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COMPILATION OF NATIONAL ACCOUNTS IN HIGH INFLATION COUNTRIES

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Due to inflation, the level of flows of funds is changing over time. Nevertheless, National Accounts aggregate flows annually. High inflation rates create additional difficulties in elaborating constant price accounts as well as current price accounts. Furthermore, one can notice that the accounts themselves partly lose their meaning: deformation of technical coefficients, lack of share between real interests and reimbursement of the debt, change of scale, within a single aggregate, of the flows that compose it. In that inflation context, the national accounts could be interpreted again if it could be possible to reprocess the evaluations: infra-annual constant price accounts, and above all, "calibrated accounts" are proposed in the course of this paper. The author ends with a description of a simple method to elaborate those "calibrated accounts."

COMPILATION OF NATIONAL ACCOUNTS IN HIGH INFLATION COUNTRIES

Among the disequilibria that a national economy can experience, inflation reflects a societal crisis concerning the monetary instruments founding the market, the preservation of wealth, and finally the very notion of value. In general this drift of prices stays within limits considered to be bearable (these limits moreover being perceived differently from one country to another and from one period to another). But in certain circumstances, the deviation sets in, a crisis appears, the movement accelerates and the public authorities powerlessly witness the irruption of a phenomenon that throws into confusion the behaviour of the economic agents; hyperinflation is present.

In connection with the deriving crisis, the national accountant is doubly concerned:

—his instrument is expected to reflect the situation the country is experiencing;
—whereas at the same time the bases of his instrument are undermined since the market price serves as its yardstick.

This paper has a twofold objective:

—to demonstrate the adverse effects of hyperinflation both on the compilation of National Accounts and for their use;
—to propose adaptation of instruments to measure the situation created by hyperinflation.

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1. Effects of Hyperinflation on National Accounts

The situation created by hyperinflation, albeit spectacular, nevertheless bears some similarity to the ordinary conditions under which National Accounts are compiled. The effects it gives rise to are also present in National Accounts, but in a sufficiently small form for them to be neglected. Hyperinflation, when it serves to reveal the economic situation, demonstrates that this choice is sometimes worth questioning.

1.1. *A Few Conceptual Guidelines*

1.1.1. Variation of Prices and Inflation

National Accounts choose market prices to valorize goods and services. For a given product with determined characteristics and available in various points of sale in a market, two types of differences in price can be observed:

—difference, at a given moment, between two distinct points of sale (instantaneous difference);

—difference, over a period of time, at the same point of sale (time difference).

Inflation refers to price variations belonging to the second category (time variations). These time variations can be subdivided into three explanatory elements:

(a) inflation corresponding to a general drift in prices of all products. Between two given dates, inflation can be represented by a single index.

(b) seasonalness, i.e. periodic variations observed for specific products and taking place each time with similar profiles and amplitudes. The most frequent period is the year; the cause can be technical (as with agricultural products) or social (holidays). In cases of high inflation, the measurement instruments are more difficult to implement.

(c) deformation of relative prices[1]: this phenomenon can be important in the context of inflation since the price readjustments are made in a discontinuous manner; a mobile average over a few months wipes out their effects to a large extent. There are also other structural deformations that can be separated into two main categories:

—regular deformations over a long period: most often they correspond to structural changes in the production costs of the corresponding products; industrial or related products are most affected (technological evolution);

—irregular or random deformations: they are of a more or less speculative nature and are based on irregular disequilibria between offer and demand; the products most affected are raw materials and their first processing.

1.1.2. Average Prices

The compilation of national accounts often makes use of average prices:

—at current prices, an average price is applied to the cumulative total of the quantities when the cumulative total of the transaction values is not directly available;

[1]The notion of relative prices applies to the comparison between the instantaneous prices of two different products.

—at constant prices, their use is almost systematic.
However, it should be realized that there are two natures of average price; mixing them is not of any consequence when inflation is low, whereas the opposite applies in case of high inflation:

Instantaneous average price. This price wipes out the instantaneous price differences that can exist for the same product sold in various channels or on which different discounts are practiced. It is also used at the most elementary level of the products nomenclature as a price measurement associated with each item, although the content of the products group remains heterogeneous. The instantaneous average price represents the extreme point of separation of the elementary differences of quality or market.

Average price over time. This price is formed by the average of the prices successively practiced over a length of time for a given product sold through a single channel. This average price over time "wipes out" the effect of the time variations that have occurred in the year under consideration (including the effect of inflation); a single price can thus be associated to a product present throughout the year despite the effective price drift. In both cases, the average is weighted by the quantities exchanged at each of the prices observed.

1.1.3. When is There Hyperinflation?

Inflation is a widespread phenomenon. Constant price accounts make it possible to isolate its effects. In the first stages of its high industrial growth, Japan lived with an inflation of approximately 30 percent p.a.; after the Second World War, France experienced even higher rates in certain years. In such cases the term hyperinflation is not used. This term applys to situations such as those experienced in recent years by Argentina, Israel, Bolivia and the Chile of the 1970s, and certainly to the crisis suffered by Germany in 1920.

Two criteria could be advanced to characterize hyperinflation:

—predominance of speculative behaviours (with, in particular, a great fall in productive investments on behalf of private agents);
—acceleration in the process despite the efforts made by the public authorities to stem it.

However, it is difficult to fix a rate above which such a crisis develops, although the 100 percent per year threshold can be taken as a telltale sign (giving 6 percent per month).

1.2. *An Example of Hyperinflation: Brazil*

Brazil is one of the countries at present affected by hyperinflation. From an annual rate of 80 percent in 1980, hyperinflation increased each year to approach 400 percent in 1985; the cruzado plan then greatly reduced this rate (there was a slide in prices of approximately 50 percent in 1986); but it seems that the phenomenon has not really been arrested and consumer credit interest rates already reached almost 500 percent per year at the beginning of 1987. It is very important to note such a discontinuance in evolution since it introduces high additional disturbances.

By way or example, it is thus interesting to refer to certain phenomena observed in this country which affect the work of the national accountant:

—Irregularly timed price readjustments: usually taking place on a monthly basis, they may however be made only once or twice a year (wages, certain public tariffs). Very irregular cost structures result from this situation for the productive branches; as for relative prices, they undergo constant deformation in the very short term.

—Irregular devaluation of the money (in terms of political criteria) that is accompanied by a more or less speculative currency black market.

—A certain "dollarization" of the economy: the dollar becomes a possible stay for savings; it serves as a reference for certain prices (as for example for the rental or sale of housing). This phenomenon is most pronounced in Peru and in Bolivia.

—A change in behaviour for the payment of goods: the prices practiced are very different depending on the term chosen.

—Sometimes very high differences in the instantaneous prices of a same product, taking account in particular of the stock turnround conditions at retailers of the discount policy practiced to attract clientele (the major part of the resources of large stores comes from the interests received).

—Very high nominal interest rates, unless there are automatic readjustment clauses of the principal; and very high real rates also, meaning speculation is preferred to investment.

—Sometimes very complex fiscal rules for the permanent revaluation of balance-sheets

—A very significant increase in social inequalities due to a high loss of purchasing power by many categories of employees.

—Conjunction of this hyperinflation with high deformations in relative prices undergone in the international markets by the raw materials for which Brazil is one of the main producers (coffee, soya beans, iron ore, etc.).

1.3. *Greater Compilation Difficulties*

Hyperinflation is not in itself an obstacle to compiling national accounts: each elementary flow examined keeps the same reality and the same instantaneous consistence, no matter how the related economic references evolve. The national accounts simply set out to measure the aggregation of these flows.

The compilation of a complete system of national accounts presupposes bringing together many statistical sources and synthesizing them in a perfectly balanced setting. However, inflation increases the distortions between statistical sources and complicates the valuation of flows by the standards planned by the system.

As for constant price accounts, hyperinflation gives them even more importance, but also causes great compilation difficulties, since it reveals the complexity and limits of the underlying principles. There is no question here of drawing up an inventory of all the difficulties met, the aim being to cite only a few of them by way of example.[2] This work refers to the construction of annual accounts.

1.3.1. For Current Price Accounts

(a) Interpretation of statistical sources and their comparison.

Among the difficulties met, the following representative cases can be cited:

—Use of average prices over time: this applies to goods which can be measured quantitatively; the average price to be applied to them must take account of the seasonal importance of the flows. The price observed for each time period is weighted by the quantity treated during the same period under consideration. There can thus be, for example, different average prices for production, intermediate consumption and final consumption of one and the same product, if these two uses intervene at different moments during the year, and without there being different instantaneous prices.

—Time lags in recordings: the same flow is not always recorded at the same moment by the two units concerned. Thus, taxes are recorded by enterprises at the time they are due, whereas the government authorities enter in the accounts the effective collection. A time lag, amplified by inflation, derives from this situation: with an inflation of 10 percent per month, a time lag of two months represents 21 percent of the total annual aggregate (amount due compared with the amount paid).

—Revalued accounts: revaluations are made both in the accounts of agents (restatement of balance-sheets) and in the way of measuring the amount of a debt at a given moment. As for the accounts of agents, fixed assets or various receivables or debts in the national money or foreign currencies may equally well be concerned. Thus, in the interpretation of differential balance-sheets it becomes very difficult to measure the gross fixed capital formation (GFCF) and to value the financial operations. The problem also concerns the interpretation of the statement of income for the direct valuation of savings, since it would be necessary to be able to isolate the gains and losses in capital appearing in it.

In order to explain these difficulties, *let us take the example of calculation of the GFCF.* This aggregate can be valued by comparing several sources:

—those relating to production or importation,

—those of an accounts origin (differential balance-sheets or direct investment data).

Disregarding inflation, there are various reasons for divergence: different definition of the product nomenclatures, valorization differences (with or without transport, taxes, related costs of assembly or legal registration, associated studies, connected financial costs, etc.).

Inflation adds other sources of divergence. Let us take the example of an imported machine:

—customs data provide a value at the exchange rate of the day of importation, for the value declared by the seller;

—the buyer records as a fixed asset the cost in local money of the currencies bought as the planned maturities are reached; he may possibly add the interests due for the loans contracted for this purchase;

[2]For a more detailed inventory, refer to the paper presented by M. Séruzier in the French National Accountancy Association Symposium, Paris, December 1986 (Archambault, E. and Arkhipoff, O., Noveau aspects de la comptabilite nationale, *Economica*, Paris, 1988).

—the variation in fixed assets between two balance-sheets also includes the revalorization authorized by the law on the grounds of the inflation (including the fixed assets under construction).

(b) Making operations coherent.

For all the operations to balance among themselves, the content of each of them is defined strictly. A transposal is thus necessary to pass from the statistical sources to the national accounts operations. One of the most typical cases of the complication introduced by inflation (but also by any other form of variation in prices over time) is that of changes in inventory. Hyperinflation aggravates the importance of a phenomenon that exists in all countries.

Changes in inventory.[3] The increase in wealth deriving from a modification in the value of the goods held does not increase savings: the sole income measured by the GDP is that arising from the production act, assessed as the price obtained in the market at the moment of realization (the same phenomenon is present in case of loss of the stored value). As a consequence, the increase in value of stored goods induced by inflation does not enter into the calculation of the GDP.

In order to transpose this into the accounts, it is necessary to record the exit of stocks at the market price of the day of exit (otherwise called the "reposition" price); and it is this same value which is used to measure the use given to this exit. These accounting principles are different from those used by enterprises and they lead to recording an amount of change in inventory that is difficult to interpret.

Let us show this by a numerical example:

Given the production in March of 100 tons of dried tobacco, bought immediately at the price of 10 by the processing industry, the latter stocks it and uses 60 tons in November when the market price has increased to 25. We have the following balance:

	March	November
Resources		
Production	$100 \times 10 = 1{,}000$	
Uses		
Intermediate consumption		$60 \times 25 = 1{,}500$
Movements of stocks	$+(100 \times 10 = 1{,}000)$	$-(60 \times 25 = 1{,}500)$

The amount of the change in inventory thus amounts to: −500 in value, whereas the tonnage variation is +40. For the 60 tons used, maintenance in stocks for 6 months led to an increase in value of

$$60 \times (25 - 10) = 900$$

and this was incorporated in the value of the cigarettes produced. Ignoring this flow would be equivalent to increasing the value added to the tobacco processing industry and thus the GDP by an element which does not originate from the processing activity.

[3]See Michel Seruzier, Le traitement des stocks en comptabilité nationale dans un contexte d'inflation, Revue STATECO, INSEE, No. 45, March 1986.

Let us suppose that the corresponding production of cigarettes amounts to 2,000 and that there no other IC. The production account of the "tobacco processing industry" is:

Production	2,000
− Intermediate consumptions (IC)	1,500
= VA	500

whereas the enterprise accounts has recorded:

Production	2,000
− Materials used	600
= VA	1,400

For the 40 remaining tons, it is only when they come out of stock (in $n+1$) that the latent increase in value concerning them becomes apparent. (However, net worth accounts would take account of this.)

In order to help in its interpretation, the "Change in inventory" operation could be split into two elements:

Variation of quantities in stocks valorized at their entry price	400
Appreciation (increase in value) realized	−900
Total	−500

1.3.2. For Constant Price Accounts[4]

More than in any other situation, the division of national accounts into volume and prices is a necessity in case of high inflation. The main objective of this division is indeed to separate, in the evolution of the aggregates, what derives from the variation in prices and what results from the evolution of the economic activity. However, it is to be observed that this division is often limited to the sole operations concerning goods and services, although inflation also transforms the evolution of all the other aggregates.

The implementation of constant price accounts is realized in two stages:
—the evolution of each operation is broken down at the most elementary level of the products nomenclature into its volume and price components;
—the elementary indices thus obtained are drawn up at the level of national aggregates.

It is at the level of the first stage that hyperinflation can introduce specific compilation difficulties to obtain the indices or the average prices over time needed. These difficulties are of the same nature as those mentioned in the previous paragraph concerning current price accounts.

What is most interesting about hyperinflation is that it requires a far greater strictness in the implementation of the compilation methods of constant price accounts. A few comments are now made in this connection.

(a) Concerning the method.

There is no specific methodological difficulty when a situation of high inflation is present. An identical drift of all prices can be dealt with by a single deflator, no matter what importance is reached by the latter. On the contrary, it

[4]Cf. *National Accounts Manual at Constant Prices*, Statistical Studies, M64, United Nations, 1979.

is the differences in relative prices, even without inflation, which make it necessary to split up the analysis per products, and which introduce representational differences depending on the base chosen. In case of high inflation however, great distortions appear in the annual evolution of prices (different times of the adjustments), which are added to the more structural differences experienced by the economies of all countries.

The possible measurement errors thus derive from not taking account of the variations in relative prices. To avoid these errors it is thus important to "separate" the analysis into elementary products, and to distinguish between what results from prices and what derives from an evolution of the quality of these elementary products. Being satisfied with a single deflator for the whole economy (or for each synthetic aggregate) is thus totally out of the question. In case of hyper-inflation, a further warning is to be given: being satisfied with applying a deflation method is dangerous since the volume index becomes small in comparison to the price index and any error in the latter has disastrous effects on the level of the former.

It is thus necessary to work in great detail with each product, distinguishing between each operation and by combining if possible direct measures of the evolution of both prices and volume, no matter what reference year is chosen ($n-1$ or a prior year). For any elementary product giving rise to the construction of a resources-uses balance, the analysis must thus be made for each operation, at basic prices and at acquisition prices; the settling of the balance becomes a choice among all the sources used.

In any case, the use of a methodology to draw up constant prices accounts presupposes a certain number of approximations. It can be said that hyperinflation is a powerful identifyer of their limits and consequently forces economists to further their understanding of this topic.

(b) Concerning the logging of prices and their variation.

In a country where prices are relatively stable, any important variation attracts attention; it is thus quite easy to detect the errors made in data processing and provide satisfactory solutions to abnormal situations. When all the variations are important, including in relative value, such means of control are lost; the underlying meaning of the phenomena to be measured must thus be found again.

—Calculation of an average price over time: such a calculation is absolutely essential to value an annual price index, either from unitary prices or by using monthly indices. A simple arithmetic average is impossible: the average price of each period must be weighted by the quantity to which it is applied.

—Calculation of an instantaneous average price: computed for the most elementary level of the products analyzed, it gives the average price of the different varieties composing the elementary group, or corresponds to the average of the prices practiced in different markets. It corresponds to an approximation compared with the strict application of the method.[5] The appearance within

Note: The existence of different prices in two different points of sale is a means of demonstrating the existence of different markets. It is of course a matter of instantaneous price differences. In case of hyperinflation the distinction between these differences is far more difficult if all the prices are not noted at exactly the same instant.

[5]The United Nations manual *M64* recommends that: "Goods sold at different times or in different locations must be treated as different goods" (Section 2.12).

the group of a deformation in relative prices or volumes makes it necessary to make a finer breakdown, as shown by the following example:

Let us consider a simple product acquired by enterprises (they give the quantities and the purchase value; it is assumed there is no inflation):

	Year n			Year $n+1$		
	Q	Price	Value	Q	Price	Value
Intermediate Consumption	110	10.91	1,200	110	10.45	1,150

The following indices can be calculated *a priori*:

Volume index: 100
Price Index; 95.8

Let us now examine the origin of this product and consider two different hypotheses:

1—The fall in price results from the appearance of a new national product introducing another technology.

	Year n			Year $n+1$		
	Q	Price	Value	Q	Price	Value
Production 1	100	11	1,100	50	11	550
Production 2	—	—	—	50	10	500
Importation	10	10	100	10	10	100

This evolution cannot be accounted for by statistics and the same indices as for the uses are observed for all the supply.

2—The fall in prices results from a preference given to an imported product.

	Year n			Year $n+1$		
	Q	Price	Value	Q	Price	Value
Production	100	11	1,100	50	11	550
Importation	10	10	100	60	10	600

The indices for the evolution of supply are no longer the same:

Volume: 95.8
Prices: 100

The separation of supply into two different products, a national one and an imported one, reveals that the instantaneous average price chosen both in case 1 and for uses was an approximation: the volume evolution to be chosen finally for enterprise IC is 95.8 whether it is a matter of case 1 or case 2. The question then arises as to how far the breakdown into elementary products is to be taken.

—Price indices, when available, are related to basic prices (or ex works) for supply, and are related to acquisition prices for uses. To make these different indices coherent it is necessary to choose between the possible evolutions of the prices of transport, trade margins and net taxes assigned to products. However, high differences can exist between these items (speculation on products intervening in the level of margins, modifications of net taxes assigned to products) and it is necessary to interpret their volume and price content.

1.4. *Distorted accounts*[6]

Supposing that the difficulties presented by the compilation of accounts in a context of hyperinflation are correctly overcome does not mean that we have a satisfactory instrument to reflect the situation the national economy is undergoing. True, constant price annual accounts provide an additional element of information, but this is not sufficient. Indeed inflation has other distorting effects on accounts, the influence of which cannot be neglected when it gains in importance. Thus, in addition to the above mentioned measurement difficulties, it is the very basis of this measurement (and what is expected from it) which are shaken: within a given year current price aggregate lose part of their meaning.

A mathematical explanation can be given for this: the construction of accounts is based on the idea that a multidimensional space, that of economic phenomena, can be projected on to a linear space structured by accounting coherences. A vector of monetary values drawn from the market allows making this projection. Economists recognize the pertinence of this vector due to the relations of order it introduces in the space under consideration. However, these relations of order must be stable, not only between different phenomena, but also for the same phenomenon over a period of time. Of course, as inflation becomes higher this second condition is less and less fulfilled.

A few examples explain the consequences of this in a situation of hyperinflation:

In order to facilitate comprehension of the phenomena, the analysis is made on a quarterly basis and inflation is assumed to be constant at the rate of 50 percent per quarter (i.e. 406 percent per year).

1—The farmers in a region successively harvest soya beans on the same land in the first quarter and wheat in the third quarter. The assumption is made that the two products have the same value per ton. The yield of wheat per hectare is two-thirds that of soya beans.

	1	2	3	4
Production (tons)				
Soya beans	1,200			
Wheat			800	
Price	10		22.5	
Value	12,000		18,000	

[6]Similar questions arise when consumption surveys are performed in a context of inflation: see on this subject "Correçao para inflaçao en dados de orçamentos familiares" by Fransisco de Assis Moura de Melo. IBGE internal document, Brazil, 1985.

The total annual production thus amounts to 30,000, wheat representing 60 percent (as against 40 percent leaving inflation aside).

2—The same farmers sow the following crops at exactly the same time; the same cycle being repeated each year. Let us assume that the costs (seeds, fertilizers, etc.) are 5 per ton of soya beans and 6 per ton of wheat at the price of the first quarter and that they are all made at the beginning of the cycle. In the year studied, we will have the following IC:

	1	2	3	4
Unitary soya beans IC			11.25[7]	
Total soya beans IC			13,500	
Unitary wheat IC	6			
Total wheat IC	4,800			

The VA obtained in the year by soya beans is 1,500, whereas that of wheat amounts to 13,200. Simultaneously, there is a distortion of the technical coefficients. Thus, for wheat, this coefficient is 0.27 (4,800/18,000) with inflation as against 0.60 (4,800/8,800) without inflation; such a coefficient varies from one year to another, depending on the rate of inflation; and the distortion also appears in the constant price accounts.

This distortion results from the principle chosen to valorize the IC at the market price of the day of its entry in the production process. The longer this process is, the greater the gap between the amount of the IC and the production value. When production is made in a regular manner over a period of time and in a constant quantity, the distortion disappears. It arises as soon as the production volume is modified over a period of time, in particular in case of seasonal production.

The contradiction could be attenuated by considering that there is a stock of products in the land (being grown) for wheat, but a significant gap would still remain. This is why a better solution would consist, in the case of seasonal agricultural productions, in waiting for the production moment to record the IC (and by valorizing them at the price of the day). Until then, the corresponding product would remain in the stocks of raw materials of the user sector.

3—Soya beans are exported at exactly the same time and give rise to a 10 percent tax levy on the customs value amounting to 16,000. Wheat is subsidized to 20 percent. It is sold regularly at the mills throughout the year:

	1	2	3	4
Tax on soya bean income	1,600			
Tons of wheat sold at the mills	200	200	200	200
Selling price of this wheat	8	12	18	27
Subsidy	400	600	900	1,350

[7]For a harvest in $n+1$.

We thus have: tax on soya beans 1,600
wheat subsidy 3,250

Whereas the tax would cover the subsidy if inflation was not present.

Other examples would be possible for other operations, including financial ones (thus the issues of securities at different moments of time are no longer comparable). True, the cumulative total of flows remains exact and the accounting balances are respected, but it is the very meaning of these flows which disappears. In particular any ratio becomes unusable when it involves operations that do not have the same seasonalness.

This means that, compiled in such a context, the national accounts lose part of their quality, in particular for economic forecasting. The question then arises as to whether it would be possible to adapt the instrument in order to at least partly wipe out the distortions introduced by inflation.

2. Adapting National Accounts

In answer to this question, two complementary solutions can be envisaged that can be implemented independently of each other. The first solution affords specific insight into activity and the second into income, as a complement to the information already available in the accounts drawn up customarily.

Before presenting these solutions, *a prior question* which is less clear than it appears at first sight must be considered. It is one we do not pretend we can answer: how can inflation be measured? Inflation, as already stated, is a general drift in prices that can be accounted for by a single number: an index provided with a fixed periodicity, for example monthly. In general, the consumer price index is chosen since it is available in most countries; but it constitutes only a partial measurement of the phenomenon. Without a doubt it would be better to consider the price index of the GDP (which has as a counterpart the final uses, the trade balance with the exterior included), in which case we would expect the National Accounts to measure it. However we will see that this interferes directly with the proposals made below.

However no matter what theoretical deflator is used, it cannot be forgotten that its value also depends on the elements its calculation is based on:
—period taken as the reference base;
—respective weight of the products chosen to weight the elementary indices;
—level of detail used to measure the price variations within each product group.
Our aim here is not to choose which would be the best possible deflator, since this is discussed elsewhere. Let us simply observe that the proposals generally made associate inflation with the sole evolution of prices of goods and services (distributed and financial operations are excluded). In the rest of this paper we will consider that such a deflator exists and that it can be measured monthly.

2.1. *Infra-Annual Constant Price Accounts*

The methodology of these accounts has already been discussed above. It is used customarily for annual or quarterly accounts, but can also be applied to monthly accounts; a base month is then chosen for which the price-vector

serves as a reference for the quantities produced in each of the different months.[8]

(a) What is obtained:

Such accounts are limited to goods and services and production accounts (with a few additional difficulties for the allocation operations that the latter contain). The evolution of the infra-annual economic activity can thus be estimated. These accounts also give a measure of the variation of the prices of the aggregates considered and thus an estimation of the inflation based on the GDP, which is very useful.

Certain countries interested by this more short-term information draw up quarterly constant price accounts. In cases of very high inflation, accounts would thus be drawn up monthly.

However, the limits of constant price accounts are known: the prices obtained in a given month by production serve as a reference to measure the production of all the other months. In cases of distortion of the relative prices which differ when the base month is changed, different pictures of the same economic situation are obtained. When comparing production levels, this disadvantage is considered as secondary in the light of the advantage provided by constant price accounts: introduction of a time aggregation instrument that maintains the same relations of order between all the products and thus allows making comparisons between periods.

Since production is simultaneously the income of the economic agents, it is also important to analyze income in terms of the value given to it by money. Hyperinflation destroys the reference used to make this comparison over a period of time. Further, constant price monthly accounts do not explain the distortions which, month after month, affect the structure of incomes. In addition, they are limited to the primary allocation of income and are of no assistance in the operations of income reallocation and the financial operations, for which their methodology does not apply (nevertheless, tests exist for allocation operations).

For these various questions, a simple example can help in better understanding what is involved.

Let us take the example of two farmers A and B, engaged in non-seasonal productions, one with onions and the other with potatoes; sliding has occurred in the quantities produced and thus in the prices. Further, we have an inflation indicator.

Quarters	1	2	3	4	Total
Inflation (general deflator)	8	12	18	27	
Production A					
Q_A	80	100	100	120	400
P_A	9	13	18	25	
Current value	720	1,300	1,800	3,000	6,820
Value at 4 prices	2,000	2,500	2,500	3,000	10,000
Value at 1 prices	720	900	900	1,080	3,600

[8]The examples presented below take December (or the fourth quarter) as the base.

Quarters	1	2	3	4	Total
Inflation (general deflator)	8	12	18	27	
Production B					
Q_B	110	100	100	90	400
P_B	7	12	18	29	
Current value	770	1,200	1,800	2,610	6,380
Value at 4 prices	3,190	2,900	2,900	2,610	11,600
Value at 1 price	770	700	700	630	2,800

We observe:

—A progression by 376.5 in the total of the incomes of A and B, between quarters 1 and 4, whereas the inflation index amounts to 337.5.

—A ratio of cumulated nominal incomes $A/B = 1.07$ whereas the average of these ratios for each quarter amounts to 1.04.

—Taking the first quarter as the reference for constant prices, we have:

Price index	328.0
Volume index	114.8
Income ratio	$A/B = 1.29$

—Taking the fourth quarter as the reference;

Price index	348.3
Volume index	108.1
Incomes ratio	$A/B = 0.86$

This example sheds light on the following points:

(1) Mere addition of the flows in constant value aggregates incomes which cannot be compared among themselves from the point of view of the purchasing power they represent when they appear.

(2) Constant price accounts are affected by the weighting given to the period taken as the reference: the picture they give of the economy is different depending on the observation point chosen. Further, the existence of seasonal phenomena would accentuate these differences.

(3) Annual accounts obtained by aggregating constant price monthly accounts would thus present different structures depending on the month taken as the base for prices.

(4) Neither of these two representations thus allows making a comparison (and aggregation) of incomes from different periods of time when the scale of values used as the reference is distorted greatly by inflation.

(b) Compilation conditions

Without dwelling on this point, it is necessary to emphasize the great difficulty in executing such work. In addition to the conceptual difficulties already mentioned in the previous paragraph for annual accounts, difficulties also arise from the workload involved by infra-annual compilation:

—need to obtain detailed data on prices and/or quantity;

—necessity to make data coherent in value then in volume, monthly (or quarterly).

However we know about the awkwardness of such balancing between data which do not have the same seasonalness.

It thus seems difficult to compile such accounts (all the more so since inflation already causes additional work for the annual accounts). However, if these accounts are not compiled, the possibility is then lost of being able to measure a deflator based on the DGP in order to account for inflation.

2.2. *"Calibrated" accounts*[9]

(a) *The proposal*

The idea is simple and is based on the very practice adopted in countries experiencing a hyperinflation process: in order to maintain over time the value of flows of stocks expressed in monetary value, an indexing factor is introduced (otherwise called monetary correction) which indicates on a daily basis the coefficient which applies to their original value in order to obtain their present value. In the same manner, annual accounts could be formed in which the flows of each elementary period would be indexed in such a way that there is a certain comparability in purchasing power between them.

Inflation indeed leads to a progressive devalorization in the value expressed in monetary terms. Not only do prices grow, but simultaneously all the operations expressed in accordance with this reference devaluate; contracts, financial instruments, accountancy entries. In order to defend against this deterioration, indexing clauses are introduced which concern prices (rents for example), contracts (amount of wages, insurance premiums, etc.), and taxes or certain financial instruments (excepting money). The deflator introduced can be agreed among the parties or imposed by the public authorities (the general case) and it refers to the inflation the country is experiencing.

For the national accounts, the deflator to be used could be drawn up on economic bases and a monthly periodicity could be envisaged. One month would be taken as a reference and all the other months would be compared with it. In other words, a flow made in January would be compared with its equivalent in December by multiplying it by the inflation differential observed between the two months. The same inflation differential would be used for all the operations made in the month. Calibrated annual accounts are then obtained by aggregation of the different months thus indexed.

Let us refer back to the example proposed in 2.1(a) by taking the fourth quarter as the reference. Taking account of the rhythm of inflation indicated, the flows of the four quarters are to be revaluated respectively by the monetary correction factor below:

	1	2	3	4	Total
Monetary correction	27/8	27/12	27/18	27/27 = 1	
Producer *A*	2,430	2,925	2,700	3,000	11,055
Producer *B*	2,599	2,700	2,700	2,610	10,609

[9]In reference to the use of this term in the manufacture of arms: flows are given the same "section" regardless of their date of realization.

The method gives both a representation of the evolution of incomes at constant value (in the sense of constant general purchasing power) and their "calibrated" annual amount. Thus, the ratio of the calibrated annual incomes of the two producers $A/B = 1.04$ would have the same value whatever quarter is taken as the reference.

More generally, it becomes possible again to relate incomes with different annual profiles, including at the level of their aggregation over a year: an identical "scale" is given again to all the flows. Furthermore, the ratios obtained can be compared over time once more; pluriannual comparisons of calibrated accounts are possible, no matter what inflation rhythm occurs each year, and the ratios obtained are representative of the behaviours behind them (technical coefficients, tax rate, consumption elasticity, etc.).

On the contrary, calibrated incomes cannot give any idea about the effective evolution of the value of the wealth of agents. Each of them must see to maintaining the value of their wealth;

—by buying/selling goods,
—by buying/selling foreign currencies,
—by indexed financial investments,
—or by non-indexed investments that are sufficiently remunerated (interest rates on short term investment are generally very high).

Experience shows that everyone is active in this respect!

(b) *Formalization*

Let the inflation indicator be $\alpha_t (1 \leq t \leq n)$, n the number of equal periods considered in the year ($n = 12$ if monthly periods are considered).

The calibrated accounts proposal is tantamount to making a homothetic transformation of each period over a reference period. In the rest of this reasoning, it is the period n which is chosen as the reference.

The homothetic transformation ratio is thus:

$$\gamma_t = \frac{\alpha_n}{\alpha_t} \quad (\text{with } \gamma_n = 1).$$

(The result would be identical, to within one multiplying coefficient, no matter what reference is chosen.)

Let X_i be the different national accounts operations for the year under consideration. They are globally characterized by a generalized accountancy coherence (no matter what development is chosen for the annual accounts), which we represent by

$$\Psi X_i.$$

Each annual operation is the sum of the values taken by the flows in each of the infra-annual periods, in such a manner that

$$X_i = \sum_1^n X_i^t.$$

During each of these periods, we also have the same accountancy coherence

between the different X_i^t, meaning that there also exists

$$\Psi X_i^t \quad \forall_t.$$

Let us designate by $\bar{X}_i$ the operation X_i calibrated over all the year:

$$\bar{X}_i = \sum_t \gamma_t X_i^t.$$

Due to the transitivity of the additive relations, we have:

$$\sum_t \gamma_t \Psi X_i^t = \Psi \sum_t \gamma_t X_i^t.$$

Meaning that all the calibrated operations respect the same accountancy coherence and there exists:

$$\Psi \bar{X}_i.$$

Consequently it is not necessary to draw up infra-annual balances (monthly for example) to obtain calibrated accounts: each operation can be treated separately and we can be satisfied with forming the balance at the level of the calibrated annual operations.

We must however pay special attention to the operations interfering with the revalorization of wealth:

—the change in inventory:

Over a given period the latter has the value

$$\sum_j e_j - s_j$$

where e_j and s_j are the entrance and exit flows from day to day (cf. the example with figures given in 1.3.1). The variations can be high from month to month as well as the effect of the appreciation. The balance over the year brings back the amount to the sole effect of the differences in relative prices.

An example (still the same inflation)

	1	2	3	4	Total
Production	750				750
IC				2,700	2,700
Δs	+750			−2,700	−1,950
After calibration					
Production	2,531				2,531
IC				2,700	2,700
Δs	+2,531			−2,700	−169

—The interests:

The rates of interest are very different depending on whether the principal to be paid back is indexed or not. However, no matter what method is used, the financial instruments are revalorized and thus need to be indexed in all cases. In exchange, it is necessary to consider only the sole so-called "real" part of interests, i.e. after deduction of the part corresponding to implicit reimbursement of the principal.

Let us consider a loan of 80 made in the first quarter and paid back in the fourth with a real rate of 1 percent per quarter payable at quarter end. The bank can adopt either of the following two solutions:

	1	2	3	4	Total
Inflation	8	12	18	27	
1—Indexed load	+80			−270	−190
Interests (1 percent of the principal indexed per quarter)		−1.2	−1.8	−2.7	−5.7
2—Non-indexed loan	+80			−80	0
Interests (52.1 percent per quarter)		−41.7	−41.7	−41.7	−125.1
The first solution can be calibrated without difficulty:					
Loan	+270			−270	0
Interests		−2.7	−2.7	−2.7	−8.1
In the second solution, we obtain:					
Loan	+270			−80	+190
Interests		−93.8	−62.6	−41.7	−198.1
					−8.1

The same final balance is thus found, but the first accounts better point out the coherence over time of the flows of receivables and debts.

(c) *The compilation conditions*

The implementation of calibrated annual accounts is a task which should not present insurmountable difficulties. Further, it can be partial (limited to a few aggregates) or complete, if the wish is to build the system in its entirety (with the resulting accountancy coherence). The compilation method presented here relates to complete implementation (monthly calibrated accounts would also be possible, but more difficult to design).

(1) Choosing and measuring an inflation indicator (the deflator).

Most countries measure their inflation rate on the basis of the consumer price index; in general the Laspeyres price index is used, the weighting of which refers to a standard structure of final consumption for a past year. A different measurement of it can be envisaged on the basis of the same elementary indices by using an updated weighting considered to be more representative of the global economic activity. We could also choose the GDP price index of constant price monthly accounts, if they are compiled.

(2) Drafting the $\bar{X}_i$

This involves calculation of each calibrated aggregate in terms of the chosen inflation rate. The method is different depending on whether the monthly evolution of the latter can be divided or not into a price component and a volume component.

—*The division is possible*: this is the case of goods and services operations and

a few allocation operations. Let us consider the aggregate X_i. Let:

IP_i^t: be the monthly index of the price of the aggregate X_i

IV_i^t: be the monthly volume index.

Assuming

$$M_i = \sum_t (IP_i^t \times IV_i^t),$$

as the indicator of the value evolution, for all the period. We have:

$$X_i^t = X_i \frac{IP_i^t \times IV_i^t}{M_i}.$$

However, the calibrated aggregate is measured by

$$\bar{X}_i = \sum_t \gamma_t X_i^t,$$

whence

$$\bar{X}_i = \left(\frac{\alpha_n}{M_i} \sum_t IV_i^t \frac{IP_i^t}{\alpha_t} \right) X_i.$$

In other words the calibrated aggregate is obtained by mere application to the current annual aggregate, of a coefficient obtained from monthly evolution indices of its volume and its relative price. For want of directly calculated indices, simple hypotheses can be established concerning them.

—*The division is not possible*: it is then necessary to have the monthly values of the aggregate. This information generally exists for the financial operations and for the allocative operations made by the general government, but an approximative profile has to be proposed for the others.

(3) The work ends by comparison of the operations thus calibrated within the accounting model proposed by the national accounts (balances resources—uses of products, accounts of branches and institutional sectors, balance per operation); the choices to be made to reach balance afford an occasion to check the quality of the hypotheses selected in the previous step.

CONCLUSION

Drawing up national accounts in a context of hyperinflation is a difficult to ignore challenge since it would mean forgoing economic measurement at a particularly delicate moment in the life of a country. The difficulties are particularly increased by this phenomenon, for a result whose content cannot be interpreted immediately.

These difficulties are of a statistical nature, but are also related to concepts, and result mainly from the disappearance of a stable referent to account for value. However, it is interesting to observe that the methodological effort thus made necessary also contributes to solving more general problems concerning the national accounts.

The problem of the interpretation of the accounts thus obtained remains. There seems to be two possible pathways for this purpose. The compilation of constant price monthly account uses an already well-tried methodology, more specially adapted to follow the volume evolution of activity and to measure inflation, but its implementation remains difficult. Calibrated annual accounts can also be compiled, resulting from a sort of indexing of monthly flows, both real and financial, in order to make their values comparable over time. This instrument seems to be quite simple to design, at least according to our theoretical analysis. If the interest for it was thus confirmed, we could envisage applying it experimentally, including in countries where inflation, without being very high, is already sufficient to disturb the macroeconomic volumes proposed by the national accounts.

ANNOUNCEMENT

NANCY RUGGLES TRAVEL AWARDS

The International Association for Research on Income and Wealth is pleased to invite young (under 35) economic statisticians to apply for a Nancy Ruggles Travel Award. These awards are made possible through a fund recently created by the membership of the Association in memory of Nancy Ruggles and are intended to support travel to the next (21st) Conference of the Association in Lahnstein, Germany, 20–25 August, 1989. Candidates for these awards should submit (i) a statement of their age and the availability of alternative sources of funding, and (ii) a previously unpublished paper on a topic within the range of interests of the Association as reflected in recent issues of the *Review of Income and Wealth.* Successful candidates will be expected to present their papers at the 21st Conference, and to offer them for publication in the *Review.* Submission should be sent to Graham Pyatt, Coopers & Lybrand Research Professor in Economics, University of Warwick, Coventry CV4 7AL, U.K., to arrive by April 15, 1989.

LUXEMBOURG INCOME STUDY SUMMER WORKSHOP

The *Luxembourg Income Study* has made comparable several large microdata sets which contain comprehensive measures of income and economic well-being for a set of modern industrialized welfare states. The LIS databank currently covers eleven countries—Australia, Canada, France, Germany, Israel, Netherlands, Norway, Sweden, Switzerland, United Kingdom and the United States, with others (Italy, Finland, Poland) to be added shortly.

The *LIS Summer Workshop* is a two week pre- and post-doctoral workshop designed to introduce young scholars in the social sciences (economics, sociology, etc.) to comparative research in income distribution and social policy using the LIS database. The 1988 workshop attracted 26 attendees from 14 countries. The second workshop will be held July 16–28, 1989 in Luxembourg. The cost will be 36,000 Belgium Francs (about $950) which will include tuition, local travel, and full board. International transportation is not included. Students are expected to be subsidized by home countries, national and international research foundations, universities, and other sources, including at least two special scholarships from the Ford Foundation LIS Development Initiatives Fund. The Workshop is also sponsored by the LIS country sponsors and by the European Economic Community (DGXII, Directorate for Scientific Research). The language of instruction will be English. The course of study will include a mix of lectures and assistance

and direction using the LIS database to explore a research issue chosen by the participant. Faculty are expected to include Anthony Atkinson (U.K.), Aldi J. M. Hagenaars (Netherlands), Richard Hauser (Germany), Kryzstof Starzec (France), Frank Cowell (U.K.), Shelly Phipps (Canada), Michael O'Higgins (OECD), Peter Saunders (Australia), and the entire LIS staff.

Additional information, including application forms are available from Tim Smeeding, LIS Project Director (VIPPS, 1208 18th Avenue South, Nashville, TN 37212, U.S.A.); Lee Rainwater, LIS Research Director (Sociology, Harvard University, Cambridge, MA 02138, U.S.A.); or John Coder (LIS at CEPS/INSTEAD, B.P. #65, L-7201 Walferdange, Luxembourg). Applications are due by April 1, 1989.