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THE IMPACT OF DROUGHT ON THE NATIONAL ACCOUNTS FOR LIVESTOCK IN SAHELIAN COUNTRIES

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The evaluation of livestock production in the United Nations System of National Accounts implies a measure which is inconsistent with the general principle evaluation of production in this system.

This paper deals with a critical appraisal of the methods used by the SNA and two sahelian countries in livestock accounting.

Finally, estimations of NIGER's GDP over the period 1983 to 1985 are carried out, using the four livestock production assessments presented. Differences in GDP's evaluations are large, reaching 17 percent in 1984 and 7 percent in 1985 in terms of rate of growth.

The evaluation of livestock production in the United Nations SNA implies a "net" measure of production, which is inconsistent with the general principle of "gross" evaluation of production in this system. This inconsistency creates a limited bias in "normal" times, but its impact can be considerable in times of severe drought. Moreover, the evaluation methods of livestock production during the severe droughts of 1972-73 and 1984-85 in Sahelian countries were not consistent with the SNA method. The SNA method would have implied a negative production. The Sahelian countries applied their own method to evaluate livestock production, thus creating an additional inconsistency.

In this paper the authors present a critical appraisal of the various methods used by the SNA and two Sahelian countries (Mali and Niger) in livestock accounting. We propose another method based upon the production concept in the SNA. Finally, we examine the impact of those methods on the assessment of Niger's GDP in 1984-85.

1. THE MEASUREMENTS OF LIVESTOCK PRODUCTION IN THE SNA

The UN SNA handbook deals with livestock production. This method, referred to as the "SNA method" will first be described. However, another method can be inferred from the production concept in the SNA. It will be referred to as the "SNA production assessment method."

1.1. The SNA method

In most countries, national accountants usually calculate livestock production as the balance resulting from the following indentities:

$$(1)\quad \text{Production} + \text{Imports} = \text{Total Utilizations}$$

(2) Total Utilizations = Slaughterings + Gross Fixed Capital Formation + Changes in stocks + Exports

(3) Production = Total Utilizations − Imports.

All the components of the right side of (3) being known, production can then be calculated.

The problem arises from the method of calculation used for Gross Fixed Capital Formation (GFCF) and changes in stocks.[1] According to the UN SNA handbook, GFCF is "the value of livestock variation." This is clearly inconsistent with the method of estimating production used in the SNA: production is always estimated "gross," i.e. including depreciation and destruction of capital goods.

The SNA method measures *Net* fixed Capital Formation and not *Gross* Fixed Capital Formation. If an animal's value decreases, due to weight loss or ageing, or if it dies (of disease, starvation or thirst), it is accounted as a negative variation of the livestock and therefore of the so-called "G" FCF. In the SNA method, livestock is a stock of fixed capital, the depreciation or destruction of which are subtracted from the total utilization considered in identity (3). This "net" evaluation of the "G" FCF infers an underestimation of production.

An illustration can be provided if we first consider the situation of a single animal and then the situation of total livestock.

1.1.1. The Production of a Single Animal

The difference between gross and net production can be illustrated by considering the way the animal's life cycle appears in the national accounting system. Let us consider for instance a heifer born in year t_1 which gains weight during the first three years and is slaughtered at the end of its tenth year. Its *weight* increases as shown in Chart 1. The evolution of the *value* of the animal is slightly different for, as a cow grows older, its production prospects (calves and milk) diminish and so does its value. Chart 2 illustrates this evolution. Of course, prices are taken to be constant and value is calculated in real terms (volume in National accounting).

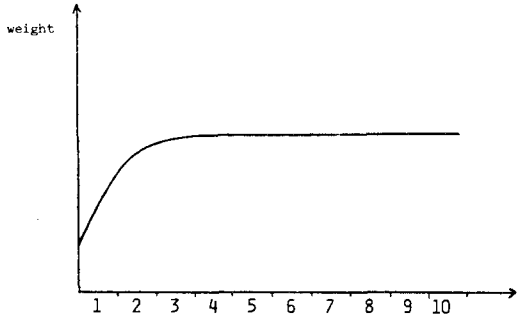

Chart 1. Evolution of An Animal's Weight

[1]To simplify we shall class the sum GFCF + changes in stocks as "GFCF," the distinction being irrelevant for our purpose.

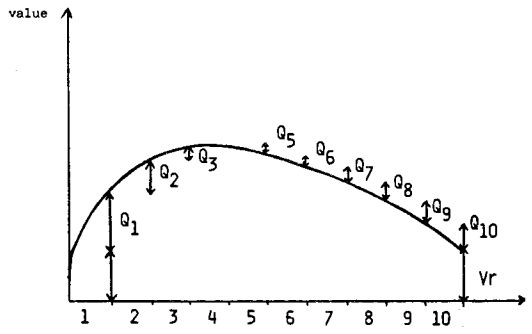

Chart 2. Evolution Of An Animal's Value

During the weight increase period, production for each year consists of the value increase:

$Q1$ for year 1
$Q2$ for year 2
$Q3$ for year 3

The animal being a fixed capital stock, its annual value increase, i.e. its production, is accounted for in the GFCF, an element of the total utilizations in identity (3). In year 4, the value of the animal is steady and therefore production is nil. From year 5 onwards, the value of the animal decreases. According to the SNA, a negative variation of the animal value means a negative GFCF and consequently a negative production is we refer to identity (3). From year 5 to year 10, the production of the animal is negative: the value of each year is shown as $Q5, Q6, \ldots, Q10$ in Chart 2.

As already mentioned, this method is inconsistent with the definition of production in the SNA: from year 5 onwards, the animal, in fact a fixed capital, "wears out" and its loss in value $Q5, Q6, \ldots, Q10$ should be considered as depreciation, which should not be accounted for in flow accounting, either as negative GFCF on the total utilizations side, or as negative production on the total resources side. Assuming that the animal is sold for slaughter at its casting value Vr at the end of year 10, production for this year is not altered. In fact, from year 9 to year 10 that animal's value loss is $Q10 + Vr$, accounted as negative GFCF; whereas the slaughtering of the animal is a positive utilization, the value of which is Vr. Consequently production can be expressed as:

$$Vr - (Q10 + Vr), \quad \text{i.e.} - Q10$$

1.1.2. Production of Total Livestock

The livestock consists of a multitude of animals of different breeds, sexes, ages and weights. If we first consider the animals of the same breed and sex, they can be allocated in various categories corresponding to certain intervals of ages and/or of weights.

In the course of time, an animal moves from one category to another as it grows older or as its weight changes, Moreover, it can enter the livestock by birth or by being imported, and leave it by death, slaughtering or as an export.

The livestock GFCF can be expressed in three equivalent ways:

- being a "net" evaluation, it is the capital variation (in real terms) represented by the livestock, i.e. from year $t-1$ to year t:

$$\text{GFCF}(t) = \text{livestock}(t) - \text{livestock}(t-1) \tag{4}$$

- GFCF can also be split into two elements:
  - the existing livestock $(t-1)$ variation due to category changes only;
  - the livestock variation due to accretion and to outflows:

$$\text{GFCF}(t) = \text{category changes from } (t-1) \text{ to } t + \text{accretions}(t) - \text{outflows}(t). \tag{5}$$

- GFCF can finally be written as the difference between livestock population in t and $(t-1)$, multiplied by the price per head for each year (in real terms):

$$\text{GFCF}(t) = \text{population}(t) \times \text{price per head}(t) - \text{population}(t-1) \times \text{price per head}(t-1). \tag{6}$$

Price per head (t) means the price per head of the animals which make up the livestock at the end of year t, at constant prices.

National accountants, in actual fact, often use the third expression, as they only consider the total populations (with no distinction of categories). However, only the second expression is appropriate in order to calculate a true "Gross" FCF. It implies breaking down the balance of accretions and outflows into accretions and outflows, and distinguishing between positive category changes and negative ones.

This can be illustrated by considering the registrations of the various steps of an "ordinary" (i.e. non-animal) capital good's life in national accounting terms. Let us consider for example a factory:

(a) when it has just been built or imported as new equipment, it is accounted for as GFCF;

(b) heavy repairs, extensions or technical improvements are also accounted for as GFCF;

(c) wear and tear and obsolescence are not registered in gross flow accounting, but only in net accounts.

(d) Destruction without further utilization is not considered in gross flow accounting. In net flow accounting, according to the SNA, Fixed Capital Consumption includes besides wear and tear and obsolescence an estimate of accidental damages which cannot be prevented by normal maintenance or repair (for instance, fire or flood damages). An evaluation of those accidental damages can be effected by considering the mean net insurance premium by unit of capital for every type or risk. The French SNA suggests that a provision for fixed capital losses due to insurable accidental damages should be included in fixed capital consumption. Consequently, it seems that the results of economic or natural disasters are not accounted for either in gross or in net flow accounting.

However fixed capital consumption is not really a goods and services operation. It is deducted from gross value added in order to calculate net value added.

(e) A second-hand factory sale is registered as a negative GFCF for the seller and as a positive one for the buyer if he uses it as a capital good. It becomes intermediate consumption if demolition materials are salvaged. The registration of those operations appears on a special product line: "recovery of waste products," not on the product lines the factory consists of (building, various capital goods . . .). Consequently, the product line "recovery of waste products" is the only one where negative GFCF can appear. Registration of a dismantled factory as negative GFCF and as intermediate consumption has no impact on the production of any branch in the economy. The registration only describe *transfers* of existing goods. For statistical reasons those transfers are registered on the "recovery of waste products" line instead of the lines of the products which make up the factory.

Let us turn back to livestock: the total livestock variations due to category changes correspond to (b) and (c) in the example above. But only (b) (positive category changes) should be accounted for in gross flow accounting. The livestock variations due to accretions and outflows correspond to (a) and (d). Again, by analogy with the factory, all the accretions and outflows should be registered, except outflows due to death without reutilization.

Thus, the SNA method *underestimates* livestock production by:

- negative category changes of the animals;
- animal deaths without reutilization.

1.2. An Accounting Method Consistent with the SNA Production Assessment Concept

The production concept is insufficiently defined in the UN SNA: "production of marketable branches within a given period is the gross value of goods and services produced within this period. The production of goods must be registered at the time of manufacture."

The French SNA's definition has a sounder theoretical base: "production is the economic activity which consists of creating goods and services usually marketable and/or manufactured through marketable factors of production." In this sense, production is an activity resulting from the combination of factors of production. Three of them are usually mentioned:

- Labor
- Fixed capital
- Natural resources

Production value is the sum of the remuneration of these factors or rather of their owners. "Gross" evaluation means that wear and tear of the factors is not substracted. Allowance for capital depreciation would be inconsistent if depreciation of labor or exhaustion of natural resources are not also taken into account.

Moreover, if production stems from a combination of factors of production, it has nothing to do with the result of an accidental destruction of those factors. The SNA has been provided with appropriate accounts in order to register such

phenomena. *Patrimony accounts* register wear and tear and destruction of fixed capital and natural resources. No confusion should be made between patrimony accounting and flow accounting in order to avoid inconsistency. Consequently, a correct use of the SNA production concept implies a livestock production consisting of births and positive category changes, i.e. the result of livestock activity.[2]

Negative category changes and losses should be considered as wear and tear or destruction of capital and included in patrimony accounts. Production is then equal to total utilizations minus imports (see identity 3), GFCF and changes in stocks being evaluated "gross."

According to identity (5), using a "net" definition, we had:

$$\begin{aligned}\text{"G"FCF} &= \text{category changes} + \text{accretions} - \text{outflows}\\ &= \text{positive category changes} + \text{negative category changes}\\ &\quad + \text{births} + \text{imports} - \text{losses} - \text{slaughtering} - \text{exports.}\end{aligned}$$

Using now a "gross" definition of GFCF and production (shown as *), we find:

$$\text{GFCF}^* = \text{positive category changes} + \text{births} + \text{imports} - \text{slaughtering} - \text{exports}$$

and

$$\begin{aligned}\text{Production}^* &= \text{Total utilizations} - \text{imports}\\ &= \text{slaughtering} + \text{GFCF}^* + \text{exports}\\ &= \text{positive category changes} + \text{births.}\end{aligned}$$

This method is consistent with the SNA concept of production.

Thus, two ways of calculating livestock production have been considered: one of them is consistent with the definition of *livestock* production in the SNA; the other is consistent with the definition of production in the SNA. The methods which are being used in Sahelian countries are related to the methods mentioned, but are not quite identical, creating further discrepancies. An illustration based upon two countries will be provided: Mali, whose definition of production is related to the SNA livestock production definition and Niger where the concepts are more closely related to the SNA production assessment method.

2. Livestock Accounting Methods in Mali and Niger

2.1. The Mali Method

A remarkable study has been carried out by M. Girier on the method and calculation of livestock accounts in Mali.[3] The method described is different from the SNA method, but it is based on a net accounting principle.

[2]We only consider the meat production of the livestock here.

[3]"Réflexions sur la prise en compte de l'élevage dans la Compatabilité Nationale," Ministère du Plan-Bamako, 1986.

Two differences from the SNA method are noticeable: the first stems from lack of data; the second is concerned with methodology and comes into evidence mainly during drought conditions.

(a) GFCF and lack of data:

In normal times, GFCF is calculated through livestock variation valorized at a constant price from one year to the next, whereas structural modifications of the livestock should be taken into account, as mentioned by M. Girier: "Livestock variation is indeed the final result of all operations carried out on the livestock: natural growth, losses, slaughterings, exports ..., which do not constitute a homogeneous set." The difficulties faced in the valorization of alterations of the livestock structure in normal times led to the use of an hypothesis which probably should only have been released after more thorough investigation.

If the livestock structure remains constant, then the GFCF evaluation is consistent with the SNA method:

GFCF = Positive category changes + negative category changes due to ageing + accretions − outflows.

In drought circumstances, two other elements must be taken into account: negative category changes due to weight loss and losses (deaths) due to drought:

GFCF = Positive category changes + negative category changes due to ageing + negative category changes due to weight losses + accretions − outflows, except by death − deaths.

The methodology used by Girier in Mali differs from the SNA method on the two following points:

- weight losses are not taken into account;
- outflows (by death or not) are accounted for at a "normal" price, i.e. before weight loss.

(b) Slaughterings:

An animal which has lost weight should be registered at its true reduced value.

In Table 1 we show that the inconsistency between SNA and Mali methods is only related to the registration dates, whereas the cumulative total on various years is similar. Three possibilities are considered as regards the further utilization in year t of an animal that lost weight in year $(t-1)$:

- slaughtering;
- death;
- recovery of its "normal" weight.

In the three cases, the weight loss is supposed to represent a decrease of half the value V of the animal.

Case No 1: The animal which lost weight in year $(t-1)$ is slaughtered in year t.

According to the SNA, the weight loss should be recorded in year $(t-1)$ as a negative category change (on the utilizations side) and as a negative production (on the production side). In year t, the animal leaves the livestock for consumption.

TABLE 1

TWO EXAMPLES OF ACCOUNTING FOR THE IMPACT OF DROUGHT ON LIVESTOCK PRODUCTION: SNA AND MALI METHODS

1—Animal with weight loss (year t) and slaughtered (year $t+1$)

SNA method		Production	Slaughtering	Category Change	Outflow
	year t	$-\frac{V}{2}$		$-\frac{V}{2}$	
	year $t+1$	0	$\frac{V}{2}$		$-\frac{V}{2}$

Mali method		Production	Slaughtering	Category Change	Outflow
	year t	0			
	year $t+1$	$-\frac{V}{2}$	$\frac{V}{2}$		$-V$

2—Animal with weight loss (year t) and lost (year $t+1$)

SNA metnod		Production	Slaughtering	Category Change	Outflow
	year t	$-\frac{V}{2}$		$-\frac{V}{2}$	
	year $t+1$	$-\frac{V}{2}$			$-\frac{V}{2}$

Mali method		Production	Slaughtering	Category Change	Outflow
	year t	0			
	year $t+1$	$-V$			$-V$

3—Animal with weight loss (year t) and recovering (year $t+1$)

SNA method		Production	Slaughtering	Category Change	Outflow
	year t	$-\frac{V}{2}$		$-\frac{V}{2}$	
	year $t+1$	$\frac{V}{2}$		$\frac{V}{2}$	

Mali method		Production	Slaughtering	Category Change	Outflow
	year t	0		0	
	year $t+1$	0		0	

This means two recordings of the same amount, with opposite signs, on the utilizations side. No production variation is registered.

Girier's Mali accounts do not record anything in year $(t-1)$, all the phenomena being concentrated, in accounting terms, in year t. Thus, the outflow of the animal is accounted for at its full value in t, cumulating the $(t-1)$ weight loss and the outflow in year t. Production decrease is then recorded in year t and not in the year when it actually happens, i.e. year $(t-1)$.

On the whole, however, taken over both years $(t-1)$ and t, Mali accounts are equivalent to SNA accounts.

Case No 2: Weight-loss in year $(t-1)$ and death without utilization in year t.

According to the SNA, weight loss should be recorded in year $(t-1)$ and loss of the animal, at half its value, in year t. Production loss represents the total value of the animal split over two parts:

- weight loss in year $(t-1)$,
- animal loss in year t.

Mali accounting once more concentrates both recordings in year t.

In both cases, the animal's decrease in value is only recorded as negative production when it actually takes place, either through consumption of the animal or by death without utilization. As Girier notes: "as long as the animal is alive, the shepherd keeps hoping it will recover its normal weight. This hope has to be recorded in national accounts."

Case No. 3: Weight loss in year $(t-1)$ regained in year t.

Mali accounts do not record temporary decrease in the value of an animal. On the contrary, the SNA records this evolution: negative category change (GFCF) and negative production in $(t-1)$; positive category change and production in t; changes are nil if one considers years $(t-1)$ and t together.

The Mali method gives identical results to the SNA method if various years are considered together. But, year by year, evaluations are different, and GDP evolution will differ and create discrepancies between the two methods. This aspect is all the more important as livestock represents a significant part of GDP in Mali, as it does in other Sahelian countries.

2.2. The Niger Method

In some respects, the Niger method is closer to the SNA production assessment method than the method used in Mali. In fact, resources are measured directly and not assessed according to utilization. The balance between resources and utilizations is then taken into account in the GFCF. Difference from the SNA production assessment method occurs in the way in which domestic resources are accounted for. Production is calculated through natural growth valorized at the mean price of animals for the basic year, as far as volumes (constant terms) are concerned. Table 2 shows the difference between the two methods. The Niger method underestimates quantities (considering births only, instead of births plus adult weight increases), but overestimates the price (based on a mean price instead of the mean price of newborn animals taken with the price gain resulting from weight increase in adults). Assuming a regular growth of a constant structure

TABLE 2

DIFFERENCES BETWEEN NIGER AND SNA PRODUCTION ASSESSMENT METHOD

Niger	SNA method of production assessment
births × mean price of livestock	births × mean price of new born animals +number of adults with weight gain ×additional value, in constant terms, of those animals

livestock, the two methods are equivalent. They differ in case of drought, when weight increases are small, use of the Niger method results in an overestimation if compared with the SNA production assessment method.

3. FOUR ESTIMATIONS OF THE IMPACT OF THE 1984 DROUGHT ON THE NIGER'S GDP

Four methods will be examined in turn:

- SNA livestock assessment and Mali methods,
- SNA production assessment and Niger methods.

The impact of those methods on Niger's GDP will then be measured.

Niger suffered a severe drought in 1984. Lack of rain during the rainy season (May-September) had an impact both in 1984 and 1985 as livestock pasture was affected until the following rainy season, i.e. May 1985. Consequently both 1984 and 1985 must be considered.

The tables presented here imply various hypotheses.

They were drawn up in cooperation with Rural Development Ministery professionals in Niger. Only the main hypotheses are presented. Only cattle, sheep and goats are considered. They represent approximately 85 percent of the total livestock value. The remaining 15 percent are mostly camels, animals which survived the drought better and were better looked after by their owners.

3.1. The Differences Between Mali and SNA Methods in Drought Conditions

The results of those 2 methods are presented in Table 3. The first column shows animal numbers (stocks and flows) and is used for both methods. The second column gives animal prices per head used in Mali method. Prices are identical, except those concerning slaughtered animals with weight-loss, in accordance with the method presented above. The latter are valued at half price.

In column 4 price evaluations in accordance with SNA rules are shown. Slaughtered animals are all valorized at a lower price than at the beginning of the year. Even "normal" animals are assumed to have suffered from drought (the loss is reflected in a 10 percent decrease: in fact there is no price change, but a category change, with a lower price in a lower category). The same price decrease is adopted for exports. Moreover the population at the end of the year is valued at a price reduced by 20 percent consistent with the 10 percent decrease already mentioned for "normal" animals on average for the whole year.

The hypothesis concerning the value of slaughtered animals with weight decrease (half-price) remains.

Columns 3 and 5 show, for both methods, the production estimates calculated as a sum of utilizations (lines 3, 4, 6 and 8). The SNA method always gives a smaller total production than the Mali method. As far as sheep and goats are concerned, production is negative with the SNA method and positive with the Mali method, both for 1984 and for 1985. As far as cattle is concerned, production is always negative, but much more so with the SNA method. The difference stems from the lower price used in the SNA method for valorizing slaughterings, exports and stocks at the end of the year.

With both methods, the heavy losses due to drought, together with the decrease in value at constant terms of the animal stock at the end of the year, play a major role in the total production and GFCF becoming negative.

3.2. Differences between Niger and SNA production assessment methods in drought conditions

Since occurrence of negative production is inconsistent with the SNA production assessment method which considers production as a result of activity, one should calculate production through a sum of births and positive category changes or through a sum of utilizations in which GFCF is evaluated "gross." This implies a clear distinction between positive category changes, accounted for as GFCF for animal remaining in the livestock, and negative category changes, i.e. wear or capital destruction that must not be registered either as production or as GFCF. There, production has been calculated directly, not through its utilizations.

As has already been mentioned, negative category changes occur even in "normal" conditions as the value of ageing animals decreases. However, they are not significant.

If the age, sex and weight structure is supposed to be relatively constant in "normal" conditions, production can be measured by multiplying the mean price of an animal by the natural growth rate. The Mali method, in spite of calculating production through its utilizations, leads to this result.

In drought times, this method of evaluation is no longer possible. Of course, natural growth remains a necessary data as births are elements of production, but the mean price of an animal in the base year can no longer be used to measure the value of natural growth. An increase in livestock creates a decrease of mean value of the animals, in constant terms, first due to more negative category changes and second because of fewer positive category changes with a lower value.

A consistent production assessment therefore requires the following information:

- the natural growth rate (births),
- the value of newborn animals (in constant terms),
- the proportion of adults with weight increase,
- their value change in constant terms.

Table 4 shows calculations and results for cattle, sheep and goat productions according to both Niger and SNA production assessment methods. The Niger method consists of multiplying natural growth (line 2) by the mean price of an animal at constant prices (line 4). The SNA production assessment method adds to the value of newborn animal (line 2 × line 3) the value of adult weight increases.

TABLE 3

CALCULATION OF LIVESTOCK PRODUCTION IN NIGER IN 1984 AND 1985 ACCORDING TO MALI AND SNA METHODS

	Mali			SNA	
	Population (heads in millions)	Price per head (1982 CFA Francs)	Total value (billions of 1982 CFA Francs)	Price per head (1982 CFA Francs)	Total value (billions of 1982 CFA Francs)
Cattle 1984					
(1) Population at the beginning of the year	3.62	69,000	249.8	69,000	249.8
(2) Natural growth	0.35				
(3) Slaughtering of "normal" animals	0.27	69,000	18.4	62,100	16.6
(4) Slaughtering of animals with weight loss	0.13	34,500	4.6	34,500	4.6
(5) Losses	0.47				
(6) Exports—imports	0.20	69,000	13.8	62,100	12.4
(7) Population at the end of the year	2.90	69,000	199.8	55,200	159.9
(8) GFCF			−50.0		−89.9
(9) Production			−13.2		−56.3
Cattle 1985					
(1) Population at the beginning of the year	2.90	69,000	199.8	69,000	199.8
(2) Natural growth	0.28				
(3) Slaughtering of "normal" animals	0.27	69,000	18.4	62,100	16.6
(4) Slaughtering of animals with weight loss	0.13	34,500	4.6	34,500	4.6
(5) Losses	0.26				
(6) Exports—Imports	0.20	69,000	13.8	62,100	12.4
(7) Population at the end of the year	2.32	69,000	159.9	55,200	127.9
(8) GFCF			−39.9		−71.9
(9) Production			−3.1		−38.3
Sheep 1984					
(1) Population at the beginning of the year	3.58	12,000	42.9	12,000	42.9
(2) Natural growth	0.76				
(3) Slaughtering of "normal" animals	0.68	12,000	8.2	10,800	7.3
(4) Slaughtering of animals with weight loss	0.34	6,000	2.0	6,000	2.0
(5) Losses	0.36				
(6) Exports—imports	0.20	12,000	2.4	10,800	2.2
(7) Population at the end of the year	3.04	12,000	36.5	9,600	29.2
(8) GFCF			−6.4		−13.7
(9) Production			6.2		−2.1

Sheep 1985					
(1) Population at the beginning of the year	3.04	12,000	36.5	12,000	36.5
(2) Natural growth	0.64				
(3) Slaughtering of "normal" animals	0.68	12,000	8.2	10,800	7.3
(4) Slaughering of animals with weight loss	0.34	6,000	2.0	6,000	2.0
(5) Losses	0.13				
(6) Exports—imports	0.20	12,000	2.4	10,800	2.2
(7) Population at the end of the year	2.58	12,000	31.0	9,600	24.8
(8) GFCF			−5.5		−11.7
(9) Production			7.1		−0.1
Goats 1984					
(1) Population at the beginning of the year	7.66	6,000	46.0	6,000	46.0
(2) Natural growth	1.80				
(3) Slaughtering of "normal" animals	1.68	6,000	10.1	5,400	9.1
(4) Slaughtering of animals with weight loss	0.84	3,000	2.5	3,000	2.5
(5) Losses	0.41				
(6) Exports—imports	0.02	6,000	0.1	5,400	0.1
(7) Population at the end of the year	6.51	6,000	39.1	4,800	31.3
(8) GFCF			−6.9		−14.7
(9) Production			5.8		−3.0
Goats 1985					
(1) Population at the beginning of the year	6.51	6,000	39.1	6,000	39.1
(2) natural growth	1.38				
(3) Slaughtering of "normal" animals	1.68	6,000	10.1	5,400	9.1
(4) Slaughtering of animals with weight loss	0.84	3,000	2.5	3,000	2.5
(5) Losses	0.28				
(6) Exports-imports	0.02	6,000	0.1	5,400	0.1
(7) Population at the end of the year	5.07	6,000	30.4	4,800	24.3
(8) GFCF			−8.7		−14.8
(9) Production			4.0		−3.1

Notes to Table 3

(7) Population at the end of the year = (1) + (2) − (3) − (4) − (5) − (6)

(8) FBCF = (7) − (1)

(9) Production = (3) + (4) + (6) + (8)

TABLE 4

CALCULATION OF LIVESTOCK PRODUCTION IN NIGER IN 1984 AND 1985 ACCORDING TO NIGER AND SNA PRODUCTION ASSESSMENT METHODS

	Cattle			
	1984		1985	
	Niger method	SNA Production Assessment Method	Niger Method	SNA Production Assessment Method
(1) Population at the beginning of the year	3.62	3.62	2.90	2.90
(2) Natural growth	0.35	0.35	0.28	0.28
(3) Price of a newborn animal		13,800		13,800
(4) Mean price	69,000		69,000	
(5) Weight increase		8.8		5.5
(6) Production	24.2	13.6	19.3	10.9

	Sheep			
	1984		1985	
	Niger Method	SNA Production Assessment Method	Niger Method	SNA Production Assessment Method
(1) Population at the begin ing of the year	3.58	3.58	3.04	3.04
(2) Natural growth	0.76	0.76	0.64	0.64
(3) Price of a newborn animal		2,400		2,400
(4) Mean price	12,000		12,000	
(5) Weight increase		4.6		5.5
(6) Production	9.1	6.4	7.7	7.0

	Goats			
	1984		1985	
	Niger Method	SNA Production Assessment Method	Niger Method	SNA Production Assessment Method
(1) Population at the beginning of the year	7.66	7.66	6.51	6.51
(2) Natural growth	1.80	1.80	1.38	1.38
(3) Price of a newborn animal		1,200		1,200
(4) Mean price	6,000		6,000	
(5) Weight increase		6.5		5.5
(6) Production	10.8	8.7	8.3	7.2

Note

(1) and (2): Millions of animals.
(3) and (4): CFA Francs.
(5) and (6): Billions of CFA Francs 1982.
(6) Production = Niger: $(2) \times (4)$ SNA: $(2) \times (3) + (5)$.

As newborn animals are rarely sold on the market, it is difficult to get an estimation of their market price. 20 percent of the mean price of an adult animal has been used in accordance with professional estimates. Specialists also considered that weight increases in 1984 and 1985 only reached 30 percent of those observed in normal conditions respectively for cattle, and 50 percent for sheep and goats. As weight increases represent more or less 80 percent of production (the 20 percent remaining being linked to births), consequently in drought conditions, weight increase for the two groups of animals will represent 0.24 and 0.4 times normal production corresponding to the population at the beginning of the year. Lines 5 were calculated in accordance with those hypotheses.

The corresponding production (lines 6) estimated by both methods show an overestimation with the Niger method compared with the SNA production assessment method. Both methods show productions clearly higher than those given by the Mali and SNA methods, and, of course, always positive.

The hierarchy of methods of calculation by decreasing order of production assessment is as follows:

- Niger method,
- SNA production assessment method,
- Mali method,
- SNA Method.

This reflects theoretical differences in concepts and leads to different estimations of GDP.

3.3. Four estimations of Niger's GDP:

After introducing further hypotheses, estimations of Niger's GDP over the period 1983 to 1985 have been carried out, using the four livestock production assessments for 1984 and 1985 presented above. Two main assumptions have been made:

- livestock production is considered identical for the four methods in 1983 (as has already been mentioned, the estimations should not be significantly different in normal times.)
- livestock production does not include production of "other" mammals (camels, donkeys, pigs, horses).

Table 5 shows GDP at constant prices and its rates of growth according to the method use to calculate livestock production. As can be noticed, differences are large, reaching 17 percent in 1984 and 7 percent in 1985 in terms of rate of growth.

Which method should therefore be used?

Conclusion

Four methods have been described:

1-the SNA method: in this method losses, weight losses and ageing of animals should be recorded as negative GFCF and production.

2-The SNA production assessment method: capital destruction and wear must not be recorded either as production or as GFCF. They should appear in patrimony (stock) accounts only.

TABLE 5

NIGER GDP CHANGES IN 1984 AND 1985 ACCORDING TO THE FOUR LIVESTOCK PRODUCTION ASSESSMENT METHODS

	1983	1984	1985
Livestock			
Animals[1]			
Mali method	64.7	−1.2	8.0
SNA method		−61.4	−41.5
Niger method		44.1	35.3
SNA production assessment method		28.7	25.1
Others[2]	49.9	37.4	44.9
Rest of the Economy	507.7	452.8	458.2
GDP in real terms[3]			
Mali method	622.3	489.0	511.1
SNA method		428.8	461.6
Niger method		534.3	538.4
SNA production assessment method		518.9	528.2
GDP rate of growth (in percents)			
Mali method		−21.4	4.5
SNA method		−31.1	7.6
Niger method		−14.1	0.8
SNA production assessment method		−16.6	1.8

[1]Cattle, sheep, goats, only. Camels, donkeys, horses, pigs are not considered here.
[2]Milk, poultry, eggs, leather.
[3]Billions of 1982 CFA Francs.

3-The Mali method is related to the SNA method, but it only records irreversible changes.

4-The Niger method is related to the SNA production assessment method since it takes into account production as an "activity" in the SNA meaning of the concept, but prices and quantities used are not the appropriate ones.

Our opinion is that SNA production assessment should be restored in the calculation of livestock production. Production is, indeed, the result of implementing factors of production. There should be no confusion between production and destruction of factors of production.

Recognizing this rule seems all the more important, as in Sahelian countries the destruction of factors of productions, beyond normal incidence, is frequent in livestock farming as well as agriculture in general and in manufacturing. If destruction of livestock is recorded as negative production (and then negative GDP) so should soil degradation, mining resource depletion and factory dereliction due to the lack of profitability and so forth.