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THE IMPACT OF THE INCREASE IN FOOD PRICES ON CHILD POVERTY AND THE POLICY RESPONSE IN MALI

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The impact of the increase in food prices on child poverty and the policy response in Mali.

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Summary: Since 2006, Mali has experienced the full effects of the global food crisis, with price increases of up to 67%. This study presents simulations of the impacts of this crisis and a number of policy responses with respect to the welfare of children. The impacts are analyzed in terms of monetary (food) poverty, nutrition, education, child labor and access to health services of children. According to simulations, food poverty among children would have increased from 41% to 51%, with a corresponding rise in caloric insufficiency from 32% to 40%, while the impacts on school participation, work and access to health services would have been relatively weak. To prepare an adequate response, the government should start by identifying the poor individuals who are to be protected, based on a limited number of easily observed sociodemographic characteristics. A method of targeting these individuals is proposed in this study. However, simulations show that with targeting about one quarter of poor children would be erroneously excluded (under-coverage), while more than a third of non-poor children would be erroneously included (leakage). These identification errors, which increase in proportion with the extremity of poverty, reduce the impact and increase the cost of any public interventions. That having been said, it is important to note that leakage to the non-poor can nonetheless improve the conditions of children in terms of caloric intake, school participation, child labour and access to health services, none of which are exclusive to poor children. When targeting children or sub-groups of children by age, benefits will likely be deflected to some extent to other family members. Moreover, it is total household income, regardless of the member targeted, that determines decisions relating to child work, education or access to health services. School feeding programs are found to be a particularly efficient policy in that they concentrate public funds exclusively on the consumption of highly nutritious foods, while cash transfers can be used by households for other purposes. Moreover, school feeding programs are likely to have desirable effects on school participation and child labour. However, there are some caveats due to the fact that these programs exclude children who do not attend school, the difficulty of exclusively targeting poor children and the possibility that child food rations at home will be proportionally reduced.

Key Words: food crisis, child poverty, nutrition, education, child labour, health, Mali

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Acronyms and abbreviations

AE	Adult Equivalent
CAGRD	Committee of Associations and Groups of Retail Traders
CAP	Common Agricultural Policy
CET	Common External Tariff
CFA	African Financial Community Franc
CGA	Approved Management Centre
CPI	Consumer Price Index
CS	Consumer Subsidies
CT	Customs tariff
DFS	Decentralized financial system
DNCC	National Directorate for Commerce and Competition
DNSI	National Directorate of Statistics and Data Processing
ECOWAS	Economic Community of West African States
ELIM	Integrated Survey of Households
FAO	Food and Agriculture Organization of the United Nations
FGT	Foster-Greer-Thorbecke
GDCM	Great Malian Cereals Distributor
GDP	Gross Domestic Product
GGB	Great Granary of Happiness
GMM	Grands moulins du Mali
HICP	Harmonized Index of Consumer Prices
HIPC	Heavily Indebted Poor Countries
HUICOMA	Cotton Oil Factory of Mali
IMF	International Monetary Fund
MDG	Millennium Development Goals
MDRI	Multilateral Debt Relief Initiative
MECF	Marginal Efficiency Cost of Funds
NERICA	New rice for Africa
OECD	Organization for Economic Cooperation and Development
OMA	Agricultural Market Observatory
OPAM	Agricultural Products Office Mali
PC	Community withholding tax
PCS	Community solidarity withholding tax
QAIDS	Quadratic Almost Ideal Demand System
SFGRP	Strategic Framework for Growth and Reduction of Poverty
SOMAKOF	Société Madala Kouma et frères
SSA	Sub-Saharan Africa
ST	Statistical Tax
UNICEF	United Nations Children's Fund
VAT	Value Added Tax
WAMEU	West African Monetary and Economic Union
WHO	World Health Organization

1 INTRODUCTION

Mali, like most developing countries, has undergone a difficult ordeal as a result of the global food crisis. Food expenses represent a significant or even predominant portion of total household expenses, particularly among the poor. An increase in food prices in the order of 30 to 40 percent can rapidly force poor populations to make difficult, or nearly impossible, reductions in their spending on food, and in the education and access to health services for their children. It can also deplete their meagre savings. Children in such a context are particularly vulnerable in terms of food, nutrition, education and health.

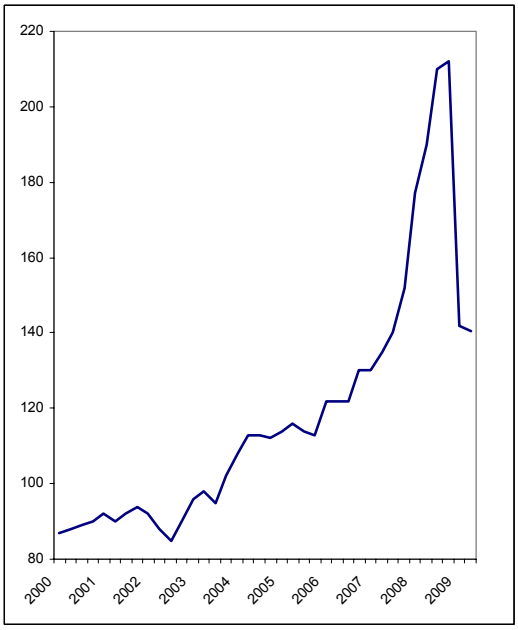
However, not everyone is affected in the same way. The increases in food prices can vary substantially by region of residence, while individuals in households that produce and sell food products even see some benefit from the increase in food prices. Differences in consumption patterns are such that the impacts differ from one region to another. Also, households with greater total income have more capacity to adjust.

This study presents detailed simulations of the impacts of the food crisis on Malian children. Over and above the impacts on monetary poverty, the impacts on nutrition, education, labour and children's access to health services are also analyzed. The study also reviews a number of compensatory policies that the Malian government could consider to respond to this crisis in order to protect the most vulnerable populations.

2 GENERAL CONTEXT

International prices for staple foods have rapidly increased since 2006. The FAO food price index rose by 7% in 2006, by 16% in 2007 and by 50% between the third quarter of 2007 and the third quarter of 2008 (Figure 1). While food prices have subsequently subsided, they remain considerably above their long term average in early 2009. Moreover, the financial crisis could exacerbate the situation by reducing real income in poor countries. The poverty gap and severity of monetary poverty in West and Central Africa seem to have regressed, threatening food and nutritional security among many rural and urban households. Children and pregnant or lactating women are of particular concern. In addition to aspects of their welfare, children may be less likely to attend school.

Figure 1: World Food Price Index



Source: FAO web site

2.1 International Context

Simultaneous increases in the international prices of oil and food commodities, including grains, were experienced, particularly from mid-2008. Increasing oil prices alone bring along higher costs for certain chemical inputs (ex: fertilizer).

Similarly, prices of other food commodities such as palm oil and milk have increased. The resulting inflation has led to revolts in Haiti, Cameroon and Burkina Faso, as well as numerous social problems in Argentina, Yemen, Mexico, Senegal, Bangladesh, Philippines, Guinea, Mauritania, Morocco, Senegal, Uzbekistan, etc. (Agriculture et PAC 2008).

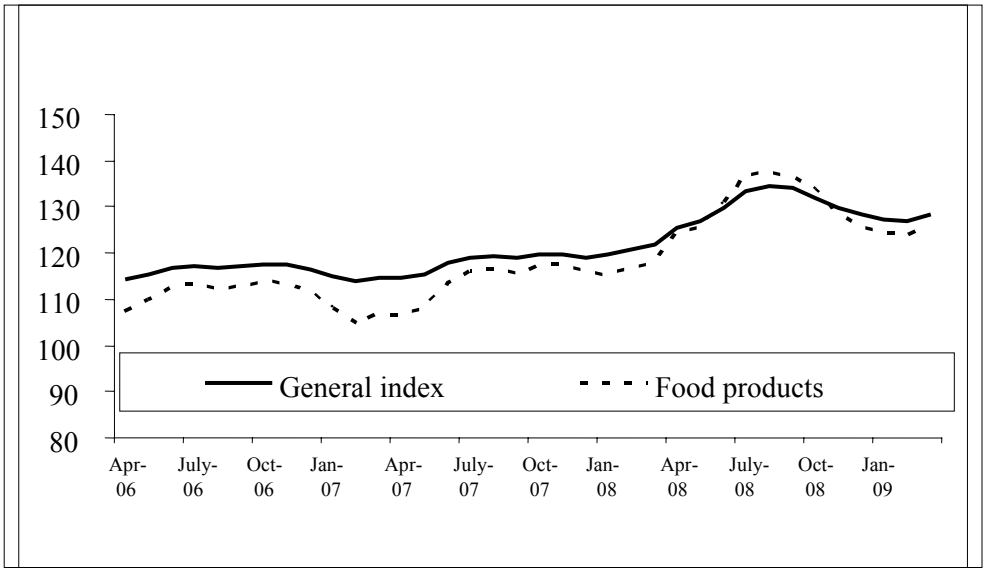
Many causes have been brought up in the literature to explain the sudden increase in food prices. Included in these explanations are droughts in some large producer countries, increasing demand in China (where demand for meat, which is grain intensive to produce, increases with income), as well as the production of biofuels in developed countries. In developing countries, growing populations are faced with declining agricultural production under the effects of massive subsidies being handed out to American and European agricultural producers. Finally, speculation appears to have exaggerated fluctuations in global prices.

The most worrisome effect of these increases in food prices is the aggravation of poverty in developing countries such as Mali. Declining living conditions for children who already faced severe deprivation due to poverty and inequality are of particular concern (DNSI and UNICEF 2008).

2.2 National context – Mali

The rise in food commodity prices at the global level has resulted in a general increase in prices in Mali (Figure 2).

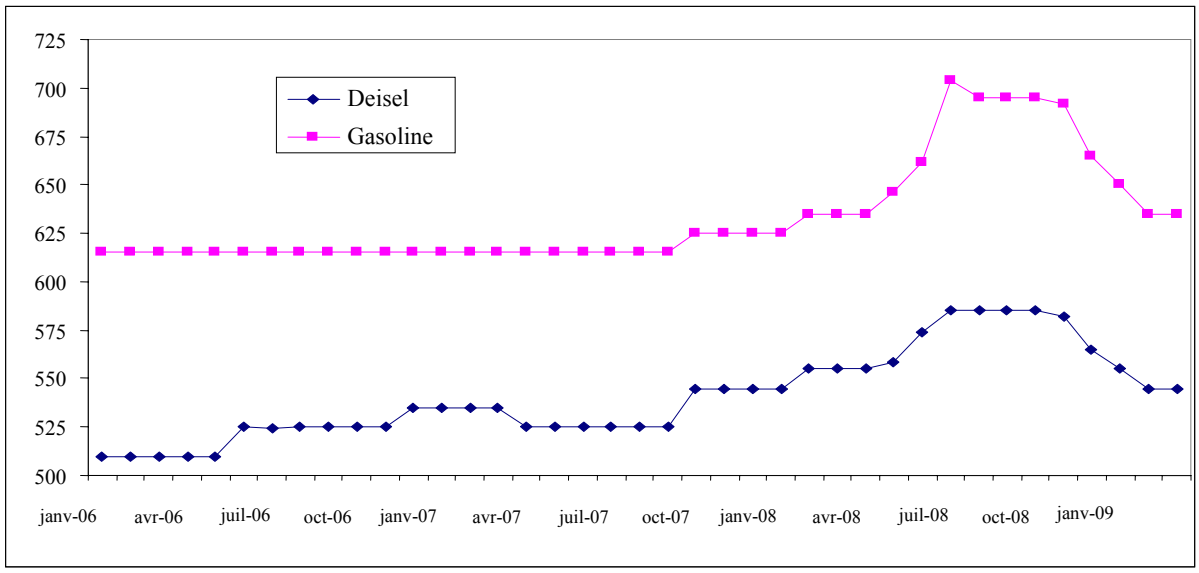
Figure 2: Change in the monthly harmonized index of consumer prices (HIPC) in Mali from 2006 to 2009



Source: DNSI.

More generally, the inflation rate, which was 1.5% in 2006 and 1.4% in 2007, rose to 9.1% in 2008. The increase in inflation resulted from price increases for hydrocarbons as well as food products, which are both imported by Mali. For example, the price of gasoline at the pump increased from 615 CFA francs per litre to 695 CFA between August 2006 and August 2008 (with a peak of 704 CFA in July 2008) while diesel rose from 525 to 585 CFA per litre (see figure below).

Figure 3: Change in pump prices of gasoline and deisel from 2006 to 2009 (CFA/litre)



Source: DNSI

From 2000 to 2008, Mali's real GDP at factor cost (which does not account for indirect taxes and subsidies) increased from 830 to 1459 billion CFA francs, indicating an average annual growth rate of 6.1% (compared to the 7% that would have been required to achieve Mali's poverty reduction objectives). The economy remains dominated by the primary sector, which accounts for an average of 39% of GDP, as opposed to 24% from the secondary sector and 37% from the tertiary sector. However, growth has been stronger in the tertiary sector (9.3%) than the secondary sector (5.1%) and the primary sector (4.0%) (see table below).

Table 1: Change in real GDP (billions of CFA and percentage)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	Annual average
Real GDP	830	928	960	1 138	1 157	1 228	1 317	1 368	1 459	1 154
Primary	42%	42%	39%	40%	38%	38%	37%	36%	38%	39%
Secondary	24%	26%	30%	23%	23%	24%	24%	22%	21%	24%
Tertiary	34%	32%	31%	37%	39%	38%	39%	42%	41%	37%
Growth	-2.8%	11.8%	3.4%	18.5%	1.7%	6.1%	7.2%	3.9%	6.7%	6.1%
Primary	-10.5%	11.4%	-3.3%	19.6%	-4.0%	6.5%	4.3%	2.5%	13.4%	4.0%
Secondary	4.7%	20.4%	19.0%	-8.7%	2.7%	8.5%	8.2%	-4.7%	-0.7%	5.1%
Tertiary	3.0%	6.1%	-0.3%	43.9%	7.1%	4.4%	9.5%	10.2%	4.9%	9.3%

Source: DNSI (2007) and Republic of Mali (2009).

Growth in the tertiary sector is mostly found in the transport and telecommunications subsectors, with telecommunications experiencing especially strong growth in recent years due to the introduction of mobile telephones. As for the secondary sector, the exploitation of gold drives growth thanks to mining laws that attract foreign direct investment and abundant gold resources. In the agricultural domain, the rice and other dry grain subsectors are the real locomotives of growth.

The current objective is to produce 10 million tonnes of grain by 2012 in order to satisfy local demand and to make Mali a net grain exporter, particularly of rice. It is expected that the Rice Initiative will attain 1 million tonnes of production of husked rice, providing 900 000 tonnes for local consumption and leaving 100 000 tonnes for export. For now, the country's exports (32% of GDP in 2008) are dominated by gold (582 billion CFA of exports in 2008), non-factor services, livestock and cotton products. The last of these has continued to decline, from 247 000 tonnes in 2007 to 190 000 tonnes in 2008, compared to 415 000 tonnes in 2006 and 534 000 tonnes in 2005.

Returning to the increase in prices, it should be said that it was accentuated by the weakness in stocks of grains and other food products. At the beginning of July 2008, total rice stocks were estimated at 91 000 tonnes, 46% of which was set aside in a number of storage depots in the country. Stocks of cooking oils were barely 1000 tonnes, while milk powder stocks only amounted to 800 tonnes (Republic of Mali, 2008a). Local cottonseed oil producers saw much less activity due to lower availability of cottonseed. The main producer (HUICOMA) experienced months of production delays despite numerous orders for oil and soap.

The data indicates that the food crisis brought about sizeable price increases (of more than 50%) for the main staples consumed and the main grains produced by the Malian population (Table 2). The geographical variations can be explained by the differing degree of food dependence in each region, particularly for imported products, as well as the differing shares of more rigid marketing/transport costs. This explains why Bamako, the capital, had the largest price increases for most products.

Table 2: Change in consumer and producer prices of food from August 2006 to August 2008 (percentage)

	Region								
	Kayes	**Koulikoro**	**Sikasso**	**Ségou**	**Mopti**	**Tombouctou**	**Gao**	**Kidal**	**Bamako**
Consumer price									
Rice	49	36	37	37	14	14	14	14	49
Millet/sorghum	24	17	21	21	17	17	17	17	24
Maize	33	17	34	34	33	33	33	33	33
Other grains	23	13	27	27	5	5	5	5	23
Beef	14	6	21	21	22	22	22	22	14
Chicken	56	17	20	20	30	30	30	30	56
Fish	7	21	32	32	-2	-2	-2	-2	7
Milk products	40	41	45	45	29	29	29	29	40
Oils	38	31	14	14	35	35	35	35	38
Fresh/dry fruit	6	3	27	27	37	37	37	37	6
Vegetables	16	3	10	10	26	26	26	26	16
Coffee/tea	12	34	4	4	67	67	67	67	12
Sugar	3	-1	17	17	20	20	20	20	3
Condiments	8	21	-21	-21	30	30	30	30	8
Drinks	4	7	0	0	23	23	23	23	4
Producer price									
Rice	30	30	25	30	30	30	30	30	30
Millet/sorghum	28	12	20	18	7	16	16	16	16
Maize	73	73	73	71	73	73	73	73	73

Source: Author's calculations from DNSI data (for the consumer price) and the OMA (for the producer price).

The extent to which these price variations affects the local populations rise with the share of their income that is dedicated to food consumption (Table 3). We also see that the consumption of inexpensive grains – millet, sorghum and maize – and total food consumption are highest in the poorest quintile.

Table 3: Budgetary share of principle staples and non-food consumption in Mali before the crisis (percentage of total expenditures)

	Population						
	Urban	**Rural**	**Bamako**	**Total**	**Quintile1**	**Quintile2**	**Quintile5**
Rice	10.9	10.6	8.9	10.7	6.9	10.0	11.1
Millet/sorghum	5.4	15.9	3.8	12.2	15.8	16.0	6.4
Maize	1.1	3.2	0.7	2.5	5.4	3.8	1.0
Other grains	4.1	2.8	4.5	3.3	2.3	3.4	3.8
Beef	5.5	3.4	4.9	4.2	2.3	3.5	5.2
Chicken	0.6	0.7	0.5	0.7	1.0	0.7	0.6
Fish	2.5	3.5	2.5	3.1	3.4	3.4	2.7
Milk products	2.2	2.3	1.9	2.2	1.5	2.1	2.5
Oils	3.2	4.8	2.4	4.3	5.0	4.5	2.9
Fresh/dry fruit	1.9	1.8	2.4	1.8	2.0	2.1	2.0
Vegetables/tubers	5.7	5.7	5.5	5.7	6.2	6.3	5.1
Coffee/tea	1.8	2.8	1.4	2.4	2.3	2.4	1.8
Sugar	3.5	4.5	2.7	4.1	5.2	4.3	3.1
Condiments	2.8	2.8	2.3	2.8	2.9	2.7	2.5
Drinks	0.6	0.7	0.2	0.7	0.9	0.8	0.6
Food (total)	51.8	65.5	44.6	60.7	63.1	66.0	51.3
Non-food	48.3	34.4	55.5	39.3	37.2	34.0	48.7

Notes: the quintiles are defined here based on total expenditures (food and non-food).
Source: Author's calculations from ELIM (2006).

2.3 Compensatory policies to address the crisis in West and Central Africa and in Mali

The policy responses to address the food crisis consisted of price stabilization measures and structural policies to stimulate domestic supply, as well as strengthening of the structures of grain management institutions as observed in Mali.

2.3.1 Price stabilization measures

Some governments in the region have tried to limit the impact of rising food prices by imposing price controls and/or granting subsidies (Benin, Burkina Faso, Cameroon, Congo, Niger and Senegal) and/or suspending/reducing import tariffs and/or the VAT on food (Benin, Burkina Faso, Cameroon, Niger, Mali, Sao Tomé and Principe, Senegal and Togo). Others, such as Burkina Faso, Guinea and Niger, have banned grain exports. This approach can stabilize internal prices but reduces supply and pushes prices higher in neighbouring import-dependent countries.

Eliminating taxes and engaging in subsidy programs are not financially sustainable in the long run. In the meantime, the governments of oil producing countries in the Gulf of Guinea have built up financial surpluses as a result of higher oil royalties receipts. Despite debt relief for the Heavily Indebted Poor Countries (HIPC) through the Multilateral Debt Relief Initiative (MDRI) that has benefited many countries in the region, nearly all low income countries are still facing substantial budget deficits, even with aid. The fiscal space to expand food subsidies is limited, except in the oil producing countries. Food subsidies have also been criticized as poorly targeted.

While traditional support mechanisms can also help limit to some degree the impacts of food price increases on the poor, these mechanisms have weakened in recent year without being replaced by formal social protection systems that reach the majority of the population. In most West and Central African countries, the state has rolled out social security systems that only cover workers in the formal sector and thus exclude 80-90% of the population, including nearly all of the poorest and most vulnerable households. Very few countries in the region, the exceptions being Cape Verde, Ghana, Sierra Leone and Nigeria, have begun to develop social protection programs that favour poor households; even these countries only have small pilot programs that reach a very limited number of those in extreme poverty.

The international and national context changed due to the surge in prices just as Mali was adopting its second Growth and Poverty Reduction Strategy Framework for the 2007-2011 period, which follows directly from the Ten-Year Action Plan (2006-2015) to achieve the MDGs. It was expected that rising food prices would have repercussions for the fight against poverty, with the risk that past accomplishments would be undone. In response, the government of Mali has set price targets, especially for basic necessities, and has made efforts to secure supplies for the population in order to address imbalances between supply and demand on food markets. Two key strategies were to lower prices and to strengthen food security among the most vulnerable groups. The second of these was pursued by increasing grain reserves through the Agricultural Products Office of Mali (OPAM) and encouraging productivity growth in domestic agriculture.

In terms of prices, the policy response consisted of eliminating import tariffs and taxes and turning to price controls for basic food staples. The use of this intervention mostly responds to three considerations (Republic of Mali, 2008b):

- The price level with respect to the 5-year average
- The level of stocks of the product, and whether shortages may be expected
- Market supply, and whether it seems to be functioning normally

The measures applied to three widely-consumed foods: rice, cooking oils and milk powder. These products were exempted from import customs and tariffs and were sold at wholesale and retail prices that were set in advance, with the possibility of putting a ceiling price on competing local goods in the future. Price controls were implemented for rice in an operation called “magasins témoins”, which supplied rice to retailers for 300 000 CFA per tonne on the condition of a sale price of 310 CFA/kg. At the same time, retailers were supplied with cooking oil for 162 970 CFA per 200 litres with a price ceiling of 815 CFA per litre, and supplied with milk at 72 970 CFA per 25kg bag with a retail price ceiling of 2 906 CFA per kg of milk powder.

To effectively apply the price policy, a follow-up plan was put into place, which included the National Directorate for Commerce and Competition (DNCC), the Chartered Management Centre (CGA) for the communes in the Bamako district and the Committee of Groups and Associations of Retailers (CAGCD) of Mali. The plan amounts to the DNCC monitoring cooking oil and milk powder stocks before any import operations.

For rice, exemptions applied to import tariffs and taxes as well as the VAT, exceptions being the 1% West African Economic and Monetary Union (WAEMU) community solidarity tax

(PCS), the 0.5% ECOWAS community tax and the 1% statistical tax, bringing the net tariff level from 14.48%[1] to 2.5%.

As opposed to 2007 when, because of Ramadan, exemptions were effective on rice from July to October, in 2008 this exemption went from April to September, i.e. a period of 6 months rather than the normal 4 month period, due to the skyrocketing prices. This affected two 10-digit tariff lines, namely cracked rice and white rice in packages larger than 5kg or in bulk (Republic of Mali, 2008c). The benefits were conditional to a wholesale price ceiling of 300 000 CFA per tonne and a retail price ceiling of 310 FCFA/kg, combined with a ban on re-exporting the product and a signed agreement with the DNCC (representing the state) to respect the specifications of the plan.

By July 21, 2008, 47 contracts had been signed for a total of 348 000 tonnes, of which 99 000 were to be imported, 88 000 of which were imported at a total estimated loss of 4 billion CFA (Republic of Mali, 2008b). Fifteen importers shared the rice market, with the four largest covering 72% of the market (GDCM, GGB, GMM and SOMAKOF).

As opposed to rice, the exemptions on cooking oil and milk were only in place from August to September, and were effective on all tariffs and taxes other than WAEMU's PCS tax and ECOWAS's PC taxes. Cooking oil was to be imported from WAEMU countries. Since there is internal free trade, the tax reduction was only effective on the VAT, since customs tariffs and statistical taxes are zero within the customs union.[2] The specifications of the plan kept three 10-digit tariff lines as eligible for possible exemption. These are refined peanut oil, refined cottonseed oil and refined palm oil (Republic of Mali, 2008d). For a simulation of 12 700 tonnes of imports, the tax losses were estimated at 1.58 billion CFA.

As for milk, the exemptions were applied to all goods in chapter 0402 with the exception of three 10-digit tariff lines as well as two other tariff lines for milk-based products which include plant materials. The simulation of 3600 imported tonnes of milk powder estimated tax losses of 2.88 billion CFA (Republic of Mali, 2008b).

2.3.2 Structural policies

Over and above the economic responses to the increase in food prices, the Malian state launched an initiative called the "Rice Initiative", which had the initial goal of increasing rice production in 2008-2009 to 1.6 million tonnes, a 50% increase with respect to 2007/08. Of this production, it was hoped that 90% will be traded on the domestic market with 10% remaining for exports. The strategy follows the general effort of "increasing productivity of different productive systems by agricultural intensification and developing agricultural fields and improving value added by putting efficient processing facilities into place" (Republic of Mali, 2008e). The planned actions are meant to act at the level of inputs (seeds, fertilizers and water), as well as the equipment for harvesting and transformation to be made available to producer groups.

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1 The CET (Coulibaly et al. 2007) on rice is obtained by :
$TEC = (DD + RS)(1 + TVA) + PCS + PC = (10\% + 1\%)(1 + 18\%) + 1\% + 0.5\% = 14.48\%$

2 $TPC = TVA + PCS + PC$

From an estimated budget of 42.65 billion CFA, the rice initiative is expected to allocate:

- 9.42 billion CFA in the form of fertilizer subsidies to bring the sale price of this input to 12 500 CFA per 50 kg bag
- 934.2 million for NERICA seed subsidies
- 32 million CFA to support the performance of the pumping station in the San-West plains
- 325 million CFA for agricultural support activities to purchase 200 motorcycles and recruit 102 support agents
- 701 million CFA to put at the disposal of rural credit organizations, through banks and the SFDs.

In order to ensure effective implementation of this initiative, an institutional monitoring and piloting framework was created within the agricultural ministry. It is comprised of a piloting and monitoring committee, a technical group, and regional coordination and monitoring committees. The missions and composition of each of these structures were specified, all with a view to periodically evaluate the state of progress of the agricultural program and to analyze and find solutions to problems that came up over the course of implementing the action plans.

Another important aspect of the public action plan to address soaring food commodity prices is the Malian Food Security Commission, created in May 2004 by the President of the Republic with the mission to develop and implement a national food security policy. Tto this end, this commission was charged with establishing and managing national food security stocks, as well as analyzing the food situation and identifying stricken or deficient regions.

Some of these interventions can be reinforced to respond precisely to the increase in food prices and its consequences on poverty and food insecurity, for example the establishment of grain banks (at the commune level) and small communal irrigated areas (Republic of Mali, 2008f).

All of these measures were undertaken in a context of increasingly restricted fiscal space as highlighted by Pereznieto and Diallo (2008, chapter 6).

3 LITERATURE REVIEW ON THE EFFECTS OF THE INCREASE IN FOOD PRICES ON POVERTY – RESULTS AND METHODOLOGY

Skyrocketing food commodity prices from 2006-2008 have led to an interest in their impacts on countries at the national level as well as at the level of households and individuals (IFPRI 2008a). This is the case for the short term as well as for the medium or long term. As reported in IFPRI (2007), net grain importing countries in the world (about four times more numerous than net exporting countries), being nearly all African countries, are most likely to be negatively affected by the increase in food prices (also see FAO, 2008; Aksoy and Isik-Dikmelik, 2008). The poverty gap will probably increase since the poor are, on average, net consumers (Poulton et al, 2006; FAO, 2008).

In particular, the effects at the national level can be seen in the impact on the balance of payments via changes in the terms of trade (see IMF, 2008), on fiscal balance due to lower tax receipts and increased expenditures on subsidies and social assistance programs, and on domestic goods markets principally in terms of the prices of internationally traded goods. The effects can also involve changes in the labour market due to upward pressure on wages, changes in the wage differential between tradable and non-tradable sectors, and local food staples markets as a consequence of the substitution effect.

At the household level, the changes in food prices can have direct and indirect detrimental effects on monetary poverty by reducing purchasing power and, consequently, real income. However, the impact mostly varies according to the types of households in the country: households that are net producers are likely to have improved welfare following the increase in food prices, while the opposite is true for net consumer households. Overall, it is likely that most of the vulnerable households are the rural poor and urban wage earners.

Finally, while a household as a whole may be negatively affected by price increases for food products, the impact may differ among household members due to subsequent changes in the intra-household distribution of power. Negative effects at the individual level may be observed in terms of educational achievement (Escobal et al, 2005) and nutrition or health status (Smith et al, 2006; Alderman et al, 2006; Pongou et al, 2005; Cornia and Deotti, 2008; FAO, 2008; Jensen and Miller, 2008). Children (and girls in particular) are the most at risk of being seriously affected by the increase in global food prices in the short term, and even more so in the long term (for a review of the various impacts see World Bank, 2008).

Most analysis on the effects of the food crisis has been focused on monetary poverty in the very short term, before the household has had a chance to adjust to the new prices. Deaton (1989) introduced the net benefit ratio, defined as the ratio between a household's net purchases of good *i* and total household expenditures, which he calls the short term elasticity of welfare with respect to the price of good *i*. The methodological approach proposed in most recent studies (Ivanic and Martin, 2008; Wodon and Zaman, 2008) on the effects of the increase in food prices on poverty follow Singh et al. (1986) and Deaton (1989, 1997) in terms of the following equation. The change in the household's welfare after a change in prices can be summarized as follows:

$$\Delta W_{c,h} = \Delta p_c \left[\left(\frac{FS_{c,h} - FD_{c,h}}{y_{ch}} \right) + \mu L_{c,h} \right] \qquad (1)$$

where $\Delta W_{c,h}$ is the change in welfare expressed in relation to the initial income or level of consumption for household h, Δp_c is the percentage price variation for food products, $FS_{c,h}$ is the total amount of food production sold on the market by household h, $FD_{c,h}$ is total food consumption by household h, $y_{c,h}$ is the income or total consumption of household h, μ is the elasticity of the wage level with respect to the price change for food products and $L_{c,h}$ is the share of labour in income or total household consumption. Most of the studies that adopt this approach also assume that own consumption is not affected by price changes.

After this calculation, the new aggregate welfare is obtained by adding $\Delta W_{c,h}$ to the initial welfare (before the price change). The new measures of poverty are then recalculated using the same poverty line. In this simple exercise, a negative value of $\Delta W_{c,h}$ corresponds to the transfer that the government would have to make to household *h* to ensure that its welfare is unaffected by the increase in prices.

However, most of these studies use the most simplified form of the above equation, without including labour market responses to changes in food prices, and adopt non parametric techniques (see Budd, 1993; Barrett and Dorosh, 1996).

Ivanic and Martin (2008) found that for nine developing countries across the world, increased prices generally have a negative impact on poverty. Vietnam and Peru are exceptions, since rural households' welfare improved enough, on average, to compensate for the negative effects that higher prices had on poor urban households' welfare. Specifically, the estimated average effects of increasing food prices between 2005 and 2007 was a 2.7 percentage point increase in the poverty rate (with 1 US dollar per day defined as the poverty line), and a 3 percentage point increase when the unskilled workers' wage responses to the price increases are excluded. Their results for the resulting change in poverty differ strongly between products and countries (for more details, also see IFPRI (2008b) on the per capita impacts on expenditures by quintile; for the effects depending on whether or not the household owns any plots of land, see FAO, 2008). On average, the effects are obviously much stronger for urban households, where agricultural activities are less prevalent. All the same, for most countries, even rural households are not sheltered from the price increases which, with the exception of meat prices, contribute to higher poverty rates. The authors simulated a 10% increase in the price of certain food products under different scenarios and found that, on average, the rise in poverty rates (measured both in terms of the headcount index and poverty gap) mostly result from higher wheat prices, followed by the effects of rice, milk and corn prices.

Wodon et al (2008) applied the methodology described above to 12 sub-Saharan countries. Their simulation of a 50% increase in food product prices predicts increases in the poverty headcount index ranging from 1.8 percentage points in Ghana to 9.6 percentage points in Senegal. The authors also found that the increase in poverty in many countries was largest in the urban area, with the exceptions of Ghana, Senegal and Liberia. The most strongly negative effects were observed in areas that initially had average levels of poverty in their respective countries (in the 30% to 60% percentile of poverty rates among regions). On average, they find that a 50% increase in the price of some goods leads to a 4.4 percentage point increase in the headcount index across the region when only considering consumers, while it causes a 2.5 percentage point decline when considering the combined effects on producers and consumers (a complete transmission of the price changes to both consumers and producers is supposed here).

As shown by Ravallion for Bangladesh and India (1990 and 2000), distinguishing between the short term and the long term suggests different results. As such, while an increase in the relative price of food products leads to more poverty in the short term, it seems that in the long term adjustments in the wage rate compensate for the negative effects. However, other authors have found results that show otherwise for a number of African countries (Christiansen and Demery, 2006).

In terms of the macroeconomic context in Mali, the IMF (2008) estimated that higher food prices result in an increase in import value of 0.6% of GDP, with a corresponding figure for the effects of rising oil prices of 2.9% of GDP. Tax exemptions on rice are expected to have reduced tax receipts by 0.3% of GDP, while the corresponding figure for petroleum products is 1.5% of GDP. More specifically for this study, Joseph and Wodon (2008), like many of the studies cited above, evaluated the potential impacts of the increase in grain prices on poverty in the short term, without considering elasticity of demand, which may compensate for some of the negative effects of the price increase. The authors focused their analysis on specific grains because they account for a large portion of total consumption. Specifically, the budgetary share for rice is higher in middle income households, while millet and sorghum are the grains most consumed by the poorest deciles. On the production side, about 40% of Malian households produce rice and 50% produce millet and sorghum. The producers are most likely to belong to the poorest quintiles – especially for millet and sorghum – with the major difference that rice is largely produced for sale while millet and sorghum are produced for own consumption. Combining the producer and consumer sides, the effect of a 25% increase in prices is a 1.7 percentage point increase in the headcount index (compared to 2.5 points when only consumers are affected by the change in price), which goes from 47.5 to 49.2%. The impact is substantially larger in urban areas (3 percentage point increase, as opposed to 1.2 points in rural areas). Finally, the increase in the price of rice has the most strongly negative effects on poverty, while an increase in the price of wheat reduces poverty.

4 POLICY RESPONSES TO THE FOOD CRISIS

This study focuses on the impacts of the food crisis on child poverty, going beyond monetary poverty to include dimensions such as nutrition, school participation and access to health services.[3] While certain interventions, particularly cash transfers to the poorest, can simultaneously act on all dimensions of poverty, other interventions such as free schooling or nutritional programs target specific dimensions of child poverty.

This section outlines some of the main policies that the Malian government could consider to limit the impacts of the increase in food prices on child poverty in Mali. A complete review of the policies actually adopted in Mali in response to the food crisis was carried out by Coulibaly et al (2007) and the policies relating to children's welfare are detailed in a number of other documents (for example, Pereznieto and Diallo, 2008; Wodon and Zaman, 2008). The types of policies adopted by developing countries to address the food crisis can be brought together into four main groups:

- **Adjustment of economic prices**: tax reductions (customs tariffs, VAT, sales taxes, etc.), price controls, consumer subsidies
- **Local food supply**: export restrictions, stock adjustments, producer supports
- **Safety nets**: cash transfers (conditional or not), public works programs, subsidies targeting consumers, food rations/assistance, traditional support mechanisms
- **Safety nets targeting children**: cash transfers directly targeting children, school feeding programs, nutrition programs for children under the age of 5.

[3] Including: prenatal care, presence of health professionals at child birth and access to health services in case of illness.

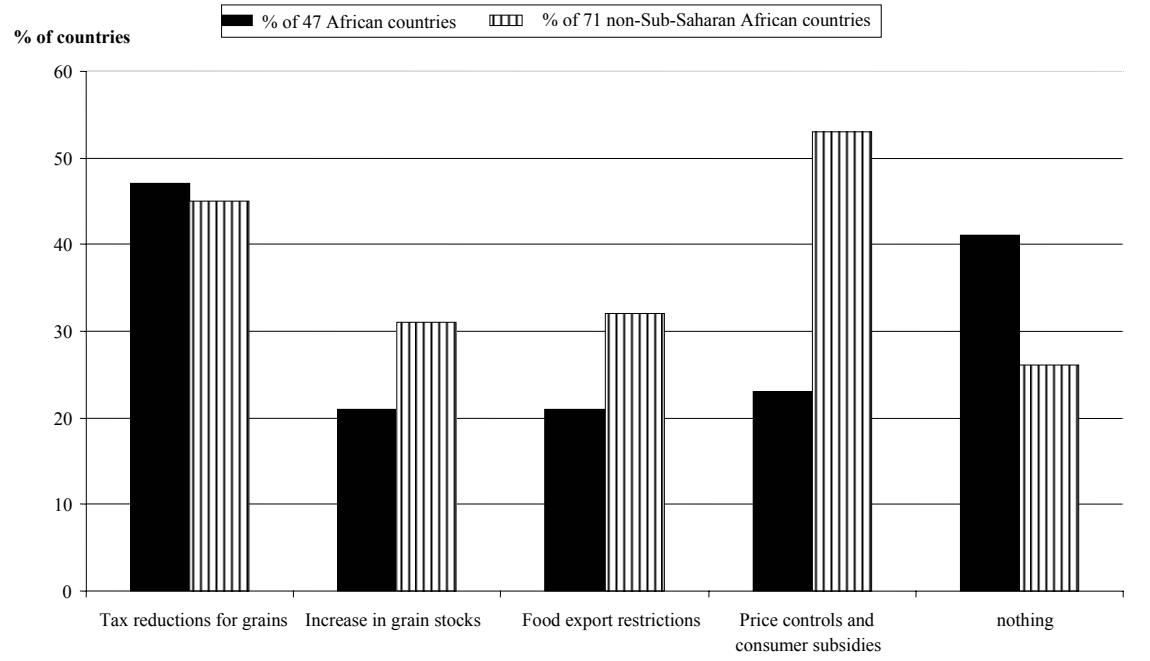
4.1 Adjustments of economic prices

The food crisis is an increase in the general level of food prices. It is quite natural to think of policy responses that act against this phenomenon by directly reducing these prices. A few examples are reductions of indirect taxes or import tariffs or introducing price controls or even consumer subsidies for food products. According to Wodon and Zaman (2008; also see the figure below):

"A recent paper based on a survey of 118 country teams and country economists carried out by the World Bank in March 2008 shows that in sub-Saharan Africa, the most common policy response was to reduce food grain tariffs – either tariffs, VAT, other sales tax or a combination of these measures (Revenga et al. 2008). On the other hand, the most common response outside sub-Saharan Africa was some form of consumer subsidy or price control, which over half of countries outside of sub-Saharan Africa used to stabilize domestic prices … However, only 22% of sub-Saharan African countries used some form of price control."

It should be noted that these policies do not necessarily need to target the staples specifically affected by the food crisis if the objective is to ensure appropriate nutrition: it would be preferable to target other staples that have similar or better nutritional properties that are available at a lower price.

Figure 4: Food price policies among countries in Africa and outside Africa



Source: Wodon and Zaman (2008).

These types of policies are relatively transparent and directly address the problem of higher food prices. However, they present a number of drawbacks in the specific case of Mali. First, with the exception of price controls, they are costly, particularly in consideration of fiscal constraints in Mali. Furthermore, they do not effectively target the poor. The World Bank (1999) shows that with inadequate targeting […], those in the highest income groups benefit more in absolute terms than the poor because the rich tend to consume greater quantities of

subsidized goods.[4] That having been said, it makes sense for these subsidies to target the poor directly or to target them indirectly, either by focusing on regions with the highest poverty rates[5] or by targeting goods that are most heavily consumed by the poor (self-selection) as will be discussed in section 6.3. Also, unlike consumer subsidies or reductions in indirect taxes, import taxes and price controls can have negative effects on local producers, preventing them from fully benefiting from higher international prices. This can, in turn, reduce the local supply response to increasing food prices, an issue that will be explored in the following section. By artificially maintaining low prices, price controls can also lead to shortages, with domestic demand exceeding domestic supply. Finally, it is not necessarily the case that price reductions generated by these policies will entirely benefit the final consumer. Intermediaries may also reap a substantial share of these benefits.

4.2 Local food supply

Another popular group of public intervention that can be used to address a food crisis aim to increase domestic supply in order to lower prices on local markets. Indeed, there are a number of government policies that can affect domestic food supply. Here, the emphasis is on the most popular among these: food export restrictions, adjustments in food stocks and local producer support.

The idea behind restricting food exports is to keep food products in the country during the period of crisis in the hope of relieving some of the demand pressures. According to a study carried out by Revenga et al (2008), export restrictions were somewhat less common outside sub-Saharan Africa (28% of countries) in comparison with Africa (21% of countries). This is probably due to the initially limited level of these exports compared to many Asian and Latin American countries. Another way to improve domestic food supply is to use food stocks, although most African countries have limited interest in this approach.

These supply-side policies share the same drawbacks as price policies. By lowering domestic prices, they deprive local producers of some of the benefits of higher international prices. The extent to which these lower producer prices are transmitted to final consumers or instead increase the profits accruing to intermediaries, is also unclear. They also share the same targeting problems as price policies.

A long term policy to increase domestic supply is to provide direct support to local producers. This has the advantage of improving the income of producers who are often among the most poor. These policies, which have long existed in some form or another in most African countries, are diverse, ranging from training in the best production methods, technologies and crops, to subsidizing inputs (fertilizers, seeds, stocks), extensive agricultural systems or research. While they have the objective of stimulating an agricultural supply response –

[4] In Yemen, for example, the wealthiest decile spends 10 times more than the poorest decile on subsidized wheat and flour. Similar targeting problems are reported in South Africa (Alderman and Lindert, 1998) and in Indonesia (Pitt, 1985) and, for example, most poor countries where the elasticity of the subsidies benefits wealthy households more than poor households, which are often disconnected from national markets (Alderman, 2002). In their review of 15 universal food subsidy programs, Coady et al. (2002) only found 3 to be progressive.

[5] "In many countries, given large differences in consumption and nutrition levels between regions, geographic targeting could be used to improve the likely impact that aid will have." (Wodon and Zaman 2008)

Wodon and Zaman (2008) note "an 8% increase in rice production in sub-Saharan Africa in 2007/08" – these policies generally take time and may not be appropriate for addressing an immediate crisis. Also, since internal prices are linked to international prices and intermediaries operate in imperfect markets, it is not clear whether or not increased domestic supply translates into substantial price reductions for consumers. Again, these policies are not targeted to provide relief for the poorest segments of the population.

4.3 Safety nets

The third group of policies – social safety nets – have a much greater potential to adequately target the poor. Social safety nets include a wide variety of interventions: social security, cash transfers (conditional or otherwise), public works programs, consumer price subsidies, micro-finance programs and traditional support mechanisms.

Formal social security is not widespread in Africa and is generally restricted to the formal labor market, which excludes a significant majority of the poor. Fiscal constraints and administrative costs probably render such a policy unsuitable for Mali. Cash transfers, whether they are conditional or not, are the most popular tool to target the poor. They depend, however, on the existence of verifiable data about the target population and require a certain level of administrative capacity to compile and update detailed data on household characteristics. This is the type of policy with the greatest potential to effectively target the poor. Targeted food price subsidies are similar. Such subsidies can target the poorest regions, the food products that are most intensively consumed by the poor or according to other common characteristics of the poor that are easily observable (such as number of children, sector of activity, etc). Public works programs – money or food for work – are characterized by self-targeting.[6]

Micro-finance and other credit programs can help address short term liquidity constraints faced by the poor when food price increases are of short duration.[7] However, the extreme poor are often not able to take full advantage of micro-credit. In general, the coverage of such safety nets remains limited.[8] According to Pereznieto and Diallo (2008, p.39), total spending on social protection systems is about 0.1% of GDP in sub-Saharan Africa. In Mali's case, they observe (p.44) that "What is striking is the very low allocation to 'other social sectors' which include social protection, social assistance, social action and resources for the

[6] According to Wodon and Zaman (2008) "The implicit assumption is that such programs are relatively well self-targeted to the poor because they typically provide low wages so that only the poor are interested in participating in them, and that they provide direct cash or in-kind benefits for program participants that may help in reducing the negative impact of higher food prices".

[7] In the case of the food crisis' impact on women's poverty, while the same arguments can be applied as for the population as a whole, Quisumbing (2008, p.4) states that "Improved credit services could buffer consumption shocks, help women retain or reclaim their assets, increase farm productivity, boost women's empowerment, and reduce poverty. Credit packages designed to meet women's needs could feature group lending (as a substitute for other collateral) with graduation to individual liability, varying interest rates and loan maturity periods, and protected opportunities to save."

[8] According to Wodon and Zaman (2008) "sub-Saharan African countries have a significantly larger share of food based safety net programs relative to non-African countries – school feeding, food for work and food ration programs. However, while many countries in sub-Saharan Africa have food-based transfer programs, the coverage of these programs tends to be very limited (in part due to lack of financing), so that the programs also have a limited impact".

protection of women and children ". According to Pereznieto and Diallo (2008), traditional support mechanisms also play an important role.

"Similarly, an analysis of transfers received by poor and non-poor households shows that the latter receive a larger share of private transfers than non-poor; the opposite is true with private transfers. This would suggest that, currently, informal transfers are providing a greater safety net for poor and vulnerable households than those coming from the government" (p.37).

They also highlight that "Remittances are also an important social protection mechanism in Mali, with officially recorded remittances having reached 3.1% of GDP in 2006 " (p.37).

Box 1: Targeting

It is common practice in the literature to describe the efficiency and equity of the targeting of redistributive policies primarily using two types of indicators. These are linked to the presence of *Type* I and *Type* II errors. Type I errors refer to accidental exclusion, i.e. when less fortunate households are excluded from the redistribution program. Type II errors refer to inclusion errors. They are found in cases where benefits are destined to better off households that should not be eligible for the program.[9]

To measure the size of these errors, leakage and undercoverage rates are often calculated. The leakage rate is typically defined as the proportion of total transfers going to those who should not be eligible. Definitions of undercoverage vary, but are usually linked to the ratio of the number of beneficiaries effectively targeted with respect to the total number of people in that group (for example, the poorest quintile).

Cornia and Stewart (1995) calculated the magnitude of these errors in food subsidy programs for a number of developing countries. They found that food subsidies generally had a very low exclusion rate, but since consumer subsidies (CS) are universally available, the leakage is high. They are significantly worse for urban populations than rural populations, mostly because more affluent people are found in urban areas.

When looking at leakage by product, they observe considerable variation depending on the product, with very high leakage for milk (more than 90%) and smaller leakage for durum wheat than for other goods.

They conclude that leakage can be significantly reduced while minimizing undercoverage by concentrating the subsidy on products that are primarily consumed by the poor. The only issue with this procedure – which could also save administrative costs – is whether it would be a politically viable option. Political support for subsidies is strong, as indicated by the food riots in the 1980s following proposals for their abolition.

[9] It is usually acknowledged that inclusion errors reduce the vertical redistribution for these programs – by failing to correctly distinguish between the eligible and non eligible – and that exclusion errors lead to horizontal inequality, since these errors discriminate between individuals with equal income.

Box 1 (continued): Targeting

However, the leakage and undercoverage rates are clearly incomplete indicators of the distributive effects of social programs. The leakage rate, for example, does not differentiate between accidental inclusion of ineligible households who are just above the income of the target group and inclusion of those who are well above this poverty line. As for the undercoverage rate, it assigns the same weight to excluded eligible households who are just below the income cut off and those who are well below it. Furthermore, these ratios only count the number of households that obtain the transfer and not the amount of the transfer to each household. This approach would always judge a CS policy as having better coverage regardless of the absolute benefit for poor households. A typical example occurs with regional targeting schemes that target inhabitants in the poorest region and exclude wealthier regions. Such a program of regional targeting can do more to reduce poverty than the CS, even though the poor in wealthy regions are excluded.[10] As sensibly pointed out by Ravallion and Datt (1995), "a policy's capacity to concentrate the benefits on a given group in the population should not be confounded with its impacts on the poverty and social welfare; the first is just a determinant of the second" (p.415).

An alternative approach for evaluating the distributive effects of social policies can be seen as an attempt to incorporate the size of the transfers and household budgets explicitly into the analysis in that the levels of the transfers may be differentiated by households with different income levels. Rather than asking to what extent the program effectively identifies the target group (for example, the poor), it asks how much does it improve social welfare, as portrayed by measures of inequality and poverty.

In the case of social assistance mechanisms in Mali, Pereznieto and Diallo (2008, p.34) find that "In principle, these benefits are destined to the poorest of the poor, but the weak selection criteria, the process of bringing the poor into the system and the scope of human subjectivism in the designation of beneficiaries bring up important question about the efficiency, effectiveness and transparency of social assistance programs" (p.34).

4.4 Safety nets targeting children

Given this study's interest in the food crisis' impacts on child poverty, a special emphasis will now be placed on policies that target children. In Mali's case, Pereznieto and Diallo deplore "the dearth of child-focused social protection interventions and of major social protection programmes of which children are direct or indirect beneficiaries" (p. 49).

The most obvious of these programs are policies that directly address the food crisis by ensuring that children have access to an adequate supply of healthy food. School feeding programs are a way to simultaneously address the lack of food and financial pressures that may lead households to pull their children out of school. Pereznieto and Diallo (2008, p. 36) note that: "The government has said it will start piloting school feeding programmes in areas with high malnutrition rates, complementing WFP's approach". The policy has the advantage of being relatively easy to administer and guarantees that food requirements are directly

[10] More details can be found in Coady et al. (2004) and in Bibi and Duclos (2007a).

addressed, as opposed to policies that change the economic prices or domestic food supply measures whose effects are transmitted imperfectly to consumers. However, this policy omits children who are too young to go to school and for whom adequate nutrition is crucial. Nutrition programs for those under the age of 5 and preventative initiatives such as nutrition programs that offer micronutrient complements and food destined to vulnerable groups (pregnant women, the handicapped and people living with HIV/AIDS) have been generally adopted.

Improved access to basic social services (such as primary school, maternal and infant health care, etc.) through which, among other things, the costs of implementing an assistance policy may be reduced, can play a major role in protection poor children from most of the damaging effects of the food crisis. However, analysis of this question is beyond the scope of the present study.

5 METHODOLOGY

The methodology followed in this study is presented in detail in Appendix A. To summarize, the analysis aims to capture the effects of the food crisis and possible policy responses on various aspects of child poverty: food poverty, caloric insufficiency, school participation, child labour and access to health services.

The increase in food prices is observed directly through data from the Agricultural Markets Observer (OMA, for production prices) and from the National Institute of Statistics (DNSI, for consumer prices). These data include prices for each major product consumed or produced by households for each region in Mali. The price changes observed between August 2006 (before the crisis) and August 2008 (during the crisis) have been used to avoid issues of seasonal price fluctuations. In the absence of price observations for some products in some regions, price changes in the neighbouring region are used.

The impact of the price increases on the nominal income of households that sell these products and on the cost of living are considered in each region. On the production side, the volume of sales is presumed unchanged by the crisis while the value of these sales simply increases proportionately to the price increase for each product. This underestimates the impact somewhat, given recently observed increases in the volume of sales in Mali in response to higher prices. Higher input costs, which counteract to some extent the increase in the value of sales, are also accounted for.

On the consumption side, changes in the consumption of each main food item facing price variations, changes in prices of other food products and changes in nominal household income are all considered. This is accomplished by estimating an econometric model of the complete demand system based on survey data from Malian households in 2006 (ELIM 2006). The consumption analyzed includes purchased food products as well as own consumption (goods that are both produced and consumed by the household). The demand system is then used to predict household adjustments in the quantity of consumption of each item following the observed price increases and the different policy scenarios that are analyzed. Re-evaluating these consumption quantities at the new prices yields the value of food expenditures under the different scenarios.

The value of food expenses before the crisis is subtracted from the predicted value of food consumption after simulating the price increase in order to obtain the real income loss associated with the food crisis for each individual. All prices are calculated in 2008 dollars. The poverty line (by region and separately for both urban and rural areas) adopted is the one constructed for Mali by the World Bank (2007).

The analysis concerns food poverty rather than total poverty, given the nature of the (food) crisis analyzed. Food poverty is measured by comparing each individual's real food expenses to the expenditures required to satisfy their caloric requirements – which we call the food poverty line – using a typical consumption basket. In contrast, total poverty is determined by comparing an individual's total expenses with a total poverty line, which is generally estimated as the food poverty line plus some fixed percentage deemed necessary to satisfy non food needs. In both cases, an individual is identified as poor if their expenses are under the poverty line in question. The headcount index is a measure of the incidence of poverty that indicates the percentage of the population that is poor, while the poverty gap measures the average deviation between actual expenses and the poverty line. Finally, to capture the distribution of expenditures among the poor, we can measure the severity of poverty as the average squared deviation from the poverty line.

A nutritional table (Barikmo et al, 2004) indicates the caloric contribution of the principal Malian staples, which can be used to calculate caloric consumption before and after the crisis for each individual. This calculation is done assuming that the staples are allocated equitably (according to caloric needs) between household members. This could turn out to be a strong assumption if there is discrimination, whether positive or negative, based on age or sex.

To uncover the impact of the crisis and policy reactions on children's participation in the labour market and at school, an econometric model of this simultaneous choice is estimated. This model accounts for other characteristics of the child, their household, the head of their household and their community, that influence this choice. It is the impact on real income that matters the most for predicting how households at risk adjust to the crisis.

Similarly, estimating an econometric model of the decision to consult health services when a child is sick – and of which type of health services is chosen – allows us to analyze the impacts that changes in real income have at this level. The model can then be used to analyse the impact on these decisions of the predicted change in real income resulting from the food crisis and policy responses.

A number of policy responses to the food crisis are analyzed:

- Cash transfers to all individuals identified as poor ("All")
- Cash transfers to all individuals identified as being among the poorest 20% of the population, i.e., the first two deciles in terms of food expenses per adult equivalent ("20%")
- Cash transfers to all children aged 0-14 who are identified as poor ("0-14")
- Cash transfers to all children aged 0-5 who are identified as poor ("0-5")
- Cash transfers to all children aged 6-10 who are identified as poor ("6-10")

- Cash transfers to all children aged 11-14 who are identified as poor ("11-14")
- Current policy: consumption subsidies and tariff exemptions for rice (2%), powdered milk (13.6%) and cooking oils (4.4%) ("current")[11]
- School feeding program: meals provided to all primary school children identified as poor ("feeding programs"). This policy does not precisely correspond to the policy in place in Mali, which targets all children in schools in poor regions rather than individuals identified as poor across the country.

The size of the cash transfer is equal to the average estimated loss of real income among the poor as a result of the crisis. This cash transfer is calculated and applied separately for each region and area (rural or urban). For cash transfers that target children, two alternative assumptions are adopted. According to the first, the cash transfers are not shared with other family members. In this case, the impacts on the children are identical to those in the first simulation ("All") where all the members of the household receive the cash transfer. According to the second hypothesis, the cash transfer targeting the child is actually shared equitably (according to caloric needs) within the household.

A major challenge in applying these different policies involves correctly identifying and targeting poor individuals. In the absence of reliable data on income or expenditures across the Malian population, the government is required to predict their status using a number of sociodemographic characteristics that can be easily observed. To do this, we estimate the relation between these characteristics and the food expenditures (per adult equivalent) observed in the households covered by the ELIM 2006 survey (Table 20 in the appendix). The estimated relationship is then used to predict food expenditures (and therefore the food poverty status) across the population or among those who requested support. In order to test how well this method performs, it is possible to use the ELIM 2006 household survey to predict the status of all individuals according to their observed food expenditures, which allows us to determine the targeting errors resulting from the prediction model. These errors come in the form of undercoverage (poor individuals excluded because they were predicted as non-poor) and leakage (non poor individuals included because they were predicted as poor).

In order to analyze the impacts of each of the scenarios presented above, we use the same procedures that were used to analyze the impact of the food crisis. The governments' costs are estimated for each scenario excluding administrative costs (i.e., the costs involved in identifying the beneficiaries, carrying out the cash transfers, etc.). These costs therefore only correspond to the total amount of cash transfers allocated or, in the case of the current policy, the cost of subsidies/exemptions provided.

6 EMPIRICAL RESULTS

The impact of different policies on child food poverty, caloric insufficiency, school participation and child labour, as well as access to health services, are each studied. In order to effectively compare the different polices, it is first necessary to have an idea of their respective costs, which we explore in the following section.

[11] We do not treat the price stabilization measures or structural policies such as the Rice Initiative here.

6.1 Policy costs

The costs of interventions vary from 7.1 to 86.3 billion CFA francs, amounting to 0.2 to 2.6 percent of Mali's GDP (Table 4). Targeting all poor individuals ("All") is by far the most expensive intervention. Limiting the intervention to the poorest 20% of the population reduces costs dramatically, by 86%. These savings can be explained in part by the fact that the poorest 20% represent half of all the poor (39.6% of Mali's population is poor, as seen in Table 6), but mostly because targeting the poorest is much less precise such that the majority of the 20% poorest are erroneously excluded (Table 5).

It turns out that when all poor individuals are targeted, 25.8% of the poor are erroneously excluded (predicted as non poor), while 35.4% of the non poor are erroneously included (predicted as poor). Overall, 54.6% of the national population benefits from these cash transfers. However, when targeting the poorest 20%, only 8.2% of the population that benefit from these cash transfers, as more than three-quarters (77.7%) of eligible individuals are erroneously excluded. As such, the savings come at the cost of dramatic undercoverage. These targeting problems can be explained by the difficulties encountered in distinguishing the poorest 20% of the Malian population from the rest of the poor based on their easily observable characteristics. Table 3, for example, shows that the food habits of the poorest 20% (the first quintile) are very similar to those of the second quintile, who are also included among the poor.

Table 4: Costs of intervention policies under different scenarios

	Cost		
	in billions of CFA	**in % GDP**	**in % of budgetary receipts**
Scenario			
All	86.3	2.2%	16.0%
20%	12.5	0.3%	2.3%
0-14	43.4	1.1%	8.0%
0-5	18.7	0.5%	3.5%
6-10	15.3	0.4%	2.8%
11-14	9.4	0.2%	1.7%
Current	8.5	0.2%	1.6%
School feeding	7.1	0.2%	1.3%

Source: Authors' calculations from ELIM 2006.

The targeting errors are costly even when all of the poor are targeted. By excluding more than a quarter of the poor population, the impact of any intervention is substantially blunted. Furthermore, including 35.4% of the non poor amounts to a large additional intervention cost that has no impacts on food poverty. Obviously, it would be desirable to minimize these errors without having to go to the astronomical effort and expense of collecting annual income (or expenditure) data for the entire Malian population. At the same time, in order to be administratively feasible it is important that the targeting mechanism rely on a limited number of variables that are easily observable but difficult to falsify. In this context, there will always be targeting errors. It may be of some consolation that the poor who are excluded

tend to be the less extreme cases (and are therefore more easily mistaken as non poor), while the non poor who are mistakenly included tend to be the poorest of the non poor.[12]

When only targeting poor children ("0-14"), the costs are half of what they are (at 43.4 billion CFA) when targeting all poor, children and adults. These savings reflect the fact that children represent half of the poor population in Mali. Similarly, targeting by age group yields costs in proportion to the group's respective share of the poor population. Since children aged 0-5 are more numerous than those aged 6-10 (the mortality rate for children aged 0-5 is very high in Mali), the costs for targeting this younger age group are higher. Targeting the group aged 11-14 is even cheaper for the same reasons, as well as the obvious fact that this group only covers four years. The current policy – which consists of consumption subsidies and reduced import tariffs for rice, milk powder and cooking oils – generates benefits for the entire population and costs somewhat less than targeting 11-14 year olds.

Table 5: Targeting performance (in percentage)

	Target population			
	All poor		**Poorest 20% of the population**	
Predicted status	**Non poor**	**Poor**	**Non poor**	**Poor**
Real status				
		NATIONAL		
Non poor	64.6	35.4	95.4	4.7
Poor	25.8	74.2	77.7	22.3
Total	**45.4**	**54.6**	**91.8**	**8.2**
		URBAN		
Non poor	91.0	9.0	98.9	1.1
Poor	53.4	46.6	76.4	23.6
Total	**79.7**	**20.3**	**96.9**	**3.1**
		RURAL		
Non poor	43.9	56.1	93.3	6.7
Poor	19.3	80.7	77.9	22.1
Total	**29.5**	**70.5**	**89.5**	**10.5**

Source: Authors' calculations from ELIM 2006.

Extending the current school feeding program policy – which is provided to all children (regardless of whether or not they are poor) in selected schools in the poorest regions in Mali – to instead target all primary school students that are predicted as poor has the lowest cost of all the scenarios studied. Indeed, this intervention is only aimed at children aged 6-10 who go to primary school.

6.2 Food poverty

Food poverty is a measure of monetary poverty that focuses entirely on food expenditures, which are compared to a food poverty line. This poverty line is defined as the necessary level of expenditures to satisfy an individual's caloric needs when adopting the typical diet in the population. It is distinguished from total poverty, a more commonly used indicator of monetary poverty, which includes non-food expenditures. The decision to focus on food

[12] For example, the median value of food expenditures among the excluded poor is 15% higher than the poor who were correctly identified.

poverty is based on the fact that we are analysing a food crisis and on the importance of food consumption for children. As such, the food poverty rate presented in this study does not correspond to the total poverty rate for Mali that is generally reported in the media.

6.2.1 Initial situation (2006)

In 2006, before the price increase for food products, the incidence of food poverty among Malian children – i.e., the percentage of children who were poor – was 41.5% (Table 6). While approximately half of rural children suffer from food poverty (48.1%), this figure was as low as a quarter of all children in urban areas. Substantial regional gaps are also noted, from 6.7% in Kidal and 13.5% in Bamako, to 63.4% in Sikasso and 44.6% in Koulikoro. There is more food poverty in male-headed households, at 42.1%, compared to 30.5% among children living in female-headed households. The child food poverty rate also increases with the number of children in the household, exceeding 50% in households with seven or more children.

Table 6: Child food poverty (0-14 years) before and after the food crisis with policy simulations

	Portion of the population*		Headcount index					Poverty Gap					Severity				
		Before	After	All	20%	0-14	Current	Before	After	All	20%	0-14	Before	After	All	20%	0-14
	Percentage (%)	%	Change in percentage points					%	Change in percentage points				%	Change in percentage points			
Total		41.5	10.3	6.8	10.1	7.8	10.0	14.1	4.9	1.7	4.3	2.7	6.8	2.9	0.4	2.3	1.1
Area																	
Urban	*29.0*	25.3	7.5	6.3	7.2	6.7	6.9	7.5	2.5	1.6	2.3	1.8	3.5	1.2	0.5	1.0	0.7
Rural	*71.0*	48.1	11.4	7.0	11.2	8.2	11.3	16.7	5.9	1.8	5.1	3.0	8.1	3.5	0.3	2.8	1.2
Region																	
Kayes	*13.0*	40.8	13.9	7.0	13.1	8.4	13.5	12.8	6.0	2.0	5.7	3.1	5.3	3.5	0.8	3.3	1.5
Koulikoro	*16.5*	44.6	10.7	5.7	10.7	6.7	10.5	15.4	5.0	1.2	4.8	2.3	7.3	3.1	0.1	2.9	1.0
Sikasso	*18.9*	63.4	11.3	8.2	10.7	9.4	11.4	25.9	6.9	1.4	4.3	3.0	14.2	4.5	-0.4	1.9	1.1
Ségou	*18.0*	37.0	10.8	7.0	10.8	9.0	10.6	12.1	4.8	1.4	4.6	2.4	5.5	2.7	0.3	2.6	0.9
Mopti	*16.4*	37.9	10.0	8.3	10.0	8.3	9.5	10.5	4.5	2.6	4.4	3.2	4.6	2.3	0.8	2.1	1.3
Tombouctou	*4.1*	38.2	5.4	4.5	5.4	4.7	3.9	12.0	3.4	2.9	3.4	3.0	5.4	1.9	1.5	1.9	1.6
Gao	*4.3*	29.0	11.5	9.5	11.5	9.5	11.5	5.7	4.0	3.2	4.0	3.3	1.7	1.4	1.0	1.4	1.0
Kidal	*0.5*	6.7	10.3	10.3	10.3	10.3	10.3	0.9	1.2	1.2	1.2	1.2	0.3	0.3	0.3	0.3	0.3
Bamako	*8.3*	13.5	2.5	1.8	2.5	2.3	2.3	3.9	1.0	0.8	1.0	0.8	1.8	0.5	0.3	0.5	0.4
Sex of head																	
Male	*95.0*	42.1	10.3	6.7	10.0	7.7	10.0	14.4	5.0	1.7	4.4	2.7	6.9	2.9	0.4	2.3	1.1
Female	*5.0*	30.5	10.4	9.5	10.4	9.5	10.4	8.5	3.5	1.9	3.3	2.4	3.7	1.5	0.5	1.4	0.8
Number of children																	
1	*1.8*	13.2	5.8	5.4	5.8	5.6	5.7	3.7	1.8	1.5	1.8	1.7	1.6	0.8	0.6	0.8	0.7
2	*5.1*	16.7	8.2	6.3	8.2	8.0	8.1	5.1	1.7	0.9	1.7	1.3	2.3	0.7	0.2	0.7	0.4
3	*9.4*	24.8	5.9	4.6	5.9	4.7	5.9	7.2	2.8	1.7	2.7	2.1	3.3	1.3	0.5	1.3	0.8
4	*12.2*	25.6	9.4	6.1	9.4	7.5	8.9	7.2	3.1	1.6	3.1	2.1	3.0	1.5	0.6	1.5	0.9
5	*11.9*	34.6	12.1	8.4	12.1	9.3	12.0	10.2	4.3	2.1	4.3	2.8	4.5	2.0	0.6	2.0	1.1
6	*10.6*	40.2	10.6	7.4	10.6	7.6	9.6	13.1	4.6	1.9	4.6	2.7	5.9	2.7	0.8	2.7	1.4
7 or more	*49.0*	54.4	11.2	7.0	10.7	8.2	11.0	19.6	6.5	1.7	5.2	3.0	9.8	4.0	0.2	2.9	1.2

Notes: * Children between 0 and 14 years of age
Source: Authors' calculations from ELIM 2006.

When considered by age group (Table 14, Appendix), we can see that food poverty affects youngest children less. Given the extreme vulnerability of the youngest children, particularly in consideration of the food crisis, this result is somewhat reassuring.

Finally, the incidence of food poverty is uniformly lower in the general population, reflecting the fact that a greater portion of children than adults are found in poor households.

6.2.2 Impact of the food crisis

The present analysis of the food crises only captures the impacts of changing food prices that were brought about by the crisis by isolating the impact of policies that were subsequently put into place by the Malian government. The latter are simulation separately, as discussed in sub-section *6.2.3.h* below.

When comparing the observed changes in food prices (Table 2) with the predominant share of food in the typical Malian household's budget (Table 3), we can anticipate the size of the effects of the food crisis. The simulations show that increases in food prices cause an increase in food poverty among children (0-14 years old) from 41.5% to 51.8% (Table 6), an increase of more than 10.3 percentage points. The impacts on the poverty gap (average distance from the poverty line) and the severity of poverty are not as large in terms of percentage points, but given that they start at a lower level, they are larger in percentage variation. As such, it seems that the decline in real income is larger among the poorest, which can be explained by their dependence on food consumption and the fact that they are less likely to sell food, which would bring income benefits from the price increases.

The incidence of food poverty increases proportionally more in urban than rural areas[13] due to the crisis, but it starts from a lower absolute level.[14] As such, the total percentage of the population falling into poverty is greater in rural areas.[15] The more than proportional impact in urban areas reflects larger price increases (ex: Bamako in Table 2) and the large portion of consumption that is purchased by urban households. Rural households, however, have greater recourse to own consumption, which is sheltered from the food crisis. Furthermore, rural households that sell grains benefit from the price increase, although this effect is tempered by the simultaneous increase in the cost of agricultural inputs. Yet, analysis of urban household behaviour (estimation of demand systems) shows that they have a greater capacity to absorb the impact of rising food prices by reducing their non-food consumption: urban households are generally richer and, as economic theory predicts, set aside a larger portion of their budget to non food consumption.[16] As such, the share of non food consumption among urban households falls from 48.3% to 41.9% in response to higher food prices, while this share remains relatively stable (going from 34.4% to 33.8%) among rural households (Table 7).

However, in the simulation the food poverty gap and severity increase proportionally in rural areas (Table 6). This is due to much higher initial levels of food poverty in rural areas and the weight of food consumption among the poor.

[13] 29.5% in urban areas, compared to 23.8% in rural areas.
[14] 25.3% in urban areas, compared to 48.1% in rural areas. As such, the absolute increase is greater in rural areas (11.4 percentage points, compared to 7.5 percentage points in urban areas.
[15] 11.4% in urban areas compared to 7.5% in rural areas.
[16] The estimations clearly show lower income elasticities for food consumption than non food (Table 18).

Tableau 7: Food and non food budgetary shares before and after the crisis (percentage of total consumption)

	Food		Non food	
	Before the crisis	**After the crisis**	**Before the crisis**	**After the crisis**
Mali	60.7	63.3	39.3	36.7
Rural	65.6	66.2	34.4	33.8
Urban	51.7	58.1	48.3	41.9
- Bamako	44.5	53.9	55.5	46.1

Source: Authors' calculations from ELIM 2006.

The simulation shows that rising food prices do not substantially change the order of child food poverty between regions, whether we consider the headcount index, poverty gap or severity. The percentage of the population affected is relatively uniform at 10-12% with the exception of Kayes (13.9%), Tombouctou (5.4%) and Bamako (2.5%). While there are regional variations, prices increase strongly in all regions, leading to significant absolute increases in food poverty in each case. Bamako is notable for its inhabitants' capacity to protect their food consumption by reducing their non food consumption, with the portion of their budget allocated to food consumption increasing from 44.5% to 53.9% (Table 7). Tombouctou and Kayes differ in their level of own consumption, which is very high in Tombouctou and very low in Kayes.[17] This explains the difference in the impacts of the food crisis in between these two regions.

The increase in food poverty among households headed by a male or a female is nearly identical, at 10.3-10.4% (Table 6). Finally, the percentage of children falling into food poverty generally increases with the number of children in the household, from 5.8% of children in one child households to 10% of children in households with 5 or more children.

In the general population, including adults, the incidence of food poverty increased from 39.6% to 49.5%, an increase of 9.9% percentage points, similar to the increase already observed among children. The profile of the impacts by area, region, the household head's sex and number of children are also similar to what has been observed among children. Finally, no particular trends come from an analysis of the impacts by age (Table 8 and, in the appendix, Table 14).

Table 8: Impacts on the incidence of food poverty by age group before and after the food crisis with policy simulations

			Targeted group (of poor)					
	Before	**After**	**All**	**20%**	**0-14**	**0-5**	**6-10**	**11-14**
	%		**Change in percentage points**					
0-5 years	39.3	10.3	7.0	10.0	7.9	9.0	9.5	9.9
6-10 years	42.7	10.4	6.8	10.1	7.8	9.5	9.0	9.8
11-14 years	44.0	10.3	6.6	10.1	7.6	9.4	9.2	9.1
0-14 years	41.5	10.3	6.8	10.1	7.8	9.2	9.3	9.7

Source: Authors' calculations from ELIM 2006.

[17] For example, rice, which represents 41% of food consumption among the poor in Tombouctou, is more than 25% own consumed.

6.2.3 Policy simulations

Table 6 shows the change (in percentage points) in the headcount index, poverty gap and the severity of poverty with respect to the situation before the crisis under the different targeting scenarios. As pointed out earlier, the food crisis brought about a 10.3 percentage point increase in the incidence of food poverty among children age 0-14. That is to say that the food crisis led 10.3% of Malian children into food poverty.

In each of the following policy response simulations, the cash transfer made to each eligible individual is the average real income loss per adult equivalent due to rising prices among those who are poor after the crisis. This average loss of income is calculated separately for each area (urban or rural) in each of the nine regions studied (Table 9). Depending on the targeting scenario, one or more members in a household are eligible to receive this transfer. These cash transfers are therefore cumulative at the household level.

Table 9: Annual cash transfer granted per individual by region and area, in CFA

Region	Urban	Rural
Kayes	14552	19819
Koulikoro	8461	12073
Sikasso	9112	12558
Ségou	10295	12158
Mopti	15928	10584
Tombouctou	11363	9056
Gao	17134	10679
Kidal		17076
Bamako	9768	

Source: Authors' calculations from ELIM 2006.

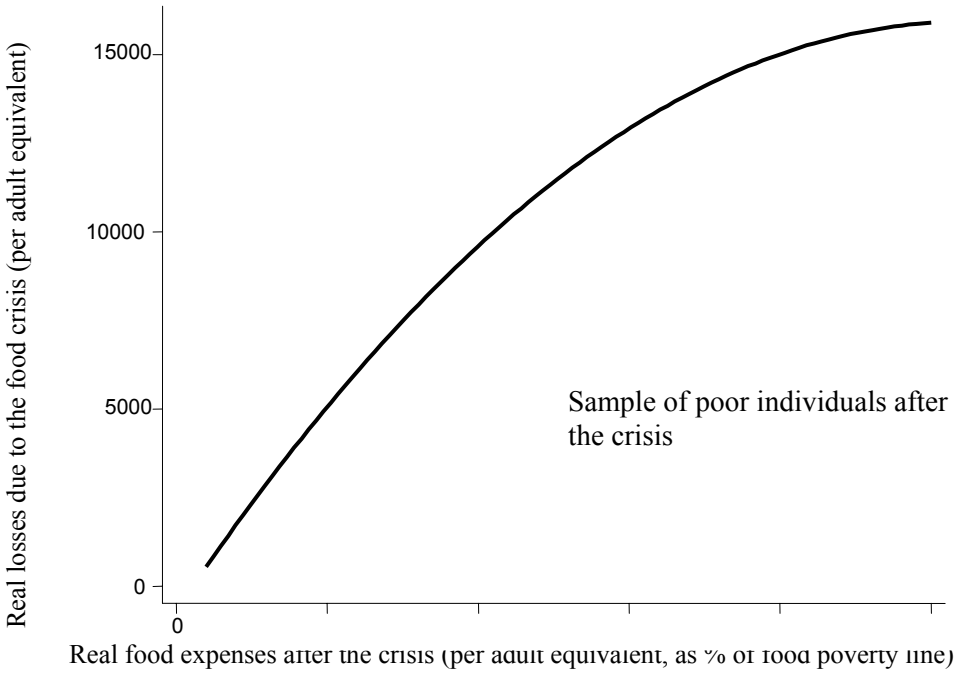
6.2.3.a Cash transfers targeting all of the poor after the crisis *("All")*

When the cash transfer targets everyone, children and adults, who is poor after the crisis, the increase in the incidence of food poverty is reduced from 10.3 to 6.8 percentage points. One may have expected even more positive results, but it must be recalled that the targeting is not perfect. By only using information that is easily observable by the government authorities to determine whether or not a household is poor, the model only correctly identifies 74% of those who are actually poor and erroneously includes 35% of non poor individuals.[18] As such, 26% of the poor do not benefit from the transfer, which substantially reduces its impact. At the same time, cash transfers to non poor individuals do not have any impact on the incidence on food poverty, yet increase the cost of the intervention.

Furthermore, the cash transfer is equal to the average annual loss of real income among poor households in the region and area in question. As seen in figure 5, the real loss increases with the level of food expenditures, surpassing 15 000 CFA per year per for those whose food expenses were 80-100% of the poverty line. Given that the average loss across the country is 12 582 CFA (about $25) per year, the cash transfer is less than the loss of real income for individuals who are closer to the poverty line. At the same time, the transfer exceeds real losses for the poorest individuals. These individuals find themselves better off than before the

crisis. It is this progressive nature of the fixed transfer that explains the strong impacts that this policy has on the food poverty gap (for which the increase is reduced from 4.9 to 1.7 percentage points) and the severity of food poverty (from 2.9 to 0.4 percentage points).

Figure 5: Real losses due to the food crisis, by food expenditures



Source: Authors' calculations from ELIM 2006.

This first scenario succeeds best in rural areas, bringing the increase in the incidence of food poverty down from 11.4 to 7 percentage points, due to the fact that the poor are more effectively targeted than in urban areas. Indeed, in rural areas, the model correctly identifies 81% of the poor, as opposed to only 47% in urban areas. However, the model incorrectly identifies 56% of the non poor as poor in rural areas, while this "leakage" rate, which raises the costs of the intervention (see section 6.1), falls to 9% in urban areas.

This policy's success also varies by region, with the strongest impacts in Kayes and Koulikoro and practically no impact in Kidal and Bamako, two highly urbanized regions. The reduction in the incidence of poverty is also more pronounced for children in male-headed households (even more so in rural areas) and those with four or more children. The profile of the results is similar in terms of the poverty gap and severity of food poverty. When analyzing the impacts by age group (Table 8), we observe an increasing impact with the age of the children.

This first scenario may be unrealistic due to its cost (section 6.1). However, we will see in section *6.2.3.c* that the results obtained here for children are identical to those that would be obtained from a cash transfer that targets children alone, if we assume that the transfer is not shared with other household members.

6.2.3.b Cash transfer targeting the poorest 20% after the crisis (20%)

An obvious way to reduce the costs of the cash transfers while still reaching the most vulnerable is to target the very poorest. This is what we explore in this simulation, which targets the poorest 20% of the population after the crisis. As may be expected, such an intervention has very little impact on the incidence of food poverty – which increases by 10.1 percentage points rather than 10.3 percentage points in the absence of the transfer – but it does reduce the food poverty gap (from 4.9 to 4.3 percentage points) and the severity (from 2.9 to 2.3) of food poverty, and costs only one seventh as much as targeting all the poor (see section 6.1). The savings are not only due to targeting only the poorest, but they also result from lower leakage (non poor households benefiting from erroneous identification). The profile of the impacts is not altered substantially, although male-headed households and the Kayes and Sikasso regions benefit somewhat more, since they are overrepresented among those identified as the 20% poorest.

6.2.3.c Cash transfer targeting all poor children after the crisis: with sharing ("All")

As discussed in section 6.1, an intervention that targets all individuals identified (correctly or not) as poor would be very costly. If we are determined to protect children from the impacts of the crisis, then targeting cash transfers to children seem to be an obvious choice.

However, it is important to understand that it is nearly impossible to know how transfers intended for children will actually be distributed within a household. There is nothing to stop the household from allocating the transfer equitably (for example, according to caloric needs) between all the members of the household. The following simulations adopt two alternative hypotheses: with and without sharing with other household members.

If only the targeted children benefit from the cash transfer, i.e., it is solely used to increase their food expenditures without sharing with other household members, the impacts on the targeted children would be identical to the first simulation, where all family members receive the cash transfer ("All"). However, the cost of this more targeted policy is only a fraction of the cost of targeting all the poor since the transfers are only provided to children (simulation "0-14" in section 6.1).

6.2.3.d Cash transfer targeted to poor children after the crisis: with sharing ("0-14")

If, however, we apply a policy that only targets children and assume that the cash transfer is shared equitably between all members in the household, the impacts on children are clearly lower. This is exactly what is observed in the "0-14" scenario. The observed increase in the incidence of child food poverty is somewhat smaller; 7.8 percentage points, as opposed to the increase of 6.8 percentage points when the transfers exclusively benefit the children (or when the transfers are made to all the family members ("All")). The reduction in the impact on the poverty gap (to 2.7 percentage points rather than 1.7 percentage points) and the severity (to 1.1 percentage points rather than 0.4 percentage points) of poverty is also smaller. The cost of the intervention is reduced by half, improving the efficiency of the program in terms of the headcount index and poverty gap, but not in terms of the severity of poverty.

In general, although the magnitude of the impacts is smaller, the profile of the impacts of transfers targeting children when there is sharing are similar to those without sharing (or when all the poor are targeted).

6.2.3.e Cash transfer targeting poor children aged 0-5, after the crisis ("0-5")

If we were especially concerned about the impacts of the food crisis on the youngest, we could decide to exclusively target them. Table 8 shows the impacts of the different policies studied on children by age group. It can be seen that the food crisis ("After") increases the incidence of poverty among children aged 0-5 by 10.3 percentage points, as is the case for children as a whole. A policy that makes cash transfers to all poor households ("All") manages to bring this increase down to 7.0 percentage points, while targeting the poorest 20% has almost no impact. Targeting only children with intra-household sharing has almost as much impact on 0-5 year olds as without sharing (or the case with cash transfers to all of the poor ("All")); an increase of 7.9 percentage points as opposed to 7.0 percentage points.

Of particular interest here are the impacts of a policy that exclusively targets children aged 0-5. Again, if we can ensure that only the targeted children benefit from these transfers, we obtain exactly the same effects on this age group as when all the poor were targeted ("All"). However, if we assume that these transfers end up being shared equitably within the household (according to the share of caloric needs for each individual in the household), the increase in the incidence of poverty is only reduced to 9.0 percentage points ("0-5"). The reduction are smaller, by slightly less than half, than those obtained from targeting all children ("0-14") due to the fact that 0-5 year olds no longer share in the cash transfers to their elders. Given that the cost of the intervention is less than half as much – by stopping the "leakage" towards households that only have children over the age of 5 – we could say that there is an efficiency gain in terms of the impact on 0-5 year olds. However, it is important to note that the reductions, through sharing, in the incidence of food poverty among "6-10" and "11-14" year olds are cut by more than half when only targeting "0-5" year olds.

6.2.3.f Cash transfers targeting poor 6-10 year-olds after the crisis: with sharing ("6-10")

Likewise, if the concern relates to 6-10 year-olds, for example to avoid school drop outs, the cash transfers could target this group. Again, if the transfer only benefits 6-10 year-old children (without sharing), it will have the same impacts on this age group as the policy that made transfers to all poor individuals ("All"), but at a fraction of the cost. However, if sharing is present ("6-10"), the impact on the incidence of food poverty among 6-10 year-olds is only brought down to 9.0 percentage points, although the cost of the intervention is six times smaller (section 6.1). Also, the impact of this policy on children in other age groups (via sharing within the household) is smaller.

6.2.3.g Cash transfers targeting poor 11-14 year-olds after the crisis: with sharing ("11-14")

Similar impacts are observed here, this time for 11-14 year-olds.

6.2.3.h The current policy: consumption/production subsidies ("Current")

The simulated impacts of the current policy on food poverty are very weak, bringing the increase in food poverty from 10.3 to 10.0 percentage points for the population as a whole.

The urban population benefits much more from this than the rural population because the targeted products represent a greater share of their consumption.

Obviously, we only capture the immediate effects of the consumption subsidies and the tariff exemptions that were attributed to a handful of specific products. The Malian government has other policies, such as the school feeding program programs that will be discussed in the following section and the Rice Initiative that aims to increase domestic production and thus has effects that go beyond the scope of the analysis in this study.

6.3 Caloric insufficiency

6.3.1 Initial situation (2006)

Insufficient caloric intake plagued Mali even before the crisis (Table 10). Nearly a third (32.1%) of Malian children did not obtain the minimal caloric requirements set by World Health Organization (WHO). As is the case for food poverty (monetary), there is a gap in caloric deficiency between rural (34.5%) and urban (26.3%) children. The rural-urban gap is not as big in terms of caloric insufficiency due to the importance of own consumption of food among rural Malian households which shelters them somewhat from global food prices.

Regional gaps persist in terms of insufficient caloric intake among children, although they are somewhat less than those observed for food poverty. While the rate of caloric insufficiency is relatively low in Kidal (7.5%), it reaches 37.6% in Kayes and 40.6% (more than two in five children) in Sikasso. While the caloric insufficiency rate slightly exceeds the food poverty rate in Bamako, Kidal and Gao, it is much lower in Koulikoro, Sikasso, Ségou and Mopti, these last regions all being characterized by high levels of own consumption of food (e.g. 25% of millet consumption in Koulikoro is own consumption). Furthermore, they consume more millet than rice, and millet is much cheaper per calorie.

While the rate of caloric insufficiency is much higher for children living in male-headed households (32.4% as opposed to 26.5% for children in female-headed households), the gap is less than that observed for food poverty. Again, this is due to the fact that male-headed households are more common in rural areas where own consumption partially compensates for food poverty.

Caloric insufficiency increases with the number of children in the household. Finally, as may be expected, the rate of caloric insufficiency decreases dramatically according to their decile ranking in terms of food expenditures. Only 5.8% of children in the poorest decile do not suffer from caloric insufficiency.

The profile of the caloric insufficiency in the general population is similar to that observed for children.

Table 10: Rate of caloric insufficiency among children, before and after the food crisis, with simulated policies

	Population share*	Before	Simulation scenarios								After		School feeding	
			After	All	20%	0-14	0-5	6-10	11-14	Current				
	Percentage		Change in percentage points											
			0-14								6-10	11-14	6-10	11-14
Total		**32.1**	**8.5**	**4.6**	**7.9**	**5.6**	**7.0**	**7.4**	**7.9**	**8.3**	**8.9**	**7.4**	**2.5**	**1.9**
Area														
Urban	*29.0*	26.3	2.0	1.2	2.0	1.4	1.8	1.9	1.9	2.4	3.1	1.3	-0.5	-2.3
Rural	*71.0*	34.5	11.1	5.9	10.3	7.3	9.2	9.6	10.3	10.6	11.2	10.1	3.7	3.7
Region														
Kayes	*13.0*	37.6	9.6	4.5	9.6	5.9	7.7	8.1	9.4	9.5	10.4	6.9	2.2	1.8
Koulikoro	*16.5*	31.6	6.1	-0.2	5.8	1.9	4.4	4.6	4.9	6.1	6.2	6.9	-1.8	0.8
Sikasso	*18.9*	40.6	13.3	7.0	10.9	8.3	9.8	11.3	11.9	13.1	14.3	10.8	3.0	-0.2
Ségou	*18.0*	32.3	11.9	8.0	11.9	9.3	11.0	10.7	11.5	11.5	13.1	11.1	7.5	6.1
Mopti	*16.4*	24.0	8.5	6.7	8.0	7.1	8.1	8.1	8.5	7.8	8.7	7.1	6.4	6.1
Tombouctou	*4.1*	37.0	4.2	3.8	4.2	3.8	4.2	4.2	3.8	3.1	4.2	5.6	3.1	3.5
Gao	*4.3*	33.1	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.4	2.2	-3.0	-6.5
Kidal	*0.5*	7.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	7.9	20.3	7.9	20.3
Bamako	*8.3*	19.0	-1.9	-1.9	-1.9	-1.9	-1.9	-1.9	-1.9	-1.0	-1.7	-2.9	-4.6	-5.7
Sex of household head														
Male	*95.0*	32.4	8.4	4.4	7.8	5.4	6.9	7.2	7.8	8.2	8.9	7.4	2.4	1.9
Female	*5.0*	26.5	9.9	7.5	9.9	9.4	9.7	9.8	9.9	10.2	10.0	7.0	5.1	1.5
Number of children														
0													0.0	0.0
1	*1.8*	14.1	3.1	1.9	3.1	1.9	2.5	2.5	3.1	2.7	4.8	6.7	4.8	5.3
2	*5.1*	17.5	4.7	3.0	4.7	3.3	4.2	4.0	4.1	4.4	4.6	4.5	1.9	4.5
3	*9.4*	19.8	6.4	4.6	6.4	5.5	5.8	6.1	6.3	6.6	5.4	4.1	3.1	1.5
4	*12.2*	23.3	6.2	4.9	6.2	5.3	5.9	6.0	6.0	6.0	7.7	5.4	4.7	3.4
5	*11.9*	26.7	6.1	4.1	6.1	4.7	5.2	5.7	5.4	5.1	4.9	5.6	1.7	3.2
6	*10.6*	30.6	10.1	6.4	10.1	7.4	9.1	9.7	9.7	9.8	11.9	4.8	6.7	0.4
7 or more	*49.0*	40.6	10.3	4.5	9.0	6.0	8.1	8.4	9.5	10.2	10.6	9.5	1.1	1.3
Decile														
1 (poorest)	*10.4*	94.2	2.7	-1.6	0.9	0.9	2.5	2.7	2.7	2.7	2.1	1.3	-1.6	0.2
2	*10.5*	76.2	11.4	2.9	11.2	5.7	9.3	9.5	10.2	12.0	12.7	9.9	-3.6	-1.5
3	*10.7*	56.4	20.2	10.3	18.2	11.9	15.7	18.0	18.4	19.3	19.8	18.5	3.8	3.9
4	*10.3*	38.9	22.0	13.7	20.6	15.7	18.1	17.7	20.0	21.5	24.6	20.4	12.7	8.6
5	*10.1*	24.1	12.7	9.8	12.4	10.3	11.8	12.3	12.3	11.7	12.4	9.2	5.0	2.1
6	*10*	9.6	9.3	6.9	9.3	7.7	8.3	8.7	9.1	8.4	9.0	6.1	5.2	2.5
7	*9.9*	6.1	3.4	2.1	3.4	2.1	2.3	2.1	3.4	3.3	3.7	3.3	2.7	2.7
8	*9.7*	3.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.8	0.8	-1.3	0.5	-1.8
9	*9.4*	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.3	0.0	0.3
10 (least poor)	*8.9*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Notes: * Share of the population of children aged 0-14
Source: Authors' calculations from ELIM 2006.

As for food poverty, the rate of caloric insufficiency is lower among the youngest children, varying from 35.0% for 11-14 year-olds to 25.7% among 0-5 year-olds (Table 15, Appendix). Given that the youngest children are especially vulnerable, this result can be seen positively.

6.3.2 Impact of the food crisis

The caloric insufficiency rate among children aged 0 to 14 increases from 32.1% before the crisis to 40.6% after the crisis (Table 10). Children in rural areas are far more affected (11.1%

of children fall into a situation of insufficient caloric intake, as opposed to 2.0% in urban areas), due to the incompressibility of their non-food consumption.[18] The largest increases in caloric insufficiency are in the Sikasso (13.3%) and Ségou (11.9%) regions, as well as in households headed by women (9.9%, as opposed to 8.4% for those headed by men). The small reduction in caloric insufficiency in Bamako can be explained by the capacity of households to absorb higher food prices by reducing their non food consumption and by substituting towards more calorie intensive foods such as millet and rice. The crisis increases caloric insufficiency more for children living in households with a large number of children.

When comparing the impacts by decile of food expenditures, it is not surprising that it is the third and fourth deciles, which are closest to the poverty line, that have the highest percentage of children falling into caloric insufficiency. Caloric insufficiency is so high among the poorest decile that the food crisis can hardly make it worse, the rate increasing from 94.2% to 97%. This weak effect can also be explained by the fact that the poorest have a higher level of own consumption and are therefore less affected by the food crisis. Among the wealthiest deciles, the food crisis only leads to a small proportion of children experiencing caloric insufficiency.

The impacts of the food crisis are mostly the same for the general population and do not vary systematically by age group among children (Table 15, Appendix).

6.3.3 Policy simulations

The changes in the caloric insufficiency rate among children (0-14 years) with respect to the situation before the crisis are presented in Table 10.

6.3.3.a Cash transfers targeting all poor individuals after the crisis ("All")

Granting a cash transfer to all poor individuals, equal to the reduction in their real income that results from the price increases, lowers the increase in the caloric insufficiency rate among children by nearly half (from 8.5 to 4.6 percentage). This is consistent with the impacts already observed for food poverty. In addition, the profile of the impacts of this policy on caloric insufficiency generally conforms to those on food poverty, with particularly notable reductions in rural areas, in Kayes and Koulikoro and in male-headed households. The decline in caloric insufficiency in Koulikoro illustrates the fact that malnourished children are mostly found among the poorest, for whom the transfer exceeds the real losses due to the crisis. The impacts of the policy are essentially focused among the poorest deciles and, as we could expect, actually lead to a reduction in the caloric insufficiency rate among the poorest decile relative to their pre-crisis situation.

6.3.3.b Cash transfers targeting the poorest 20% after the crisis (20%)

Exclusively targeting the poorest 20% for cash transfers has a moderate impact in comparison with full coverage, lowering the increase in caloric insufficiency from 8.5 to 7.9 percentage points. This decrease is greater than that obtained for the level of food poverty (from 10.3 to 10.1 percentage points), since there are more children closer to caloric insufficiency among the poorest 20%. Only children in rural areas benefit, mostly in Koulikoro, Sikasso and

[18] Voir le Tableau 19 en annexe à cet égard.

Mopti, as well as those in male-headed households and in households with seven or more children. Not surprisingly, it is children in the poorest decile that benefit the most.[19]

6.3.3.c Cash transfers targeting poor children after the crisis: without sharing ("All")

Again, the impact of a policy that targets children without any sharing with other family members is the same as that of a cash transfer targeting all poor individuals ("All"), but at a fraction of the cost (see section 6.1).

6.3.3.d Cash transfers targeting poor children after the crisis: with sharing ("0-14")

In reality, it is reasonable to assume that cash transfers to children will be at least partly shared with family members. If we assume equitable sharing (proportional to caloric needs), the impact is limited somewhat, with the increase in the caloric insufficiency rate only being held back to 5.6%. Much of the expected benefits are still achieved, but for nearly half the cost.

These gains are relatively well distributed in terms of the number of children in the household or the area (rural or urban), but are particularly concentrated in certain regions (Sikasso, Kayes, Koulikoro and Ségou) and in households headed by males or those in the poorest deciles.

6.3.3.e Cash transfers targeting poor 0-5 year-olds after the crisis: with sharing ("0-5")

We now turn to the situation of the youngest children, who are most vulnerable to the harmful effects that caloric insufficiency can have on their physical and mental development as well as their health. Recall that the caloric insufficiency rate before the crisis increases with age, 0-5 year-olds having a rate of 30.2%. That still amounts to 3 in 10 children who cannot fulfill their caloric needs. Even worse, the crisis brings about an 8.7 percentage point increase in caloric insufficiency (Table 11).

Cash transfers targeting all poor individuals (“All”) cut this increase in half, whereas targeting the poorest 20% has a relatively small impact. Targeting the poorest children with intra-household sharing ("0-14") achieves a large share of the benefits of the transfer to all poor at about half the cost. When only targeting poor children aged 0-5, the impacts would be the same as for the transfer targeting all poor individuals ("All") if we could ensure that only the targeted children would benefit from the transfer. If we assume that there is equitable sharing within their respective households, the gains are cut in half in comparison with cash transfers that target the poorest children as a whole. That means that more than half of the benefits for children aged 0-5 in this latter scenario come indirectly from cash transfers aimed at their elders. In fact, we observe non negligible gains for 0-5 year-olds even for policies that only target children in the 6-10 and 11-14 age groups.

[19] Note that children in deciles 3 and 4 benefit from the policy when they are erroneously identified as being in deciles 1 or 2, i.e. the poorest 20% of the population (targeting error).

Table 11: Caloric insufficiency rates by age group before and after the food crisis with policy simulations

	Scenario								
	Before	After	All	20%	0-14	0-5	6-10	11-14	School Feeding
	%		Change in percentage points						
0-5 years	30.2	8.7	4.4	7.9	5.6	6.8	7.6	8.2	
6-10 years	32.8	8.9	5.0	8.4	*6.0*	7.7	7.6	8.4	2.5
11-14 years	35.0	7.4	4.0	6.9	5.1	6.6	6.6	6.5	1.9
0-14 years	32.1	8.5	4.6	7.9	5.6	7.0	7.4	7.9	

Source: Authors' calculations from ELIM 2006.

6.3.3.f Cash transfers targeting poor 6-10 and 11-14 year-olds after the crisis: with sharing ("6-10" and "11-14")

Even though their initial caloric insufficiency rate is higher, 11-14 year-old children are somewhat less affected by the food crisis. The reduced impacts brought about by the various policies are generally less dramatic, especially for 6-10 year-olds. The exception, of course, is found in the policy that exclusively targets them.

6.3.3.g Current policy: consumption/production subsidies ("Current")

The current policy, which consists of small consumption subsidies and tariff exemptions, only has a very small effect, reducing the caloric insufficiency rate from 8.5 to 8.3 percentage points. The subsidy policy encourages substitution towards the targeted products: rice, cooking oil and milk powder. Given that these products have higher costs per calorie than, for example, millet and sorghum, this policy even increases the caloric insufficiency rate in the urban area. However, this analysis does not consider protein of or other nutritional contributions of these items, which may justify this intervention.

6.3.3.h School feeding programs

The Malian government currently operates a school feeding program in certain schools in the poorest regions in the country. The household survey does not indicate which children benefit from the program. Instead, we conduct a simulation of a policy where all children who are identified as poor and who attend primary school participate in the program. The program entitles them to a meal with 150 g of grains, 30 g of pulses and 10 g of vegetable oil, which provides them with 729 kilocalories, about a third of the daily caloric needs for the average male adult, without considering other nutritional needs (protein, fat, vitamins, etc.).

The simulations indicate that such a policy would reduce the increase in caloric insufficiency from 8.9 to 2.5 percentage points among 6-10 year olds and from 7.4 to 1.9 percentage points among 11-14 year-olds (Table 10). Children aged 0-5 do not participate in this program since they are not old enough to go to school. This program exceeds the impacts of all other policies studied here by far in terms of caloric insufficiency, and does so at a fraction of the cost. The annual cost per student for the meals provided (9 245 CFA at Bamako prices in September, 2008) is similar or less than the value of cash transfers offered per individual for the other interventions in most regions (Table 9). As indicated in section 6.1, the savings come from the fact that this intervention only targets children who are predicted as poor and participate in primary school. The sizeable reduction in the caloric insufficiency rate can be explained by the fact that this budget is exclusively available for highly nutritional goods

which are supplied directly to the children, whereas the cash transfers can also be used to consume other goods, such as non food consumption, and are more easily shared within the household.

As was the case for targeting based on predicted income, there are certain risks in terms of the excluded poor and included non-poor. However, given that caloric insufficiency also occurs among some non poor children, any "leakage" in their favour still contributes to reducing the average rate of caloric insufficiency. However, primary school children who are erroneously predicted as non poor, as well as poor children who do not attend primary school, do not benefit from this intervention. While the first of these are probably the least poor of the poor (and are thus most easily identified as non poor by accident), children who don't go to school are disproportionately the poorest of the poor. Children who are too young to go to school are also excluded, despite having the most acute nutritional needs. Finally, an important caveat to this policy is the possibility that the child's rations will be reduced at home when they receive a meal at school, which clearly reduces the impact on their caloric insufficiency rate.

This policy would certainly also have impacts on food poverty, and even on school participation, child labour and access to health services, that go beyond the scope of the present analysis. It is often the positive impacts on school participation that constitute the principal objective of school feeding programs.

6.4 School participation and child labour

6.4.1 Initial situation (2006)

We will analyze school participation before considering child labour. The school participation rate in 2006 was 48.1% for 6-10 year-olds and 56.7% for 11-14 year-olds, amounting to an average rate of 51.4% for children aged 6-14 (top of Table 12, "School" column). For children aged 6-10, as well as for their older siblings, the school participation rate is slightly higher for boys.

Among 6-10 year-olds, as expected, a greater portion of children go to school in urban areas (68.6%) than rural areas (40.0%). Outside Bamako (82.2%), the rate varies considerably, from 41.3% (Ségou) to 53.1% (Tombouctou). Evidently, the rate varies substantially according to the sociodemographic characteristics of the household head. For example, the school participation rate is 41.8% when the head of the household has not been to school, as compared to 87.9% when they have had schooling beyond primary school. Children from households headed by someone working in the public sector have higher participation rates (82.5%) than households headed by peasants or independent farmers (39.4%). Children in the wealthiest households, in terms of food expenditures, record a higher participation rate in primary school (69%), more than twice those in the poorest households (33%).

As for 11-14 year-old children, more than three-quarters of urban children attend school, as opposed to less than half in the rural area. The school participation rate varies most substantially between regions for children aged 6-10, ranging from 38.1% (Kidal) to 79.9% (Bamako). These are the only two regions where the school participation rate is lower than it

is for 6-10 year-olds. The school participation rate for 11-14 year olds is higher than for 6-10 year-olds in every other region regardless of the area, the education level of the household head, the decile of food expenditures, and the socioprofessional category of the household head, with the only exception being employers, for whom we observe the opposite. The general profiles are the same as for 6-10 year-olds.

As for child labour, its overall level was estimated at 36% in 2006, with 30.4% for children aged 6-10 and 45.3% for 11-14 year-olds. As was the case for schooling, the labour participation rate is highest among boys. However, it should be noted that child labour is identified in ELIM 2006 according to the UN definition of economic work, which includes work at a family farm or business, but excludes domestic work. It is clear that domestic work is much more widespread among girls.

The labour participation rate is three times higher in rural areas than in urban areas, whether considering 6-10 year-olds (38.8% in rural areas as opposed to 9.1% in urban areas) or 11-14 year olds (57.2% compared to 19.0%). The highest rates are observed in Sikasso and Mopti (more than 60% among 11-14 year-olds), while Gao and Bamako have much lower rates of child labour. Child labour decreases with the level of education of the household head and with income (measured by decile of food expenditures). Particularly high rates are found among children living in households headed by independent farmers, while it is nearly inexistent in households led by a salaried worker.

Work is not just for children who do not attend school. Indeed, 11.8% of children combine work and education ("W/S", top of Table 12); 15.3% among 11-14 year-olds. Conversely, the percentage of children who work and do not attend school ("W/NS") is 42.2%; 20.7% of children aged 6-10 and 30.0% of those who are 11-14 years old. Nearly 40% of children attend school without working ("NW/S") in the two age groups, while the “inactive” rate ("NW/NS") is higher among 6-10 year-olds (31.2%) than among 11-14 year-olds (13.3%).

Table 12: School participation rate and labour participation rate for children before and after the crisis, with policy simulations (in percentage)

Activity category	NW/NS	W/NS	NW/S	W/S	**School**	**Work**						
Age 6-14	24.4	24.2	39.6	11.8	51.4	36.0						
Activity category	NW/NS	W/NS	NW/S	W/S	**School**	**Work**	NW/NS	W/NS	NW/S	W/S	**School**	**Work**
Age subgroup	***Age 6-10***						***Age 11-14***					
Total	31.2	20.7	38.4	9.7	48.1	30.4	13.3	30.0	41.4	15.3	56.7	45.3
Child's sex												
Boy	29	21	39	11	50.2	32.0	10	30	42	18	60.3	48.3
Girl	34	20	38	8	46.0	28.6	17	30	41	12	53.1	42.1
Area												
Urban	26	5	65	4	68.6	9.1	16	35	70	9	78.4	19.0
Rural	33	27	28	12	40.0	38.8	11	31	29	18	46.9	57.2
Region							9	34				
Kayes	45	10	38	7	45.0	16.2	24	23	32	17	49.3	52.1
Koulikoro	30	23	39	8	46.7	31.7	7	46	44	14	57.4	44.9
Sikasso	23	31	26	20	46.5	51.0	9	31	28	29	56.9	63.2
Ségou	39	20	34	7	41.3	27.0	25	0	41	12	53.3	35.4
Mopti	24	33	31	12	42.8	45.3	38	23	31	16	47.0	61.5
Tombouctou	29	18	43	10	53.1	28.4	8	12	45	15	60.5	45.8
Gao	49	0	50	0	50.3	0.4			75	0	75.0	0.3
Kidal	29	22	48	1	49.1	22.6	11	10	38	0	38.1	23.4
Bamako	15	2	82	1	82.2	3.1	14	39	78	2	79.9	13.4
Education level of household head												0,0
None	34	24	31	11	41.8	34.7	15	35	34	17	50.2	51.4
Primary	23	9	61	7	67.5	15.9	10	15	62	13	75.1	27.8
Post primary	11	1	83	5	87.9	6.1	3	9	81	7	88.1	16.1
Socioprofessional category												
Salaried – public	17	1	79	4	82.5	4.3	2	5	86	6	92.4	11.6
Salaried - private	35	2	61	2	63.1	4.1	20	10	65	5	69.8	14.5
Employer	19	12	67	2	69.1	13.5	12	23	57	8	65.1	31.7
Independent farmer	31	29	26	13	39.4	42.4	12	41	27	21	47.4	61.4
Independent non farmer	30	8	59	3	62.3	11.0	16	15	61	8	68.9	23.1
Other employed	27	30	34	9	43.4	39.2	8	42	39	11	49.8	53.4
Unemployed	39	13	39	9	48.0	21.7	21	21	45	13	58.2	33.9
Decile (in equivalent food expenditures in 2006)												
dec1 (poorest)	32	35	25	8	33.3	43.2	17	44	27	12	39.1	56.7
dec2	35	23	33	9	42.6	32.0	17	30	35	19	53.2	48.7
dec3	35	25	28	12	39.9	36.9	15	33	30	23	52.2	55.5
dec4	31	26	30	13	43.1	39.0	16	34	33	17	50.2	51.4
dec5	25	27	35	13	48.0	39.9	9	33	39	19	58.2	52.2
dec6	28	20	41	11	52.0	30.6	11	28	44	17	61.5	45.0
dec7	35	16	41	9	49.5	24.9	14	32	45	10	54.1	41.3
dec8	34	13	45	8	52.7	20.5	12	22	53	12	65.1	34.7
dec9	29	12	52	7	59.2	19.3	12	20	55	13	67.5	33.2
dec10 (least poor)	27	4	65	4	69.0	8.8	9	14	70	8	77.5	21.5
Scenarios												
After	0.45	0.18	-0.35	-0.28	-0.63	-0.10	0.31	0.41	-0.29	-0.43	-0.71	-0.02
All	0.09	0.02	-0.08	-0.03	-0.12	-0.01	0.05	0.07	-0.04	-0.07	-0.11	0.00
20%	0.40	0.13	-0.32	-0.20	-0.53	-0.08	0.28	0.31	-0.26	-0.33	-0.59	-0.02
0-14	0.19	0.07	-0.16	-0.10	-0.26	-0.03	0.13	0.17	-0.12	-0.18	-0.29	-0.01
0-5	0.35	0.14	-0.28	-0.21	-0.49	-0.07	0.25	0.32	-0.23	-0.34	-0.57	-0.02
6-10	0.33	0.13	-0.26	-0.20	-0.46	-0.07	0.24	0.32	-0.23	-0.34	-0.57	-0.02
11-14	0.40	0.16	-0.31	-0.24	-0.55	-0.08	0.24	0.33	-0.23	-0.35	-0.57	-0.02
Current	0.42	0.17	-0.33	-0.26	-0.59	-0.09	0.29	0.38	-0.27	-0.40	-0.67	-0.02

Notes: S/NW=School-no work; S/W=School-work; NS/W=no school-work; NS/NW=no school-no work

Source: Authors' calculations from ELIM 2006

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6.4.2 Determinants of school participation and child labour

To analyze the impact of the food crisis and possible policies to respond to this crisis, a regression model can be used to predict the probability that a child is in one of the four situations listed above. That allows us to identify the principal determinants of school participation and child labour.

Given that the crisis essentially influences decisions via its effects on real household income, the analysis specifically focuses on the crisis' impacts on this variable. As might be expected, the probability of attending school increases significantly with household income. Yet, income does not have a significant impact on the probability that a child works. However, a negative effect may be hidden by problems of endogeneity between child work and household income, either because child labour increases household income or this income comes from physical assets that are unobserved (in the household survey) but increase the demand for child labour (see Cockburn and Dostie 2007).

When considering the marginal effects of different characteristics on the probability that a child is found in one of the four possible combinations of work and school, we find that household income has a positive effect on school participation (with or without work) and a negative effect on the probability that the child works without going to school (NS/W) or is "inactive"[20] (NS/NW).

Let's take a brief look at the impact of the other variables, which we assume to be unchanged by the crisis. Whether considering children aged 6-10 (Table 16a, Appendix) or 11-14 (Table 16b), we note that school participation is lower for girls and in rural areas, but is positively correlated with the number of children in the household (for 6-10 year-olds), school proximity, and the age and level of education of the household head. It is also significantly higher than the reference region (Kayes), in Koulikoro, Sikasso and Tombouctou (and, for 6-10 year olds, in Bamako). It is interesting to see that owning animals appears to have a negative effect on school participation for 6-10 year-olds, possibly since children are often responsible for watching over and taking them to pasture. The school participation rate initially increases with age (among 6-10 year-olds) and then declines (among 11-14 year-olds). The older children are also more likely to go to school in female-headed households.

The same determinants of school participation also act on child labour. Child labour also increases with the child's age, especially among 6-10 year-olds, although it is not affected by the child's sex or area of residence (rural or urban). There are regional differences however, with child labour particularly widespread in Sikasso. It is lower when the household head has completed primary education, but seems to be particularly high in households which are headed by individuals over the age of 61 or who are unemployed (possibly to compensate for the lack of adult income). It increases with the distance from drinking water and access to land (among 6-10 year-olds), as expected. While weak, the negative impact of school distance is surprising.

[20] Recall that the definition of child labour excludes domestic labour.

6.4.3 Impact of the food crisis

To measure the impact of the food crisis, the variation in real income is predicted, accounting for the increase in the value of food sales and the increase in the cost of living, in order to then predict the resulting participation rates in school and work among children after the crisis (row "After" at the bottom of Table 12).

The predicted changes following the crisis are weak. The school participation rate falls by 0.71 percentage points among 11-14 year-olds, meaning that 1 in 140 children is taken out of school. When considering that only 56.7% of Malian children attend school in the first place, this means that about 1 in 80 school-going children quit as a result of the crisis. The impact is slightly lower among 6-10 year-olds (a decrease of 0.63 percentage points), but given the lower initial school participation rate, it is still nearly 1 in 80 students who leave school as a result of the food crisis. These impacts may seem small, but it should be kept in mind that the decision to send a child to school depends on a number of factors other than income, as seen in an analysis of the determinants of this decision.

We also find a negative effect, albeit very weak and not statistically significant, of the crisis on child labour among 6-10 year-olds. A greater reduction in the school participation rate among children who do not combine school and work ("NW/S") is observed (a decline of 0.3-0.4 percentage points) in comparison to those who work ("W/S") (a decline of 0.2-0.3 percentage points). These children tended to move more towards “inactivity" (NW/NS), especially among 6-10 year-olds (an increase of 0.5 percentage points), than towards just work (W/NS; 0.2 percentage points for both age groups).

6.4.4 Policy simulations

By increasing household real income, each of the intervention scenarios succeeds in reducing the impact of the food crisis to some degree or another. In particular, they reduce the school dropout rate.

6.4.4.a Cash transfers targeting all poor individuals after the crisis ("All")

A cash transfer targeting all poor individuals has by far the largest impact, almost entirely countering the impact of the crisis. The “leakage” of transfers towards non poor households, incorrectly identified as poor, still contributes to an improvement in school participation due to the fact that many of these households did not send their children to school before the crisis. As such, it is not just those who drop out as a result of the crisis who are helped out by the intervention: some non poor households who did not send their children to school before the crisis also benefit from this policy. Similarly, the fact that the average cash transfer allocated does not necessarily correspond to the losses of real income for each household does not prevent this transfer from increasing the probability of attending school.

6.4.4.b Cash transfers targeting the poorest 20% after the crisis ("20%")

Targeting the poorest 20% has much less of an effect, probably due to the fact that their incomes are too low to start with for the cash transfers to bring them to the point where they would decide to send their children to school.

6.4.4.c Cash transfers targeting poor children after the crisis: without sharing ("0-14")

Again, the impact of a policy that targets children without any sharing with other family members is the same as that of a cash transfer targeting all poor individuals ("All"), but at a fraction of the cost (see section 6.1).

6.4.4.d Cash transfers targeting poor children after the crisis: with sharing ("0-14")

Targeting all poor children reduces the impacts of the crisis by more than half. Excluding the adults in a household from the cash transfer means that the total cash transfer received by households with children is still reduced. Since it is household income that dictates school-work choices, the impact of this policy is substantially lower. However, at half of the cost (section 6.1), there is a certain efficiency gain for the intervention at the expense of less complete coverage.

6.4.4.e Cash transfers targeting poor children after the crisis by age group: with sharing ("0-5", "6-11", "11-14")

Reducing the amount received by households – for children in other age groups – means that targeting a specific age group reduces the net impact of the cash transfers on children even more. Targeting 6-10 year olds nonetheless reduces the impact of the crisis on their school participation rates by more than a quarter (from 0.63 to 0.46 percentage points) for less than a fifth of the cost of a cash transfer program targeting all poor individuals.

6.4.4.f Current policy: consumption/production subsidies ("Current")

The current policy of small consumption subsidies has almost no impact on children's work-school choice, reducing the impact of the crisis by barely 0.04 percentage points.

6.5 Access to health services

6.5.1 Initial situation (2006)

The analysis indicates that 60.1% of sick children used a health service in 2006 (Table 13). The majority of them (57.1%) made use of community health services,[21] followed by traditional healers (17.1%) or a public hospital (10.6%). Private (7.7%) and regional/subregional (7.6%) services came in last.

The profiles of access to health services are not significantly different between boys and girls. However, the probability of consultation is much higher in urban areas (74.6%) than rural areas (55.4%). Urban consultations were much more likely to be in a hospital, regional or subregional service or private service than rural areas, while community services are used proportionally more in rural areas. Access to health services is most prevalent in Bamako, followed by Sikasso and Gao. The Mopti region appears to have the poorest access to these services. Community health services are the most common in all regions, while the use of traditional healers is particularly common in Sikasso.

[21] See the note at the bottom of Tableau 17 for details on suppliers of health services.

Table 13: Rate of access to children's health services before and after the crisis, with policy simulations (in percentage)

	Percentage of ill children consulting a health service	Principal type of service consulted				
		Public hospital	Regional or subregional service °	Community service °°	Private service °°°	Traditional healers
		Percentage of children who consult health services				
Total	60.1	10.6	7.6	57.1	7.7	17.1
Child's sex						
Boy	60.7	10.7	7.0	57.4	8.1	16.9
Girl	61.4	10.4	8.3	56.7	7.3	17.3
Area						
Urban	74.6	25.1	13.0	38.2	12.1	11.5
Rural	55.4	3.4	4.9	66.4	5.5	19.8
Region						
Kayes	59.4	9.8	10.6	57.7	10.1	11.9
Koulikoro	60.4	13.2	6.3	58.6	8.1	13.8
Sikasso	74.9	8.9	11.0	46.7	8.0	25.4
Ségou	59.0	13.5	3.1	55.6	10.3	17.6
Mopti	47.7	4.7	7.5	67.5	2.7	17.7
Tombouctou	57.8	29.0	3.9	53.5	6.9	6.8
Gao	71.0	20.0	0.0	66.3	13.8	0.0
Kidal	61.2	5.0	5.4	89.6	0.0	0.0
Bamako	83.2	15.1	7.9	52.6	10.1	14.3
Household head education						
None	58.3	8.6	7.4	57.4	7.3	19.3
Primary	66.5	13.5	6.7	60.0	5.2	14.6
Post primary	78.7	20.5	11.9	44.8	19.1	3.8
Socioprofessional category						
Salaried - public	78.5	17.8	10.1	56.2	12.1	3.8
Salaried - private	81.1	13.5	12.8	48.1	16.5	9.1
Employer	60.7	41.1	0.0	53.7	0.0	5.3
Independent farmer	55.5	5.7	5.9	63.4	4.5	20.6
Independent non farmer	69.3	16.1	11.7	48.1	9.0	15.1
Other employed	58.2	1.6	4.0	48.3	13.4	32.7
Unemployed	61.3	13.4	4.4	58.2	11.6	12.4
Decile						
dec1 (poorest)	70.6	3.7	9.0	46.7	4.4	36.1
dec2	58.7	7.3	3.0	57.3	8.6	23.8
dec3	59.6	10.9	3.5	48.4	9.7	27.6
dec4	53.6	12.6	6.5	63.8	5.4	11.7
dec5	61.3	12.3	10.7	54.6	4.7	17.7
dec6	57.1	4.9	7.9	67.5	4.5	15.1
dec7	61.8	10.0	9.2	52.3	6.6	21.9
dec8	58.8	12.3	6.2	66.3	6.3	8.9
dec9	56.7	15.1	11.1	51.1	8.0	14.8
dec10 (least poor)	71.4	13.0	7.9	59.0	13.8	6.3
Variations (in percentage points)						
After	-0.46	-0.08	-0.04	-0.85	-0.21	1.17
All	-0.13	-0.02	0.00	-0.17	-0.07	0.26
20%	-0.39	-0.06	-0.02	-0.68	-0.18	0.94
0-14	-0.22	-0.04	-0.01	-0.36	-0.10	0.51
0-5	-0.35	-0.06	-0.03	-0.62	-0.16	0.86
6-10	-0.37	-0.06	-0.03	-0.68	-0.17	0.94
11-14	-0.41	-0.07	-0.03	-0.74	-0.19	1.03
Current	-0.43	-0.07	-0.04	-0.81	-0.20	1.11

Notes: Regional/subregional services include health referral centres at the level of "circles" (regions). °°Community services includes community and religious health services, as well as other public, private or NGO community services. °°°Private services include private clinics and practices and pharmacies.
Source: Authors' calculations from ELIM 2006.

We also note lower use of health services and greater recourse to traditional healers for children in households headed by someone with no education or who is an independent farmer. The analysis per decile (of food expenditures per adult equivalent) shows that consultation is greatest at the extremes: the poorest make greater use of traditional healers (36.1%), the least poor make the greatest use of private services (13.8%) and public hospitals (13.0%). There is no particular profile for the rate or type of consultation in the intermediary deciles.

6.5.2 Determinants of access to children's health services

The probability that a 0-14 year old child consults a health services when ill increases with household income, registration with a parent's health insurance (such as private salaried workers in the formal sector who are registered with the National Institute of Social Security, INPS), proximity to a health structure, the number of children in the household and the level of education of the household head (Table 17, Appendix). Compared to Kayes (the reference region), use of health services is higher in Sikasso and Bamako, but is significantly lower in Mopti. Children in rural areas consult health services much less than those in urban areas. However, no significant difference is observed between girls and boys or between age groups.

In terms of the type of service consulted, sick children in Sikasso and Mopti used the services of traditional healers most often, while in Gao and Kidal they used them least. It should be pointed out that use of this type of health service increases with the number of days that the child is sick (in comparison to the CSREF health referral centres or public hospitals) and decreases with household income and health insurance coverage. It is also lower when the head of the household is over the age of 60, especially in comparison with households headed by individuals under 36. Children's access to private health services tends to remain a privilege that is limited to households headed by someone with a post-primary education in comparison to all other groups. In general, access to public health services is relatively limited for rural compared to urban households, households headed by someone between 36 and 60 (compared to those with a household head under the age of 36), and is least commonly used by those living in Mopti, Kidal and Bamako. The situation is very much the same for regional and national public hospitals.

6.5.3 Impacts of the food crisis

The results of the analysis allow us to understand the impact of the food crisis, and in particular the loss of real income that it incurs, on the probability that children between 0 and 14 consult a health services when ill, as well as the type of health services used. In general, the probability of using health services declined by 0.46 percentage points (about 1 in 200 sick children) as a result of the crisis. Community (-0.85 percentage points) and private (-0.21) health services are particularly affected. Conversely, there was a substantial increase in the number of people turning to traditional healers (1.17 percentage points, amounting to an increase of about 7%) with the crisis, surely due to the lower cost of these health consultations and traditional medicines, which are generally in the form of medicinal plants.

6.5.4 Policy simulations

6.5.4.a Cash transfer targeting all poor individuals after the crisis ("All")

Again, this is the policy that has the greatest effect in reducing the impacts of the crisis, but it is also the most costly. It reduces the impact of the crisis by 70%. Thus there would only be one out of 750 children (=100/0.13) more who would not use any health services when sick as a result of the crisis, as opposed to 1 more per 219 (=100/0.49) without any policy. As was the case for the school-work choice, the "leakage" of the program towards households who are incorrectly identified as poor nevertheless contribute to an increase in the use of health services. As such, the decline in the use of health services among the poor is partially counterbalanced by an increase in the number of non poor who are incorrectly targeted by the policy. These impacts are distributed relatively evenly among the different types of health services.

6.5.4.b Cash transfer targeting the poorest 20% after the (20%)

Targeting the poorest 20% definitely has a much lower impact on the total number of health consultations among sick children, only bringing the increase in children who do not consult health services due to the crisis down from 0.46 to 0.39 percentage points. This can be explained by smaller target population, substantial undercoverage, and the fact that these households have too little income to start with for the cash transfer to bring them to the point where they would decide to use health services when their child was sick. These impacts are similar for all types of health services.

6.5.4.c Cash transfer targeting poor children after the crisis: without sharing ("0-14")

Again, the impact of a policy that targets children without any sharing with other family members is the same as that of a cash transfer targeting all poor individuals ("All"), but at a fraction of the cost (see section 6.1).

6.5.4.d Cash transfer targeting poor children after the crisis: with sharing ("0-14")

In the presence of intra-household sharing of cash transfers targeting poor children, the impact of the crisis are reduced by nearly half, which is not far from the effect of the transfer targeting all poor individuals (children and adults). Its impact is less since there are no indirect benefits to children from transfers to adults in their households. At half the cost (section 6.1), this policy achieves a certain efficiency gain, but at the cost of less coverage. The crisis' impacts on each of the types of services are brought down by more than half.

6.5.4.e Cash transfer targeting poor children after the crisis by age group: with sharing ("0-5", "6-11", "11-14")

By removing cash transfers to children in other age groups, targeting a specific age group makes the total cash transfer to the households of affected children even lower, further decreasing the net impact of these transfers. Targeting children between the age of 0 and 5 has the greatest impact on the rate of consulting health services across all types of services.

6.5.4.f Current policy: consumer/producer subsidies ("Current")

The current policy of limited consumption subsidies and tariff reductions has very little impact on the use of health services, reducing the impact of the crisis by less than 6%.

7 CONCLUSION

Mali has not escaped the global food crisis. The considerable increases in the prices of their principal food items, especially grains, the sizeable share of food in the budget of poor households and their limited ability to adjust to these price hikes has made the crisis a major challenge. The impacts on children are particularly worrisome due to their already precarious situation in terms of nutrition, school participation, child labour and access to health services.

This document presents the results of an in-depth simulation analysis of the impacts of the food crisis and the different policies that are available to the government. The analysis goes beyond the impacts on food consumption, also considering nutritional, educational, health and child labour effects.

A number of key points can be taken from this analysis. Between August 2006 and August 2008, Mali endured huge increases in food prices of up to 67% for some food products in some regions. For most of these products, it was the Bamako and Kayes regions that saw the strongest increases in food prices.

The crisis is estimated to have increased the rate of child food poverty from 41.5% to 51.8%. While the incidence of food poverty (the percentage of poor children) increased more in urban areas, increases in the poverty gap (average distance below the poverty line) and the severity were more extreme in rural areas. Regional and socio-economic variations are also observed.

As a result of the food crisis, the rate of caloric insufficiency among children is expected to have increased from 32.1% to 40.6%. It is especially children in rural areas who are predicted to have been the most affected due to the incompressible nature of their non food consumption. In Bamako, by contrast, the initial share of non food consumption was much higher, leaving them more flexibility to cut such expenditures in order to maintain their caloric intake.

There are also strong reasons to believe that households are more likely to take their children out of school and put them to work when they are faced with a loss in real income. The analysis effectively reveals a positive relation, albeit a weak one, between income and school participation, which is predict to have led to the drop out of 1 out of every 80 school-going children. The majority of these children were not put to work and instead became “inactive” (although that may hide participation in domestic work, which is excluded from the definition of child labour adopted in the 2006 ELIM survey.)

Finally, a small decline (0.46 percentage points) is observed in the percentage of ill children with access to health services as a result of the crisis. A definite shift towards greater use of traditional medicine was also observed.

In terms of policies, most of the scenarios look to compensate the poor for the impacts of the food crisis via different types of cash transfers. The differences mostly have to do with the population targeted by the policy. Many important lessons can be taken from the results.

To start with, in the absence of reliable information collected on household income or expenditures, any policy targeting the poor requires that we can accurately predict whether the household is, or is not, poor. This work must be done using a limited number of easily observable characteristics that are difficult for the households to manipulate. The estimated relation between these characteristics and household income, based on analysis of recent household survey data, is used for this purpose. This is clearly not an exact science and some households will be misidentified, either in terms of under-coverage (erroneously excluding households that are actually poor) or leakage (erroneously including households that are actually non poor). While the first error reduces the impact of the policy on the target population, the second increases its costs. A number of targeting approaches were tested. In the best of these cases, about a quarter of the poor were erroneously excluded, while a third of the non poor were included. In rural areas, the exclusion errors are smaller and the inclusion errors are greater, whereas the opposite is true in urban areas. When targeting the poorest 20%, the exclusion error soars to more than three-quarters of the poor. This is because it is particularly difficult to effectively distinguish the poorest of the poor due to similarities in their observable characteristics.

In general, our simulations demonstrate the importance of having good criteria for identifying the poor. The better we can identify the characteristics that effectively identify the population of interest, the lower the costs and the greater the impact of the policy. The identification criteria must be operational (easily observed and difficult to manipulate) in the actual context of their implementation by government.

Rather than targeting all members in poor households, it is also possible to target poor individuals within households, such as children. Many lessons come from considering these approaches.

First, there is no way to control the allocation of a cash transfer within a household to make sure that only the children benefit. Even if the transfer is in the form of a meal that is directly provided to the child at school, it is quite possible that the allocation of household food resources to the child will be reduced in turn. If children could be precisely targeted, it would be possible to significantly reduce the costs of the policy (by eliminating all transfers to adults) without compromising the impacts on child food poverty and nutrition. However, even in this case, their participation in school and their access to health services suffers because these decisions depend on total household income. As such, the reduction in transfers to adults in their household has direct negative effects on children, and these effects increase with the adult to child ratio in the household. Clearly, excluding households that only include adults offer pure savings to a policy whose sole concern is the welfare of children.

If, however, we assume that the entire transfer to a child is, in fact, shared within the household – proportionally to the caloric needs of each member – nothing changes in terms of school participation or access to health services, but it dramatically reduces the impact on the children's food and nutritional poverty. That having been said, the decrease in the impact is proportionately smaller than the savings given that excluding households without children constitutes a "pure" savings. As such, we can speak in terms of a cost-benefit efficiency gain and of a significant absolute cost reduction, but at the price of a smaller average impact on the targeted children.

As for targeting specific age groups of children, such as the youngest when the main concern is nutrition or their elder siblings when the main concern is school participation, other lessons can be drawn from this exercise. Again, there is no way to guarantee that the transfers heading to a particular age group are not shared within the household, reducing the impact on food poverty and caloric intake. Regardless of intra-household sharing, the elimination of transfers to children in other age groups within the household reduces the impact on household total income and, consequently, on school participation and access to health services for the target age group.

These simulations also offer an interesting lesson concerning "leakage" (erroneously included non poor households). While this leakage only increase costs without any benefits in terms of reducing food poverty, it has beneficial impacts on the caloric insufficiency rate, school participation and children's access to health services. This is because of the non negligible number of non poor children suffering from caloric insufficiency, not attending school and/or having no access to health services.

The policies of making cash transfers to all poor individuals (adults and children) is by far the most costly (86.3 billion CFE, or 2.6% of GDP), but has the strongest effects. The increase in food poverty due to the food crisis is brought down from 10.3 to 6.8 percentage points, while the rate of caloric insufficiency increases by only 4.6 percentage points rather than 8.5, the school participation rate decreases by just 0.1 percentage points rather than 0.6-0.7 and the decline in the number of children using health services is held to 0.13 percentage points as opposed to 0.46 when no policy to mitigate the effects of the crisis is considered.

When only targeting the poorest 20% of the Malian population, the cost falls by 80%, partly because the targeted population is half the size, but especially because exclusion errors (erroneously excluded individuals) increase from 25.8 to 77.7%. The decrease in the impacts range from 80 to 94% depending on the type of poverty analyzed for the same reasons. Given the difficulty in targeting this population, this policy does not seem desirable.

Whether targeting children in general or by age group, the savings are in tandem with the proportion of the poor in that age group (ex: 50% savings when targeting children in general), but the impacts on school participation and access to health services decrease less than proportionally as the exclusion of adults-only households constitutes a "pure" savings. In terms of food poverty and caloric insufficiency, the impact depends on the assumptions with respect to intra-household sharing of the cash transfers. Without sharing of the benefits, the impact on children is the same as a policy of cash transfers to all poor individuals, but at a fraction of the cost. However, if the transfer is shared, the impact diminishes in proportion to the degree of intra-household sharing. Even if the sharing is "complete" (equitable), the impacts decline less than in proportion to the costs. As such, we can speak in terms of efficiency gains, even if these gains come at the price of a lower average impact.

The analysis of the school feeding program policy brings specific lessons for this intervention. If one supposes that the child's food rations at home are not reduced, this policy nearly manages to eliminate the impact of the food crisis on the caloric insufficiency rate. Positive impact in terms of food poverty, school participation (for which the school feeding

program constitutes a strong incentive) and even access to health services (only if the household can reduce food expenses by limiting the child's rations at home) are also to be expected. Moreover, this intervention is less costly than cash transfers. These savings mostly originate from the fact that the program is limited to poor children going to primary school. Also, it specifically concentrates the funds on nutritional foods, while cash transfers granted to households can also be used for non food consumption as well as less nutritious food consumption.

A few limitations to this policy should be kept in mind. To start with, this intervention does not reach children who do not go to primary school. Since these excluded children are young (when nutritional needs are most important) or are among the poorest children (less likely to attend school), this is an important exclusion error. Other complementary measures aimed at the excluded children should therefore be considered. Also, where children's food rations are cut at home, the impacts on the rate of caloric insufficiency and food poverty would be lower, although these savings for the household could lead to better school participation and access to health services. Also, the household (or the child) is deprived of the benefit of the increased non-food consumption that can result from cash transfers.

The last simulation is of the current policy adopted by the Malian government, which takes the form of consumer subsidies and tariff exemptions on specific products: rice, cooking oil and milk powder. Although relatively inexpensive, this policy only has very weak effects on the aspects of child poverty studied in this project. Additionally, it is not very efficient since the effects are spread among the entire Malian population, poor or otherwise. Finally, we observe that it is especially the urban population that benefits, due to the nature of the products that are chosen. This analysis neglects other policies put in place, notably the "Rice Initiative", which act through supply-side channels.

This analysis has effectively shed some light on the inherent difficulties of implementing state interventions that benefit the poor. Although efforts to better target the poor simultaneously reduce costs (by excluding the non poor) and increase its impacts (by maximizing the number of poor who are included), they should take into consideration the importance of using simple mechanisms, based on a limited number of easily observable characteristics that are difficult to falsify. It is tempting to target only the extreme poor to reduce costs, but they are even more difficult to effectively target because they share similar observable characteristics to the "moderate" poor. The targeting errors reach unacceptable levels, which simultaneously increase costs and decrease the impacts. We might then prefer to carry out cash transfers that specifically target children, but this also carries certain dangers. On the one hand, we cannot be sure that the benefits in terms of food and caloric consumption would not be directly or indirectly shared with other household members. On the other hand, school related decisions and access to health services are driven by total household income regardless of which member is targeted for cash transfers. Nonetheless, by excluding households without children, a certain efficiency gain is achieved by targeting children alone.

In the challenging context of the food crisis, simulations of a school feeding program policy stand up fairly well. By ensuring that the funds are only used to purchase highly nutritious food, it strongly reduces the caloric insufficiency rate and probably food poverty too, all the

while acting as an incentive for children to go to school rather than work. However, a substantial portion of children do not benefit from this intervention. This group includes the most vulnerable (too young to go to school) and the most poor (too poor to go to school, even with the incentive of a school-feeding program). As such, other complementary policies directed towards these excluded children should also be implemented.

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APPENDIX A: METHODOLOGY

1 METHODOLOGY FOR ANALYZING THE IMPACTS OF THE FOOD CRISIS ON CHILD POVERTY

1.1 Main notation

1. $\mathbf{y} = (y_1, y_2, \ldots, y_h, \ldots, y_H)$ is a vector of household welfare (income, for short) for a population of H households and N individuals ($N = \sum_{h=1}^{H} n_h$), where n_h is the size of household h.
2. $\mathbf{p}$ is a vector of K prices, where p_k is the price of good k.
3. $\mathbf{q}_h$ is a vector of K quantities of goods bought by household h, where $q_{k,h}$ is the quantity per person of good k consumed in household h.
4. $\mathbf{Q}$ is a vector of K aggregate quantities consumed by the population, with $Q_k = \sum_{h=1}^{H} n_h q_{h,k}$.
5. $w_{h,k}$ is the budgetary share allocated by household h to good k: $w_{h,k} = \frac{n_h p_k q_{h,k}}{y_h}$.
6. η_h is the number of adult equivalents (AE) living in household h (η_h can be equal to n_h if we ignore the differences between adults' and children's needs and the economies of scale for intra-household consumption).
7. $\mathrm{x} = (x_1, x_2, \ldots, x_h, \ldots, x_H)$ is a vector of welfare per person or per adult equivalent (income, for short): $x_h = \frac{y_h}{\eta_h}$, $\eta_h \leq n_h$.
8. To support the poor, we make the assumption that the government has a budget per person equal to ρ. This budget can be used to intervene with either direct transfers or consumption subsidies.

1.2 Theoretical framework

The analysis is focused on the effects of the increase in the price of food commodities on food poverty. The analysis also extends to other aspects of poverty, such as school participation, nutrition, access to health services and child labour.

The objective is to compare the level of welfare for households facing different consumption options following the crisis that saw soaring prices for food products. To achieve this goal, we fix a reference price, called $\mathbf{p}^r$, and use the concept of *equivalent income* as defined by King (1983). More precisely, let $x_{c,h}$ be exogenous nominal income (corrected, if necessary for household size, differences between the needs of adults and children and the economies of scale linked to intra-household consumption) for a household h living in strata c, and facing price $\mathbf{p}_c$. This price system is presumed to be constant within each state but varies from one strata to another.

For a given budget ($\mathbf{p}_c$, $x_{c,h}$), the *equivalent income* is defined as the amount of income that ensures the same level of utility that would have been obtained at the reference ($\mathbf{p}_c$, $x_{c,h}$):

$$v(\mathbf{p}_c, x_{ch}) = v(\mathbf{p}^r, e_{c,h}) \quad (2)$$

where $v(.)$ is the indirect utility function and $\mathbf{p}^r$ is the reference price system. By inverting the indirect utility function, we obtain the equivalent income in terms of expenditures:

$$e_{c,h} = e(\mathbf{p}^r, \mathbf{p}_c, x_{c,h}) \quad (3)$$

where $e_{c,h}$ is the equivalent income for household h living in strata c facing price $\mathbf{p}_c$, and has a nominal income per head (or per adult equivalent) of x_{ch}. The equivalent income ($e_{c,h}$) is the level of income that, at the reference price $\mathbf{p}^r$, offers the same utility as obtained with the level of income $x_{c,h}$ and price system $\mathbf{p}_c$. Given that $e_{c,h}$ is an exact monetary measure of the utility function, the properties of the equivalent income function can be derived $v(.)$. This implies that the function $e(\mathbf{p}^r, \mathbf{p}_c, x_{c,h})$ is increasing with respect to $\mathbf{p}^r$ and $x_{c,h}$, decreasing with respect $\mathbf{p}_c$, concave and homogenous of degree one with respect to the reference price, and is continuous in its first and second derivatives and for all its arguments.

Determining the equivalent income depends on the choice of the reference price system. As was effectively highlighted by King (1983), many choices of $\mathbf{p}^r$ are possible. In this work, we choose to fix the level of the n prices that were in effect before the crisis $\mathbf{p}^0$:

$$p_k^r = p_k^0 = \frac{1}{C}\sum_{c=1}^{C} p_{c,k}^0 \quad (4)$$

where C is the total number of strata.

The first use of the equivalent income is to predict the individual welfare losses following the food crisis and the welfare gains of anti-poverty policies that could be implemented to mitigate the impacts of the food crisis. A natural measure of the value of a given change of $\mathbf{p}_c$ and $x_{c,h}$ for an individual is the change in their equivalent income. For $\mathbf{p}^r = \mathbf{p}^0$, King (1983) shows that this measure of the change in welfare is given by the equivalent gain:

$$EG_{c,h} = e(\mathbf{p}^0, \mathbf{p}_c^1, x_{c,h}^1) - e(\mathbf{p}^0, \mathbf{p}_c^0, x_{c,h}^0) \quad (5)$$

The equivalent gain, which may be negative, is the amount of money that the household would consider as equivalent to the impact of the change in their budgetary constraint from $(\mathbf{p}_c{}^0, x_{c,h}{}^0)$ to $(\mathbf{p}_c{}^1, x_{c,h}{}^1)$.

In terms of poverty, we define z_e as the real minimum income required per head (or adult equivalent) to escape poverty. In other words, z_e is an equivalent poverty line given by:

$$z_e = e(\mathbf{p}^0, \mathbf{p}_c^0, z_c^0) \quad (6)$$

where $z_c{}^0$ is the poverty line specific to strata c evaluated at price $\mathbf{p}_c{}^0$.

It is common to express measures of poverty in terms of the normalized poverty gap, g_{hc}, defined for an individual by

$$g_{c,h} = \max\left(\frac{z_e - e(\mathbf{p}^0, \mathbf{p}_c, x_{c,h})}{z_e}, 0\right) \tag{7}$$

$\mathbf{g} = (g_1, g_2, \ldots, g_h, \ldots, x_H; n_1, n_2, \ldots, n_h, \ldots, n_H)$ is thus the vector of the poverty gaps.

An important group of measures of poverty is the FGT (Foster, Greer, and Thorbecke, 1984) class of indexes, defined by:

$$\begin{aligned} P_\alpha(z_e, \mathbf{x}) &= \frac{1}{N}\sum_{h-1}^{H} n_{c,h} g_{c,h}^{\alpha} \\ &= \frac{1}{N}\sum_{h=1}^{H} n_{c,h}\left(\frac{z_e - e(\mathbf{p}^0, \mathbf{p}_c, x_{c,h})}{z_e}\right)^{\alpha} I\left(e(\mathbf{p}^r, \mathbf{p}_c, x_{c,h}) < z_e\right) \end{aligned} \tag{8}$$

where α can be considered as a measure of aversion to poverty, or also, inequality among the poor: a higher value of α gives a greater weight to income lost by a very poor individual than the same amount of income lost by a less poor individual. As is well known, the $P_0(\mathbf{x}, z_e)$ gives the incidence of poverty (the poverty rate), $P_1(\mathbf{x}, z_e)$ gives the average poverty gap (or the normalized poverty deficit) and $P_2(\mathbf{x}, z)$ is often described as being the severity of poverty.

1.3 Impact of the crisis on food poverty

In terms of the effects of the price changes on food poverty, it is supposed that each household h has an exogenous nominal income per equivalent adult ($x_{c,h}^1 = x_{c,h}^0$) before the global food crisis, and afterwards faces a new price system $\mathbf{p}_c^1$.[22] The levels of poverty (or any other metric of social welfare) can be compared when households face different price systems. The literature offers numerous strategies to do this, according to whether or not we account for substitutability between different goods. We will briefly present these different methods.

1.3.1 Uniformity of price effects on households

The easiest approach is to suppose that the price changes have uniform effects across households, independently of their consumption patterns and sociodemographic characteristics. To see how that can be done, with π_t^0 being the official consumer price index (CPI), given the average growth in prices between the reference date 0 and date t, where the aggregate CPI is calculated from ELIM 2006 using the following formula

$$\pi_0^t = \frac{\mathbf{p}^t\mathbf{Q}^0}{\mathbf{p}^0\mathbf{Q}^0} = \frac{\sum_{k=1}^{K} p_k^t Q_k^0}{\sum_{k=1}^{K} p_k^0 Q_k^0} = \sum_{k=1}^{K} \overline{w}_k^0 \frac{p_k^t}{p_k^0} \quad \text{or} \quad \overline{w}_k^0 = \frac{p_k^0 Q_k^0}{\sum_{k=1}^{K} p_k^0 Q_k^0} \tag{9}$$

[22] The nominal revenue $x_{c,h}^1$ can also be different than $x_{c,h}^0$ if, for example, the household derives a part (or all) of their revenue from the production of goods that faced the price change. The following methodology easily allows the analyst to account for such cases.

By definition, $\pi^0_0 = 1$ and $\pi^1_0 > 1$ regardless of the exact point in time between the dates that the prices increase. Each household's purchasing power in any given period can be approximated by

$$xr^t_{c,h} = \frac{x^t_{c,h}}{\pi^t_0} \tag{10}$$

The impact of the price changes on poverty can be calculated by

$$\begin{aligned}\Delta P &= P(\mathbf{x}^1, z) - P(\mathbf{x}^0, z) \\ &= \frac{1}{N}\left(\sum_{h=1}^{H} n_{c,h} \left(\frac{z - \frac{x^1_{c,h}}{\pi^1_0}}{z} \right)^{\alpha} - \sum_{h=1}^{H} n_{c,h} \left(\frac{z - \frac{x^0_{c,h}}{\pi^0_0}}{z} \right)^{\alpha} \right)\end{aligned} \tag{11}$$

where z is a real poverty line calculated at the national level.

1.3.2 Price effects on specific households: ad-hoc method

It is clear that the preceding approach is somewhat unsophisticated since the effects of the same price changes vary between households according to the structure of their consumption. It is, for example, well known that the poor allocate a larger portion of their budget to food than the non poor. That means that the global food crisis affects the poor more than the less poor or non poor.

To account for this fact, a specific consumer price index should be calculated for each household. There are two ways to go about this. The first is to calculate a price index specific to the household such that

$$\pi^t_{0,h} = \sum_{k=1}^{K} w_{h,k} \frac{p^t_k}{p^0_k} \quad \text{or} \quad w_{h,k} = \frac{n_h p^0_k q^0_{hk}}{y^0_h} \tag{12}$$

Using the price index specific to the household $\pi^t_{0,h}$, rather than the aggregate price index π^t_0 found in equation (11), better characterizes the impacts of the price changes on poverty.

An alternative assumption, adopted by Wodon and Zaman (2008) for example, is that none of the changes in the prices of food products bring about any change in the quantity of food products consumed (and produced), such that the extra food costs are entirely absorbed by a reduction in non food consumption. Since the quantities of foods consumed would not be affected, there would not be any impact on food poverty, which is the primary form of poverty that this study is interested in, whereas total poverty (including non food poverty) would increase. As an approach that is not only theoretically unsupportable, this approach is not adequate in the context of this analysis.

1.3.3 Approach based on microeconomic theory: the strong separability case (fixed budgetary shares)

An approach that is more based on microeconomic consumer theory consists of fixing, as shown above, $\mathbf{p}^0$ as a reference price system and using the concept of equivalent income. Formally, we have:

$$e_{c,h}^{t} = e(\mathbf{p}^{0}, \mathbf{p}_{c}^{t}, x_{c,h}^{t}) \tag{13}$$

where t = 0, 1 and $e_{c,h}{}^{t}$ is the equivalent income of household h from strata c at date t when facing price system $\mathbf{p}_{c}{}^{t}$ and having a nominal income of $x_{c,h}{}^{t}$.

Ideally, a complete demand system should be estimated to derive the equivalent income functions. However, if we maintain the assumption of a total absence of substitution between goods, this estimation becomes useless. In such cases, it suffices to suppose that the portion of the budget allocated to each consumption product is fixed following the price changes. Stated differently, any price rise for a product leads to a proportional reduction in the quantity consumed such that total expenses are constant.[23] The Cobb-Douglas utility function corresponds perfectly with this practical, yet restrictive assumption. The indirect utility function is therefore

$$v(\mathbf{p}_{c}^{t}, x_{c,h}^{t}) = \frac{A x_{c,h}^{t}}{\prod_{k=1}^{K} (p_{c,k}^{t})^{w_{c,h,k}}} \tag{14}$$

Following equations (2) and (14), the equivalent income for each household is given by

$$e_{c,h}^{t} = \frac{x_{c,h}^{t}}{\Gamma_{0,c,h}^{t}} \quad o\grave{u} \quad \Gamma_{0,c,h}^{t} = \prod_{k=1}^{K} \left(\frac{p_{c,k}^{t}}{p_{k}^{0}} \right)^{w_{c,h,k}} \tag{15}$$

$\Gamma_{0,c,h}^{t}$ appears in the actual cost of living index when is theoretically more telling than the approximate cost of living $\pi_{0,h}^{t}$ given by (12).

The impact of poverty on price changes can be calculated by:

$$\begin{aligned} \Delta P &= P(\mathbf{x}^{1}, z_{e}) - P(\mathbf{x}^{0}, z_{e}) \\ &= \frac{1}{N} \left(\sum_{h=1}^{H} n_{c,h} \left(\frac{z_{e} - e(\mathbf{p}^{0}, \mathbf{p}_{c}^{1}, x_{c,h}^{1})}{z_{e}} \right)^{\alpha} - \sum_{h=1}^{H} n_{c,h} \left(\frac{z_{e} - e(\mathbf{p}^{0}, \mathbf{p}_{c}^{0}, x_{c,h}^{0})}{z_{e}} \right)^{\alpha} \right) \end{aligned} \tag{16}$$

1.3.4 Approach based on microeconomic: accounting for substitutability between goods

Under this much more theoretically appropriate assumption, we move beyond the simple assumption that households adjust to price changes with a proportional reduction in the quantities that they consume of the affected goods (fixed portions of their budget). In estimating households' effective response in terms of substitution between food and non food goods, we obtain a more realistic measure of the impacts on poverty and we can explore the nutritional impacts in greater detail. Better yet, it becomes possible to predict the change in household consumption baskets following price changes.

In order to render the estimations of demand behaviour both as flexible and consistent with economic consumer theory as possible, we estimate the following demand system:

[23] That naturally brings about nutritional consequences for the household members

$$w_{j,c,h} = a_j + \sum_{k=1}^{K} b_{j,k} \ln p_{k,c} + c_j \ln \frac{x_{c,h}}{z(\mathbf{p}_c)} + \frac{d_j}{b(\mathbf{p})} \left(\ln \frac{x_{c,h}}{z(\mathbf{p}_c)} \right)^2 + e_j D_{c,h} + \mu_c + \varepsilon_{j,h} \qquad (17)$$

where $w_{j,c,h}$ is the portion of the budget allocated by household h in strata c to good j, $p_{j,c}$ is the price of this good in strata c, $D_{c,h}$ is a vector of sociodemographic characteristics, $z(\mathbf{p}_c)$ is the cost of subsistence (see Deaton and Muellbauer 1980)

$$\ln z(\mathbf{p}_c) = a_{0c} + \sum_{k=1}^{K} a_k \ln p_{c,k} + \frac{1}{2} \sum_{j=1}^{K} \sum_{k=1}^{K} b_{j,k} \ln p_{c,j} \ln p_{c,k} \qquad (18)$$

Which can be approximated by the poverty line in strata c, $b(\mathbf{p})$ is a price index given

$$b(\mathbf{p}) = c_0 \prod_j p_j^{c_j} \qquad (19)$$

μ_c is a specific effect for strata c, and $\varepsilon_{k,h}$ is the residual term.

Equation (17) corresponds to the QAIDS (*Quadratic Almost Ideal Demand System*) suggested by Banks et al. (1997) in which the budgetary shares are linear in b_{jk}, c_k and d_k. The estimation strategy conforms to Deaton (1997) and relies on the spatial variability of prices in Mali to estimate the parameters for price (b_{jk}) and income (c_k and d_k) in equation (17). Model (17) can also include explanatory variables linked to household sociodemographic characteristics to predict the impact of price changes according to certain relevant characteristics such as the number of children.

Once the equation's parameters are estimated, it becomes possible to predict the changes in real income that are inherent to any price changes, whether resulting from the food crisis or from a public intervention (via subsidies) that combats poverty. For instance, it is more appropriate to substitute the equivalent income that results from the preference system described by the QAIDS questions in equation (16):

$$\ln e_{c,h} = b(\mathbf{p}_r) \left[\frac{\ln x_{c,h} - \ln z(\mathbf{p}_c)}{b(\mathbf{p}_c)} + \left(c(\mathbf{p}_r) - c(\mathbf{p}_c) \right) \right] + \ln z(\mathbf{p}_r) \qquad (20)$$

where $z(\mathbf{p})$ and $b(\mathbf{p})$ are respectively given by equations (18) and (19), and $c(\mathbf{p})$ is a price index given by:

$$c(\mathbf{p}) = d_0 \prod_j p_j^{d_j} \qquad (21)$$

With this approach, it is finally possible to estimate the new consumption vectors which will be used in the subsequent analysis of the nutritional impacts of the food crisis.

1.4 Nutritional impacts of the food crisis

The caloric poverty index is determined by the number of calories required by an individual. Assuming that each household member needs the same amount calories, normalized per adult

equivalent (ex: the calories are equitably distributed within the household in proportion to the caloric needs of each member), we have

$$CAR_{hn} = CI^*_{hn}/CR^*$$

where

CI^*_{hn} = calories consumed by individual *n* in household *h* expressed in terms equivalent to the reference male adult

CR^* = the reference adult male's caloric needs.

The poverty line is simply ($CI^*_{hn} = CR^*$). The amount of each food consumed by the household is equal to the value of consumption divided by the price index:

$$Q_{hi} = V_{hi}/p_{hi}$$

where

Q_{hi} = quantity of good i consumed by household h

V_{hi} = value of good i consumed by household h

p_{hi} = price of good i for household h (average price in the strata).

The quantities consumed by each adult equivalent (per adult male) are obtained by dividing household consumption by their equivalence scale, which is the sum of the caloric needs of its members divided by those of an adult male:

$$Q^*_{hin} = Q_{hi}/(\Sigma_n CR_{hn}/CR^*)$$

where

Q^*_{hin} = the quantity of good i consumed by member n of household h expressed in terms of the equivalent adult male of reference;

CR_{hn} = the caloric needs of individual n in household h ;

$CI^*_{hin} = Q^*_{hin} * K_i$

$CI^*_{hn} = \Sigma_i CI^*_{hin}$

1.5 Impacts of the crisis on the school participation rate and child labour

- It should be pointed out that children can be in 4 possible situations: i) no work – no school; ii) no work – but school; iii) work – but no school; iv) work – school.
- Bivariate probit regression of the probability of both the child's probability of going to school and of working on individual/household characteristics and real income.
- Use the real income effects to predict the change in probability that the child would be in one of the four situations.

1.6 Impact of the crisis on access to health services

- Regress the probability that a sick individual consult health services and, among those who have used a health service, regress the probability of access to the principle types of health services consulted on individual/household/community characteristics and real income
- Probit regression of the probability of using health services and multinomial logit regression of the probability of the type of health service consulted
- Use the effects of real income estimated in the preceding steps and the estimated regression to predict the variation in the rate of consulting health services and the main type of health service consulted.

2 TARGETING METHODS

To deal with the food crisis, the government must choose between a number of possible transfer schemes. We test the effectiveness of a variety of transfer schemes with the same budget (revenue neutral programs). These programs can be based on direct transfers or indirect transfers via consumption subsidies. In what follows, we will review numerous possible methods of intervention.

2.1 Targeting with perfect information: the ideal solution to the crisis

To better understand the types of transfers that can mitigate the effects of the crisis, we will start of by studying the case of perfect targeting, i.e., the situation where the income vector is a variable that is perfectly observable by policymakers. In this case, the optimal allocation of the available anti-poverty budget is the solution to the following system:

$$\min P_\alpha(z, x+T) \quad \text{subject to} \quad \frac{1}{N}\sum_{h=1}^{H} n_{ch} T_{ch} = \rho \tag{22}$$

where $T_{c,h}$ is the real per capita income transfer that should be allocated to household i which earns an income of $x_{c,h}$ per head with the transfer and ρ is the per capita cost of the government social program. The income transfer is presumed non negative for all households since the problem of financing the program is not posed in this study. When the income distribution is perfectly observable by policy makers, the optimal solution to the problem described by equation (22) is often called “perfect targeting” (or “targeting with perfect information”) and is denoted by $T_{c,h} = T_\alpha(x_{c,h}, z_c, \rho)$ for household h.[24]

Bourguignon and Fields (1997) show that the transfer scheme which minimizes the poverty rate, $P_0(.)$, when the standards of livings are perfectly known, would be called "*r-type*". It consists of starting off by allocating the transfers to the richest of the poor, such that the transfer brings the maximum number of them out of poverty:

$$\begin{cases} T_{c,h} = z_c - x_{c,h} & \text{if} \quad x_{c,h} > x_{\min,c} \\ T_{c,h} = 0 & \text{if} \quad x_{c,h} \le x_{\min,c} \end{cases} \tag{23}$$

where $x_{\min,c}$ is the income threshold required to be eligible for the "*r-type*" program. Exactly the opposite approach is taken if the goal is to minimize an FGT poverty measure that is sensitive to declining inequalities among the poor. With $\alpha > 1$, they show that it is optimal to target the entire budget allocated to poverty reduction to the poorest of the poor. In this case, the transfer scheme would be "*p-type*"

$$\begin{cases} T_{c,h} = x_{\max,c} - x_{c,h} & \text{if} \quad x_{c,h} \le x_{\max,c} \\ T_{c,h} = 0 & \text{if} \quad x_{c,h} > x_{\max,c} \end{cases} \tag{24}$$

where $x_{\max,c}$ is the level of income at which individuals become ineligible for the program. If the budget is not sufficient to bring all the poor out of poverty, we obviously get $x_{\max,c} < z_c$.

[24] Including the equivalence scale in the analysis, it is important to consider the transfer in terms of adult equivalents to evaluate poverty and in per capita terms to evaluate the budgetary cost.

As the available budget to combat poverty, $x_{\max, c}$ increases to the point that it is equal to the poverty line, z_c, perfect targeting brings all the poor out of poverty if there is enough funding.

Unfortunately, perfect targeting is not possible because income distribution is not perfectly observable (Besley and Kanbur, 1990). Policy makers are thus forced to choose among imperfect targeting schemes to decide who will, and who will not, be beneficiaries of the support policy. This can be done by targeting in terms of consumption goods using food subsidies, poverty profiles or regression models.

2.2 Targeting using consumption profiles

Among the range of redistributive public programs in developing countries that are expected to have an immediate impact, consumption subsidies (CS) have caught the attention of academics and international organizations. Their central position in the literature comes from their observability in household surveys, their regular use as a redistributive tool and their supposed lack of efficiency in obtaining their stated objectives.

CSs can be seen as a sort of auto-selection mechanism since they only benefit households that choose to consume the subsidize goods. They have, however, long been criticized for poor targeting. The World Bank (1999) indicates that inadequately targeting […], means that groups with higher incomes benefits more in absolute terms than the poor because the rich tend to consume greater quantities of subsidized goods. In Yemen, for example, the highest decile spends 10 times as much as the lowest decline on subsidized wheat. Similar targeting programs are reported in South Africa (Alderman and Lindert 1998) and Indonesia (Pitt 1985) and for example, for most low income countries where many poor households are often not highly integrated into the national economy. (Alderman, 2002). In their review of 15 food subsidy programs, Coady et al. (2002) only found that three of them were progressive.

In our approach, we suppose that each household h, living in strata c, has exogenous nominal income per capita (or, if necessary, per adult equivalent) $x^0_{c,h}$ and faces price system $\mathbf{p}_c^0$ before the global food crisis. Following the price changes for food products, each household h can continue to have the same nominal income ($x^1_{c,h} = x^0_{c,h}$) but faces a new price system $\mathbf{p}_c^1$.[25] The impact of price changes on poverty can therefore be calculated as follows:

$$\begin{aligned}\Delta P_\alpha^1 &= P_\alpha(e^1, z) - P_\alpha(e^0, z) \\ &= \frac{1}{N}\left(\sum_{h=1}^{H} n_{c,h}\left(\frac{z - e(\mathbf{p}^r, \mathbf{p}_c^1, x_{c,h}^0)}{z}\right)_+^\alpha - \sum_{h=1}^{H} n_{c,h}\left(\frac{z - e(\mathbf{p}^r, \mathbf{p}_c^0, x_{c,h}^0)}{z}\right)_+^\alpha\right)\end{aligned} \tag{25}$$

With an eye to compensating the poor for certain adverse effect of the food crisis, the Malian government could introduce a consumer subsidy program. Whether it comes in the form of a tax reduction, price controls or consumer subsidies, the economic price adjustments are experienced by the consumers simply as a change in the price of the goods they consume. That is also the case for policies that aim to regulate domestic supply as discussed in section

[25] This assumption is put forward for the sake of clarity. The following methodology can also be used to consider the effects of simultaneous variations in prices and nominal revenues.

3.2. As such, they have exactly the same impacts on poverty and can be analyzed with the same methodology. These adjustments can therefore be defined as a reform which goes from $(\mathbf{p}_c^1, x_{c,h}^0)$ to $(\mathbf{p}_c^2, x_{c,h}^0) = ((1-\mathbf{s})\mathbf{p}_c^1, x_{c,h}^0)$, where s is the vector of the rate of food subsidy rates. The impact of a reform on poverty is given by:

$$\begin{aligned}\Delta P_\alpha^2 &= P_\alpha(e^2, z) - P_\alpha(e^1, z) \\ &= \frac{1}{N}\left(\sum_{h=1}^{H} n_{c,h}\left(\frac{z - e(\mathbf{p}^r, \mathbf{p}_c^2, x_{c,h}^0)}{z}\right)_+^\alpha - \sum_{h=1}^{H} n_{c,h}\left(\frac{z - e(\mathbf{p}^r, \mathbf{p}_c^1, x_{c,h}^0)}{z}\right)_+^\alpha\right)\end{aligned} \tag{26}$$

Equation (26) therefore makes it possible to evaluate the portion of the adverse effects of the food crisis attenuated by implementing a food subsidy program. However, even if targeting individuals via food prices can totally eliminate the effects of the food crisis (for example, even if $\Delta P_\alpha^1 + \Delta P_\alpha^2 = 0$), it is still difficult to verify whether the subsidies target the best basket of goods. Stated otherwise, it must be determined whether another group of goods exists that can attain either the same objective with a smaller budget or a greater reduction in poverty with the same budget (see Bibi and Duclos, 2007a). As such, we also explore the potential effects that alternative uses of the budget allocated to subsidized goods could have on poverty.

2.2.1 Marginal reform of indirect taxes

To show how this approach can be pursued (scenario 2), let $\mathbf{p}_c$ and $\mathbf{t}$ respectively be the K price vectors and the tax rates. To simplify things, the producers' prices are often assumed unaffected by changes in $\mathbf{t}$ and normalized to 1. We therefore have $p_{ck} = 1 + t_k$ and $dp_{ck} = dt_k$, where p_{ck} and t_k are respectively the consumer price for good k and the indirect tax rate. Good k is subsidized when $t_k < 0$. Let $q_{c,kh}(x_i, \mathbf{p})$ be the quantity of good k bought by consumer h facing price $\mathbf{p}_c$ and having an exogenous income x_{ch}. Let $R(\mathbf{t})$ be the government's per capita income given by:

$$\begin{aligned}R(\mathbf{t}) &= \frac{1}{N}\sum_{h=1}^{H}\sum_{k=1}^{K} n_h t_k q_{c,k,h}(x_{ch}, \mathbf{p}_c) \\ &= \rho\end{aligned} \tag{27}$$

This theory of optimal taxation plays an important role in identifying the tax reforms that are favourable to redistribution and are neutral with respect to government tax revenues ($dR(\mathbf{t}) = 0$). To see this, let $\overline{q}_k$ be per capita consumption of good k, E_k the marginal efficiency cost of funds (MECF) of the taxation on k,[26] and D_k the social cost (benefit) of the increase (decrease) in t_k expressed as a proportion of $\overline{q}_k$. E_k and D_k are formally defined as:

$$E_k = \frac{\overline{q}_k}{\partial R(\mathbf{t}) \big/ \partial t_k} \tag{28}$$

and

[26] See Bibi and Duclos (2007b) for a more detailed discussion of this.

$$D_k(\alpha,z)=\frac{\partial P_\alpha(z,e(\mathbf{p}^r,\mathbf{p}_c,\mathbf{x})\big/\partial t_k}{\overline{q}_k} \tag{29}$$

It should be pointed out that D_k can be interpreted as a Feldstein (1972) index of the distributive characteristics of good k. By applying Roy's identity to equation (29) and imposing the equality $\mathbf{p}^r = \mathbf{p}_c$, we get:

$$D_k(\alpha,z)=\begin{cases} q_{c,h,k}(z,\mathbf{p}_c)/\overline{q}_k & \text{if } \alpha=0 \\ \dfrac{\alpha}{Nz\overline{q}_k}\displaystyle\sum_{h=1}^{H} q_{c,h,k}(x_{c,h},\mathbf{p}_c)\left(\frac{z-e(\mathbf{p}^r,\mathbf{p}_c,x_{c,h})}{z}\right)_+^{\alpha-1} & \text{if } \alpha>0 \end{cases} \tag{30}$$

The product of these two indicators E_k and D_k yield λ_k, i.e., the total social cost per marginal unit of public revenue obtained by increasing t_k by a very small amount

$$\lambda_k(\alpha,z)=\frac{\partial P_\alpha()\big/\partial t_k}{\partial R(\mathbf{t})\big/\partial t_k}=D_k(\alpha,z)E_k \tag{31}$$

The greater the value of $D_k(.)$, the greater the benefit of a reduction in the tax rate t_k. To put it more clearly, the value of D_k varies depending on whether α is equal to or greater than zero. Bibi and Duclos (2007b) have shown that:

- With $\alpha = 0$, the objective of a tax reform in terms of poverty is to reduce the portion of the population in poverty. Because the tax reforms considered are marginal, it is only the levels of consumption at the margin or very close to z that matter in identifying the goods for which variation in the tax (or subsidy) rate can be used to pass indirect transfers on to the poor. Omitting the efficiency criteria (given by E_k), the goods which take up a large share in the budget of households whose income is equal to z necessarily decline (increase) in the tax (subsidy) rate. However, goods which are barely consumed by these households (or ideally not consumed at all) can be taxed more heavily. Looking to reduce $P_0(z)$ can therefore lead to a reform that benefits the richest of the poor but penalizes the poorest of them. That can happen if the consumption profile of those whose income is close to z differs significantly from the consumption profile of the poorest, raising important ethical questions.
- With $\alpha > 0$, the consumption of each of the poor counts, but not necessarily equally. The consumption weights, $q_{i,k}(x_i, \mathbf{p}_c)$, are proportional to the normalized poverty gap in $P_{\alpha\text{-}1}(z)$. *Ceteris paribus*, the bigger the value of α, the greater the social cost of increasing the tax rate on goods primarily consumed by the poorest. When a good is not consumed by the poor, there is no distributive cost in increasing the tax rate on that good. It should be noted that $D_k(\alpha=1, z)$ is obtained by giving an equal weight of 1 for the consumption level of good k among poor households and a weight of zero for non poor households' consumption of this same good. The distribution of the

consumption of good k among the poor thus has no relevance for targeting when $\alpha>1$.[27]

In terms of efficiency, the greater the value of E_k, the smaller the efficiency of a change in tax revenues via an increase in t_k. This is because the increase in t_k has little effect on public finances (as is the case for elastic goods). Therefore, higher values of E_k also imply higher economic efficiency costs resulting from a given tax increase.

It is therefore clear that λ_k is (intuitively) the product of the distributive and efficiency costs of changing a tax: it is the social cost of increasing public tax receipts by one monetary unit following an increase in t_k. This is the dilemma faced by a decision maker in terms of social considerations between economic efficiency and judgments of the distributional value, measured here by the reduction in poverty. It should be pointed out that E_k can also be negative. This would be the case if the tax receipts declined following the increase in t_k, i.e., when situated on the falling part of the Laffer curve where it is economically efficient to reduce t_k.

Given this interpretation, it is not necessarily surprising that λ_k plays an important role in identifying desirable tax reforms and social subsidies. Indeed, what matters for revenue neutral changes in distributive policies are the relative values of λ_k for the k different goods. When $\lambda_k < \lambda_j$, poverty can decline by increasing tax receipts from taxes on good k by one monetary unit (i.e. by increasing t_k) and by reducing the tax receipts generated by taxing good j (therefore maintaining a constant level of taxes collected by the government).

Exploring the possibility that tax reforms and indirect subsidies that necessarily bring about improved social welfare or a reduction in poverty is something that cannot be ignored. A way to test for the existence of tax reforms that are desirable and that are also robust to different poverty lines and measures of poverty is simply to draw the $\lambda_k(\alpha, z)$ curves for a given value of α as well as for all possible poverty lines. Curves which never intersect for a pair of goods j and k imply that a robust tax reform could be easily constructed.

Application of the above methodology requires data for the distribution of both income and consumption. This can be easily obtained from budget-consumption household surveys. To find tax reforms which reduce poverty, estimations of the average consumption basket for those at or near the poverty line are needed. That can be carried out non parametrically using a simple kernel density estimation – see for example Silverman (1986). Applying this methodology finally requires simulations of how aggregate demand for goods changes following a change in prices so as to evaluate the expected impact of the tax reform on state receipts. Such estimations can be obtained from an estimation of the demand system given in equation (17) above.

Once the parameters in equation (17) are estimated, we can calculate the marginal cost efficiency of funds for each good, E_k, and draw the different $\lambda_k(\alpha, z)$ curves to explore the possibility that changes in the tax or subsidy rate do not necessarily reduce poverty. We can

[27] The reduction in the tax leakage (as was argued by Cornia and Stewart (1995)) can be justified when the decision maker's social target is to minimize $P_1(z)$ for $E_k = 1$ for all $k = 1, \ldots, K$.

then test specific reforms by estimating, with the help of equation (20), the change in equivalent income resulting from a change in the structure of food subsidies deduced from the analysis of the $\lambda_k(\alpha, z)$.

2.2.2 Cost analysis

While the impacts of various alternative policies on food poverty may be identical, their effects on the state budget may be different. Setting aside administrative costs, which likely vary from one policy to another, and consumer behaviour, we can then observe the indirect costs. In the case of a consumer subsidy or a reduction in indirect taxes, the per capita cost can be calculated as follows:

$$\rho = \frac{1}{N}\sum_{h=1}^{H}\sum_{k=1}^{K} n_{c,h} s_k \cdot p^1_{c,k} \cdot q_{c,k,h}(\mathbf{s}.\mathbf{p}^1_c, x^0_{c,h}) \tag{32}$$

where **s** represents the effective subsidy rate resulting from the reduction in indirect taxes and $q_{c,k,h}(.)$ is the per capita consumption of good k by household h living in c after implementation of the consumption subsidy. In other words, the calculation requires that a prediction of households' consumption level can be obtained from results estimated in a QAIDS model.

In the case of price controls, there is no direct cost. In the case of tariff reductions, the immediate direct cost can be measured by:

$$\rho = \frac{1}{N}\sum_{h=1}^{H}\sum_{k=1}^{K} n_{c,h} s_k \cdot m_k . p^1_{c,k} \cdot q_{c,k,h}(\mathbf{s}.\mathbf{p}^1_c, x^0_{c,h}) \tag{33}$$

where m_k represents the average share of good k that is imported.

If we integrate the consumer's adjustments for non marginal interventions, the methodology is somewhat more complicated, based on the model developed in section 4.3.

We do not analyse policies aiming to reduce prices via an increase in domestic supply since this goes beyond the scope of this study.

While reforming food subsidies may be an attractive option to limit the harm inflicted by the food crisis, it can be very costly in that a large portion of the available budget ends up as leakage to the non poor. An alternative approach to protect the poor would be to intervene via direct transfers using poverty profiles or regression models.

2.3 Targeting using poverty profiles

One of the characteristics traits of the Foster-Greer-Thorbecke (1984) (FGT) class of poverty indexes is that they are additively decomposable. This facilitates the implementation of cost efficient programs that compensate for the consequences of the food crisis by constructing a poverty profile that captures the contribution of each group to total poverty. For the purposes of this study, the subgroups can be defined in terms of variables presumed to link household sociodemographic characteristics and poverty, such as the region of residence, the number of children and the occupation of the head of the household.

To see how that is done, we consider J mutually exclusive subgroups in the population with a specific poverty level $P_{j,\alpha}(.)$ in subgroup j. Since $P_\alpha(.)$ is additively decomposable, equation (6) can also be written as

$$P_\alpha(z,\mathbf{x}) = \sum_{j-1}^{J} \frac{N_j}{N} P_{\alpha,j}(z,\mathbf{x}_j) \tag{34}$$

where $\mathbf{x}_j$ is the income distribution in subgroup j. Let ρ be the government's cost of capital to compensate for the consequences of the food crisis. If each subgroup is defined in terms of the region they live in, Kanbur (1987) for example shows that the optimal budget allocation made available for each region can be determined from the following program optimization.

$$\begin{aligned} &\min . P_\alpha(z,\mathbf{x}) = \sum_{j-1}^{J} \frac{N_j}{N} P_{\alpha,j}(z,\mathbf{x}_j + T_j) \\ &\text{subject to} \\ &\sum_{j-1}^{J} \frac{N_j}{N} T_j = \rho \end{aligned} \tag{35}$$

where T_j is the total sum of transfers issued to each member of j. T_j is therefore constant within each subgroup but varies between subgroups. The first order conditions of the minimum $P_\alpha(.)$ under the constraint of ρ_j is given by

$$\begin{aligned} &\frac{N_j}{N} \frac{\partial P_{\alpha,j}(z,\mathbf{x}_j + T_j)}{\partial \rho_j} + \lambda = 0 \\ &-\frac{N_j}{N} \frac{\alpha}{N_j z} P_{\alpha-1,j}(z,\mathbf{x}_j + T_j) + \lambda = 0. \end{aligned} \tag{36}$$

Kanbur (1987) defines the parameter λ as the reference price that results in marginal growth of the available budget. Equation (44) indicates that this budget is distributed such that the last unit of money allocated to each subgroup leads to the same level of poverty reduction. This means that the optimal distribution of the available budget between the different regions is reached if

$$P_{\alpha-1,j}(z,\mathbf{x}_j + T_j) = P_{\alpha-1,l}(z,\mathbf{x}_l + T_l). \tag{37}$$

Following Kanbur (1987), the first order condition given in equation (45) is very informative. If the objective is to minimize the measure of poverty $P_\alpha(.)$ at the national level, the available budget is allocated so as to equate $P_{\alpha\text{-}1,j}(.)$. According to these authors, the intuition behind this result is clear when $\alpha = 1$. The measure of the poverty gap $P_1(.)$ is proportional to the sum of the poverty gaps. The amount that this sum changes when each income increases marginally is given by the number of households under the poverty line having the same per capita income, which is proportional to $P_0(.)$. Expression (37) emphasizes the fact that any poverty measure makes a statement about the average welfare among the poor, given that the optimal allocation of the available budget requires marginal data. Also, while $P_{\alpha\text{-}1}(.)$ is not in

itself the objective, it nevertheless plays a crucial role as an indicator by fixing the portion of the available budget that benefits each group.

Targeting by indicators can be put into place as follows: the level of poverty $P_{\alpha\text{-}1,j}(.)$, for $j = 1,\ldots, J$, is first calculated and ranked in decreasing order (i.e. from the poorest group to the non poor group with $P_{\alpha\text{-}1,j}(.) = 0$). The entire amount of the transfer is then given to each person in the poorest group up to the point where $P_{\alpha\text{-}1,j}(.)$ in this group is equal to the next poorest group. Income is then equally distributed to both of these groups until the level of poverty in each group is equal to that in the third poorest group. This process is repeated until all of the available funds are distributed.

The biggest drawback about the targeting procedure is that the non poor who are targeted benefit from the poverty reduction program while the poor who are not caught by the targeting procedure are excluded. This problem can be reduced by increasing the number of household indicators and increasing the number of subgroups. Such a process cannot, however, be applied for continuous variables such as the age of household members without losing relevant data about the poor.

2.4 Targeting using regression models

While the poverty profile obtained from decomposing the FGT measures of poverty offers certain perspectives on the determinants (if causality can be supposed) of poverty, it cannot effectively take on the question of relations between some characteristics of households and poverty that are continuous. An important reason for that is that households in the same subgroups differ considerably in a number of ways, including in socioeconomic and sociodemographic characteristics. A multivariate model of poverty is thus necessary. A basic model uses real household income (corrected, necessarily, for differences in individual needs, family composition and the prices they face) as the dependant variable in a regression where exogenous household characteristics are the explanatory variables. Such a model of welfare is a reduced form of the equation of a number of structural equations that express the household's income gain and consumption behaviour.[28] The easiest approach is to estimate a consumption model to predict household welfare using relevant characteristics linked to poverty, such as the amount of assets per sex, their ages, their level of education, the household head's sector of activity, the region, the area of their residence, the demographic structure of the households, etc. This model should explicitly capture the contribution of each characteristic at the level of household consumption:

$$x_{c,h} = Z_{c,h}\beta + \varepsilon_h, \;\; h = 1, 2, ..., H \qquad (38)$$

where $Z_{c,h}$ is a vector of household characteristics for the household of interest and ε_h is the residual error term.

If the assumption that household welfare has no effect on these variables is accepted, then all the variables in $Z_{c,h}$ are exogenous and the model in equation (38) can capture the net effect of each characteristic. A simple ordinary least squares (OLS) estimation of (38) is sufficient when this assumption is held. Yet, if the goal is to use the determinants of poverty for the

[28] See, for example, Glewwe (1991).

purposes of targeting them within a policy, model (38) and the OLS estimation are not the best choice. Indeed, the OLS method of estimation is tied to the average of the distribution in the dependent variable and only offers good predictions on the average, which is often too far above the poverty line. Furthermore, it is supposed in this case that the marginal effect of a given household characteristic, such as the number of children or the level of education, is the same across the population, regardless of the nature of poverty within each household. Model (38) is thus not entirely appropriate for the problem posed in this study.

There are many ways to address a situation where the marginal effects of household characteristics can be presumed variable across the income distribution. We can estimate model (38) separately for the poor and the non poor or introduce a set of interactions (between the binary variable, poor/non poor, and certain elements in $Z_{c,h}$). These two approaches are econometrically equivalent but applying them can be problematic for targeting. To the extent that these methods lead to biased estimates of the determinants of poverty, they contrast with the principal assumption of imperfect targeting.[29]

Another important issue is that the OLS estimators for anti-poverty methods are sensitive to the presence of controls, to the non normality of error terms when the sample size is not sufficiently large, to heterogeneity and poor specification. Using a regression for each of *e* quantiles addresses these questions in terms of robustness (Koenker and Bassett 1978). In this case, it is a chosen quantile of the distribution of living standards variable and its determinants that is modeled. This methodology has two weaknesses. To start with, if the error terms are approximately normal, some efficiency is lost compared to OLS. Otherwise, if the distribution of the error term is long tailed, which is common in living standards data, the quantile regression can be more efficient than OLS. Furthermore, the chosen quantile is not determined by the unconditional dependent variable, but is rather the quantile of the error term in the estimated equation. However, it is the quantile of the error term that is more relevant if we are interested in predicting the errors that afflict the transfer system.

A greater emphasis can be placed on the poor if the distribution of welfare is suitable for a censored model, in which case a *tobit* regression or one with censored quantiles may become an appropriate way to capture the link between household characteristics and poverty. This requires an assumption that equation (38) is the correct model of welfare for the poor and that the same group of explanatory variables determines whether or not a given household is poor. No assumptions are made about the determinants of the welfare for the non poor, since the transmission of their welfare as well as the parameters may or may not be the same. The model does not address any income level above the poverty line of *z*, which means that the data is censored at the poverty line:

$$x_{c,h} = \begin{cases} x_{c,h} & \text{if} \quad x_{c,h} < z_c \\ z_c & \text{if} \quad x_{c,h} \geq z_c \end{cases}, \; h = 1, 2, ..., H \tag{39}$$

This model allows the possibility of different parameters for the poor and the non poor. However, a comparison of the parameters estimated by equation (38) with those in (39) can

[29] This brings up the assumptions of imperfect targeting, since household welfare is not directly observable. These questions rule out, for example, the selection of a Heckman type model.

be used to test whether the parameters in the first model are significantly different between the poor and the non poor. This is especially relevant for human capital parameters, which measure the benefits of different components of human capital. We can therefore test, for example, how the benefits of qualifications differ across the entire distribution. Another promising characteristic of equation (39) is that it is linked to the poor's welfare, since it is simply a transformation of the households' poverty gap:[30]

$$g_{c,h} = \begin{cases} z_c - x_{c,h} & \text{if} \quad x_{c,h} < z_c \\ 0 & \text{if} \quad x_{c,h} \geq z_c \end{cases}, \; h = 1, 2, ..., H \tag{40}$$

We can also replace z_c in (40) by $x_{\max,c}$ derived from equation (24) to directly estimate $T_{c,i}$ rather than $g_{c,i}$,

$$T_{c,h} = \begin{cases} x_{\max,c} - x_{c,h} & \text{if} \quad x_{c,h} < x_{\max,c} \\ 0 & \text{if} \quad x_{c,h} \geq x_{\max,c} \end{cases}, \; h = 1, 2, ..., H \tag{41}$$

In each of these three possibilities, if the error term in the latent model follows a normal distribution, the predictions of living standards can be obtained from (39), (40) or (41) using a *tobit* model under the constraint of certain household characteristics. However, a number of factors render the *tobit* estimations inconsistent. To start with, the assumption of normality that the *tobit* model relies on is often rejected. Also, heteroscedasticity is likely to arise from the heterogeneity among households.

The household survey data used to estimate (39), (40) or (41) also contain a number of sources of measurement error. If the errors are only found in the dependent variable, they do not bias the estimated coefficients (as long as the errors are not correlated to any of the variables in the estimated model), but they affect the variance covariance matrix. It is potentially possible that the measurement errors systematically increase with the level of expenditures. This increases the probability of correlation between variables on the right side of the equations, such as the level of qualification, which is possibly correlated to the level of expenditures. This inevitably leads to estimation biases in (38), (39), (40) and (41).

According to Grootaert and Braithwaite (1998, p.11-12), "the presence of measurement error has led several authors to substitute limited-dependent variable models for the continuous welfare equation. Gaiha (1988) used a binary logit model to predict the probability that a rural household in India would be poor." Rodgers (1994) used a binary *probit* model to explain why poverty rates for families headed by women are much higher than for couples and for families headed by men. He estimates the *probit* model separately for each of the three family groups selected and decomposes the poverty rate between two groups of data which differ as a function of conditional poverty and differences in the distribution of household characteristics, following the approach of Oaxaca (1973) and Blinder (1973).[31] Returning to Grootaert and Braithwaite (1998, p.12):

[30] See, for example, Bibi (2003).

[31] While the Oaxaca-Blinder decomposition is highly relevant to this subject, it cannot be followed too closely due to absence of variables associated with the sex of the household head in the survey data used in this study.

"Diamond et al. (1990) estimate a multinomial *logit* model on U.S. data to predict the probability of belonging to an income quintile, conditional upon certain personal and household characteristics. Diamond et al justify their approach, relative to a continuous welfare regression, by arguing that the restrictions imposed by the functional form of a level regression (often linear or log-linear) may cause it to fit poorly on the actual distribution, and demonstrate that this is the case for their U.S. data set. The multinomial *logit* model allows for discontinuities in the underlying welfare model and thus also solves the concern of imposing equal parameters over the entire distribution discussed earlier. In the case of two groups (poor and non poor) the approach collapses to a binary *logit* or *probit* model, although then the underlying welfare model is again continuous (Ravallion 1996)."

Applied to our context, such an approach models living standards based on an equation that infers the status of poor households such that:

$$d_{c,h} = Z_{c,h}\beta_2 + \varepsilon_{2,h},\ \ h = 1,2,...,H \tag{42}$$

where $y_{c,h}$ is a binary variable indicating whether or not household h is poor:

$$d_{c,h} = \begin{cases} 1 & \text{if} \quad x_{c,h} < z_c \\ 0 & \text{if} \quad x_{c,h} \geq z_c \end{cases},\ \ h = 1,2,...,H. \tag{43}$$

Equation (51) is therefore estimated across all observations and captures the probability of being poor given the households' characteristics:

$$\Pr(d_{ch} = 1) = \Pr(d_{ch} > 0) = \Phi(Z_{ch}\beta_2) \tag{44}$$

where $\Phi(.)$ is the cumulative distribution function specified for the error term $\varepsilon_{2,h}$. This binary model will be estimated as a *probit* model, considering the same variables for all households.

As opposed to OLS estimators, the coefficients in the *probit* model do not give the marginal effects of the variable of interest on the probability of being poor. These can also be calculated using classical transformations.

It is clearly a matter of judgment as to whether or not the information contained in the *probit* regression (i.e., falling in the total distribution between the two values) compensates for the risk of biases linked to measurement errors. However, the results of the *probit* model can be used to test whether the results of the *tobit* model or the regression by quantile have a better probability of correctly predicting that those who are predicted as poor are, in fact, poor.

The best way to choose between the different regression options is to calculate the predicted changes in the poverty index that result from the different models. The model that reduces poverty the most with a fixed budget is the most desirable. Following the approach used when targeting by poverty profiles, the means tests lead all regression models to work as follows: the program grants the household with the lowest predicted income a per capita transfer that reduces their poverty gap to that of the next poorest. This process is repeated until all the funds have been allocated. As such, if $\hat{T}_{c,i}$ is the cash transfer received by household i under whatever imperfect targeting system is used (regional targeting, means tests, etc), its impact on poverty can be calculated as follows:

$$\Delta P_\alpha(z) = \frac{1}{N}\left(\sum_{h=1}^{H} n_{c,h}\left(\frac{z - e(\mathbf{p}^r, \mathbf{p}_c^1, (x_{c,h}^0 + \hat{T}_{c,h}))}{z}\right)_+^\alpha - \sum_{h=1}^{H} n_{c,h}\left(\frac{z - e(\mathbf{p}^r, \mathbf{p}_c^1, x_{c,h}^0)}{z}\right)_+^\alpha\right) \quad (45)$$

where $\mathbf{p}^r$ is the vector of the reference prices ($\mathbf{p}_c^0$ calculated using equation (4)) and $\mathbf{p}_c^1$ being the price system after the food crisis. However, a better alternative for evaluating the effectiveness of direct transfers is to compare them with an alternative approach that has the same budget. As such, if $\mathbf{p}_c^2$ is the price system with the food subsidies (or reduction in indirect taxes), the impact on poverty would instead be given by:

$$\Delta P_\alpha^3(z) = \frac{1}{N}\left(\sum_{h=1}^{H} n_{c,h}\left(\frac{z - e(\mathbf{p}^r, \mathbf{p}_c^1, (x_{c,h}^0 + \hat{T}_{c,h}))}{z}\right)_+^\alpha - \sum_{h=1}^{H} n_{c,h}\left(\frac{z - e(\mathbf{p}^r, \mathbf{p}_c^2, x_{c,h}^0)}{z}\right)_+^\alpha\right) \quad (46)$$

While ΔP_α^3 is greater (in absolute terms) than ΔP_α^2 (given by equation (13)), we can conclude that socio-demographic targeting transfers are more effective at reducing the adverse effects of the food crisis than the consumer subsidies.

If, however, these two policy alternatives do not require the same amount of funds, the effectiveness of the social poverty programs depends on the size of the budget that it requires. As such, it is important to consider both the costs and benefits of using these transfers (whether direct or indirect) for policies with redistributive objectives.

To bring both the costs and benefits of the redistributive transfers into the picture, it suffices to divide the impact on poverty from one source of income by the size of this source. Let ρ^i be the per capita cost of social intervention *i*. The impact of the policy on poverty is simply *i*:

$$\Gamma_\alpha^i(z) = \frac{\Delta P_\alpha^i(z)}{\rho^i} \quad (47)$$

Comparing $\Gamma_\alpha^i(z)$ over all *i* can help to evaluate which transfers are most effective, per dollar spent, at reducing poverty. As long as $\Gamma_\alpha^i(z) > \Gamma_\alpha^j(z)$, each dollar spent on program *i* reduces average poverty more than if it had been spent on program *j*.

3 NOTES ON IMPLEMENTING THE METHODOLOGY

3.1 Impacts on food poverty – fixed budget shares

First step: calculate the standard poverty indicators using ELIM 2006 survey data

- Aggregate expenditures, own consumption and the value of gifts received for all consumption goods in the household to calculate total consumption
- Allocate this consumption to household members by dividing total consumption by the number of adult equivalents in the household (under the assumption of a unitary model).
- There are two ways to calculate the adult equivalents for the purposes of this study:
  1. OECD scale: AE = 1 + 0.7(NumberAdults - 1) + 0.5*NumberChildren
  2. Caloric needs:
     - Calculate the caloric needs of each household member (based on the WHO tables of caloric needs by age and sex)

- Divide this number by 2450 kcal, corresponding to the norm used to estimate the official poverty line in Mali, in order to calculate the number of "equivalent adults" in the household

- Normalize the consumption values to account for the price differences between the regions. We start off by dividing the consumption values by the food poverty line for the corresponding region, and then multiply this figure by 100. This effectively normalizes the poverty line to 100 for all individuals. This facilitates the robustness of our analysis (stochastic dominance, poverty curves)
- Calculate the standard poverty indicators for children and adults from the expenditures per adult equivalent, according to region, sex, etc. using the DASP module

Second step: recalculate the standard poverty indicators with the adjusted consumption data accounting for changes in the price of food products

- Adjust household consumption to account for changes in the prices of food products:
  1. Obtain the monthly price indexes for each region, according to the categories in ELIM 2006, for both 2006 and 2008
  2. Generate new consumption distributions by adjusting household consumption from ELIM 2006. We assume fixed budget shares (Cobb-Douglas utility function) and therefore than all price changes cause a proportional decline in the quantity consumed (unitary price elasticity). We explore three possibilities:
     - Deflate the 2006 consumption values for all food goods by the estimated change in its price to obtain the real value of consumption in the new price system
     - Deflate total consumption in 2006 by the change in the official CPI between 2008 and 2006
     - Deflate total consumption by the CPIs for each household, which we estimate using information on the change in food prices in Mali and the portion of the budget that households allocate to each product type according to ELIM 2006 (again, fixed budget shares are presumed, see the appendix). It should be noted that the household-specific CPIs can be presented separately from the poverty indicators. This is another way to describe the impact of the food crisis on different household categories. Also, these household specific CPIs can be calculated such that they conform to two alternative formulas given by equations 8 and 14 in the appendix.
  3. As such, a higher price for a given consumption good is equivalent to a reduction in real consumption. The subsequent decline in households' purchasing power brings about more poverty, which is estimated
- Adjust for all income gains from the sales of food products (ELIM questionnaire, p.28). Since own consumption (section K1 in the questionnaire) is included in the corrected total consumption above, it is also counted as "sales"
  1. Calculate the growth in the value of sales of agricultural products induced by the price changes under the assumptions that the quantity of sales are unchanged and that price increases are completely transmitted to producers: i.e. multiply the 2006 value of sales (including own consumption) for each food product by the price change and add across all food products.
  2. Calculate total cost growth for agricultural inputs (ELIM questionnaire p.27) induced by the price changes for food products under the assumption that there are no changes

in the quantity of inputs, i.e., multiply the 2006 cost of agricultural inputs by the change in their respective prices and add across all inputs

3. Calculate the change in profits induced by the price changes for food products assuming that all other costs remain constant, i.e., subtract the increase in costs from the increases in sales value.
4. Multiply the real amount of total consumption estimated after the crisis by the ratio of the change from 2006 profits (under the implicit assumption that profit growth is allocated proportionally to the shares in 2006 for each consumption good in total consumption)

- Recalculate standard poverty indicators with and without adjusting income as shown above and compare them with the 2006 data

3.2 Impacts on food poverty – substitution effect

Applying this methodology requires data on the distribution of income or total expenditures. This is easily obtained from the consumption budget survey among Malian households. This also requires estimates of how the equivalent income given by equation 25 varies in response to price variations in order to evaluate the expected effect on the price change.

First step: define the consumption aggregates

- It is impossible to estimate an entire demand system that includes all the consumption goods measured in ELIM 2006
- The natural groupings of consumption are: grains, fruits and vegetables, meat and fish, milk products, others foods and non food products. Within these groups, there is an implicit assumption of perfect substitution.
- However, given that the emphasis of this project is on the food crisis and its specific impacts on grain prices, we distinguish between the three main grains consumed by Malian households: millet/sorghum, maize and other grain products
- We show the share of expenditures for all food products included in ELIM 2006 by regional income level

Second step: estimating the demand system

The objective of the QAIDS demand system is to estimate the model

$$w_{j,c,h} = a_j + \sum_{k=1}^{K} b_{j,k} \ln p_{k,c} + c_j \ln \frac{x_{c,h}}{z_c} + d_j \left(\ln \frac{x_{c,h}}{z_c} \right)^2 + e_j D_{c,h}$$

with (48)

$$b_{j,k} = b_{k,j}; \sum_{j=1}^{J} a_j = 1; \sum_{j=1}^{J} b_{j,k} = \sum_{j=1}^{J} c_j = \sum_{j=1}^{J} d_j = \sum_{j=1}^{J} e_j = 0$$

where $w_{j,c,h}$ is the budget share allocated by household h living in strata c to good j, $p_{j,c}$ is the price of this good in strata c (the average price of j in c) z_c is the poverty line in c and $D_{c,h}$ is a vector of household sociodemographic characteristics. This equation (17) can be rewritten as:

$$w_{j,c,h} = a_j + \sum_{k=1}^{K} b_{j,k} \ln p_{k,c} + c_j \ln y_{c,h} + d_j \left(\ln y_{c,h} \right)^2 + e_j D_{c,h}$$

with (49)

$$y_{c,h} = \frac{x_{c,h}}{z_c}$$

Equation (17) corresponds to the *Quadratic Almost Ideal Demand System* (QAIDS) suggested by Banks et al. (1997) in which the budget shares are linear in b_{jk} and c_j. The estimation strategy follows Deaton (1997) and relies on the spatial variability of prices in Mali to estimate the parameters for price (b_{jk}), income (c_j and d_j) and the effects of sociodemographic characteristics (e_j).

The parameters in equation (49) are estimated by three stage ordinary least squares. $y_{c,h}$ are total expenses per head in each household normalized to the local poverty line, and are presumed endogenous.

Third step: use the estimated demand system and the observed price changes to predict the new consumption vectors

3.3 Nutritional impacts

- We obtain nutritional tables for all food items, focusing here on caloric content.
- Estimate the changes in the nutritional intake on the basis of before and after consumption values.

APPENDIX B: COMPLEMENTARY TABLES

Table 14: Incidence of food poverty by age group

	Before the crisis (2006)					After the crisis (2008)					Change in percentage points				
	0-5	**6-10**	**11-14**	**0-14**	**All**	**0-5**	**6-10**	**11-14**	**0-14**	**All**	**0-5**	**6-10**	**11-14**	**0-14**	**All**
Total	39.3	42.7	44.0	41.5	39.6	49.6	53.1	54.3	51.8	49.5	10.3	10.4	10.3	**10.3**	9.9
Area															
Urban	23.5	26.5	26.6	25.3	23.7	30.7	34.9	33.3	32.8	30.1	7.2	8.4	6.7	**7.5**	6.4
Rural	45.5	49.2	51.9	48.1	47.2	57.0	60.3	63.9	59.5	58.5	11.5	11.1	12.0	**11.4**	11.3
Region															
Kayes	37.6	42.0	47.1	40.8	38.9	52.4	53.9	62.1	54.7	52.6	14.8	11.9	15.0	**13.9**	13.7
Koulikoro	42.9	45.5	46.2	44.6	43.6	53.8	55.7	57.2	55.3	54.0	10.9	10.2	11.0	**10.7**	10.4
Sikasso	61.7	64.8	64.6	63.4	63.1	73.6	76.8	75.1	74.7	74.5	11.9	12.0	10.5	**11.3**	11.4
Ségou	35.2	38.3	38.1	37.0	35.4	45.4	50.0	48.6	47.8	46.1	10.2	11.7	10.5	**10.8**	10.7
Mopti	35.1	39.6	41.8	37.9	37.2	45.3	49.4	51.5	47.9	46.7	10.2	9.8	9.7	**10.0**	9.5
Tombouctou	35.3	39.8	41.3	38.2	33.9	41.3	43.7	48.3	43.6	39.3	6.0	3.9	7.0	**5.4**	5.4
Gao	22.1	31.4	35.2	29.0	27.2	28.6	44.5	51.2	40.5	37.0	6.5	13.1	16.0	**11.5**	9.8
Kidal	8.8	5.6	4.1	6.7	5.9	17.0	14.1	26.2	17.0	15.7	8.2	8.5	22.1	**10.3**	9.8
Bamako	10.4	15.1	16.9	13.5	12.3	12.2	18.8	18.9	16.0	14.8	1.8	3.7	2.0	**2.5**	2.5
Sex of household head															
Male	39.8	43.2	45.0	42.1	40.5	50.2	53.6	55.1	52.4	50.2	10.4	10.4	10.1	**10.3**	9.7
Female	29.1	32.9	29.7	30.5	26.7	38.4	41.9	43.5	40.9	37.4	9.3	9.0	13.8	**10.4**	10.7
Number of children															
0				10.4					15.5						5.1
1	8.1	16.2	27.4	13.2	15.8	15.3	18.9	33.0	19.0	22.2				**5.8**	6.4
2	13.5	18.3	26.7	16.7	18.0	20.3	30.3	33.1	24.9	26.6	7.2	2.7	5.6	**8.2**	8.6
3	22.3	24.0	32.4	24.8	25.9	28.7	28.6	39.6	30.7	31.9	6.8	12.0	6.4	**5.9**	6.0
4	24.0	26.6	27.6	25.6	26.9	33.2	36.1	36.9	35.0	35.6	6.4	4.6	7.2	**9.4**	8.7
5	33.3	35.4	35.8	34.6	34.8	45.0	47.6	48.7	46.7	48.2	9.2	9.5	9.3	**12.1**	13.4
6	39.5	42.0	38.6	40.2	40.8	50.2	52.5	48.9	50.8	50.1	11.7	12.2	12.9	**10.6**	9.3
7 or more	54.4	54.6	54.1	54.4	54.4	66.2	65.7	65.0	65.6	65.4	10.7	10.5	10.3	**11.2**	11.0

Source: Authors' calculations from ELIM 2006

Table 15: Caloric insufficiency rate by age group

	Incidence of poverty								
	Before the crisis (2006, %)			After the crisis (2008, %)			Change in percentage		
	0-5	6-10	11-14	0-5	6-10	11-14	0-5	6-10	11-14
Total	30.2	32.8	35.0	38.8	41.7	42.4	8.7	8.9	7.4
Area									
Urban	23.3	27.0	30.7	24.7	30.1	32.1	1.4	3.1	1.3
Rural	32.8	35.1	36.9	44.3	46.3	47.1	11.5	11.2	10.1
Region									
Kayes	35.3	38.1	42.9	45.4	48.5	49.8	10.1	10.4	6.9
Koulikoro	31.3	31.5	32.3	37.0	37.7	39.3	5.7	6.2	6.9
Sikasso	38.2	41.2	44.6	51.9	55.4	55.3	13.8	14.3	10.8
Ségou	30.2	33.1	34.8	41.5	46.2	45.9	11.3	13.1	11.1
Mopti	23.5	24.0	25.3	32.6	32.7	32.3	9.0	8.7	7.1
Tombouctou	35.7	38.1	37.9	39.3	42.3	43.4	3.6	4.2	5.6
Gao	25.0	35.2	41.9	27.0	37.7	44.1	2.0	2.4	2.2
Kidal	9.4	6.2	5.9	17.0	14.1	26.2	7.6	7.9	20.3
Bamako	14.5	21.1	24.2	12.9	19.4	21.3	-1.6	-1.7	-2.9
Sex of household head									
Male	30.8	32.8	35.1	39.2	41.7	42.5	8.5	8.9	7.4
Female	17.8	31.5	33.3	29.6	41.5	40.3	11.8	10.0	7.0
Number of children									
1	13.3	12.9	18.9	14.7	17.7	25.6	1.5	4.8	6.7
2	14.3	22.8	20.8	19.1	27.3	25.2	4.8	4.6	4.5
3	17.3	20.0	25.6	25.3	25.3	29.7	8.0	5.4	4.1
4	21.3	23.1	28.3	26.7	30.8	33.7	5.4	7.7	5.4
5	24.5	28.1	28.6	31.9	33.0	34.2	7.4	4.9	5.6
6	29.8	30.6	32.0	40.8	42.6	36.8	11.1	11.9	4.8
7 or more	40.3	40.4	41.5	50.7	51.0	50.9	10.4	10.6	9.5
Decile									
1 (poorest)	93.5	94.7	94.8	97.6	96.8	96.2	4.1	2.1	1.3
2	75.3	74.8	79.8	86.5	87.6	89.6	11.2	12.7	9.9
3	57.4	55.5	55.9	78.7	75.3	74.4	21.3	19.8	18.5
4	39.1	36.8	41.9	59.9	61.4	62.3	20.8	24.6	20.4
5	20.4	25.4	28.6	35.4	37.9	37.7	14.9	12.4	9.2
6	9.5	8.7	11.2	20.7	17.7	17.2	11.2	9.0	6.1
7	7.6	6.5	2.5	10.7	10.2	5.7	3.2	3.7	3.3
8	2.7	2.9	3.6	3.0	3.7	2.3	0.4	0.8	-1.3
9	0.0	0.0	0.0	0.1	0.0	0.3	0.1	0.0	0.3
10 (least poor)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Source: Authors' calculations from ELIM 2006

Table 16a: Determinants of children's participation in school and work (6-10 years old)

	Coefficients		Marginal effects			
	School (S)	**Work (W)**	**S/NW**	**S/W**	**NS/W**	**NS/NW**
Income (ln)	0.20 ***	0.16 ***	0.048 ***	0.031 ***	0.008	-0.086 ***
Sex of child: Girl	-0.18 ***	-0.05	-0.054 ***	-0.017 **	0.005	0.065 ***
Child's age: 6 (CG)						
7	1.08 ***	0.28 ***	0.279 ***	0.119 ***	-0.044 ***	-0.354 ***
8	1.43 ***	0.56 ***	0.294 ***	0.205 ***	-0.044 ***	-0.455 ***
9	1.53 ***	0.58 ***	0.282 ***	0.227 ***	-0.055 ***	-0.453 ***
10	1.45 ***	0.48 ***	0.311 ***	0.189 ***	-0.053 ***	-0.448 ***
Rural	-0.22 ***	0.20	-0.097 ***	0.009	0.038 ***	0.049 *
Region: Kayes (CG)						
Bamako	0.62 ***	0.13	0.177 ***	0.063	-0.028	-0.212 ***
Gao	-0.07	-0.32	0.004	-0.034 **	-0.034	0.063
Kidal	0.16	0.36	-0.001	0.065	0.039	-0.103
Koulikoro	0.16 ***	0.03	0.049 **	0.013	-0.007	-0.055 **
Mopti	0.13	0.01	0.043	0.009	-0.008	-0.044
Ségou	-0.02	0.19	-0.028	0.022	0.028	-0.022
Sikasso	0.22 ***	1.22 ***	-0.133 ***	0.221 ***	0.170 ***	-0.258 ***
Tombouctou	0.38 ***	0.19	0.094 **	0.055 **	-0.004	-0.145 ***
Education: None (CG)						
Primary	0.56 ***	-0.17 *	0.206 ***	0.012	-0.052 ***	-0.166 ***
Post primary	1.04 ***	0.06	0.294 ***	0.075 *	-0.059 ***	-0.310 ***
Age of head: <36 (CG)						
36-45	0.10	-0.09	0.044	-0.004	-0.018	-0.022
46-60	0.17 **	0.03	0.054 *	0.014	-0.008	-0.061 *
61+	0.19 **	0.32 *	0.019	0.056 **	0.030	-0.106 ***
Sex of head: Woman	0.07	0.03	0.020	0.008	-0.001	-0.027
Number of children: 0-3(CG)						
4-6	0.22 ***	-0.10	0.086 ***	0.003	-0.027 *	-0.062 **
7+	0.26 ***	0.00	0.087 ***	0.017	-0.017	-0.087 ***
Occupation: Indep farmer (CG)						
Unemployed	0.01	-0.17 *	0.021	-0.017	-0.021 *	0.018
Indep non farmer	0.10	0.00	0.034	0.006	-0.007	-0.033
Other	0.16 ***	-0.24 **	-0.016 ***	-0.016	-0.037 ***	-0.027
Sector of activity: Agric (CG)						
Fishing	-0.71 ***	0.57 *	-0.256 ***	-0.002	0.179 *	0.078
Commerce	-0.15	-0.44 *	-0.015	-0.044 ***	-0.042 *	0.101
Other	0.61 ***	-3.86 ***	0.525 ***	-0.290 ***	-0.653 ***	0.418 ***
Access to land	-0.02	0.38 ***	-0.045 *	0.038 ***	0.047 ***	-0.039
Own animals	-0.11 ***	-0.03	-0.033 *	-0.011	0.003	0.041 **
Distance to potable water (mn)	0.00	0.01 ***	-0.000	0.001 ***	0.001 ***	-0.001 ***
Distance to market (mn)	-0.00	0.00	-0.000	0.000	0.000 *	0.000
Distance to primary school (mn)	-0.00 ***	-0.00 ***	-0.001 ***	-0.000 ***	-0.000	0.002 ***
Interview in August	-0.05	0.08	-0.027	0.006	0.014	0.007
Constant	-4.07	-1.06				
Probability (y=1)			0.403	0.074	0.091	0.433
n observations	6884					
Rho	-0.045					
Wald rho test=0	Prob>chi2=0.3962					

Notes: CG: Reference group (for dummy variables); S/NW=School-non work; S/W=School-work; NS/W=non school–work; NS/NW=non school–non work; Econometric model: bivariate probit; significant at 1% (***), 5% (**), 10% (*).

Source: Authors' calculations from ELIM 2006

Table 16b: Determinants of children's participation in school and work (11-14 years old)

	Coefficients		Marginal effects			
	School (S)	Work (W)	S/NW	S/W	NS/W	NS/NW
Income (ln)	0.22 ***	0.03	0.037 **	0.049 ***	-0.039 ***	-0.047 ***
Sex of child : Girl	-0.35 ***	-0.03	-0.061 ***	-0.076 ***	0.063 ***	0.074 ***
Age of child: 11 (CG)						
12°	-0.11	-0.03	-0.014	-0.027	0.016	0.026
13°	-0.10	0.03	-0.026	-0.014	0.025	0.016
14°	-0.26 ***	0.20 *	-0.094 ***	-0.009	0.087 ***	0.016
Rural	-0.40 ***	0.09	-0.097 ***	-0.054	0.090 ***	0.061 ***
Region: Kayes (CG)						
Bamako	0.03	0.27 *	-0.059	0.072 *	0.036	-0.048 *
Gao	0.10	-1.28 ***	0.241 ***	-0.203 ***	-0.194 ***	0.156 ***
Kidal	-0.95 ***	0.35	-0.228 ***	-0.126 ***	0.263 **	0.092
Koulikoro	0.24 ***	-0.18	0.089 ***	0.001	-0.072 ***	-0.019
Mopti	0.12	0.16	-0.017	0.063	0.001	-0.046
Ségou	0.00	-0.03	0.008	-0.008	-0.005	0.006
Sikasso	0.36 ***	0.64 ***	-0.108 ***	0.242 ***	0.008	-0.142 ***
Tombouctou	0.25 *	-0.01	0.047	0.047	-0.049	-0.044
Education: None (CG)						
Primary	0.50 ***	-0.29 ***	0.168 ***	0.015	-0.130 ***	-0.054 ***
Post primary	0.63 ***	-0.03	0.112 **	0.109 ***	-0.121 ***	-0.100 ***
Age of head: <36 (CG)						
36-45	0.34 ***	0.13	0.029	0.101 **	-0.049	-0.081 ***
46-60	0.39 ***	-0.03	0.082 *	0.070 *	-0.081 **	-0.071 ***
61+	0.38 ***	0.27 **	-0.004	0.148 ***	-0.039	-0.105 ***
Sex of head: Woman	0.29 ***	-0.04	0.062	0.046	-0.061 *	-0.047 *
Occupation: Indep farmer (CG)						
Unemployed	0.08	0.01	0.011	0.018	-0.013	-0.017
Independent non farmer	0.05	-0.08	0.029	-0.010	-0.023	0.004
Other						
Sector of activity: Agric (CG)	-0.08	-0.22 **	0.032	-0.064 ***	-0.023	0.055 ***
Fishing	-0.17 **	0.04	-0.042	-0.023	0.040	0.025
Commerce	-0.03	0.17	-0.046	0.035	0.034	-0.023
Other						
Access to land	-1.09 ***	0.04	-0.225 ***	-0.173 ***	0.190	0.209 **
Own animals	-0.07	-0.07	0.003	-0.029	0.000	0.026
Distance to potable water (mn)	0.98 ***	-3.46 ***	0.688 ***	-0.317 ***	-0.593 ***	0.222 ***
Distance to market (mn)	-0.02	0.18	-0.045	0.037	0.033	-0.025
Distance to primary school (mn)	0.03	0.11	-0.020	0.031	0.013	-0.024
Interview in August	0.00	0.00 **	-0.001	0.001 **	0.000	-0.001 **
Constant	0.00 *	-0.00	0.000	0.000	-0.000 *	-0.000
Probability (y=1)	-0.00 ***	-0.00 *	-0.000 **	-0.001 ***	0.000 ***	0.001 ***
n observations	-0.01	0.03	-0.010	0.005	0.008	-0.003
Rho	-2.90 ***	1.26				
Wald rho test=0			0.355	0.234	0.243	0.168
Occupation: Indep farmer (CG)	4288					
Unemployed	-0.298					
Indep non farmer	Prob > chi2 = 0.0000					

Notes: CG: Reference group (for dummy variables); S/NW=School-non work; S/W=School-work; NS/W=non school–work; NS/NW=non school–non work; Econometric model: bivariate probit; significant at 1% (***), 5% (**), 10% (*).

Source: Authors' calculations from ELIM 2006

Tableau 17: Determinants of the consultation rate and choice of main type of service consulted

	Consultation		Principal type of service consulted									
			Public hospital		Regional and subregional services°°		Community services°°°		Private services°°°°		Traditional healer	
	Sick children 0-14		Sick children 0-14 having consulted a health establishment									
	coeff.	ME	coeff.	ME	coeff.	ME	coeff.	ME	coeff.	ME	coeff.	ME
Sex – Male (CG)												
Sex - Female°	-0.04	0.030	0.24	0.015	0.35	0.011		-0.034	0.09	0.003	0.1	0.005
Age group: 0-5(CG)												
Age group 6-10°	-0.21	0.037	0.21	0.016	-0.46 *	-0.016		-0.003	0.09	0.005	-0.03	-0
Age group 11-14°	-0.19	0.044	0.63 *	0.048	0.39	0.012		-0.067	0.17	0.005	0.11	0.002
Rural°	-0.3 *	0.040	-2.93 ***	-0.277	-1.98 ***	-0.060	***	0.387	-1.48 ***	-0.06	-0.54	0.009
Region: Kayes(CG)												
Koulikoro°	-0.22	0.044	1.05 **	0.093	-0.04	-0.007	**	-0.108	0.11	-0	0.4	0.025
Sikasso°	0.53 ***	0.042	0.68	0.040	0.64	0.018	***	-0.146	0.32	0.007	0.91 **	0.081
Ségou°	-0.24	0.044	0.46	0.033	-1.1 ***	-0.030		-0.055	0.04	-0	0.57	0.055
Mopti°	-0.77 ***	0.050	-0.34	-0.023	0.1	0.003		-0.009	-1.32 ***	-0.06	0.81 **	0.093
Tombouctou°	0.01	0.082	1.35 *	0.167	-0.65	-0.021		-0.107	-0.14	-0.02	-0.11	-0.02
Gao°	0.45	0.137	1.65	0.242	-34.1 ***	-0.061		-0.065	0.61	0.039	-33.7 ***	-0.15
Kidal°	0.7	0.120	0.39	0.052	0	0.006		0.115	-34.44 ***	-0.07	-33.9 ***	-0.1
Bamako°	0.88 ***	0.065	-0.76 **	-0.040	-1.25 ***	-0.029		0.042	-0.99 ***	-0.04	0.55	0.072
Educ of head: None (CG)												
Educ, primary°	0.39 **	0.040	-0.12	-0.002	-0.56 *	-0.016	**	0.065	-0.68 **	-0.03	-0.24	-0.01
Educ, post primary°	0.54 *	0.068	0.71	0.054	0.19	0.002		-0.092	1.03 **	0.088	-0.64 *	-0.05
Age: <36(CG)												
Age head 36-45°	-0.09	0.056	-0.56 *	-0.032	-0.01	0.003		0.067	-0.77 ***	-0.04	-0.08	0.001
Age head 46-60°	-0.28	0.053	-0.96 ***	-0.055	0.25	0.015	**	0.101	-1.37 ***	-0.07	-0.03	0.01
Age head 61+°	0	0.060	-0.76 **	-0.035	-0.51	-0.010	***	0.159	-1.49 ***	-0.06	-0.95 **	-0.06
Sex head-female°	-0.13	0.069	0.51	0.016	1.02	0.037	**	-0.194	0.79	0.04	1.06 *	0.101
N children: 0-3(CG)												
N children 4-6°	0.13	0.045	0.17	0.015	-0.68	-0.022		0.018	0.4	0.03	-0.49	-0.04
N head 7+°	0.44 **	0.047	0.26	0.019	0.14	0.005		-0.009	0.12	0.007	-0.22	-0.02
Distance health service (mn)	-0.00 ***	-0.00	-0.00 *	-0.00	-0.01 ***	0.000	**	0.000	0.00 *	0.000	-0.00	0.000
Days sick	0	0.000	0.02 **	0.001	0.02 ***	0.001	**	-0.002	0	-0	0.01 **	0.001
Health insurance	0.52 ***	0.116	-0.34	-0.016	-0.03	0.003	*	0.070	-0.15	-0	-0.79 ***	-0.05
ln income	0.21 **	0.050	0.03	0.007	-0.1	-0.002		0.041	0.24	0.02	-0.76 ***	-0.07
constant	-1.74		-0.62		0.76				-3.1		7.84	
n observations	**2164**		**1380**									

Notes: ° binary variables: Coefficients and marginal effects (ME), read with respect to the comparison group (CG); °°the regional/subregional services include health reference centres that are found at the level of circles (regions); °°°community services (the reference group) include community services centres, religious health centres and other public, private or NGO community services °°°°private services include: dental clinics, private health clinics, private clinics and pharmacies.

Source: Authors' calculations from ELIM 2006

Table 18: Price and income elasticity (own and cross) matrix

Product	Rice	Millet	Maize	Other grains	Beef	Chicken	Fish	Milk	Peanuts	Fruit	Vegetables	Coffee	Sugar	Condiments	Beverages	Non food	Income
									Urban households								
Rice	-0.06	0.32	-0.20	-0.32	-0.12	0.10	0.27	0.30	-0.14	0.07	-0.35	-0.02	0.02	-0.02	0.07	-0.91	0.34
Millet	0.65	-1.03	0.50	-0.17	0.44	-0.08	-0.10	0.28	-0.45	-0.51	-0.18	-0.10	0.14	0.08	0.06	-0.52	0.44
Maize	-1.98	2.46	-2.63	0.54	-1.83	0.07	-0.68	-0.94	1.87	0.47	0.75	0.71	-0.64	-0.25	0.02	1.06	-0.84
Other grains	-0.86	-0.22	0.14	-0.87	0.69	-0.05	0.03	0.05	0.00	0.11	0.18	0.02	-0.03	0.11	-0.02	-0.29	0.95
Beef	-0.25	0.44	-0.37	0.51	-0.82	-0.01	0.08	0.06	0.07	-0.27	-0.23	0.04	0.28	0.04	0.01	-0.59	0.92
Chicken	1.85	-0.73	0.14	-0.32	-0.06	-1.33	-0.26	-0.13	-0.71	0.23	1.29	-0.19	0.90	0.39	0.10	-2.17	1.27
Fish	1.19	-0.22	-0.29	0.05	0.18	-0.06	-0.48	0.06	-0.24	-0.17	-0.15	0.07	-0.18	-0.02	-0.07	-0.67	1.07
Milk	1.49	0.69	-0.47	0.10	0.15	-0.03	0.07	-0.88	-0.07	-0.14	-0.47	0.01	0.08	0.10	-0.12	-1.50	0.96
Peanuts	-0.47	-0.76	0.63	0.00	0.11	-0.13	-0.19	-0.05	-1.04	-0.20	0.00	0.08	0.08	-0.03	0.05	0.92	0.60
Fruit	0.39	-1.50	0.28	0.23	-0.78	0.07	-0.23	-0.16	-0.35	-0.52	0.03	-0.05	-0.19	-0.05	-0.04	1.88	1.56
Vegetables	-0.67	-0.17	0.14	0.13	-0.22	0.13	-0.07	-0.18	0.00	0.01	-0.87	-0.02	0.08	-0.05	0.05	0.70	0.83
Coffee	-0.13	-0.30	0.43	0.05	0.11	-0.06	0.10	0.01	0.14	-0.05	-0.06	-1.35	-0.11	-0.08	0.04	0.25	0.44
Sugar	0.07	0.22	-0.20	-0.03	0.44	0.15	-0.13	0.05	0.07	-0.10	0.14	-0.06	-1.23	0.10	0.04	-0.52	0.44
Condiments	-0.06	0.15	-0.10	0.17	0.07	0.08	-0.02	0.08	-0.03	-0.03	-0.11	-0.05	0.12	-0.99	0.00	-0.27	0.63
Beverages	1.24	0.58	0.03	-0.17	0.12	0.10	-0.29	-0.45	0.25	-0.13	0.43	0.11	0.23	0.00	-0.91	-2.13	-0.08
Non food	-0.21	-0.06	0.02	-0.02	-0.07	-0.03	-0.04	-0.07	0.06	0.07	0.08	0.01	-0.04	-0.02	-0.03	-0.69	1.38
									Urban households								
Rice	-2.49	1.17	-0.22	-0.27	0.08	-0.01	-0.15	0.12	0.06	0.16	-0.13	0.02	0.17	-0.04	0.03	0.50	0.96
Millet	0.78	-1.78	0.01	-0.03	-0.07	-0.01	-0.02	0.01	0.03	-0.13	-0.18	-0.01	0.04	0.05	-0.01	0.34	1.28
Maize	-0.72	0.03	-0.02	-0.02	0.38	-0.02	-0.10	-0.19	-0.11	-0.03	0.27	0.38	-0.24	-0.10	0.10	-0.61	-1.70
Other grains	-1.01	-0.18	-0.02	-0.95	0.08	-0.01	-0.12	-0.14	0.13	0.13	0.14	0.11	0.06	0.03	0.09	0.65	1.10
Beef	0.26	-0.34	0.36	0.07	-1.12	0.09	0.28	0.06	0.25	-0.11	0.01	0.17	0.07	0.00	-0.03	-1.02	1.40
Chicken	-0.14	-0.28	-0.08	-0.03	0.44	-0.90	-0.25	0.04	0.14	0.17	0.55	-0.11	-0.45	0.02	-0.14	0.03	-0.01
Fish	-0.45	-0.09	-0.09	-0.10	0.27	-0.05	-0.83	0.01	0.08	0.08	0.07	-0.04	0.07	-0.08	0.03	0.12	1.11
Milk	0.56	0.05	-0.27	-0.18	0.08	0.01	0.02	-0.86	0.00	-0.05	-0.07	0.07	-0.22	0.00	-0.03	-0.12	1.64
Peanuts	0.14	0.09	-0.08	0.08	0.18	0.02	0.06	0.00	-0.96	-0.03	-0.03	0.07	-0.08	0.07	-0.02	-0.49	0.83
Fruit	0.94	-1.12	-0.05	0.20	-0.20	0.07	0.16	-0.06	-0.08	-0.92	0.02	0.06	-0.14	-0.04	0.12	0.04	1.36
Vegetables	-0.24	-0.49	0.15	0.07	0.01	0.07	0.04	-0.03	-0.03	0.01	-0.97	0.02	-0.02	0.04	-0.03	0.39	1.05
Coffee	0.09	-0.08	0.44	0.11	0.21	-0.03	-0.05	0.06	0.12	0.04	0.04	-1.04	0.13	-0.04	-0.02	-0.98	0.61
Sugar	0.39	0.13	-0.18	0.04	0.05	-0.08	0.05	-0.11	-0.09	-0.06	-0.02	0.08	-0.29	0.00	-0.01	-0.93	0.80
Condiments	-0.16	0.28	-0.11	0.03	0.00	0.00	-0.10	0.00	0.12	-0.03	0.09	-0.04	0.01	-1.00	0.02	-0.12	1.11
Beverages	0.39	-0.24	0.46	0.38	-0.14	-0.15	0.16	-0.11	-0.12	0.31	-0.26	-0.06	-0.06	0.07	-0.80	-0.85	0.69
Non-food	0.15	0.16	-0.06	0.05	-0.10	0.00	0.01	-0.01	-0.07	0.00	0.07	-0.08	-0.12	-0.01	-0.02	-0.98	1.11

Source: Authors' calculations from ELIM 2006

Table 19: Price and income elasticity of caloric demand (rice and millet)

	Urban	Rural
Income	0.533	0.910
Price of rice	-0.037	-0.292
Price of millet	0.009	-0.347

Notes: Income elasticity of caloric demand (η_r) is calculated with the following formula:

$$\eta_r = \sum_{i=1}^{15} \eta_i \omega_i$$

The price elasticity of caloric demand (ε_p) is calculated with the following formula:

$$\varepsilon_p = \sum_{i=1}^{15} \varepsilon_{ip} \omega_i$$

where η_i and ε_{ip} are respectively the income and price elasticity of caloric demand for good i and ω_i is contribution of good i to total calories consumed

Source: Authors' calculations from ELIM 2006

Table 20: Results of the "proxy-means" regression to identify poor individuals

	Urban	Rural
Kayes	0.000	0.000
Koulikoro	-0.058	-0.049
Sikasso	-0.541***	-0.357***
Ségou	-0.121**	-0.037
Mopti	-0.014	0.160***
Tombouctou	-0.195**	0.199***
Gao	0.024	0.071
Kidal	0.123	0.405***
Bamako	-0.062	
hh_ageabove14	-0.036***	-0.028***
hh_agebelow15	-0.040***	-0.026***
Owner	0.086***	
Toilet		0.100**
Floor	0.085*	0.119**
Wall	0.209***	0.142**
Electricity	0.124***	0.224***
Automobile	0.328***	0.461***
Moto	0.154***	0.199***
Distance	-0.160**	-0.106***
Constant	12.17***	11.91***
"cut-off point"	11.74	11.74

Notes:

- Dependent variable: logarithm of food expenses (per adult equivalent) divided by a regional price deflator
- Econometric model: OLS (*ordinary least squares*)
- Coefficients significant at 1% (***), 5% (**), 10% (*) level
- R^2 pour "urban" 0.39; for "rural" 0.24
- The "cut-off point" is expressed in logarithmic form and corresponds to 125 719 (CFA), the poverty line for 2008 in Bamako (each food expenditure is in terms of "Bamako")
- To identify the individuals who are poor, all that is required is to multiply the variables for each household by their respective coefficients. If the total sum is less than 11.74 the household is considered as poor, otherwise it is considered as non poor.

Source: Authors' calculations from ELIM 2006

Legend:
Regions = binary variables for each region (Kayes is the reference group)
hh_ageabove14 = number of household members aged 15 and over
hh_agebelow15 = number of household members aged 14 and under
owner (only for "urban") = binary variable equal to 1 if the household owns or rents a plot of land; 0 otherwise
toilet (only for "rural") = binary variable equal to 1 if the household as a private flush toilet; 0 otherwise
floor = binary variable equal to 1 if the household lives in a house with a cement or tiled floor (urban), or cement (rural) ; 0 otherwise
wall = binary equal to 1 if the household lives in a house with hard or semi-hard walls; 0 otherwise
electricity = binary equal to 1 if the household lives in a house without electricity (supplied by EDM, private solar panels, electric generator or rural electrification/multifunction platform); 0 otherwise
automobile = binary equal to 1 if the household has an automobile; 0 otherwise
moto = binary equal to 1 if the household has an motorcycle; 0 otherwise
distance = binary equal to 1 if the household lives 2 km or more from a usable road (for urban), 3 km or more from public transport (rural); 0 otherwise

To identify the first quintile of individuals (which we have called the "poorest 20%" in the text) we have used the following independent variables: *Regions*, *hh_ageabove14*, *hh_agebelow15*, *toilet* (as defined above – only applies to rural area), *floor* (binary equal to 1 if the household lives in a house with a constructed floor; 0), *wall* (binary variable equal to 1 if the household lives in a home with mudbrick walls; 0 otherwise), *distance* (binary equal to 1 if the household lives 4 km or more from a usable road for the urban area or 4 km or more from public transport for the rural area; 0 otherwise).