MANAGING PRICE RISK IN LOCAL FOOD RESERVES

Analysing the prospects for a stabilisation fund in Mali and Niger

CREDA–UPC–IRTA

This research paper analyses the possibility of developing a stabilisation fund as an effective price risk management tool designed to strengthen local food reserves by reducing their vulnerability to price cycle inversions. Four hypothetical scenarios were considered and modelled on the basis of the price data collected in 12 cereal markets from Mali and Niger over a 15-year time span. The main conclusion to be drawn is that the type of stabilisation fund outlined in this research paper could effectively represent a viable solution for price risk management in countries where the option of using market-based tools to tackle price risk is not available.

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1 INTRODUCTION

Local Food Reserves (LFR) are formal or informal collective initiatives set up and owned by small producers with the objective of increasing availability and access to food (food security reserves), or of increasing income by buying grain from producers when prices are low and selling it when prices are more attractive (commercial local food reserves). Although their fundamental objectives differ, both types of reserves ultimately try to improve the conditions of producers by managing the price cycle. Local food reserves can contribute to food security in several ways (from mitigating the effects of price hikes to improving income and protecting livelihoods and assets).

Numerous civil society organisations and small producer federations promote the creation of local food reserves, recognising their contribution to food security strategies and their potential to empower communities and decrease their dependence on external structures. Oxfam has promoted the development of local food reserves for more than ten years with the dual objective of increasing the income of grain producers (in surplus zones) and increasing food security (in surplus and deficit zones).

Despite their potential as effective food security instruments, the rate of failure among LFR is high, largely as a result of a combination of climate and price risks, coupled with challenges linked to their design, planning and management (Oxfam, 2012).

Price risk remains the most complex factor affecting the vulnerability of LFR and the least studied. For the purposes of this paper, price risk is defined as **the probability of a local food reserve purchasing grain at a price above its selling price.**

The question of how often this situation occurs has received growing attention in recent years. Preliminary research carried out prior to this study showed that LFR had a probability of losing out as a result of lower prices during the lean season (“**price cycle inversion”**) as high as 25% (Oxfam, 2012)**.** Given the low financial capacity of LFR, it has been estimated that two years of price cycle inversion (or even as little as one year in certain cases) could lead LFR to bankruptcy.

In developed countries, the possibility of using market-based tools for farmers or cooperatives to manage price risk has been evolving over several decades. Price insurance coverage is widespread in developed financial markets, but less so in developing countries, where it rarely serves small farmers. Several reasons account for this limited coverage[1].

- The lack of commodity exchanges limits the availability of price information.
- The lack of use of grades and standards limits the possibility of establishing long-distance contracts both for buying and selling.
- Government interventions in markets affect prices and discourage financial institutions to provide price insurance.

In developing countries, the few documented cases of price insurance systems for cooperatives that exist have focused on cash crops, given the lower odds of government interventions in this realm. Price insurance markets are still underdeveloped and most projects have not progressed beyond the pilot phase. In West Africa, the possibility of working with adequate price insurance coverage is also limited by the absence of large financial institutions with the capacity to provide the required backing to this type of initiative.

In the absence of appropriate price risk management tools, LFR can resort to two main mechanisms in order to protect themselves against price risk:

- **Profit savings**: Saving money during the profitable years in order to cover losses during the years affected by inverted price cycles.
- **Year-round sales**: Lowering risk by selling grain during the whole year instead of selling it during the lean season.

This research paper reviews these two mechanisms by analysing 4 hypothetical scenarios: the first one consists of selling all production during the lean the season (at the end of the crop year, just before harvest). In contrast, different sale allocations over time are considered in scenarios 2-4. The two mechanisms are analyzed as follows:

Profit savings: This first mechanism is based on preventive measures that could in principle allow **compensation between negative and positive years in all four scenarios**. Under this mechanism, LFR accumulate savings during the years with a positive balance and use these savings to cover the years with a negative balance. In order for this to be possible, the number and quantity of savings during positive years would have to offset the negative balance years. The conclusions of this research report suggest that under the specific circumstances considered, the establishment of a stabilisation fund[2] would be viable.

This stabilisation fund would be set up in a federation of cooperatives with the aim of limiting the damage caused by the inversion of price cycles.

Year-round sales: Assessing the potential effectiveness of this first mechanism requires measuring both the **price risk and the profits of selling during the whole year versus the price risk borne and profits obtained when sales are limited to the lean season**. Scenarios 2, 3 and 4, described later, measure this relationship. The conclusions show that risk in year-round sales is lower than selling at the end of the season, but profits are also lower.

2 LOCAL FOOD RESERVES AND PRICE RISK

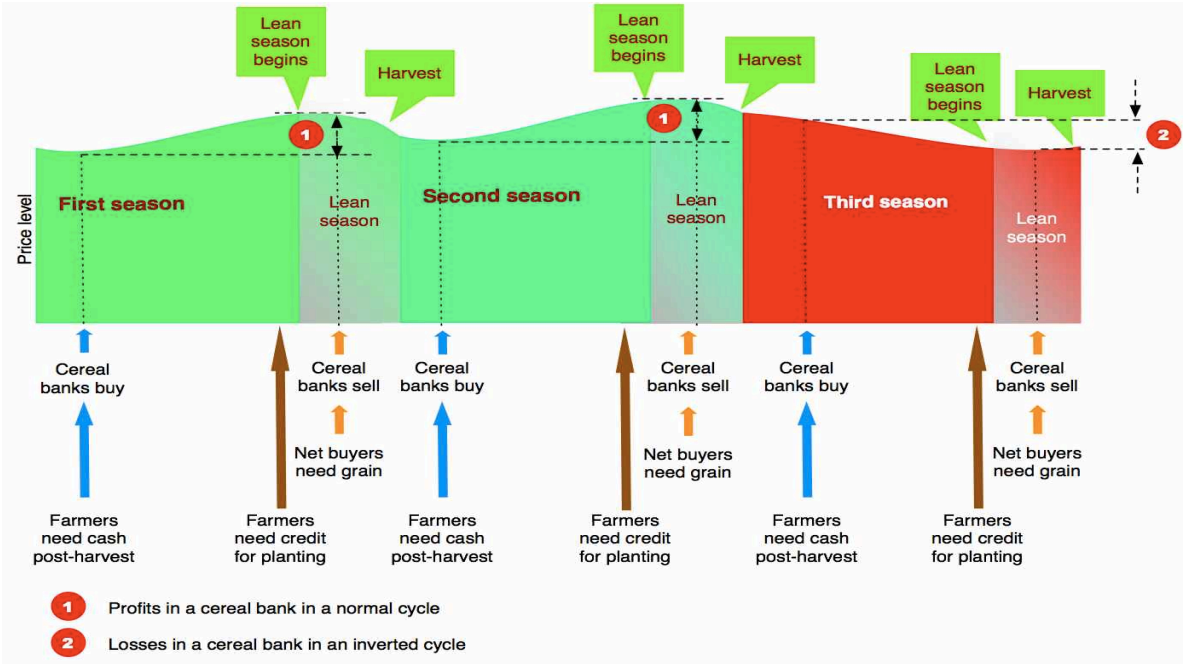
For the purposes of this paper, price risk is defined **as the probability of a local food reserve purchasing grain at a price above its selling price**. It is important to distinguish price risk from price variation. The latter is necessary in order to cover changing maintenance, storage and transport costs, since if the price is not higher at the end of the season than at the beginning, no trader will be willing to store. Price variation between seasons is also necessary in order to give signals to farmers to invest more or less in a crop, according to its abundance or scarcity in the market. This difference in price across different moments in time is known as temporal arbitrage.

The same logic applies to price variation between different locations, since if the price is not higher far from local markets, there will be no incentive for traders to move grain to deficit areas. These differences in price across geographic locations are known as spatial arbitrage, which constitutes a key challenge for cereal banks.

In the case of cereals, price risk is not the same for producers than for intermediaries or local food reserves. For producers, price risk means that sudden changes in input prices or drops in cereal prices can compromise crop profitability. If they have enough cash to retain the harvest for a few months (or they belong to a cereal bank), the price risk is then the same as that borne by the intermediary or the LFR (i.e. to have lower prices around the lean season than during the

harvest season). For local food reserves, as for any intermediary, price risk implies that prices at the end of the season may be lower than the prices witnessed at the beginning (as illustrated in Figure 1).

Figure 1: How inversion in price-cycles affects local food reserves



Source: Oxfam (2012)

This inversion in the normal cycle can happen one year out of four in the landlocked Sahelian countries, according to preliminary calculations made by Oxfam on the basis of statistical data (Oxfam, 2012). This research confirms the preliminary evidence presented in that first study. Several likely reasons explain this cycle inversion:

- Two consecutive good harvests; beginning of the season with higher prices than usual, compensated by the entry of grain at the end of the season; higher initial stocks in hands of private sector, or lower prices in the international markets.
- State intervention is probably a more frequent reason for cycle inversion. When faced with volatile prices, the State can adopt various strategies. It may try to control high prices (usually at the end of the season) by prioritising consumption at lower prices (through imports, export bans, or food aid), in an effort to avoid damaging the majority of people who are net-buyers.
- Trade (import and export) measures do have an impact on local domestic prices. Export restrictions may be the only way exporting countries have of preventing the effects of price hikes on international markets having similar effects on their domestic markets. In such cases, expert recommendations advocate for export restrictions to be allowed with the objective of ensuring sufficient internal availability of grain to cover domestic needs, but should be forbidden beyond this point (Galtier, 2012). This research does not allow for any explicit trade or policy measure, because the objective is not to identify the causes of price changes, but their consequences.

3 ASSESSING THE PROSPECTS FOR THE ESTABLISHMENT OF A STABILISATION FUND

The aim of this study is to evaluate the possibility of developing a stabilization fund that can limit the negative effects of agricultural price volatility on the economic viability of LFR in West Africa by considering three key questions:

- What would be the economic performance of a LFR that only sold in the lean season?
- What would be the economic performance of a LFR that allocated sales throughout the market year (as opposed to only in the lean season)?
- How would a stabilization fund set up to compensate years of losses with years of profits operate in each market?

In order to address these questions, the research focused on the following variables:

- **LFR standard margins:** estimating the margins (average level and variability) that a typical LFR could obtain by selling during the lean season.
- **LFR margins by market:** estimating the evolution of these margins in different markets with a view to establish the time cycle of profits and losses.
- **LFR margins by sales timing:** comparing these results across different scenarios where sales were distributed throughout the market year.
- **Implementation mechanisms:** proposing possible mechanisms to facilitate economic sustainability of LFR.

METHODOLOGY

Prices

This research study analyses the prices of millet and maize in 12 markets located in Mali and Niger during the period from 1995 to 2011. Monthly consumer and producer cereal prices are used as proxies to estimate unit income and cost faced by LFR. Consumer prices (collected from consumer markets) are taken as proxy for LFR cereal sale prices and producer prices (collected from markets located in production areas) are used as an indicator of the cereal unit costs paid by LFR.

Selected markets

Twelve market combinations in Mali and Niger were selected to reflect a combination of surplus, intermediate (precarious balance) and deficit areas (as defined by Afrique Verte, 2006):

Surplus areas are characterized (in the absence of natural disasters) by a constant cereal production that exceeds the needs of the population. Hence, grain availability problems are unusual in consumer markets of these areas. Increasing income is the main objective of LFR established in surplus areas. These reserves operate in a similar manner to LFR in deficit areas but with a different objective in mind, since they seek to obtain the highest possible prices during the lean season and share the profits gained with producers (once the maintenance costs are deducted). If effectively managed, both types of reserves can also help to reduce the

vulnerability of net food buyers caused by seasonal market fluctuations and supply shocks by releasing stocks when prices rise as a result of low levels of supply.

Intermediate areas are those where there is a succession of good and bad harvests. The needs of the population are covered both by external sources and local production, depending on the years.

Finally, **deficit areas** are those which lack the level of grain production required to effectively meet the needs of the population and are therefore dependent on exchanges with surplus areas. LFR located in deficit areas primarily seek to increase food access and availability. Experts in Mali and Niger economy provided a classification of Mali and Niger markets into the 3 categories mentioned. Since producer prices were not available for each market considered (but mainly available for production areas), each consumer market was paired with a producer market (on the basis of expert recommendation).

Table 1 shows the markets selected for our analysis, as well as their classification into the 3 categories considered.

Table 1: Selected markets where LFR buy and sell

Market category	Zone	Country	
		Mali	Niger
Production markets	Surplus	Sikasso, Loulouni,, M'Pessoba, Ségou, Macina	Maradi, Magaria
Consumption markets	Deficit	Gao	Tillabéri
	Surplus	Sikasso, Loulouni	Maradi
	Precarious balance	Djenné	Filingué

Source: Agreed terms of reference (Intermón Oxfam and CREDA)

Map 1 : Selected markets in Mali and Niger

Table 2 shows the 12 combinations of production zones and consumer markets selected for the purposes of this analysis, as well as the distance between the two markets. The latter is relevant since the results obtained (margins and profits) are not net of transport costs.

Table 2: Market combinations (production and consumption markets) and distance between markets

Area	Crop	Country	Production market*	Consumption market**	Distance between markets (km)
Surplus	Maize	Mali	Loulouni	Loulouni	0
	Maize	Mali	M'Pessoba	Loulouni	226
	Millet	Mali	Macina	Loulouni	360
	Millet	Niger	Maradi	Maradi	0
Precarious balance	Millet	Mali	Macina	Djenné	247
	Millet	Niger	Maradi	Filingué	664
	Millet	Niger	Magaria	Filingué	900
Deficit	Maize	Mali	Loulouni	Gao	1,070
	Maize	Mali	M'Pessoba	Gao	908
	Millet	Mali	Macina	Gao	1070
	Millet	Niger	Maradi	Tillabéri	779
	Millet	Niger	Magaria	Tillabéri	1,015

* Using producer prices ** Using consumer prices

Source: The agreement between INTERMON OXFAM and CREDA.

Scenarios

Four scenarios were constructed to reflect a set of possible LFR business strategies that primarily differed in terms of the selected timing and frequency of cereal sales (thus making LFR more or less speculative in nature). The different business strategies of LFR considered were:

Scenario 1: LFR sell production during the three months immediately before the next harvest (the lean season).

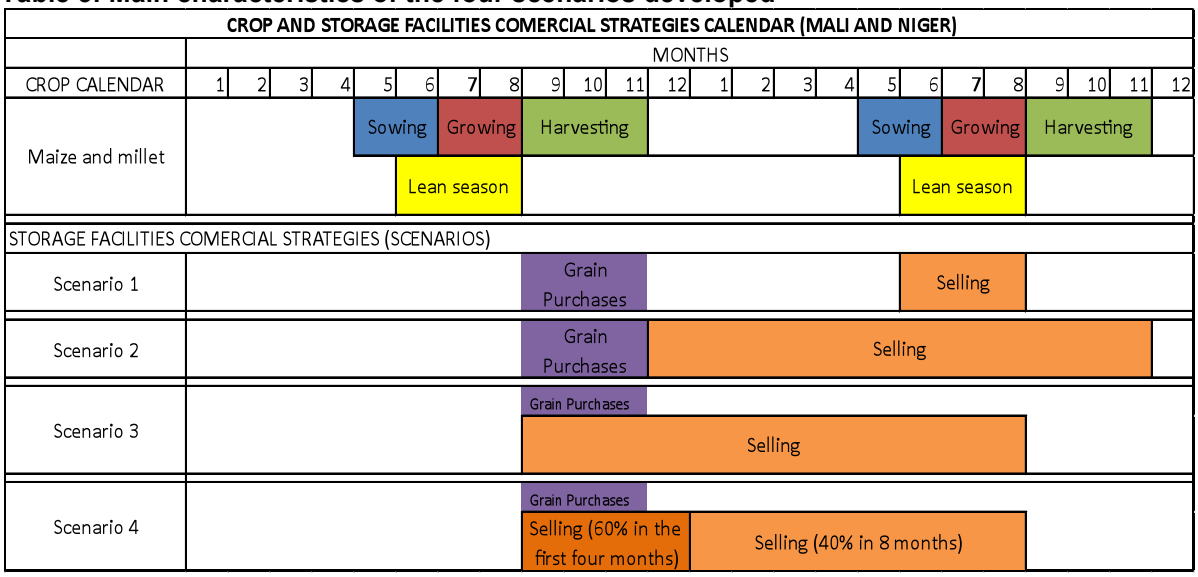
Scenario 2: LFR prorate sales monthly, starting the first month after harvest (for 12 months, overlapping next harvest).

Scenario 3: LFR prorate sales monthly, starting the first month of harvest.

Scenario 4: LFR sell 60% of their production in the first four months (starting in the first month of harvest), and the remaining 40% during the course of the following eight months.

Note that in terms of grain purchases, the four scenarios assume LFR paid the same average price during the harvest months.

Table 3: Main characteristics of the four scenarios developed



Sources: Authors (calculations based on data from GIEWS).

LFR Margins

In this study, margins are defined as the difference between consumer and producer prices (average levels for each market combination and for each scenario). In most cases these margins are positive, but in a few cases (for specific markets) they are negative. However, it is important to note that, although margins are positive (i.e. consumer prices are higher than producer prices), this does not mean that the LFR is making a profit, since the margin may not cover operating costs, retail margins and transport costs.

The margins obtained are expressed in two ways: firstly, in CFA francs per kilo marketed (in real terms, deflating the series obtained by the consumer price index for each country, with base 1995 = 100), and secondly, in number of legal minimum wages. The storage capacity of LFR was assumed to be 50 tons (standard capacity in the area according to experts consulted). Finally, using data from the International Labour Organization (ILO), the margin was estimated as the number of legal minimum wages LFR would earn with this storage capacity.

Table 4: Minimum wages, nominal and real (in CFA francs)

Country	Legal minimum wages (CFA francs per month, 2011)	Legal minimum wages (CFA francs per year, 2011)	Real legal minimum wages (CFA francs per year, average 1995-2011)
Mali	28,460	341,520	284,812
Niger	28,347	340,164	275,575

Source: Nominal minimum wages, ILO. Http://www.ilo.org/dyn/travail/travmain.home

Price indices: World Bank

Operating costs

One of the main challenges encountered by this study was the dearth of detailed information on the operating and financial costs of LFR in the two focus countries. The operating costs included have been calculated on the basis of an estimation of these costs obtained by Intermon Oxfam for a LFR with a capacity of 50 tons in Niger. These operating costs amount to approximately three times the legal minimum wage in the country. These estimates were also used as a reference for approximating the operating costs of LFR in Mali. The collection of refined information on LFR costs is an area that would merit further research Table 5 shows the operating costs of an LFR in Niger for a storage capacity of 50 tons. These costs range between 635,000 and 1,050,000 CFA francs annually (from 1.9 to 3.1 legal minimum wages). In this study 3 minimum wages are taken as a reference cost.

Table 5: LFR operating costs in Niger

Item	Quantity	Price per unit CFA francs	Total cost	
			Cost A	Cost B
Cereal Bags	100 bags in A, 500 in B	700	70,000	350,000
Manager commission	500 bags	200 CFA per bag	100,000	100,000
Amortisations*	1	200,000 to 300,000	200,000	300,000
Disinfecting and treatment of cereals	1	50,000	50,000	50,000
Technical monitoring	1	150,000	150,000	150,000
Other costs	1	65,000 to 100,000	65,000	100,000
TOTAL in CFA francs			635,000	1,050,000
Number of legal minimum wages			1.9	3.1

Notes:

Cost A: Minimum cost value

Cost B: Maximum cost value (with 500 bags, and higher amortisations)

Source: Intermón Oxfam (with data from Mooriben)

4 FINDINGS

The economic results (profits and losses) of LFR were estimated for each market combination and possible scenario by using the difference between the margin obtained (for a storage capacity of 50 tons) and operating costs. The difference between margin and cost provided an approximate LFR profit.

It is important to note that the profit is estimated before deducting transport costs between markets, as well as retail margins. In a future extension of this research, these two concepts (transport costs and retail margins) will be analysed in detail.

Subsequently, the study analysed whether years of losses were offset by profit years, with a view to determine whether or not LFR could be economically sustainable

LFR MARGINS: LEVELS AND VOLATILITY

Results from estimating LRF margins (i.e. before deducting operating costs) are presented in tables 6 and 7. When operating costs are ignored, LFR **margins are usually positive** (since producer prices at harvest season are rarely higher than consumer prices during the lean season). This means that only in a few cases are cereal-purchasing prices higher than selling prices. However, this does not imply that LFR had profits (given that operating costs were not included in this first conclusion).

Generally**, scenario 1** which represents a speculative sales policy, **yields higher margins relative to other scenarios, but at the cost of risk:** margins obtained under this scenario are much more volatile compared to the rest. In contrast, scenarios 2 to 4 yield margins that have both lower first and second moments than scenario 1 (see tables 6and 7).

LFR ECONOMIC RESULTS (PROFITS AND LOSSES): LEVELS

As noted above, net margins are calculated for an LFR with a storage capacity of 50 tons (with a turnover equal to this capacity) and operating costs of approximately 3 legal minimum wages. Results presented in table 8 show that different scenarios yield negative results (losses) in several years. However, in most cases, these **losses are offset by positive results (profits) in other years in all scenarios.** Only Djenné market in Mali presents very small profits, which compromises the viability of LFR in this market even in scenario 1. Some intervention in this market seems essential to ensure the economic viability of LFR in this zone (table 8).

Analysing the results by zone (table 8), the findings suggest that:

- In surplus areas, average profits range from 3.5 to 4.8 minimum wages for scenario 1, and between 0.2 and 3.8 in the other scenarios (results vary significantly depending on the scenario, market and crop).
- In intermediate areas, a wide range of results are obtained, depending on the consumer market in question. For millet in Filingué (Niger), average profits represent approximately 10 minimum wages in scenario 1, between 3 and 5 in scenarios 3 and 4, and show losses in scenario 2. As noted, no scenario makes a LRF viable in Djenné (Mali).
- In deficit areas, almost no case shows losses, since consumer prices in these areas are usually far above those of other markets located in other areas (surplus or intermediate areas). Since distances between deficit areas and producer areas are relevant, the impact of transport costs will be higher. This implies that, without knowing the exact amount of these costs, it does not seem possible to ascertain that LFR in these zones show profits.

Finally, differentiating results by crop (table 8), it was found that maize generally obtained more positive results than millet, which could help to explain the significant increase in production that has occurred in the area.

LFR PROFITS: EVOLUTION PER SCENARIO (1995-2011)

This section analyses the evolution of margins over time for each combination of markets and by zone type (surplus, deficit and precarious balance). Results are calculated for a 50 tons storage capacity facility and operating costs amounting to three legal minimum wages. The economic results (profits or losses) are expressed in number of legal minimum wages (i.e. LFR profit= margin - operating costs (3 minimum wages).

Surplus zones

Average results by scenario are reflected in Table 9. Charts 1 to 4 show the evolution of the results year by year in terms of legal minimum wages.

In scenario 1, with approximate costs amounting to three legal minimum wages, findings suggest that between 2 and 3 years out of 15 show margins lower than costs for maize, and between 3 and 4 years in the case of millet. Maximum losses range between 2.2 and 3.4 minimum wages in the case of maize in Mali, and between 3.1 (Mali) and 4.4 (Niger) minimum wages for millet.

In scenarios 2 to 4, between 3 and 5 years out of 15 register margins below cost for maize, with scenario 2 showing the worst performance. For millet, 4 years of negative profits in scenarios 2 and 3 are found. Scenario 4 in Maradi stands out with 8 bad years.

The maximum amount of losses for maize in these scenarios varies from 2.1 to 4.5 minimum wages, with scenario 4 showing the best performance and scenario 2 showing the worst.

The cycles in all scenarios were generally quite erratic, which makes their prediction a difficult task. A clear pattern however is that, the first 10 years of the period analysed display a higher level of volatility, relative to the most recent sample.

Intermediate areas

Average results by scenario are reflected in Table 10. Charts 5 to 7 show the evolution of the results year by year in terms of legal minimum wages.

In scenario 1, the average margin for millet in the period 1995-2011 varies between 4.2 minimum wages (in the combination Macina-Djenné, Mali) and approximately 13 minimum wages (in Maradi-Filingué and Magaria-Filingué price pairs, Niger).

If the cost were close to 3 minimum wages, margins below cost would be recorded in 9 years in Djenné. In contrast, this only happens 1 year in Filingué. The amount of losses ranges from 0.6 minimum wages (in the combination Magaria-Filingué) to 9.3 minimum wages (in Djenné). Results show that the combination Macina-Djenné faces viability issues even in scenario 1.

Cycles were rather erratic, and their duration cannot be determined with clarity. However, higher volatility is registered during the first 10 years of the period, as compared to more recent years of the period.

In the rest of the scenarios, the Djenné market continues to present viability issues. In the other markets, scenario 2 produces the most negative results in terms of number of years operating under three minimum wages.

Deficit areas

Average results by scenario are reflected in Table 11. Charts 8 to 12 show the evolution of the results year by year in terms of legal minimum wages.

LFR located in deficit areas are primarily driven by food security goals as opposed to LFR located in surplus areas, which mainly seek to make a profit. They function as cooperatives and sell grain at prices below the market. These LFR often face difficulties when they need to replenish their stocks, since prices tend to be high. This issue differs from price risk, which will be dealt with in future research studies.

Preliminary results obtained for deficit areas show margins and profits in consumer markets in these areas to be much higher than those in the previously analysed zones. This may be due to the fact that the distances between production zones and consumption markets are very significant in deficit zones (between 800 and 1100 km). This factor is important to consider since the margins and profits calculated in this study include both transport costs and retail margins.

The analysis by scenario shows:

- In scenario 1: Average profits amount to approximately 11 minimum wages for maize and between 6 and 12 for millet.
    - With costs close to 3 minimum wages, two years show margins below this value in the market combination Macina-Gao (Millet) and only one year in the combination Magaria-Tillabéri (also for millet).
    - The maximum loss ranges between 1.9 minimum wages (in Macina-Gao) and 0.9 (in Magaria-Tillabéri).
- In all other scenarios, the average profits are approximately 9 annual minimum wages for maize and between 4.7 and 8.4 annual minimum wages for millet.
- Average profit in these markets is never less than 4.7 minimum wages in any of the scenarios. Only two combinations show some years with negative profits for millet (Macina-Gao in Mali, and Magaria-Tillabéri in Niger).
- Magaria-Tillabéri losses are relevant and range between 6 and 10 minimum wages depending on the scenario considered.

The cycles were rather erratic in each market, and their duration cannot be easily predicted. However, higher volatility was witnessed during the first 10 years of the period, compared to the last phase of the period.

5 CONCLUSIONS AND RECOMMENDATIONS

This research study sought to determine the viability of setting up a stabilization fund to improve the economic viability of LFR in Mali and Niger under a given set of scenarios. To this end, the study has analysed the possible results that LFR with different business strategies would have had in several markets of these countries for maize and millet.

The findings presented in this study confirm the hypothesis that LFRs may be economically sustainable in most of the frameworks considered. In most of the markets analysed within the framework of this research, the losses suffered during bad years are offset with the profits

gained during good years. However, LFR do not seem viable in some of the markets and scenarios analysed, where the overall losses incurred during negative years are too high to be offset by the positive results obtained during good years.

Summary of key findings

1. **In most cases** (market combinations analysed), **a stabilization fund seems to be economically viable regardless of the considered scenario** (). This means that profits during good years offset losses during bad years. Only in certain specific cases does external intervention appear necessary to ensure the economic viability of LFR.

2. **LFR adopting "speculative" business strategies** (i.e. storing for longer periods in order to take advantage of higher prices in the lean season) **yield higher results** (margins) **than LFR distributing sales monthly throughout the year. However, the former strategy also entails higher levels of variability** (risk).

3. **LFR applying less speculative business strategies** (i.e., apportioning sales throughout the year, as analysed in scenarios 2 to 4) **have slightly lower margins, but also lower risk levels**. Furthermore, losses suffered in some years can be offset by profits obtained in other years in most of the cases analysed.

4. **In some of the cases analysed, the economic viability of LFR seems to be compromised**. This is the case of precarious balance markets, such as Djenné in Mali (depending on the business strategy used). LFR may not be viable in two other markets (Filingué and Maradi in Niger, both for millet).

This research results should be taken with care due to the rough approximation that has been made to operating costs. The effective development and piloting of a price stabilization fund would necessarily require the completion of a detailed analysis as proposed in a forthcoming second phase of this research project.

Recommendations

Despite the lack of detailed information on LFR operating and financial costs in the markets analysed, various ways of operating a stabilisation fund could be suggested at this preliminary stage of the research, based on market mechanisms and/or varying degrees of public intervention.

Possible measures could include:

- **Establishing self-regulating LFR** (save in good years to offset bad years). This could be done either by saving in good years or by paying smoothed prices to farmers (prices above the market price when these are below a threshold considered "minimum" and paying below the market price when it is above a "maximum" threshold).
- **Introducing adequate public policies**: several possibilities with different degrees of public intervention could be considered for a future research. These possibilities include: a) support from a public compensation fund (activated for facilities with negative results caused by public interventions that reduce the market sale prices); b) creation of a public price insurance system, c) introduction of a system of direct subsidies to LFR (triggered when the margin leaves an “adequate” range).

In summary, despite the absence of data on operating and financial costs for the markets analysed, it can be concluded that, in most cases, **LFR are likely to be economically viable**, independently of the buying and selling strategy that they pursue. **Negative economic results during bad years are offset by positive results during good years** (there are more good

years that bad years and the profits are higher than losses). However, given the extremely limited financial capacity and vulnerability of many LFR, this viability may require the creation and implementation of an external fund to compensate storage facilities during bad years.

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NOTES

1 Conclusions of Oxfam America's January 13-14, 2011 Convening on Price Risk Transfer, Tools for Poor Farmers in Africa, which explored the potential for utilizing market-based price risk management tools for smallholders in Africa.

2 For the purposes of this study, the term "stabilization fund" refers to an internal arrangement managed by federations, not to the state-owned hard-currency savings used by countries that are too dependent on one or two commodities to protect themselves against price risk.

ANNEX

Table 6 Storage facility margins per scenario (average 1995-2011).

In CFA francs per kilo sold (in real terms) and margin percent over producer price.

Zone	Crop	Country	Production market	Consumption market	Scenario 1		Scenario 2		Scenario 3		Scenario 4	
					Margin (CFA francs per kilo sold)	Margin % (margin over producer price)	Margin (CFA francs per kilo sold)	Margin % (margin over producer price)	Margin (CFA francs per kilo sold)	Margin % (margin over producer price)	Margin (CFA francs per kilo sold)	Margin % (margin over producer price)
Surplus	Maize	Mali	Loulouni	Loulouni	37	67%	23	42%	23	41%	19	35%
	Maize	Mali	M'pessoba	Loulouni	40	75%	26	49%	25	48%	22	41%
	Millet	Mali	Macina	Loulouni	44	53%	38	46%	37	44%	39	46%
	Millet	Niger	Maradi	Maradi	43	53%	26	32%	24	30%	18	22%
Precarious balance	Millet	Mali	Macina	Djenné	24	29%	14	17%	13	16%	10	12%
	Millet	Niger	Maradi	Filingué	73	91%	19	24%	47	59%	39	49%
	Millet	Niger	Magaria	Filingué	69	82%	15	18%	43	51%	35	41%
Deficit	Maize	Mali	Loulouni	Gao	78	141%	70	127%	69	126%	68	124%
	Maize	Mali	M'pessoba	Gao	80	152%	73	138%	72	136%	71	134%
	Millet	Mali	Macina	Gao	51	61%	44	54%	44	53%	44	53%
	Millet	Niger	Maradi	Tillabéri	84	105%	63	78%	61	76%	54	67%
	Millet	Niger	Magaria	Tillabéri	80	95%	59	69%	57	68%	50	59%

Source: Calculations by authors based on RESIMAO price data.

Table 7 Storage facility margin variability per scenario, coefficient of variation per market and scenario.

Zone	Crop	Country	Production market	Consumption market	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Surplus	Maize	Mali	Loulouni	Loulouni	61%	57%	46%	35%
	Maize	Mali	M'pessoba	Loulouni	61%	59%	50%	42%
	Millet	Niger	Maradi	Maradi	67%	57%	51%	45%
	Millet	Mali	Macina	Loulouni	65%	68%	48%	34%
Precarious balance	Millet	Niger	Maradi	Filingué	41%	132%	25%	24%
	Millet	Niger	Magaria	Filingué	59%	262%	66%	80%
	Millet	Mali	Macina	Djenné	165%	219%	160%	124%
Deficit	Maize	Mali	Loulouni	Gao	31%	23%	18%	17%
	Maize	Mali	M'pessoba	Gao	31%	23%	18%	16%
	Millet	Mali	Macina	Gao	68%	63%	42%	28%
	Millet	Niger	Maradi	Tillabéri	30%	24%	19%	14%
	Millet	Niger	Magaria	Tillabéri	47%	49%	51%	55%

Source: Calculations by authors based on RESIMAO price data

Table 8 Storage facility economic results for 50 tons of storage capacity and operating costs

(amounting to 3 legal minimum wages. In terms of legal minimum wages, MW, and number of bad years*, average 1995-2011.

Crop	Country	Market combinations		Zone	Scenario 1		Scenario 2		Scenario 3		Scenario 4	
		Production area	Consumption area		Profit (nº of MW)	Bad years	Profit (nº of MW)	Bad years	Profit (nº of MW)	Bad years	Profit (nº of MW)	Bad years
Millet	Mali	Macina	Loulouni	Surplus	4.8	4	3.7	4	3.5	3	3.8	1
		Macina	Djenné	PB	1.2	9	-0.6	9	-0.7	11	-1.2	12
		Macina	Gao	Deficit	5.9	2	4.8	3	4.7	1	4.7	0
	Niger	Maradi	Maradi	Surplus	4.7	3	1.7	3	1.4	4	0.2	8
		Maradi	Filingué	PB	10.3	0	0.5	7	5.6	0	4.1	0
		Magaria	Filingué	PB	9.6	1	-0.3	5	4.8	1	3.3	1
		Maradi	Tillabéri	Deficit	12.3	0	8.4	0	8.1	0	6.9	0
		Magaria	Tillabéri	Deficit	11.5	1	7.7	1	7.4	1	6.1	1
Maize	Mali	Loulouni	Loulouni	Surplus	3.5	3	1.1	5	1.0	4	0.4	4
		M'Pessoba	Loulouni	Surplus	4.0	2	1.4	4	0.8	3	1.4	4
		Loulouni	Gao	Deficit	10.6	0	9.3	0	9.2	0	9.0	0
		M'Pessoba	Gao	Deficit	11.1	0	9.7	0	9.6	0	9.4	0

* Bad years = years when the margin was lower than three minimum wages.
We marked in red the markets and scenarios where the activity would not be viable.

Table 9 Margins in terms of number of wages and years with margins less than 3 minimum wages. Surplus zones. Scenarios 1 to 4.

Crop	Country	Production market	Consumption market	Scenario 1			Scenario 2			Scenario 3			Scenario 4		
				Profit (nº of MW)	Bad years	Max. losses (nº of MW)	Profit (nº of MW)	Bad years	Max. losses (nº of MW)	Profit (nº of MW)	Bad years	Max. losses (nº of MW)	Profit (nº of MW)	Bad years	Max. losses (nº of MW)
Maize	Mali	Loulouni	Loulouni	3.5	3	2.2	1.1	5	3.3	1.0	4	2.7	0.4	4	2.1
Maize	Mali	M'pessoba	Loulouni	4.0	2	3.4	1.4	4	4.5	0.8	3	2.6	1.4	4	2.2
Millet	Mali	Macina	Loulouni	4.8	4	3.1	3.7	4	3.6	3.5	3	1.9	3.8	1	0.3
Millet	Niger	Maradi	Maradi	4.7	3	4.4	1.7	3	3.8	1.4	4	3.2	0.2	8	2.9

* Assuming a cost of 3 minimum wages

Source: Calculations by authors based on RESIMAO price data.

Table 10 Margins in terms of number of wages and years with margins less than 3 minimum wages. Precarious balance zones. Scenarios 1 to 4.

Crop	Country	Production market	Consumption market	Scenario 1			Scenario 2			Scenario 3			Scenario 4		
				Profit (nº of MW)	Bad years	Max. losses (nº of MW)	Profit (nº of MW)	Bad years	Max. losses (nº of MW)	Profit (nº of MW)	Bad years	Max. losses (nº of MW)	Profit (nº of MW)	Bad years	Max. losses (nº of MW)
Millet	Mali	Macina	Djenné	1.2	9	9.3	-0.6	9	9.3	-0.7	11	6.6	-1.2	12	4.9
Millet	Niger	Maradi	Filingué	10.3	0	0	0.5	7	10.4	5.6	0	0	4.1	0	0
Millet	Niger	Magaria	Filingué	9.6	1	0.6	-0.3	5	22.2	4.8	1	9.9	3.3	1	13.3

Source: Calculations by authors based on RESIMAO price data.

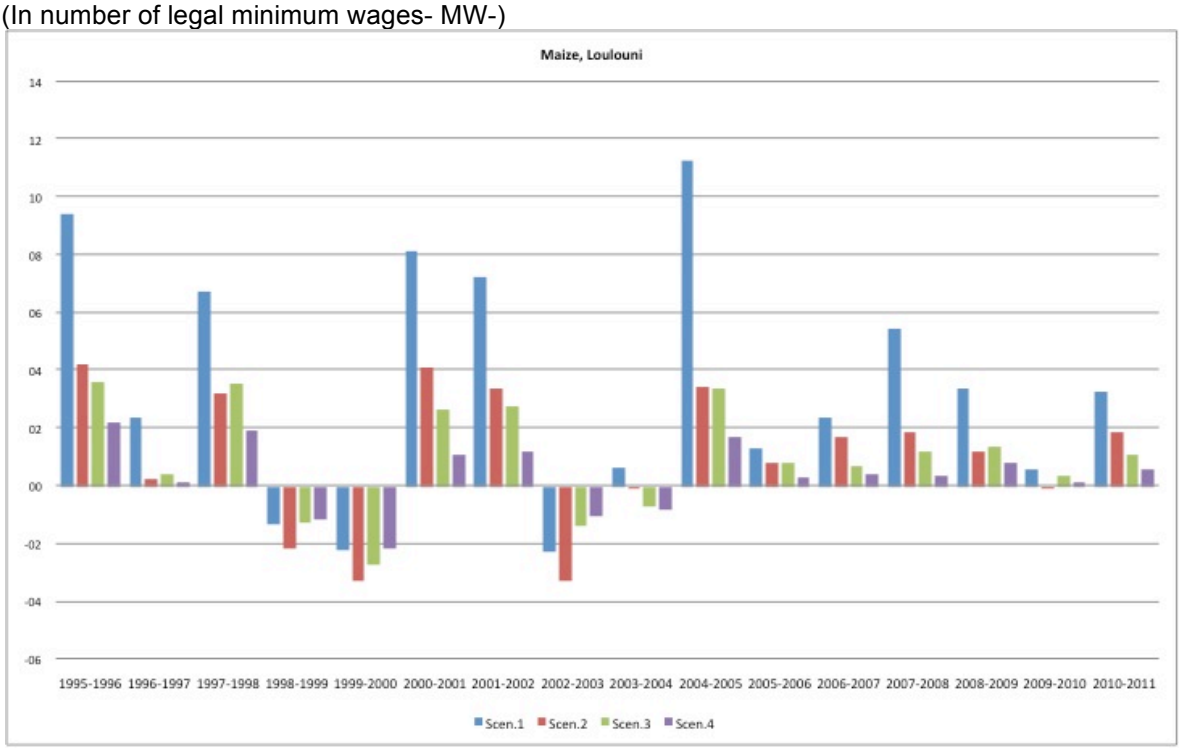
Table 11 SF profits in legal minimum wages. Results by scenario.

Crop	Country	Production market	Consumption market	Scenario 1			Scenario 2			Scenario 3			Scenario 4		
				Profit (nº of MW)	Bad years	Max. losses (nº of MW)	Profit (nº of MW)	Bad years	Max. losses (nº of MW)	Profit (nº of MW)	Bad years	Max. losses (nº of MW)	Profit (nº of MW)	Bad years	Max. losses (nº of MW)
Maize	Mali	Loulouni	Gao	10.6	0	0	9.3	0	0	9.2	0	0	9.0	0	0
Maize	Mali	M'pessoba	Gao	11.1	0	0	9.7	0	0	9.6	0	0	9.4	0	0
Millet	Mali	Macina	Gao	5.9	2	1.9	4.8	3	2.2	4.7	1	0.7	4.7	0	0
Millet	Niger	Maradi	Tillabéri	12.3	0	0	8.4	0	0	8.1	0	0	6.9	0	0
Millet	Niger	Magaria	Tillabéri	11.5	1	0.9	7.7	1	5.8	7.4	1	7.7	6.1	1	9.9

Source: Calculations by authors based on RESIMAO price data

Chart 1: SF profits per scenario: Maize, Loulouni

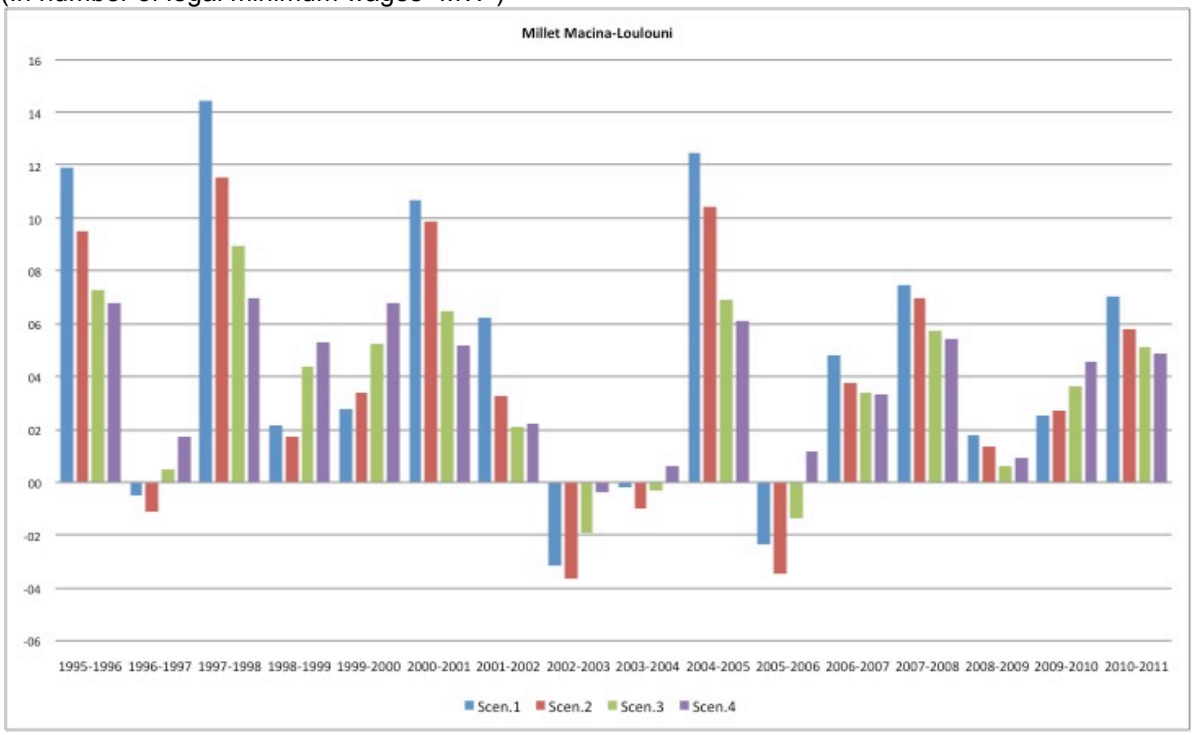
(In number of legal minimum wages- MW-)



Source: Calculations by authors based on RESIMAO price data

Chart 2 SF profits per scenario: Millet-Macina-Loulouni

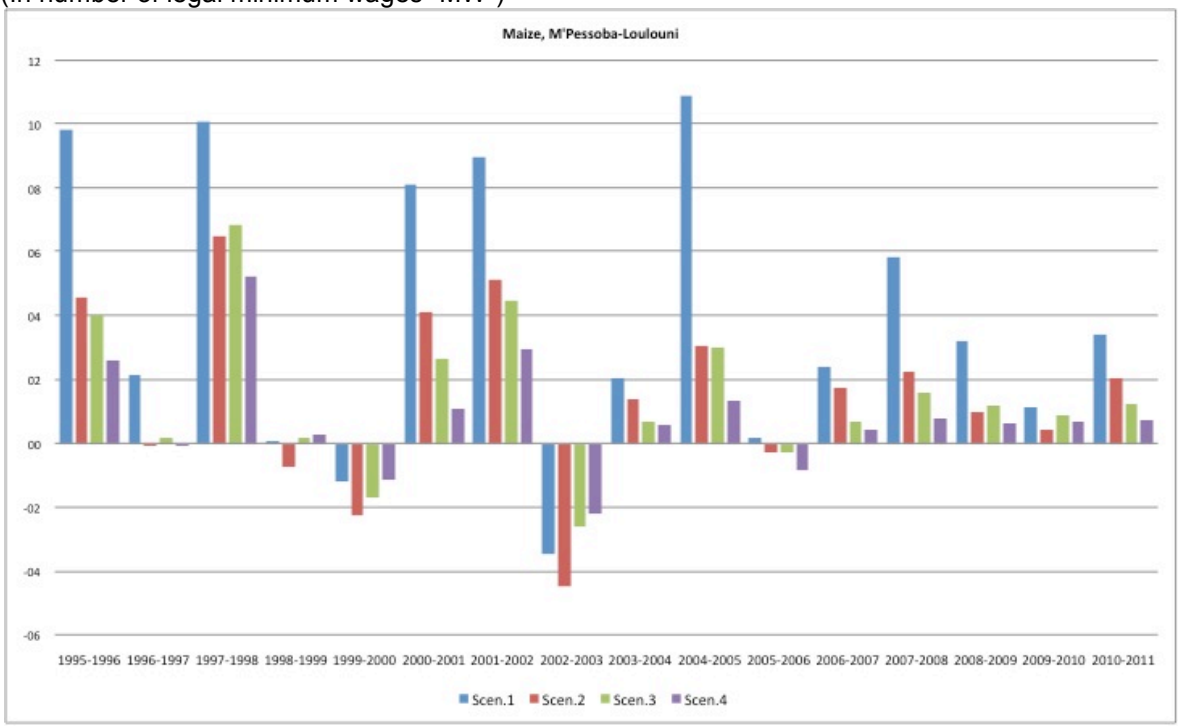
(In number of legal minimum wages- MW-)



Source: Calculations by authors based on RESIMAO price data

Chart 3 SF profits per scenario: Maize M'Pessoba – Loulouni

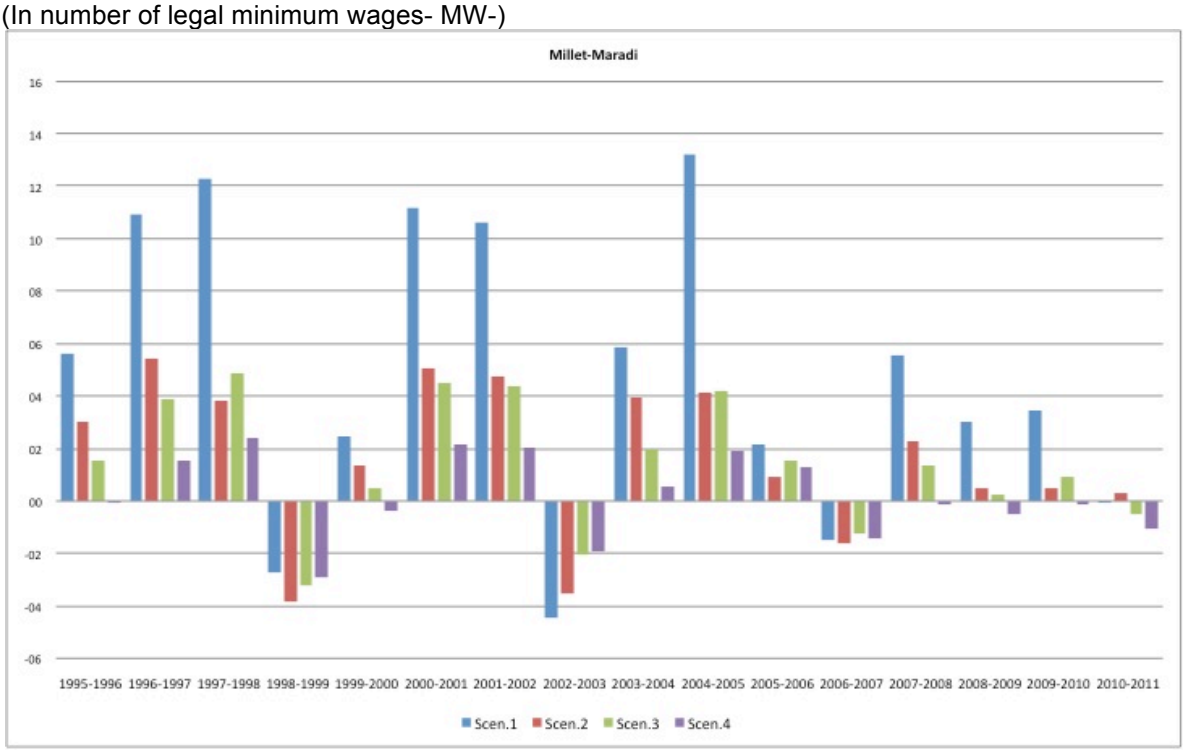
(In number of legal minimum wages- MW-)



Source: Calculations by authors based on RESIMAO price data

Chart 4 SF profits per scenario: Millet-Maradi

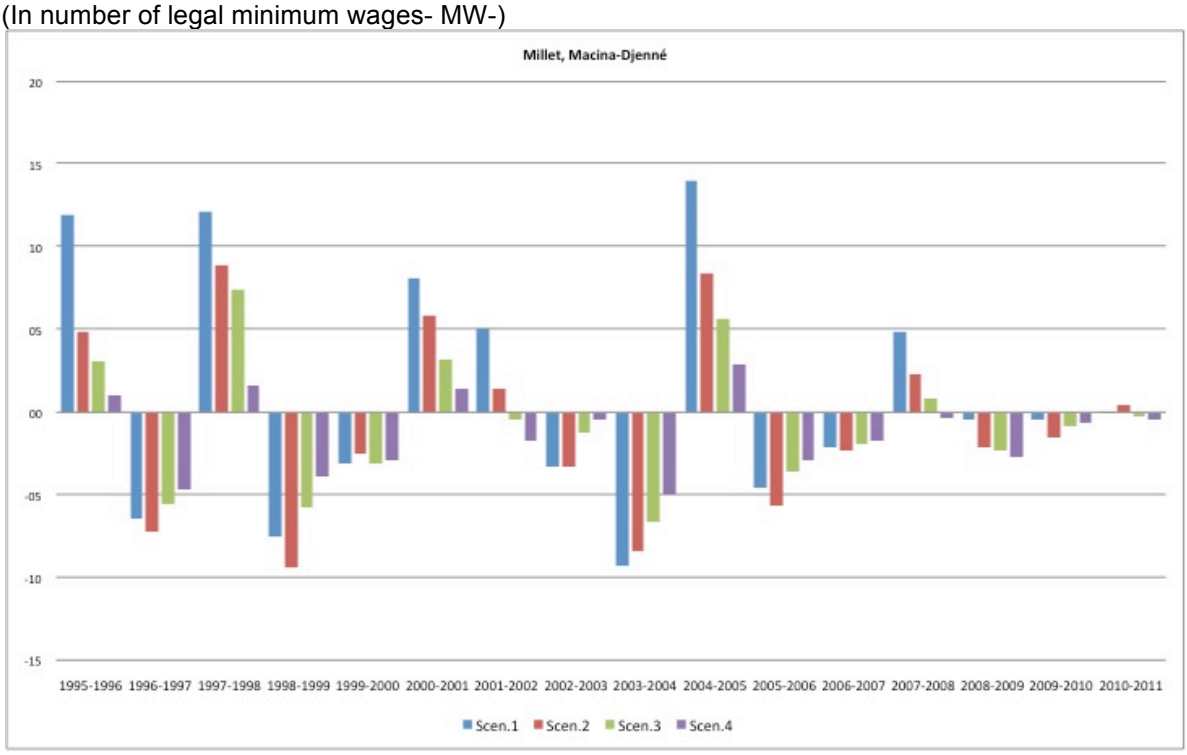
(In number of legal minimum wages- MW-)



Source: Calculations by authors based on RESIMAO price data

Chart 5 SF profits per scenario: Millet-Macina-Djenné

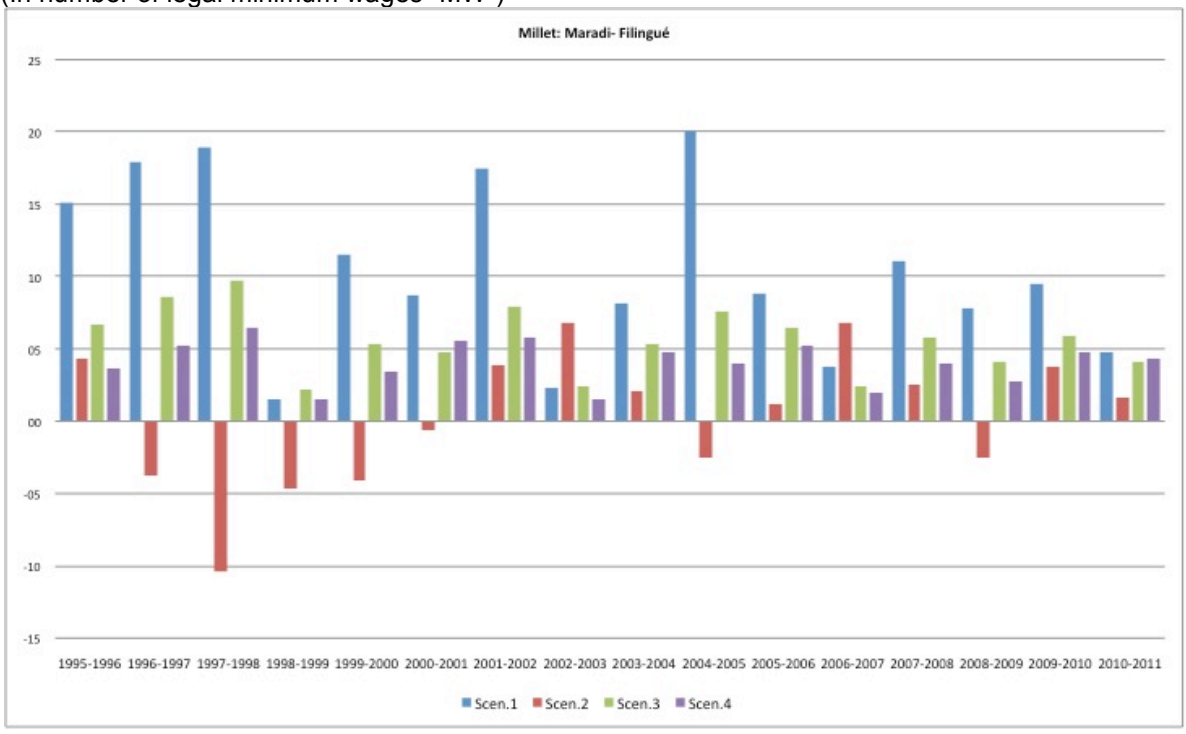
(In number of legal minimum wages- MW-)



Source: Calculations by authors based on RESIMAO price data

Chart 6 SF profits per scenario: Millet-Maradi – Filingué

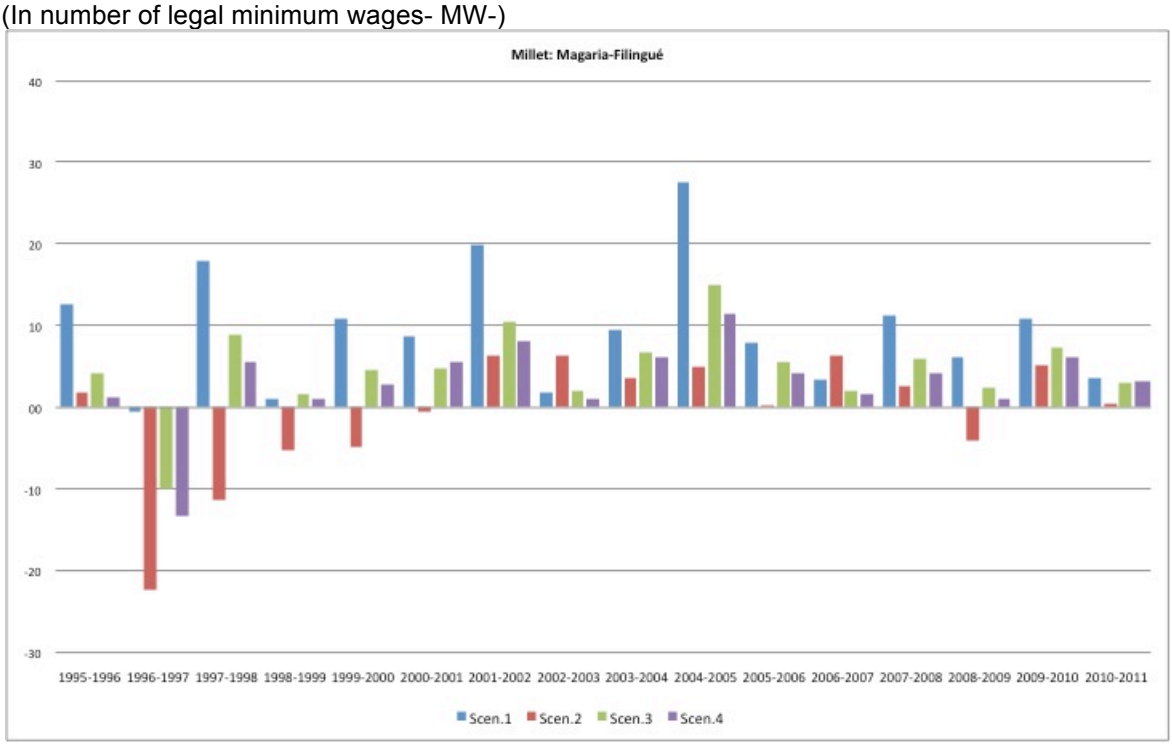
(In number of legal minimum wages- MW-)



Source: Calculations by authors based on RESIMAO price data

Chart 7 SF profits per scenario: Millet-Magaria- Filingué

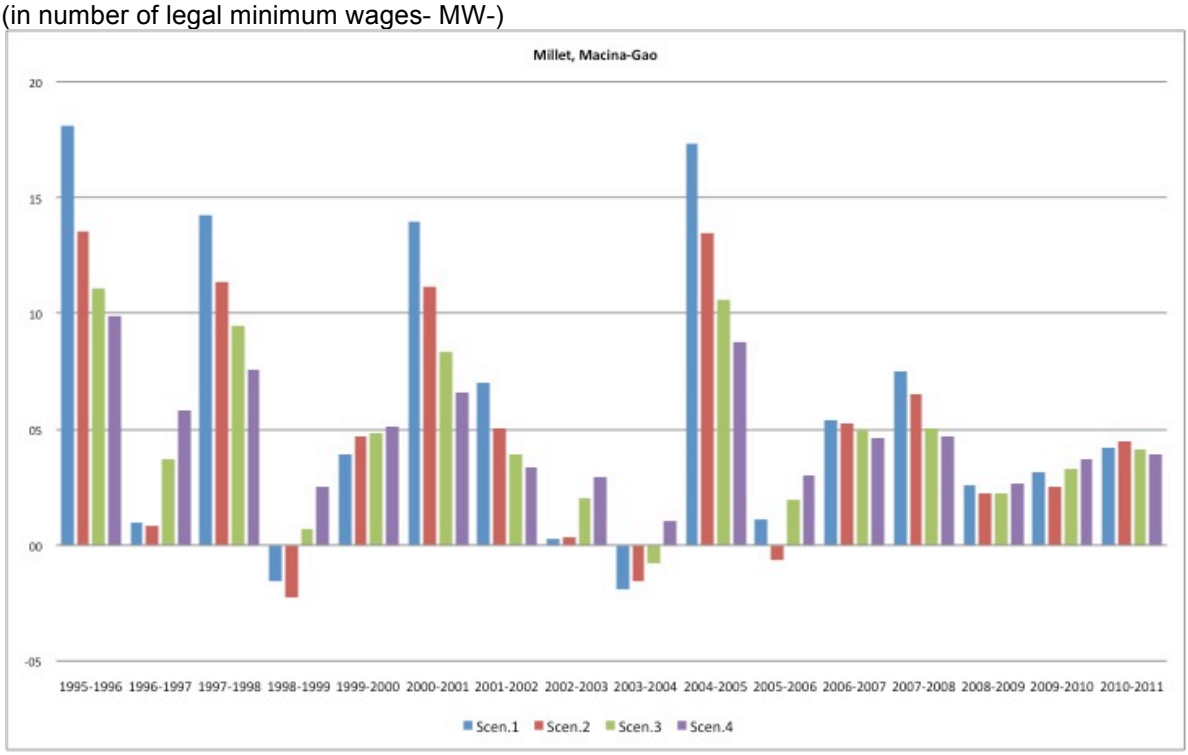
(In number of legal minimum wages- MW-)



Source: Calculations by authors based on RESIMAO price data

Chart 8 SF profits per scenario: Millet-Macina-Gao

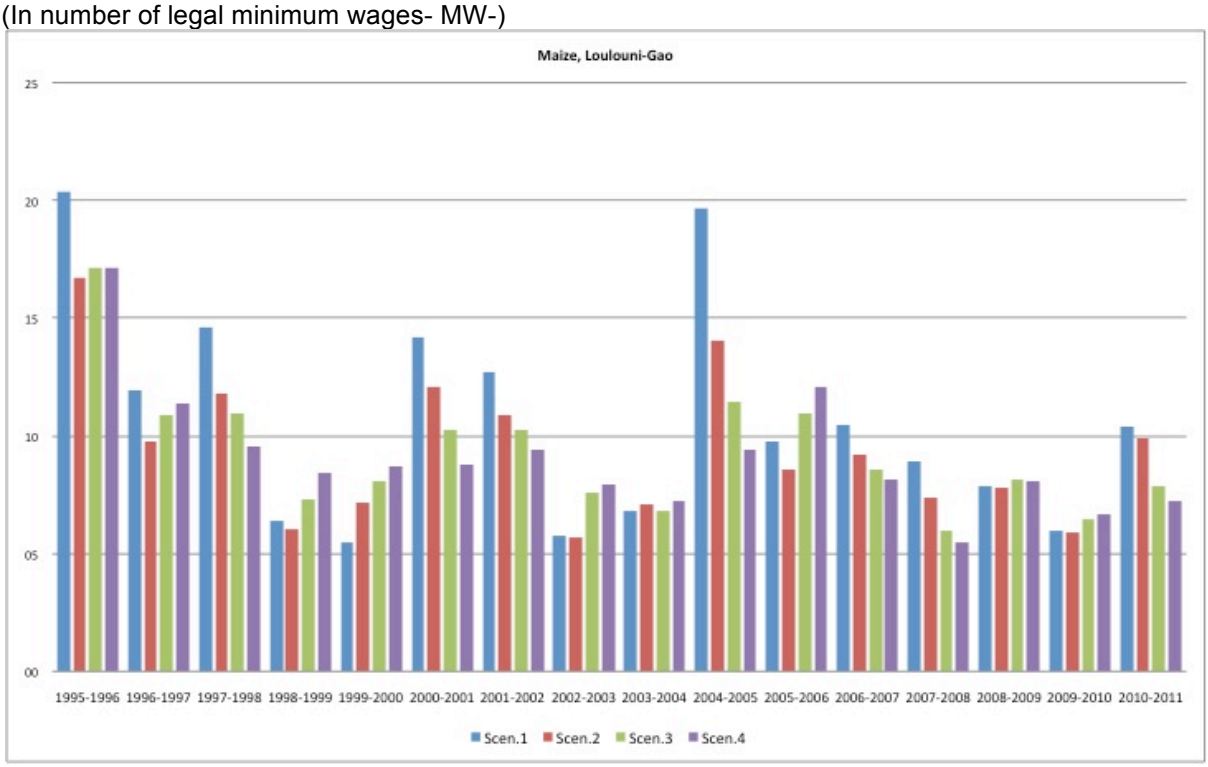
(in number of legal minimum wages- MW-)



Source: Calculations by authors based on RESIMAO price data

Chart 9 SF profits per scenario: Maize, Loulouni-Gao

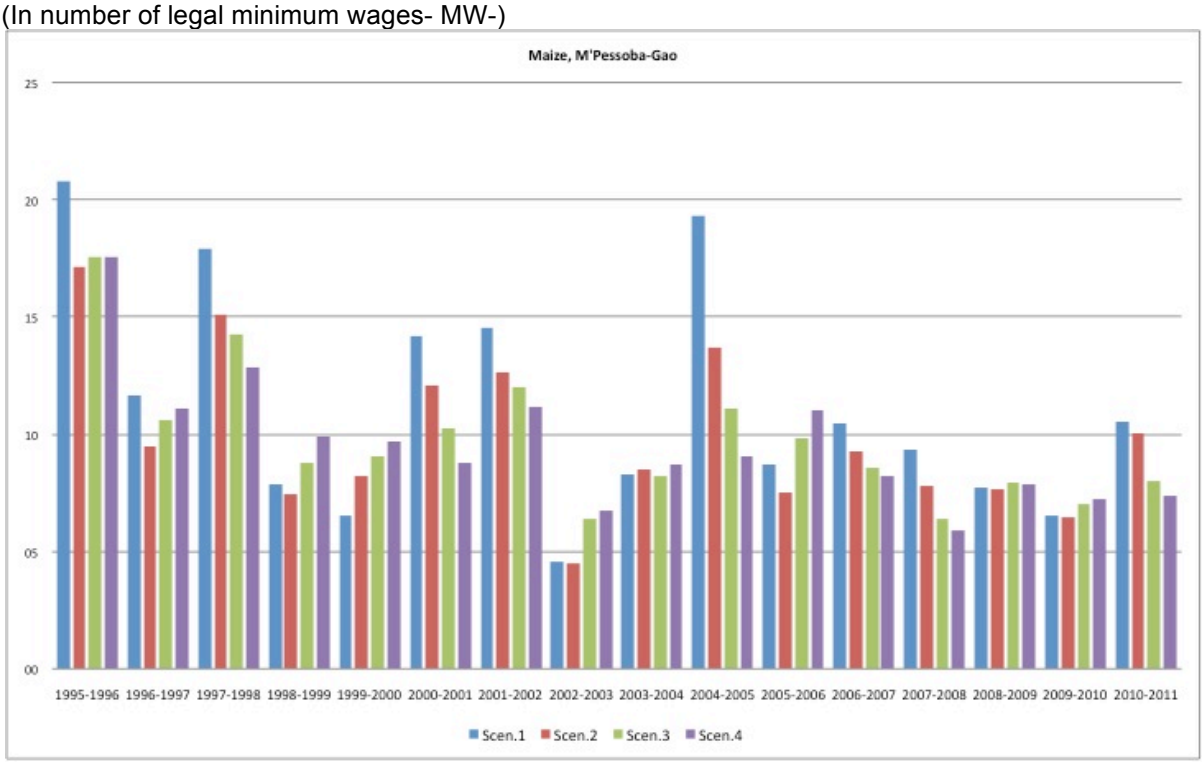
(In number of legal minimum wages- MW-)



Source: Calculations by authors based on RESIMAO price data

Chart 10 SF profits per scenario: Maize, M'Pessoba-Gao

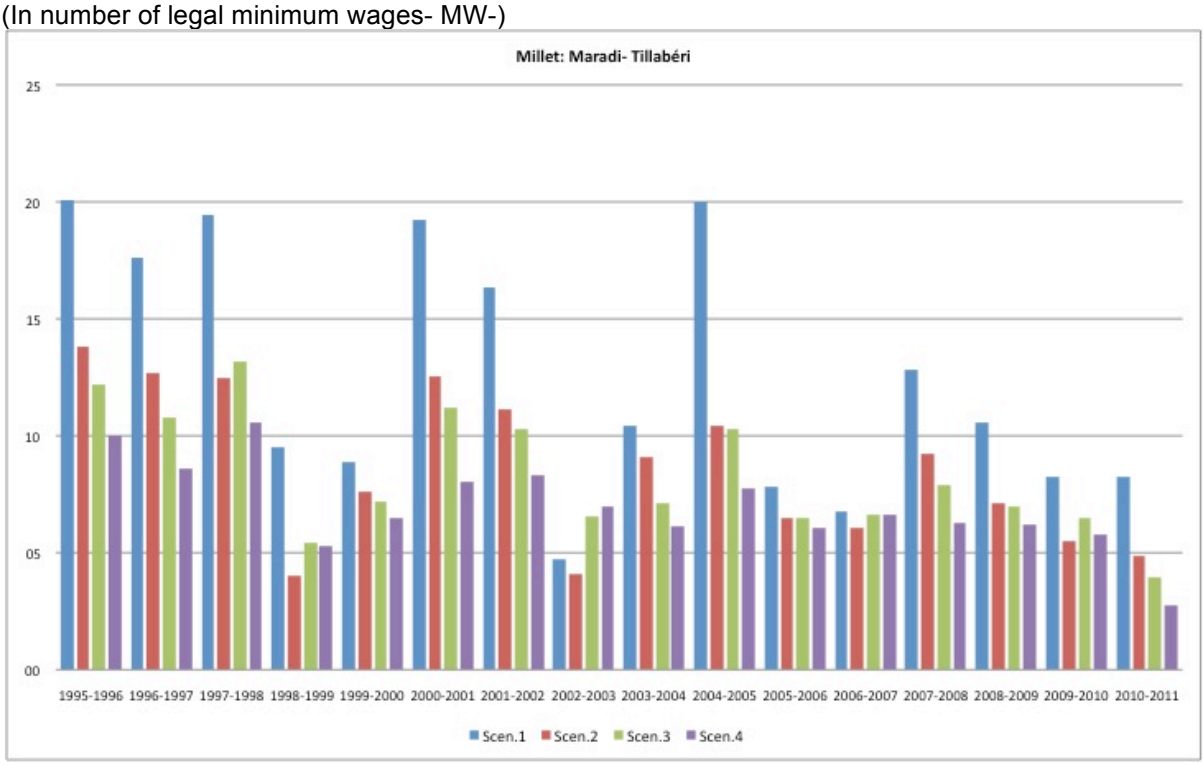
(In number of legal minimum wages- MW-)



Source: Calculations by authors based on RESIMAO price data

Chart 11 SF profits per scenario: Millet, Maradi-Tillabéri

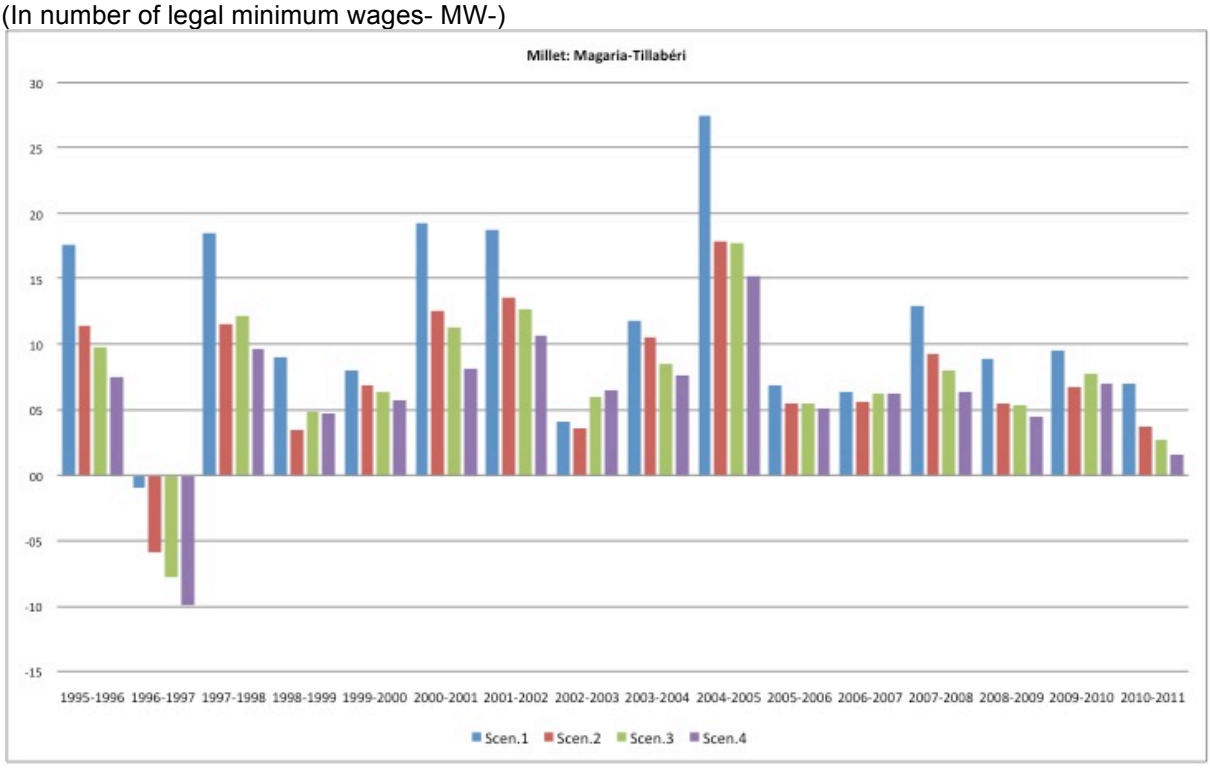
(In number of legal minimum wages- MW-)



Source: Calculations by authors based on RESIMAO price data

Chart 12 SF profits per scenario: Magaria-Tillabéri

(In number of legal minimum wages- MW-)



Source: Calculations by authors based on RESIMAO price data

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