to the consumer's preferences among infant foods. The methodological cost of these advantages is that we must look outside the experiment to set the monetary measure of willingness to pay for each type of food. We use the market price of Cérélac (FCFA 1500 per 400 g. tin) because approximately 39 percent of the respondents actually buy Cérélac, implying that their willingness to pay for it is somewhat above that market price, and the remainder could probably resell the tin for a similar price if they so chose. Using a different willingness to pay for the Cérélac would change the estimated willingess to pay for each other good (p^* and p), but not the price *differences* between them ($p^* - p$), which are the variables of interest in this study.

5. Data and results

Descriptive statistics for the willingness-to-pay (WTP) data are given in Table 2. (The complete set of underlying data, as well as the original questionnaires and photographs of the survey process, are available from the authors on request.) Our principal interest is in the consumer's WTP for certification, which is the difference between the anonymous and the certified products. The recorded maximum difference in WTP for these two goods was 1038 FCFA (approximately US$1.60) per 400 g. bag of food, or over two-thirds of what is paid for Cérélac. About only 1% of the respondents expressed no difference, or a zero willingness to pay for certification. The mean WTP for certification was FCFA 455 (US$0.70), implying that the average mother would pay 30% of Cérélac's price for quality information alone. The mean WTP for processing was FCFA 585 (US$0.90), and for ingredients was FCFA 119 (US$0.18). The gap between the price usually paid for Cérélac (FCFA 1500) and the WTP for Certilac (FCFA 1159) represents the premium paid for higher-cost ingredients (notably skim milk powder, a more flavorful source of fats), higher-cost packaging (notably a resealable canister, instead of a plastic bag), and brand recognition.

The results of the experiment suggest fairly wide variation in mothers' willingness to pay for quality certification, with a coefficient of variation of 55 percent. Figure 1 shows the full cumulative distribution, in the sense of the proportion of respondents who traded the uncertified for the certified product, at each level of price difference between the two otherwise similar products. Note that the distribution is nearly symmetrical, as the median (where about half

prefer a quality-certified to an uncertified product) occurs near the mean (at about 450 FCFA per bag). Before we investigate the costs and possible net benefits of certification, we would need to ask whether this distribution is purely random, or whether our socioeconomic data can help explain respondents' choices.

To test for socioeconomic correlates of WTP for certification, we looked for correlations between respondents' revealed WTP and their other survey responses listed in Table 3, using OLS regressions. Although the WTP data are symmetrically distributed, a Shapiro–Wilk W test failed to prove that its distribution is normal, in either a level or log form. But the sample size is small, and the distribution of sample means tends to become normal under random sampling as the size of the sample increases, even if the distribution in the original population is far from normal (Snedecor and Cochran, 1989), so we proceed with caution to use OLS on these data. Another particularity of the dataset is that, except for willingness to pay for processing (WTPPRO), all other regressors are categorical or count variables.

The basic regression equation is:

$$WTPCERT_i = \beta_0 + \beta_1 socioecomic\_factors_i + \beta_2 survey\_site_i + \varepsilon_i \qquad (3)$$

where β_1 is an estimated vector of coefficients on socioeconomic factors hypothesized to influence willingness to pay for certification. Our data on these socioeconomic factors for each respondent includes their willingness to pay for processing, the labor available to produce complementary foods at their home, the number of children and total size of their household, plus the respondent's working status, education level, use of Cerelac or other foods, and ownership of her home and major household appliances. Dummy variables for each survey site help control for any other socioeconomic factors that are correlated with location.

Results are shown in Table 4. Using robust standard errors to account for heteroskedasticity across the survey sites, the only strongly statistically significant coefficients in the full model with all variables (column 1) are completion of elementary education and home ownership (both positive), plus four of the residence areas, which are closely linked to income and social status. Clearly, higher-income and better-educated households did reveal a higher WTP for certification. This is consistent with certification being a normal good, and also a complement to education. There is also some significant correlation between WTP for

certification and WTP for processing, as households unwilling to do their own processing are also willing to pay more for certification, perhaps simply because they are wealthier.

To reduce the degrees of freedom taken up by individual neighborhood dummies, model 2 uses the variable "suburban" to indicate residence in any of the three areas (Kalabankoro, Magnambougou, and Sébénikoro) remote from downtown Bamako whose inhabitants have similarly low income levels. This regression also drops the secondary education variable, which is nonzero for only three respondents. Results are nearly identical to model 1, but the mother working outside the home gains significance (and is positively correlated with WTP for certification).

A final robustness test is model 3, which includes all residence variables but only selected socioeconomic ones. Their coefficients are largely unchanged, implying that the other socioeconomic variables are just noise, and our results are robust to their inclusion or exclusion. The only coefficient whose significance (but not magnitude) changes is for the use of other types of complementary foods, which becomes significant only when the other variables are dropped.

One fundamental result from our analysis is the robust importance of mother's education level, and whether she works outside the home, even when controlling for total household income as best we can. This result is consistent with many previous studies showing the influence of mother's education and access to resources on childcare practices (Barrera, 1990; Alderman and Garcia, 1994).

Another fundamental result is that although socioeconomic status matters for WTP (our equation R^2 of 12-14 percent is acceptable for this kind of data), almost all mothers revealed WTP levels well above what we estimate are the costs of certification. In other words, even very poor and uneducated mothers are unwilling to pay for anonymous products, whose quality is unknown. Offering them a lower-cost way to obtain infant foods is likely to have a major impact on their childcare practices, and on their children's nutritional status.

6. Costs and net benefits of certification

Although our work focuses on mother's demand for certification, here we provide a rough budget for certification costs and an estimate of its net benefits, to establish the orders of

magnitude involved and assess whether it is likely that certification services could be introduced on a voluntary, self-financing basis.

The establishment of a certification program would involve large fixed costs, so the average cost schedule depends on the number of units certified. To locate that cost schedule, we assumed that only residents of Bamako would purchase certified products, so as to be conservative in our estimate. From file data of the *Direction Nationale de la Statistique*, we computed that there were 49,598 children between the ages of 6 and 24 months in the city of Bamako in 1999. If the average child consumes 100 g. per day (Dijkhuizen 2000), they need about 8 units of 400 g. per month. To ask what proportion might consume a certified food, we took as our low estimate the share that now receives at least some Cérélac, and as our high estimate the share that now receives any kind of additional food. From our pre-experiment survey, these data are 39 and 89 percent respectively, with 11 percent receiving no food other than breast-milk. The result is a total potential market size between 154,746 and 353,138 units per month. Note that this is only a rough estimate. To provide a more accurate figure it would be necessary to conduct a survey focusing on current feeding practices, with a larger sample than we used for the willingness-to-pay experiments.

To guesstimate the costs of certification, we assumed that one unit of each thousand sold would be sampled, and purchased at an average cost of 220 FCFA for whatever was the smallest available packaging size of each kind of product. The unit cost of testing each sample is 3,300 FCFA, which is the current cost quoted by the *Laboratoire National de la Santé* for the three macronutrient density tests. Indivisible staff costs were estimated to be one million FCFCA for each increment of 50 bags sampled per month. Transport costs, for the staff to visit markets and production sites, were estimated to be 600,000 FCFA for each increment of 20 bags sampled per month. And most importantly, a continuous expenditure of ten million FCFA per month was allotted for advertising and marketing to establish credibility. Obviously this is by far the largest cost involved in a certification program, and our budget (approximately $200,000 per year) is ample to assure universal awareness of the certification brand throughout the target population.

With those data, we find that average per-unit certification costs are likely to be between 81 and 121 FCFA per 400 g. bag, for the high and low market-size estimates respectively. Given a mean WTP of FCFA 455 per 400 g., it seems very likely that a certification program could be

introduced, and recover its costs in user fees, while still generating large net social benefits to families using infant foods. Using the smaller market-size estimate, the total economic benefit shared amongst families using infant foods is over FCFA 70 million per month, and total costs are about FCFA 19 million per month, for a net social benefit of about FCFA 51 million per month, or US$0.94 million per year. Using the larger market size estimate, net social benefits are US$2.4 million annually. A larger survey effort would be needed to estimate total demand and program impacts, but from these initial estimates it appears that introducing certification would generate substantial net benefits among the children most at risk of malnutrition.

7. Conclusions and policy implications

This study measures and analyzes consumer demand for quality certification of infant foods, using a market experiment, an associated socioeconomic survey, and a rough budget for the provision of certification services. We find that mothers' willingness to pay for quality information is well above the cost of introducing an independent laboratory-based sampling and testing service. Introducing quality certification on a voluntary, self-financing basis is therefore likely to be feasible, and likely to generate a substantial improvement in child nutrition.

Currently, mothers are forced to choose between high-cost brands, raw ingredients requiring very laborious processing, and "anonymous" processed products with no brand recognition or quality assurance. Effective demand for the anonymous products is very low, despite their low cost – and despite the fact that consumers can obtain far too little of either the high-cost brands or the laborious home-produced foods to meet their children's nutritional needs.

Our study was motivated by the hypothesis that low effective demand for anonymous infant foods could be due to the unobservability of their quality, following the logic of Akerlof (1970). Our market experiment provides a quantitative measure of this effect. We find that if quality certification were introduced, consumers would be willing to pay (on average) an additional FCFA 455 (US$0.70) per 400 g. bag for the certified product over the anonymous product. This is about one-third of the price currently being paid for Nestlé's Cérélac, the heavily advertised branded good that dominates this market.

We find some link between consumers' willingness to pay and their wealth, education, and employment. On average, mothers who reported that they own their home, completed

secondary school, or work outside the home, revealed a willingness to pay for certification that was 90, 80, and 40 FCFA higher than other mothers respectively. These findings are consistent with the idea that better-educated mothers with more independent resources, even controlling for wealth, demand higher quality care for their children. Nonetheless, even the poorest and least educated group of respondents revealed a willingness to pay that was well above the cost of providing certification.

In sum, the introduction of an appropriate certification program in Bamako is likely to be an extremely effective, well-targeted approach to improving families' ability to meet their children's nutritional needs. Other kinds of nutrition interventions are also needed, of course – and would be helped by certification, which would reduce prices and increase availability of infant foods without using public funds.

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Table 1. Infant foods for sale in Bamako, Mali (1999)

		Retail Prices (FCFA/unit)*		
Brand name	Packaging	Open market	Stores	Pharmacy
Cérélac (wheat)	400 g. can	1400	1500	1615
Cérélac (wheat)	200 g. box	600		850
Cérélac (rice)	400 g. can		1600	
Cérélac (wheat/Banana)	400 g. can		1750	
Cérélac (wheat +3 fruits)	400 g. can			2240
Blédilac** (wheat)	250 g. can			1270
Blédina** lactée fruits	250 g. box			1830
Farinor** (maize/soy)	400 g. box		1690	1750
MISOLA	500 g. bag			300***
UCODAL (e.g. Sinba)	200 g. bag		200***	

* In 1999, US$1.00 = 600 FCFA.
** Farinor is a regional brand imported to Mali from Côte d'Ivoire. Blédilac and Blédina are European brands.
*** In 1999, MISOLA and UCODAL were available only from the production site, but in 2000 MISOLA was stocked in at least one urban pharmacy, and the UCODAL products in some supermarkets.

Source: Trèche (1999) for all except MISOLA and UCODAL, for which data are from authors' interviews.

Table 2. Summary statistics for willingness-to-pay (WTP) results

	WTP (FCFA per 400 g.)			
	Average	Standard Deviation	Minimum	Maximum
WTP by product				
Certilac	1159.83	357.77	667	1500
Anonymous product	704.59	210.36	462	1500
Raw ingredients	119.14	35.07	75	150
WTP for premium				
Certification (anon. to cert.)	455.24	251.22	0	1038
Processing (raw to anon.)	585.45	213.97	312	1425

Notes: Willingness to pay for each product is computed based on quantities exchanged for Cérélac, for which WTP is assumed to equal its market value (15000 FCFA). Market premiums are the differences in WTP between the anonymous product and Certilac (for certification), and between the raw ingredients and the anonymous product (for processing). Using a t-test on matched samples, the 95% confidence intervals around the point estimates are (423, 487) and (558, 613) for certification and processing respectively.

Source: Survey data.

Table 3. Description of variables in the regression model

Variable	Definition	Units	Mean	Std.Dev.
WTP certification	Premium paid for "Certilac" over anonymous product in the market experiment	FCFA per bag (=400 g.)	455.24	251.22
Market site	Indicator of respondent's location (1 of 10 market sites).	0/1 dummy var. for each area	na	na
Suburban site	= 1 if respondent's location is any of three lower-income areas (Magnan, Same, or Sebeni).	0/1 dummy variable	na	na
WTP processing	Premium paid for anonymous product over raw ingredients in the market experiment	FCFA per bag (=400 g.)	585.45	213.97
Labor available	Number of care-givers in the household able to prepare home made complementary foods	1 caregiver	1.08	0.43
No. of children	Number of children under 10 in the household	1 child	2.32	1.25
Household size	Number of members in the respondent's household	1 member	7.99	4.89
Working status	= 1 if respondent works outside family	0/1 dummy variable	0.50	0.50
Primary ed.	= 1 if respondent has obtained primary school certificate ("C.E.P.") (6 years)	0/1 dummy variable	0.20	0.40
Elementary ed.	= 1 if respondent has obtained elementary school diploma ("D.E.F.") (9 years)	0/1 dummy variable	0.11	0.31
Secondary ed.	= 1 if respondent has any post-elementary school diploma (certificate, diploma or degree)	0/1 dummy variable	0.03	0.18
Training session	= 1 if respondent attended a formal training session on complementary feeding practice	0/1 dummy variable	0.48	0.50
Uses Cérélac	= 1 if comp. foods used by respondent include Cérélac	0/1 dummy variable	0.38	0.49
Uses other foods	= 1 if respondent uses compl. foods other than Cérélac	0/1 dummy variable	0.51	0.50
Owns home	= 1 if the respondent's household owns their home	0/1 dummy variable	0.61	0.49
Electricity	= 1 if electricity is available in respondent's home	0/1 dummy variable	0.30	0.46
Refrigerator	= 1 if a refrigerator is available in the respondent's hh	0/1 dummy variable	0.16	0.36
Television	= 1 if a television is available in the respondent's hh	0/1 dummy variable	0.55	0.50

Table 4. Regression results for socioeconomic correlates of WTP

Dependent variable: WTP for certification	**Model 1**	**Model 2**	**Model 3**
Independent variables:			
Market site = Bankoni	49.187*** (16.722)	-	39.305*** (11.244)
Market site = Boulkassoumbougou	44.502*** (15.233)	-	44.993*** (10.186)
Market site = Kalabancoura	-92.340*** (20.338)	-	-86.317*** (18.586)
Market site = Kalabankoro	-47.317 (36.988)	-	-48.151*** (12.294)
Market site = Magnambougou	-8.400 (26.334)	-	-11.115 (17.931)
Market site = Djikoroni-Para	27.607 (23.106)	-	19.789* (11.700)
Market site = Samé	-57.009*** (20.982)	-	-54.398*** (14.758)
Market site = Sébénikoro	-18.506 (24.406)	-	-16.992 (20.365)
Market site = Torokorobougou	-3.487 (18.356)	-	-10.744 (11.131)
Market site = suburban (remote/low income)	-	-13.011 (24.956)	-
WTP for processing	*.231*** *(.104)*	0.200* (0.114)	*0.231*** *(0.101)*
Labor available for food preparation	-11.024 (55.354)	-16.704 (48.020)	-
Number of children less than 10 years of age	4.429 (16.677)	7.462 (16.091)	-
Household size	3.678 (4.116)	2.926 (3.634)	-
Working status of mother (works outside family)	40.841 (28.647)	51.546** (20.754)	42.486* (23.244)

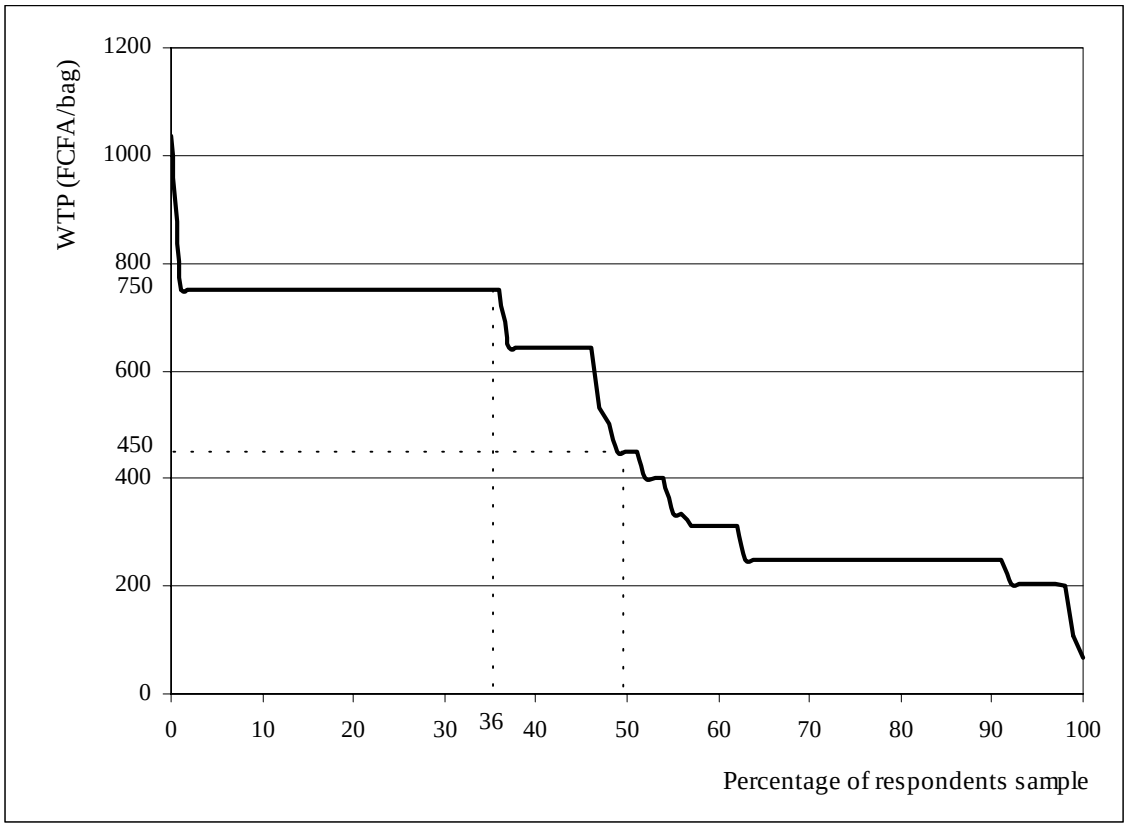
(continued on next page)

Table 4 *(continued)*

Dependent variable: WTP for certification	**Model 1**	**Model 2**	**Model 3**
Independent variables:			
Primary ed. certificate completed (6 yrs.)	74.891	69.231	-
	(75.712)	(70.585)	
Elementary ed. diploma completed (9 yrs)	*95.698****	87.706**	*82.927****
	(35.069)	(38.500)	*(28.021)*
Secondary education completed	-26.256	-	-
	(105.449)		
Training session on child feeding attended	-13.725	-20.030	-
	(37.094)	(33.362)	
Uses Cérélac as a complementary food	10.330	8.512	-
	(77.586)	(70.493)	
Uses other types of complementary foods	70.039	76.823	69.084**
	(74.954)	(67.446)	(29.783)
Household owns home	103.525**	95.143***	89.931**
	(45.659)	(43.973)	(41.661)
Electricity available	-42.798	-19.302	-
	(55.204)	(47.516)	
Refrigerator available	34.079	32.597	-
	(36.842)	(37.626)	
TV available	14.823	10.494	-
	(40.763)	(36.802)	
Constant	194.821**	205.005***	234.435***
	(85.749)	(71.688)	(57.791)
Number of observations	240	240	240
R^2	0.14	0.12	0.13

Note: Robust standard errors are in parentheses, with asterisks on coefficients signifying that they differ from zero at significance levels of 10 percent (*), 5 percent (**), and 1 percent (***).

Figure1. Distribution of Willingness to Pay (WTP) for Certification



Section 2: Consumer Choices Recording Sheet

Warning! Each respondent will win one of the 16 choices below, drawn randomly from the 16 choices. Each choice represents one product. Each choice between two products must be mark with the sign ✔ in the corresponding box to the left of concerned quantity. Each section of the choice process starts with equal quantities of the two products, but quantity of the second product is progressively increased. For lot Nº 1, respondent must choose between 400g of Cérélac and 400 g. of Certilac. For lot Nº 2 she mus choose between 400 g. of Cérélac and 500 g. of Certilac, and so on. Respondent must make a choice for each lot.

In section B, quantities (**in bold**) are not yet identified. They depend on previous responses. Lot Nº 7 must contain the first quantity of *Certilac chosen in section A. Fo*r example, if respondent had retained Cérélac for lots Nº 1, 2, 3 et 4, followed by Certilac for lots Nº 5 et 6 (800 g. et 900 g. respectively), lot Nº 7 would consist of 800 g of Certilac or 800 g. of the unknown product. Lots Nº 8, 9, 10 and 11 would be composed of 800 of Certilac always, but the quantity of the unknown product would increase: lot Nº 8 would contain 900 g., lot Nº 9, 1000 g., lot Nº 10, 1100 g., and lot Nº 11, 1200 g.

For section C, the quantity of the unknown product starts with its first quantity chosen in section B, but quantity of the bundle of raw ingredients start with 4000 g. and is always increased by 1000g after each choice by respondent up to a maximum quantity of 8000g.

Section A. Choice between the imported brand (Cérélac) and the certified local product (Certilac)
Choices started with equal quantities of Cérélac and Certilac.

Lot Nº 1	☐	400 g. Cérélac	☐	400 g. Certilac
Lot Nº 2	☐	400 g. Cérélac	☐	500 g. Certilac
Lot Nº 3	☐	400 g. Cérélac	☐	600 g. Certilac
Lot Nº 4	☐	400 g. Cérélac	☐	700 g. Certilac
Lot Nº 5	☐	400 g. Cérélac	☐	800 g. Certilac
Lot Nº 6	☐	400 g. Cérélac	☐	900 g. Certilac

Section B. Choice between Certilac and the uncertified local product (Unknown Product)
Complete bold numbers, using the first quantity of Certilac chosen in section A.

Lot Nº 7	☐	__ **00 g.** Certilac	☐	__ **00 g.** Unknown Product
Lot Nº 8	☐	__ **00 g.** Certilac	☐	__ **00 g.** Unknown Product
Lot Nº 9	☐	__ **00 g.** Certilac	☐	__ **00 g.** Unknown Product
Lot Nº 10	☐	__ **00 g.** Certilac	☐	__ **00 g.** Unknown Product
Lot Nº 11	☐	__ **00 g.** Certilac	☐	__ **00 g.** Unknown Product

Section C. Choice between Unknown Product and package of raw grains

Complete bold numbers, using the first quantity of Unknown Product chosen in section B. Quantity of the package of raw grains starts at 4000g, and is increased by increment of 1000g until the maximum quantity of 8000g which value is equivalent to the average price of a-400g-can of Cérélac.

Lot Nº 12	☐	__ **00 g.** Unknown Product	☐	4000 g. Raw Grains
Lot Nº 13	☐	__ **00 g.** Unknown Product	☐	5000 g. Raw Grains
Lot Nº 14	☐	__ **00 g.** Unknown Product	☐	6000 g. Raw Grains
Lot Nº 15	☐	__ **00 g.** Unknown Product	☐	7000 g. Raw Grains
Lot Nº 16	☐	__ **00 g.** Unknown Product	☐	8000 g. Raw Grains