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DEFECTS, USES, AND ABUSES OF NATIONAL FOOD SUPPLY AND CONSUMPTION DATA*

Before World War II little serious attention was given to the development of comprehensive food supply and "consumption" estimates for individual nations. But as the threat of wartime food shortages spread and government food marketing controls were extended, all of the major belligerent governments gave increased attention to improving their own national food statistics and their appraisals of the changing food positions of other countries, particularly enemy and enemy-occupied countries. The natural result was refinement and extension of the balance sheet accounting technique previously used for analyzing the national supplies and utilization of individual food commodities and groups of commodities in specific countries (e.g., *1*, pp. 255–305; *2*; *3*, pp. 1–98; *4*, pp. 375–88).

I. HISTORICAL DEVELOPMENT OF FOOD CONSUMPTION ESTIMATES AND COMPARISONS

The first major study to present comparative data on national food supply levels and "consumption" changes for several countries was the 1944 report of the Combined Food Board, compiled to assist in its work of international allocation of foodstuffs (*5*). This pioneer effort was confined to the food supply data of three highly developed countries—Canada, the United Kingdom, and the United States—whose food statistics rank among the best in the world; and it had the additional advantage of being made at a time when food supplies were under an abnormally high degree of government control. The economic and statistical staffs of those countries were not only well trained, but also sufficiently knowledgeable and well equipped with supplementary information (from dietary surveys, commodity marketing studies, and wartime records of controlled food distribution) to recognize and make allowance for some of the most disturbing deficiencies in the data. Nevertheless, there remained sizable margins of error in the individual figures and many inherent incomparabilities not adequately discounted in the interpretations offered in the Report.[1]

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[1] Illuminating comments on the origin and limitations of the Combined Food Board's comparisons appear in R. J. Hammond's authoritative study on British food policy during the Second World War (*6*, pp. 386–88).

The second landmark was the publication in 1946 of the first *World Food Survey* of the Food and Agriculture Organization of the United Nations (FAO). This contained an ambitious series of estimates of the prewar food supplies and "consumption" of 70 countries that accounted for roughly 90 per cent of the world's population—countries whose basic food statistics ranged all the way from reasonably good to practically nonexistent (with many countries close to the "nonexistent" end of the scale). Despite these and other inadequacies, the *World Food Survey* estimates were put forward as measures of the different food consumption levels of the different countries and "as a guide in working out proposals for future world food and agricultural policies" (*7*, p. 1). Several years later the first detailed FAO balance sheets appeared, covering 41 countries deemed to have "adequate" statistics.[2] (*8*) These were followed in 1952 by publication of FAO's *Second World Food Survey* (*7A*), and in 1955 by a second series of food balances (*8A*); both substantially revised many of the earlier consumption estimates, mostly upwards.

Although FAO's two *World Food Surveys* fell far short of recognized standards as statistical documents,[3] although they failed to live up to early hopes as a "guide" to policy decisions, and although their alarming conclusions about the extent and geography of "world hunger" have been convincingly criticized (*10*, pp. 189–212), these surveys and associated food balances nevertheless contributed to food consumption analysis by calling attention to the differing patterns of food consumption in different countries and by stimulating some governments to study and improve their own national food supply statistics.

Throughout the postwar period the United States Department of Agriculture has shared with FAO the world's leadership in presenting and interpreting foreign food consumption data. Its leadership qualities were firmly established even before 1949, when it issued one of the most careful, comprehensive national consumption studies ever published (*11*).[4]

Aware of the greater deficiencies in the food supply data for most other countries and of the pitfalls in international comparisons, the Department's experts long hesitated to publish their tentative foreign food balances, preferring to discuss world food supply and consumption changes in more trustworthy, less quantitative terms (*13*). Not until 1951 did the Department publish its first group of foreign balance sheets, wisely limited to West European nations that had been closely studied for many years by some of the Department's most capable analysts (*14*). Even so, the Department's specialists very properly warned that the resulting estimates were "far from perfect" (*14*, p. 5); that they had encountered many difficult, partially unsolvable problems in attempting to construct the balance sheets (*14*, pp. 63–66); and that despite their efforts to compensate for unreported production and for changes in official methods of crop estimation, there remained

[2] The inclusion of the following countries in the "adequate statistics" group is particularly surprising: Madagascar, Mainland China, Burma, Indo-China, Java and Madura, Philippines, Colombia, and Peru.

[3] A pertinent criticism of the methods and figures used for the first World Food Survey was subsequently circulated by Werner Klatt (*9*).

[4] This was preceded by a less substantial preliminary study that had appeared in 1941 (*12*), as well as by the consumption estimates published in the Combined Food Board's reports. A major revision published in 1953 (*11A*), together with subsequent supplements, still stands as the primary source of American food consumption data.

disturbing inadequacies and incomparabilities in some of the figures. Over the past decade, however, the Department has moved farther and farther away from this cautious, scholarly publication policy. At first it reluctantly followed, but later became as bad as FAO in publishing for many countries consumption estimates to which little research time had been devoted and for which both the basic data and necessary supplementary information were meager.

Today there is renewed and intensified interest in national food supply and consumption estimates. During the past year the United States Department of Agriculture has published hastily prepared "food balances" for 76 foreign countries (*15; 16; 17; 18*), followed by a politically oriented summary and interpretation, *The World Food Deficit* (*36*),[4a] which set the questionable national supply figures against even more questionable "food requirement" standards. Meanwhile, FAO has been preparing a comprehensive *Third World Food Survey,* also based on hastily assembled figures. In some quarters it is asserted that such data can serve as a useful guide to FAO in promoting its current Freedom from Hunger Campaign, to the governments of "food-deficit" countries in planning future expansion of food output, and to the United States Government in attempting to increase its Food for Peace disposals.

In view of these optimistic claims, it is important to take a closer look at the available food supply and consumption estimates—to consider how they were made, what defects they have, and to what extent and for what purposes they are truly useful. The fundamental question is whether the defects are mostly of minor significance and mutually offsetting or whether they are large enough to distort the indicated levels and patterns of national food consumption. The present paper is intended to throw additional light on this problem.

II. THE CONSTRUCTION OF FOOD BALANCE SHEETS: GENERAL

To understand the nature of the national food consumption estimates published by FAO, the United States Department of Agriculture, and various national governments, one must understand how national food balance sheets are customarily prepared. Such a balance sheet purports to show the total supply of foodstuffs available to the country in question in a given year (or period of years) offset by the itemized utilization of those foodstuffs.

As now formalized, the food balance equation lists three elements on the supply side: domestic production; net imports or net exports; and net changes in year-end food stocks. Similarly, six elements are listed on the utilization side: seed use; industrial "non-food" use (counting alcoholic beverage as non-food); animal feed; waste on farms and in distribution up to the so-called "retail level"; processing or extraction rate losses of foods like cereals and oil seeds; and the net food supply available for human consumption at the so-called "retail level." Finally, the net food supply of each product is expressed in per capita terms, based on the estimated national population; and this per capita food availability, inexactly referred to as "consumption," is shown totaled in terms of calories and grams of protein per capita per day.

Ideally, for each food commodity, each of the nine supply and utilization esti-

[4a] An equally objectionable companion study appeared while the present article was in press (*36A*).

mates and also the population and nutrient conversion figures should be both independent and trustworthy. Ideally also, the sum of the three supply elements should in every case precisely equal the sum of the six utilization elements. Alternatively, eight of the nine balance sheet elements might be independently and reliably estimated, with the ninth determined as a residual that could be adequately tested and found reasonable.

In actual fact, however, not even the dozen or so countries with the most highly developed statistical services fully meet either of these ideal standards. Even these countries never attempt to collect statistical reports on all food production, intentionally avoiding the difficulties and the heavy costs of obtaining data on minor crops, minor producing areas, and/or home gardens. Moreover, these countries usually limit stocks records to major commercial and government holdings of a few primary food commodities; they rarely have more than the crudest, most incomplete records of the foodstuffs fed to animals or of the amounts lost and wasted on farms, in transport, and in storage; and their direct information on non-food industrial use is often confined to earlier census data supplemented by annual reports from a selected sample of large industrial firms. Indeed, even the current population estimates for such countries may well be wrong by one or two per cent (e.g., *11A, 19, 20*).

Disturbing as such statistical shortcomings may be in the construction of food balances for highly developed countries, they shrink almost to insignificance compared with the distorting defects and inadequacies of the food statistics and population estimates of many underdeveloped countries. Throughout much of Africa and Asia, and in smaller areas of Latin America, agricultural production statistics are collected (if at all) only for a small number of crops, often being confined to government controlled commercial or export production, to the neglect of domestic food staples; cattle and sheep numbers may be estimated (in some crude fashion), but not the numbers of smaller animals nor the associated production of meat, milk, or eggs; and even the scanty available "estimates" of crops and livestock may be no more than the unsupported guesses of local administrators, who are primarily concerned with "more important" governmental tasks (*21; 21A*). It is noteworthy that the *FAO Production Yearbook, 1959,* shows no aggregate cereal production estimates for well over half of the 40-odd African countries in any recent year.

Other items in the balance sheet for underdeveloped countries are also critically inadequate. Stocks data are either nonexistent or limited to government holdings of a few export products; estimates of the quantities of foodstuffs lost in storage and of the amounts used for seed, feed, and beverages differ widely; population estimates frequently have a margin of error of 10 per cent, sometimes much more (e.g., Ghana, Ethiopia, Thailand); and such independent per capita consumption estimates as exist usually rest on seriously defective dietary surveys, even poorer budget studies, or the questionable judgments of administrators who have their own untested ideas about local food levels and patterns.

How did FAO and the United States Department of Agriculture construct from such unpromising materials the precise-appearing food balances and consumption estimates they have published for 70–80 countries? Contrary to a com-

mon misconception,[5] national food balances are not customarily constructed in a routine, automatic manner by beginning at the production side of the equation, successively inserting the best available estimates of production, net trade, change in stocks, then deducting the several non-food utilization items and waste, and finally ending with a *residual* figure that is accepted as the national food consumption estimate. They are actually constructed in a number of different ways, depending on the nature of the available data, the supplementary information known to the estimator, and the estimator's own judgment, ingenuity, and available research time.

On the basis of extensive wartime experience with national food supply appraisals, John M. Cassels, writing in 1945, stressed four elements which he regarded as most important in such work—elements which deserve even greater emphasis today as food consumption research is rapidly extending to the many underdeveloped countries of Asia, Africa, and Latin America. He wisely remarked (*23*):

> Intelligent statistical work must necessarily be more than just a mechanical manipulation of figures. It involves judgment; a judicial weighing of the evidence; the corroboration of one set of observations by cross checking with others that should bear a logical relation to it; and a critical examination of the reasonableness of the results that are obtained.

This type of cross-checking and judicial weighing of much related evidence can be done effectively only for highly developed countries having a mass of supplementary statistical and nonstatistical information of the type required.

III. FOOD BALANCE CONSTRUCTION IN HIGHLY DEVELOPED COUNTRIES

The kind of balance sheet construction that favorable conditions make possible is exemplified by American, British, and Canadian wheat estimates. In these three countries most balance sheet items for wheat are based on direct, independent estimates that are subject to checks and cross-checks at different levels. First, the initial local reports on wheat acreage and yields per acre are tested for internal consistency and corrected for obvious sampling errors. Then the resulting national wheat production figure can be cross-checked by the summation of reported marketings and changes in reported old-crop farm stocks. Later the production figure is again tested and simultaneously used as a testing element when the reported total wheat supplies are balanced against the summation of independently estimated utilization elements (including reported mill grindings for flour and breakfast cereal, farmers' reports on seed use and use of home-produced feed, and incomplete processors' reports on commercial feed production). Because these countries have good milling records, and because their per capita national flour consumption varies little from year to year, the *direct* "food consumption" estimate for wheat is normally rated as the best figure on the utilization side of the wheat balance equation and is therefore accepted as given. In contrast, the least satisfactory direct utilization estimate is that for animal feed;

[5] Unfortunately, this misconception has been reinforced not only by the standardized item arrangement of most food balance sheets, but also by the oversimplified explanatory *Handbook* on food balance sheet construction published by FAO (*22*).

therefore, this item is often calculated as a *"residual"* (usually including part or all of the loss and waste on farms), a residual that can itself be crudely tested for "reasonableness" through correlation with such factors as incomplete feed-use records, livestock-feed price ratios, feedgrain-wheat price ratios, and crop quality ratings. Thus reported, checked, cross-checked, and adjusted by judgment decisions supposedly giving priority to the most consistent, most trusted combination of evidence, the wheat production and consumption figures of these three countries can be accepted as good, reliable estimates—at least until a final check can be made on the basis of new information supplied by subsequent agricultural, industrial, and population censuses.

It would be wrong to infer that the production and consumption estimates shown for all other foods in American, British, and Canadian food balances are similarly trustworthy. In practically all developed (as well as underdeveloped) countries, the most complete, independent statistical estimates and the most adequate supplementary information for checking are those for the principal foodgrains. Even in countries with the best food statistics, it is no mean task to derive "reasonable" estimates of the different quantities of different types of meat available for domestic consumption at the retail level. Almost invariably such estimates must be based on incomplete slaughterhouse and local butcher records, and on still less adequate reports of farm slaughterings[6]—all customarily tied, as judgment dictates, to earlier, less incomplete census data, and all inadequately checked by fragmentary commercial marketing statistics, cold-storage stocks records, and household consumption survey data.

Difficult as the problems of balance-sheet estimation are for meat, they are even worse for milk, eggs, vegetables, and fruits (including, of course, home-garden produce). The two major problems are to get satisfactory independent reports and checks on the volume of production and to arrive at a fair approximation of loss and waste up to the "retail level" (since non-food utilization is usually negligible except for potatoes and fruits used for wine). In estimating American production and consumption of these foods, Department of Agriculture specialists use many different sources of information—a mass of data for which no equivalent exists in underdeveloped countries. Despite this great advantage and despite the great amount of time and attention given to this work, those responsible warn that the resulting figures are exceedingly rough, having been influenced by subjective decisions made in the face of "insurmountable problems."

IV. FOOD BALANCE CONSTRUCTION IN UNDERDEVELOPED COUNTRIES

The complexities and uncertainties of food balance sheet estimation for countries with the most highly developed statistical services and research agencies raise the obvious question: How have food balances been constructed for the underdeveloped countries of Asia, Africa, and Latin America—countries that have collected little, if any, of the data needed for such work? A vague clue is

[6] Not only are most meat records in terms of carcass weights that include heavy, variable amounts of fat which are trimmed off before delivery to retail buyers, but there is often a tendency for the basic slaughter records for farms and small slaughter units to become "standardized," unduly influenced by previous reports. For American meat consumption figures, standard deductions are made from reported carcass weights (*11A*).

offered in the general notes appended to two groups of Asian and African food balances recently published by the United States Department of Agriculture (*16*, p. 1; *18*, p. 3), the Far Eastern study commenting:

> Official figures were used where possible, but frequently these are underreported or are otherwise incomplete. For some commodities no official estimates of production have been made. Thus, it has been necessary to employ FAS [United States Department of Agriculture] estimates in many instances, especially for commodities that enter but little into commercial channels. . . .
>
> Trade data are taken primarily from official sources. . . . Changes in farm stocks for many of the grains were estimated. For many commodities no data are available on stocks, and it was assumed that changes were not significant. Utilization data were generally unavailable from official sources, and FAS estimates have been widely employed.

This means that for many Asian and African countries, the United States Department of Agriculture found official production estimates either nonexistent or so questionable as to be practically unusable. It means, too, that many of the "better" official production figures were found to be incomplete (1) because they do not cover (or do not cover adequately) food production in non-reporting districts, (2) because they apply only to commercial marketings, omitting much food consumed by producers, and/or (3) because farmers underreport their crops with a view to minimizing taxes (which in many underdeveloped countries are based directly or indirectly on estimated production).

None of this is surprising. What *is* surprising is that the Department nevertheless decided to construct and publish food balances for so many underdeveloped countries in such a short time. If there were reason to believe that the Department's so-called "estimates" were carefully derived by close, prolonged study and ingenious analysis of many fragments of significant quantitative and qualitative evidence, such research results would be welcome, if cautiously interpreted. Unfortunately, there is nothing to support this view. Conspicuously missing are the illuminating national research monographs that would have been associated with careful production and consumption studies of the type required, the kind of monographs for which the Department's foreign division was well known in earlier years (before surplus disposal problems became so time-consuming). FAO's *World Food Survey* figures are, of course, subject to the same basic criticism—hasty preparation without adequate research.

We can get a clearer idea of the statistical uncertainties involved in food consumption "estimates" for underdeveloped countries by considering the problems of balance sheet construction for Nigeria, which was one of the first of the few African countries that have ever attempted to make a careful sample survey of agricultural production. That census, carried out in 1950/51, supplied practically all of the systematically collected information on Nigerian domestic food production that has appeared to date.[7] Although it was planned as a random sample

[7] For recent years, FAO *Production Yearbooks* carry only "Eastern Region" estimates of manioc and an undescribed 1957 national production figure for millets and sorghums. Private reports indicate that during the five years ending 1959 a small team of well-trained enumerators, moving from province to province in different years, carried out a new sample survey of crop areas and yield; if so, the results have apparently not yet been published.

survey that called for independent crop-area measurements and recorded weights of sample crop yields, public opposition proved so strong that the original census program was considerably modified. In the most hostile of the three national regions—the Eastern Region—all direct measurement plans were abandoned and the unsupported production estimates of local agricultural officers were substituted. In the other two regions lesser concessions were made (*24*, p. 11; *25*, pp. 289–94).

The percentage of error in the Nigerian census totals remains in doubt. On the one hand, the sample cuttings apparently resulted in inflated "biological" or "potentially available" yields; on the other hand, the crop areas may well have been underestimated (*25*, pp. 165–69; *26*, pp. 25–27). Some scholars have accepted the census production estimates as given; others have substantially lowered the indicated per capita figures; still others have raised them. In preparing Nigerian food balance sheets for 1953 and 1958 (*27; 18*, p. 28), the United States Department of Agriculture boldly cut the per capita census estimate for manioc production by 35–40 per cent (more for 1958 than for 1953), reduced by 20 per cent the per capita cereal production figure reported by the census (for a year of substantial drought damage), and similarly reduced for 1953, but slightly increased for 1958, the indicated per capita output of roots other than manioc. Standing in sharp contrast are the strikingly *increased* estimates of Prest and Stewart, who devoted special attention to agricultural production in a Nigerian national income study sponsored by a Cambridge University committee of highly regarded economists and published by the British Colonial Office. In explaining their own independent crop estimates, Prest and Stewart commented (*26*, p. 25):

> For certain crops . . . our figures of tonnages . . . are different from those computed by the Census, for . . . we have used acreages or yields based upon other data, such as Assessment Reports. We have also drawn extensively upon the accumulated experience of administrative and agricultural officers . . . In so far as we have built up estimates first from data on production and then independently from . . . the few family budget studies that were available, it is reasonable to claim greater accuracy for the resulting compromise estimate.

Prest and Stewart put the 1950/51 manioc crop (cassava or tapioca) over twice as high as the census estimate, almost three times the United States Department of Agriculture approximation for 1953; and they raised the census figures for cereals and "other roots" by 38 and 84 per cent or more, respectively.[8] The very magnitude of these differences and the staple-food character of the specified crops suggest that the crudest sort of utilization test might help in evaluating the conflicting production figures. Since very little is known about loss, waste, and nonfood utilization of roots and cereals in Nigeria, the only scientific way to test conflicting production figures is to set up hypothetical utilization estimates in the form of probable ranges that allow for some of the uncertainties involved—not statistically determined probability ranges, but very crude "judgment approximations."

[8] Calculated from Prest and Stewart data that referred to production minus seed and waste, expressed in processed forms. As here reproduced, their crop figures are put at minimum levels, since the most conservative possible allowances have been added for seed and waste.

Such a series of ranges is presented in Table 1, an abridged and partial balance sheet.[9] Column 6 shows the per capita net food supply or "consumption" figures implied (as residuals) by each of the crop approximations previously described—"implied" on the assumption that the ranges shown in previous columns for "non-food use and waste," cereal extraction rates, and population are in line with reality.

The manioc figures deserve special attention, because they illustrate a peculiarly difficult balance sheet construction problem encountered in many African countries. Unlike practically all other staple foods, mature manioc can be harvested at any time over a period of years. Moreover, since manioc usually ranks as a non-preferred food, and since it is often planted for price speculation and as a "hungry season" reserve, large quantities are never harvested but remain on land abandoned to bush fallow (*25*, pp. 96–7, 186–90; *28*, pp. 160, 324, 330–31; *29*, pp. 144–47). Hence, if manioc production is estimated by applying data on sampled yields per acre to the total acreage under manioc, the result is inevitably an inflated "potential production" figure, rather than an indication of the crop harvested in a single year. Although the Nigerian census of 1950/51 partly relied on yield samplings, both the yields and recorded acreage were supposed to apply only to manioc plantings of the twelve preceding months—a correcting factor. It is by no means certain, therefore, what kind of "production" the Nigerian census figure for manioc refers to—the harvested tonnage, or the potential "biological" production, or something in between. Similar uncertainty prevails about the other manioc production figures shown in Table 1 (though all purport to be harvested output), and also about the manioc production figures of many countries (*30*, pp. 40–43).

To make some allowance in Table 1 for this peculiar "manioc estimation problem," the upper limit of the range for "non-food use and waste" of manioc has been put 10–15 percentage points above what otherwise might be considered "reasonable." Perhaps the best that can be said for this arbitrary, unorthodox allowance is that it stands as a warning to users of the great uncertainties involved, leaving intact the original crop estimates. Two other balance sheet uncertainties have also been expressed in terms of modest ranges—a 5 per cent range for cereal extraction rates and a 10 per cent range for population estimates (with the lower population figure that currently published by the United Nations Statistical Office). Finally, the per capita net supply or "consumption" figures have been converted from kilograms to calories by using three different calorie conversion factors, published respectively by FAO, the United States Department of Agriculture, and the British Medical Research Council.

Having thus allowed for major uncertainties, we must now ask whether the resulting wide "consumption" ranges in column 10 convey any significant information. If they do not, then it would seem necessary to conclude that balance sheet construction for Nigeria and similar underdeveloped countries is, at best, a waste of research time. Six generalizations appear to be warranted.

1. *The wide ranges in Table 1 do not obscure the broad pattern of Nigeria's*

[9] Since trade records indicate that Nigeria's foreign trade in these staple foods is insignificant, and since year-to-year changes in preharvest stocks are presumably small as well as unknown, these two items have been omitted.

TABLE 1.—CONFLICTING ESTIMATES OF NIGERIAN PRODUCTION AND CONSUMPTION OF SELECTED FOODS*

(Million metric tons, except as indicated)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
		Non-food, waste[a]		Implied food supply		Implied per capita net food supply ("consumption")				
							Calories per day[b]			
Source of crop estimate	Crop	% of crop	Tonnage	Gross	Net[c]	Kg. per year[d]	Factor I	Factor II	Factor III	Range
				Manioc (Cassava) Roots						
Census 1950	9.5[e]	15–30	1.4–2.9	6.7– 8.1		239–319	714– 954	635– 849	727– 971	630– 970
P. & S. 1950	21.4		3.2–6.4	15.0–18.2		537–718	1604–2143	1427–1907	1634–2182	1425–2180
USDA 1953	7.5		1.1–2.2	5.2– 6.4		151–202	452– 603	402– 537	460– 614	400– 610
USDA 1958	8.0		1.2–2.4	5.6– 6.8		147–196	439– 586	391– 522	447– 597	390– 600
FAO 1958	13.0[f]		2.0–3.9	9.1–11.0		239–319	713– 953	635– 848	726– 970	630– 970
				Other Roots and Tubers (Primarily Yams and Cocoyams)						
Census 1950	11.0	30–45	3.3–4.9	6.0– 7.7		217–303	534– 748	516– 723	505– 706	500– 750
P. & S. 1950	20.2		6.1–9.1	11.1–14.2		399–558	983–1377	950–1330	929–1300	930–1375
USDA 1953	10.5		3.2–4.7	5.8– 7.4		166–233	410– 574	396– 555	388– 542	390– 575
USDA 1958	16.0		4.8–7.2	8.8–11.2		231–323	569– 797	550– 770	538– 753	540– 800
				Sorghum and Millets						
Census 1950	2.8	15–30	.4– .8	2.0– 2.4	1.8–2.3	64– 90	597– 841	588– 829	590– 831	590– 840
P. & S. 1950	4.0		.6–1.2	2.8– 3.4	2.6–3.3	92–129	582–1202	840–1184	842–1188	840–1200
USDA 1953	3.0		.4– .9	2.1– 2.6	1.9–2.4	54– 77	507– 715	499– 705	501– 707	500– 710
USDA 1958	3.0[g]		.4– .9	2.1– 2.6	1.9–2.4	50– 70	462– 651	455– 642	457– 643	450– 650
FAO 1957	3.0		.4– .9	2.1– 2.6	1.9–2.4	50– 71	470– 663	463– 653	465– 655	460– 660
				Maize						
Census 1950	.76	10–15	.08–.11	.64– .68	.58–.65	21– 26	205– 252	202– 248	195– 239	200– 250
P. & S. 1950	.92		.09–.14	.78– .83	.70–.79	25– 31	249– 306	245– 302	236– 290	240– 310
USDA 1953	.60		.06–.09	.61– .64	.55–.61	16– 19	155– 190	154– 188	148– 181	150– 190
USDA 1958	1.10		.11–.16	.94– .99	.84–.94	22– 27	218– 268	215– 265	207– 255	210– 270
				Total Specified Foods						
Census 1950							2050–2795	1941–2649	2017–2747	1950–2800
P. & S. 1950							3688–5028	3462–4723	3641–4960	3450–5000
USDA 1953							1524–2082	1451–1985	1497–2044	1450–2100
USDA 1958							1688–2302	1611–2199	1649–2248	1600–2300

* All data refer to the Federation of Nigeria, including the Cameroons, formerly under British Administration. Since published trade reports show no significant exports or imports of any of these foods, the crop figures in column 1 are equivalent to total supplies unadjusted for changes in stocks. Sources for crops: "Census" (*24*, p. 43); "P. & S.", approximations based on data given by Prest and Stewart (*26*, pp. 26–27); "USDA" 1953 (*27*); "USDA" 1958 (*18*); "FAO" (*39*)—also see note (*f*).

[a] Includes seed, feed, and alcoholic beverages. Percentage ranges in column 2 are approximations by the writer, designed to reflect the basic uncertainties involved (a mimeographed explanatory supplement, "Notes on the Utilization of Roots and Cereals in Nigeria," can be obtained from the Food Research Institute on request). Column 3 is derived from columns 1 and 2, using unrounded figures.

[b] Columns 7–9 converted from column 6 at the calories per kg. figures shown in *40* for Factor I (FAO conversion factor), in *41* for Factor II (U.S. Department of Agriculture factor), and *42* for Factor III (B.S. Platt conversion factor). Column 10 shows rounded maximum and minimum figures from columns 7–9.

[c] Net figures for cereals represent quantities remaining after processing into meal or flour (extraction rates described in mimeographed supplement referred to in note [a]).

[d] Data in column 4 for roots, column 5 for cereals, divided by an estimated population range, for which the bottom is that indicated in UN, *Demographic Yearbook 1959* (*37*), the top 10 per cent higher. For 1950/51 and 1958, respectively, the population ranges used are 25.4–27.9 and 34.6–38.1 million.

[e] As adjusted by W. O. Jones for error in reporting stratum 5 (*25*, p. 169).

[f] Approximated from data for the Eastern Region (8.5 million tons) assuming that production in the Eastern Region represented the same percentage of the total in 1958 as indicated by the census for 1950/51.

[g] No allowance is made for possible net exports: the USDA 1958 balance sheet (*18*) indicates net exports of 300,000 tons, but FAO's *Trade Yearbook 1959* (*43*) reports no exports in 1958.

total food supplies. The estimates agree in indicating that all roots and tubers combined contribute more calories than all specified cereals, and that manioc, other roots, and the sorghum-millet group are individually very important calorie contributors, whereas maize is much less important. On the other hand, the data afford no firm basis for determining which of the three most important food groups furnishes the largest number of food calories, which the smallest number. Nor do they indicate how the different kinds of food are shared among the inhabitants of the different regions.

2. *The per capita consumption figures neither confirm nor negate the assertion that significant changes in Nigerian food consumption patterns have occurred over the past decade.* For this, however, the paucity of comparable annual data is more responsible than the width of the calorie ranges. In most underdeveloped countries, food consumption patterns vary markedly from year to year, depending on weather conditions and associated harvests; and such variations can be distinguished from trend factors only when a fairly long series of comparable annual data is available.

3. *Calorie conversion factors are much rougher and more inexact as applied to national food supply data than is generally realized.* This is particularly true for certain starchy roots and tubers and for bananas and plantains—foods that are major dietary staples in many underdeveloped tropical countries. Manioc may be taken as an extreme example (no more extreme, however, than bananas or plantains in other countries). Table 1 indicates that the estimated number of calories contributed to the Nigerian diet by manioc could be put 14 per cent, roughly 100 calories, higher or lower, depending on which commonly used conversion factor is employed (and these particular conversion factors presumably do not cover the entire range appropriate for different seasons and different localities). Clearly, there is reason to ask whether any "international" calorie conversion factor for manioc (or plantains or other highly variable food) is sufficiently representative of differing national types to give an undistorted view of the calorie contribution of that product in individual countries. For Nigeria, at least, there are some grounds for doubt with respect to manioc.[10] In any case, the lesson for statisticians and economists is clear: the calorie figures shown in national food balance sheets may significantly understate or overstate the calorie contributions of major national foods solely because of unrepresentative calorie conversion factors. Deviations of even greater relative magnitude are likely to be encountered in protein and vitamin conversions.

4. *When the per capita consumption figures for the four root and cereal groups are combined in Table 1, the resulting ranges are so wide and differ so*

[10] This may be illustrated by Galletti's estimate that a group of Southwestern Nigerian women who made manioc meal (*gari*) for sale, obtained 50 kilos of meal from 100 kilos of purchased roots (*28*, p. 369). If FAO calorie conversion factors are applied, it appears that from roots containing 109,000 calories these remarkable women obtained 169,000 calories in the form of meal! Even more surprisingly, United States Department of Agriculture conversion factors suggest that manioc roots containing only 97,000 calories were transformed into meal with a calorie content of 180,000—a multiplication of food energy reminiscent of the biblical miracle of the loaves and the fishes! Part of the discrepancy may reflect the greater efficiency of the commercial gari makers, perhaps in selecting choicer or drier roots; part may be due to error in Galletti's estimate. But even if the Nigerian average yield of manioc meal approximates 40 per cent—the figure reported by Prest and Stewart (*26*, p. 26) and one well within the range of Platt's reported analyses—a substantial miracle would still be indicated.

strikingly that they afford little basis for generalization about the absolute level of consumption. In order to narrow these differences and to arrive closer to true probabilities, we must look not to statistical formulas, but to supplementary evidence on Nigerian food consumption. Such evidence is available in the dietary surveys reported by two major investigators or teams: (1) the surveys made by Galletti, Baldwin, and Dina of the food consumption of 187 Southwestern cocoa-growing families (*28*, pp. 236–41, 716–18), and (2) the survey data reported by B. M. Nicol for an unstated but probably roughly similar number of families located in seven rural villages in the Northern Region and five villages in the South (*31; 31A; 32*). Both sets of surveys show sizable intergroup and intragroup variations. Nevertheless, they broadly agree in indicating a mean total food "intake" level of something like 2,000–2,100 calories per capita per day (excluding alcoholic beverages), with cereals and roots contributing 70–85 per cent of the total.[11] Allowing 10–20 per cent for loss and waste between the "retail" and "intake" levels (including household storage losses), the per capita net supplies or consumption at the "retail level" would be 2,200–2,600 calories, with root and cereal consumption accounting for 1,550–2,200 calories.

In the absence of better information, these figures are here taken as a rough benchmark for judging the diverse aggregate calorie levels for roots and cereals shown in Table 1. Obviously, the two United States Department of Agriculture calorie ranges fit best with the criterion figures; and, although mainly higher, the census range also shows a substantial overlap. The outstanding deviate is the Prest and Stewart range, more than twice as high. Only one conceivable condition could justify the Prest and Stewart crop estimates—current underestimation of the Nigerian population by roughly 100 per cent! Since this is outside the range of probabilities worth considering, the Prest and Stewart crop figures can be discarded. The remaining root and cereal consumption aggregates in Table 1 overlap each other and also the so-called "criterion range"; and, in view of all of the uncertainties that remain, no confident choice can be made between them. On the other hand, the top half of the census-implied aggregate appears unrealistically high, suggesting that one or more of the assumptions underlying Table 1 is wrong, or that some of the census crop figures exaggerate the harvested output. The better fit of the Department of Agriculture calorie total with the "benchmark" does not necessarily mean that the Department's cereal and root production figures are "good," but merely that its "judgment adjusted" figures were probably derived as residuals from a Department balance sheet based on a benchmark and untested assumptions similar to those used in Table 1.

5. *Only a few conflicting scraps of evidence exist regarding the quantities of other foods produced in Nigeria: this further increases the guesswork required for the construction of any Nigerian food balance.* Even in the 1950/51 agricultural census no attempt was made to collect data on such important domestic foods as palm-oil fruit, bananas and plantains, locust beans, baobab nuts, shea-butter nuts, tamarinds, or other tree crops (*24*, pp. 8–9). And although a livestock count was included in the census, the results were so discouraging that

[11] Since most of the data reported by Nicol refer to "adult diets" only, these have here been converted to approximate per capita figures on the basis of the population structure reported in the 1952/53 census.

they were discarded: as compared with an actual census count of 4,100,000 cattle, preference was expressed for an "opinion" figure of 6,000,000 (*24*, p. 43), which in turn appears conservative compared with the 1948 Livestock Mission estimate of "not less than 7,000,000 or 8,000,000" (*33*, p. 67). Similar or greater uncertainties exist about Nigerian production and consumption of peanuts, pulses, and other vegetables and fruits, particularly the many types of green leaves and wild seeds, nuts, and fruits collected for food. Such collected foods and also fish and game are never included in agricultural censuses or annual agricultural statistics, and all too often are also omitted from or underestimated in dietary surveys—this despite their significant contributions of protein, calcium, and vitamins to the diets of many underdeveloped countries (*34*, p. 35; *35*, p. 47; *25*, pp. 109–10, 115–16). Clearly then, the construction of any Nigerian food balance must be based on much sheer guesswork; and reported balance sheet quantities for individual foods and food groups should be regarded with the greatest skepticism. This means, of course, that the still more uncertain nutrient calculations cannot be trusted except in terms of ranges so wide as to be virtually meaningless.

6. *Finally, regional differences in Nigerian food consumption are so great that even a perfect national balance sheet would seriously misrepresent the dietary pattern of the majority of the Nigerian population.* The available dietary surveys indicate that the great bulk of the cereals shown in the national balance sheet are eaten by people in the North; that the still larger quantities of manioc, yams, and cocoyams contribute only slightly to Northern diets and are eaten mainly in the South and East. They indicate, too, that diets in the North are higher in calories as well as in protein. Such regional differences mean that national average "consumption" figures for Nigeria are essentially meaningless, even with respect to dietary patterns, to say nothing about the more questionable nutrient levels.

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The difficulties and defects of food production estimation and balance sheet construction outlined for Nigeria are broadly representative of the problems encountered in all underdeveloped countries. A primary and important difference is that for most low-income countries, underestimation of production, not overestimation, appears to be the chief problem. Moreover, unlike Nigeria, many underdeveloped countries have no independent official production data, or none that warrant serious consideration; this is true even of a number of countries that provide FAO with annual "production" figures. For subsistence crops, such so-called "production" figures are often derived by first making rough guesses about per capita consumption and then multiplying these by currently accepted population figures, with added questionable allowances for non-food use, waste, and trade. To call such guesses "production estimates" is at best semantic fiction, at worst, actual falsehood; to derive residual "consumption" estimates from them is farcical—the more so if the original population figure is subsequently revised in line with new census information, without corresponding revision of the "production estimates" based on it. This now appears likely to happen for Ghana, whose reported "production" figures have had little or no statistics-collecting

base and whose 1960 population count turned out 34 per cent higher than had been expected.

V. QUALITY, USES, AND IMPROVEMENT OF SUPPLY AND CONSUMPTION DATA

The preceding illustrations indicate that national food supply and consumption estimates differ sharply in nature and quality for different countries, different commodities, and different nutrients. It is now time to attempt some broader generalizations on this subject and on the use and possible improvement of these estimates.

First, there are four common concepts or measures of food consumption that need to be differentiated: (1) "net availability" or "net supplies" of food at the so-called "retail level"—the balance sheet consumption measure that includes not only food delivered to retail outlets and restaurants, but also food bartered, given away, or immediately eaten or taken to producers' homes after harvesting; (2) consumption defined as the food purchases of representative families—a budget study approach; (3) consumption defined as the "food prepared" for eating—one of several closely related dietary survey measures; and (4) "food intake," referring to food actually eaten (i.e., with "plate waste" deducted). From one to another of these four levels or stages of consumption, significant loss and waste occurs, so that the raw data from different types of consumption studies are inherently incomparable.

Second, agricultural production (the most important element in most national food balances) appears to be more frequently underestimated than overestimated in official statistics. Incomplete coverage, whether of crop areas or crops, is characteristic of the agricultural statistics of practically all countries; but it is relatively small for most highly developed countries, whereas it is disturbingly great for many underdeveloped nations, especially for those with scattered, nonhomogeneous, primitive populations and rudimentary systems of transport (*21; 21A*). Such crop reporting deficiencies are much greater for subsistence crops (including home gardens) than for commercial crops, greater for minor than major crops, and greater for secondary successive and mixed crops than for single primary crops. Only in countries heavily dependent on manioc is there evident a common tendency toward *over*estimation of the harvested area and sometimes the harvested production of a staple food crop. Even in these countries the total area under manioc and the total "potential" supply may not be overestimated. As for yields per acre, *under*reporting appears to be quite common in low-income countries, where taxes are often tied directly or indirectly to farm output; on the other hand, *over*estimation is found in some countries, notably (1) the few which employ preharvest sampling methods without appropriate adjustment for later losses, and (2) those whose government officials fabricate or "adjust" yield and production figures primarily for the purpose of impressing either the voting public or their own superiors. In general, it can be said that the official food production data for low-income nations have very large margins of error, with underestimation probably the most common weakness.

Third, national food supply and consumption estimates rarely reflect the full

degree of underestimation or overestimation found in the corresponding national production data. This is because consumption estimates typically include substantial "judgment adjustments." Since the data for the more prosperous countries are subject to considerable cross-checking, little scope remains for any estimator to "adjust" them more or less arbitrarily to conform with his own personal views. For underdeveloped, low-income countries, on the other hand, the opposite is the case: the official production, utilization, and even population data may be so questionable, and the pittance of additional marketing and consumption evidence so fragmentary and localized that per capita consumption estimates for these countries are heavily dependent on sheer guesswork. It is certainly not surprising to see FAO and United States Department of Agriculture "estimates" of fruit and vegetable consumption in a given low-income country differ by 50, 75, or even 100 per cent; yet the calorie estimates of both are almost certain to fall within the range 1,900–2,500 calories per capita per day, and are not likely to differ by more than about 300 calories or 15 per cent. This is primarily because consumption estimators have come to regard a daily calorie range of 1,900–2,500 as "expected" for low-income countries, with the lower portion of the range applicable to populations in warm climates, who are relatively short and light in body weight, and/or who are envisaged (rightly or wrongly) as chronically "hungry" or inactive.[12] Thus do assumed "calorie requirements" and preconceived ideas of nutritional status influence estimated food availabilities and associated production adjustments!

Fourth, national food balance estimates are at their worst when constructed for individual years and accepted as evidence of year-to-year changes in consumption. Only the largest indicated annual changes, say 20 per cent or more, can be relied on as reflections of actual variations in food consumption in most countries, and even these only as indicators of the direction, not the magnitude, of change. There are many reasons for this, of which three deserve emphasis. (1) The concept of a 12-month supply of food is artificial and misleading, particularly for the warmer countries, where planting and harvesting take place in practically every month and where the failure of a major crop may be partly compensated for by unusually heavy plantings and consumption of later secondary crops, as well as by the world-wide practice of reducing waste and "invisible" stocks. (2) The customary use of *calendar-year* or *July-June* trade data for all food products listed in an annual balance sheet (regardless of differing production years for different foods) further distorts the derived annual consumption figures of those foods for which imports or exports are substantial. (3) Estimates of food production, stocks changes, and non-food use and waste are all much less reliable and much more distorted by timing irregularities and by the "opinion adjustments" of individual estimators in single years than on the average over several years; and unreported stocks changes, which may be very important in single years, shrink in significance as the number of years increases.

Fifth, estimates of trend changes in national food supplies or consumption can be no better than the food statistics on which they are based. This means

[12] Agreement is also promoted by the tendency for estimators to be influenced by previous "estimates," whether made by their own organization or by other agencies, a tendency particularly pronounced when the available objective evidence is most scanty.

that trend estimates that rest on data for only two or three single, time-separated years may be misleading even as to direction. It means, too, that trend estimates for low-income countries are usually much less valid than those for highly developed countries. And it means, further, that estimates of trend changes over very long periods are likely to be less trustworthy than over shorter periods for which agricultural production and population statistics are likely to be more comparable.

In appraising the consumption trends implicit in FAO and United States Department of Agriculture food balances (e.g., *7–8B; 39,* pp. 245–52; *14–18A; 27*) two pitfalls are to be avoided: (1) incomparabilities in the production data owing to changes in statistical coverage of producing areas and/or in methods of crop and livestock estimation; (2) incomparabilities in the assumptions and "judgment approximations" made by different estimators in different years. Only if estimates for successive periods are based on adequate and comparable (or comparably adjusted) production data and on consistent, fact-based approximations of non-food use and waste can the indications of trend be taken seriously. Even then, each of the periods compared must represent what are frequently called "normal peacetime conditions," i.e., not characterized by continuing unusual crop weather (like the 1933–37 North American drought), or by wartime or early postwar food shortages, temporary government price and marketing controls, or international food allocations that encourage under-estimation of production.

The consumption trends of rapidly developing low-income countries are the most likely to be seriously distorted. This is due partly to their poorer food statistics, partly to conflicting tendencies directly associated with economic growth. On the one hand, such countries usually attempt to improve their agricultural statistics, extending coverage to areas, crops, and animal products previously covered inadequately, if at all; and sometimes (fortunately, thus far rarely) they adopt unadjusted "biological yield" methods of sampling. These two factors artificially exaggerate the true upward trend of food output. On the other hand, the broadening shifts in dietary patterns normally associated with rising incomes operate in the opposite direction—toward under-stating upward trends. Such shifts are likely to mean a decline in per capita consumption of the basic foods most fully reported in official production statistics (e.g., cereals), and an increase in consumption of the more expensive foods most commonly underreported in such countries (animal products, fruits, and vegetables). These complex, conflicting developments may result in some countries in statistical exaggeration of the true upward trend of consumption, and in other countries in statistical understatement of the real increase.

Sixth, national food balances can usually be trusted to indicate the most conspicuous differences in the food supply patterns of different countries; but they cannot be trusted to indicate lesser differences of this kind, nor to measure national differences in supply or consumption levels. Specifically, such figures usually correctly show whether the hypothetical "average person" of a given country customarily consumes much or very little meat or milk as compared with "average persons" in other countries; whether the specified country depends very heavily or very little on the typical "cheap foods"—cereals and major starchy roots and

tubers; whether wheat, rice, or some specified cheaper grain is the dominant cereal; and what kind of starchy roots and tubers are most common. Yet this is about as far as international comparisons of national food supply patterns can properly be carried if they are to extend beyond the 15 to 20 countries with "highly developed statistics."

Seventh, for many low-income countries the national average pattern of consumption is practically meaningless, because it represents a composite of several distinctly different types of diets consumed by different subgroups of the population, e.g., regional subgroups in Nigeria, racial subgroups in South Africa, etc. The best information on such subgroup diets and the best checks on national food balance data come from good dietary surveys. In the past, however, most dietary surveys have been seriously inadequate and often misleading: they have been limited to small and unrepresentative samples of the population, frequently undescribed as to family composition, body size, weight, activity, health, and/or income level; they have been incomplete as to food coverage, often omitting or underreporting consumption of alcoholic beverages, wild fruits, leaves, seeds, and herbs, foods consumed outside the family dwelling, and even home-produced foods (if based on budget studies); they have not taken adequate account of varying seasonal patterns of consumption (particularly pronounced in underdeveloped areas); and sometimes they have been intentionally designed and timed to provide information about the food consumption of especially vulnerable population groups in years characterized by unusual food shortage. These inadequacies have been most marked in the very countries for which good dietary surveys are most needed—the low-income countries whose national food production statistics are most untrustworthy. Nor does this situation seem likely to change in the near future, since "good" dietary surveys require highly trained native interviewers, heavy expenditures (in most instances), and a degree of understanding cooperation from sampled families that is rarely obtainable in low-income countries.

Eighth, since national food supply and consumption estimates at the "retail level" are often compared improperly with estimated nutrient requirements at the "intake level," it is important to note that substantial national differences in nutrient losses between the two levels are disregarded. There is no question that nutrient losses and waste beyond the "retail level" vary markedly from country to country, from commodity to commodity, from year to year (depending mainly on weather conditions and crop quality), and from times of food shortage to times of plenty. They are probably greatest in high-income countries like the United States, where heavy meat consumption is associated with heavy waste of meat fat, where extensive restaurant and institutional feeding increases "plate waste," and where customary labor-saving practices and family cooking habits combine to maximize waste of "leftovers." Such losses are probably at a minimum in frugal, low-middle-income countries like Japan, where storable cereals and pulses are dominant foods, and where most retail establishments and households have well-supervised, though modest storage facilities. In between these extremes come the more primitive, tropical countries heavily dependent on root crops, plantains, and maize; not only do such foods deteriorate rapidly after harvest in hot, moist climates, but some of the less desirable, like manioc, may be so

amply available that they are wastefully prepared for consumption in producing areas.

One might guess that calorie losses beyond the "retail level" vary from 5 to 10 per cent of the net total in some countries to more than 20 per cent in others. Yet such national differences and uncertainties are entirely disregarded by FAO and United States Department of Agriculture estimators, who unquestioningly employ a uniform 15 per cent allowance for such losses (*7A; 36*). This unrealistic procedure partly accounts for the substantial hidden margins of error in existing estimates of national calorie and protein "requirements" as calculated at the so-called "retail level." And it raises additional questions about the validity of FAO's precise "calorie requirement" estimates—e.g., 2,230, 2,250, and 2,270 calories per capita per day for the Philippines, India, and Ceylon, respectively; and 2,440, 2,450, and 2,460 calories, respectively, for Venezuela, Brazil, and Cuba (*7A*, p. 22). It is even more disturbing, of course, to note that a recent United States Department of Agriculture publication avoided such "precise" national requirement figures only by averaging several to obtain absurd calorie "reference standards" for such huge geographical areas as Africa, the Far East, Latin America, etc.; and that the Department then used these so-called "standards" to calculate the "calorie deficit" or calorie adequacy of the estimated food supplies of all individual nations within those respective areas—even of nations differing markedly in "requirement" characteristics from the corresponding regional standards (*36*). This meant that a number of FAO's nationally calculated "calorie requirement" estimates would classify as "deficit calorie levels" under the Department's new regional or continental "reference standards"!

Ninth, valid estimates of chronic national "food deficits" or "nutritional gaps" simply cannot be derived from comparisons of estimated national food supplies, on the one hand, with estimated national nutrient requirements, on the other. This would be true even if the requirement estimates were perfect (and they are far from perfect). If for no other reason, it would be true because of the many deficits and deficiencies in the national food supply estimates already described. And even if these supply figures were also perfect, it would still be true for many underdeveloped countries characterized by large *regional differences* in food consumption patterns, usually associated with regional differences in climate and with rudimentary marketing systems that inhibit interregional exchanges. Even within homogeneous food-producing regions, the incidence of undernourishment and/or malnutrition may vary markedly from district to district, from low-income to higher-income classes, and from one racial, tribal, religious, or other cultural subgroup to another. It is possible to study such subgroup and regional differences and to appraise the general nutritional status of any given country. But this can be done only if sufficient money, time, and necessary skill are devoted to coordinated medical-and-dietary surveys of representative population groups. It cannot be done by comparing estimated national food supplies with estimated national requirements.

Finally, it is important to reconsider the object of national food supply and consumption estimates, to improve their quality and increase their usefulness, and to discourage misuse and misinterpretations. Formal food balance construction and comparison virtually began with wartime efforts to appraise conditions

in a few highly developed countries and was later taken up by FAO, apparently largely for the purpose of publicizing and magnifying the importance of its own continuing campaign against hunger and malnutrition (*7*, p. 5; *7A*, pp. 1–2). Hence, there has been undue and misleading emphasis on the significance of national food *levels*, while other more appropriate and more promising applications of the balance sheet technique have been neglected. Chief among these is the improvement of statistics of national food production and utilization. Others, hardly less important, are (1) the measurement of changes over time in the *pattern* of national food consumption, and (2) the estimation of changes in the contributions of the agricultural sector and primitive food processors to the gross national product (national income) of individual countries. Although not yet widely used or appreciated, these are two of the best empirical measures of economic development.

The following specific suggestions are offered for making food balance sheets and consumption estimates more useful for these particular purposes.

1. The methods employed by each country in estimating its food production should be fully described (in greater detail than is now available) in frequent new editions of FAO's *Methods of Collecting Current Agricultural Statistics* (*21*), with interim changes noted in annual supplements. The repeated collection and publication of such information would call the attention of governments to the importance of improving their own methods of estimating food crops and livestock products and would give users of the data much information that is urgently needed for economic analysis of underdeveloped countries.

2. In all international statistical tables, special symbols should be used to indicate estimates of "acceptable" *vs.* "unacceptable" quality. A first step in this direction has been taken by the United Nations Statistical Office in reporting population data (*37*).

3. Similarly, a special symbol should be used to indicate breaks in comparability between successive estimates differing with respect to coverage, method of estimation, or some other element. For this purpose, the United Nations Statistical Office has recently employed a bar—horizontal to designate incomparability within columns, vertical to indicate incomparability between columns (*38*).

4. Food balance sheets should give as much information as possible to users, rather than presenting (as they now do) an arithmetical façade misleadingly suggestive of sound statistical balance—a "balance" usually attained only by personal "adjustments" of officially reported production data, which are not presented. This does not mean that research-based "judgment adjustments" of official estimates should be avoided, but rather that the user should be allowed to see both the official figures and the adjusted figures and should be told on what basis the particular adjustments were made. In addition, each balance sheet should have a "balancing item" column. This would permit the best objective estimates of production and utilization to be published as derived, with the "balancing item" showing the net discrepancy.

5. All "judgment approximations" and "adjustments" ought, strictly, to be expressed in terms of probable ranges rather than single figures; for

reasons of space, however, single midpoint figures in the tables, with attached footnotes indicating the estimated percentage ranges regarded as "reasonable" would be an acceptable substitute.

6. Table symbols, balancing items, designated "adjustments," and estimates expressed as ranges serve only to warn, not inform, the user unless detailed explanatory notes are appended. In recent years a few international organizations have taken the lead in providing users of their statistical tables with more of the information needed for proper interpretations: e.g., the International Monetary Fund's *International Financial Statistics* and the United Nations *Supplement to the Monthly Bulletin of Statistics: Definitions and Explanatory Notes.* Both FAO and the United States Department of Agriculture, however, appear to have moved in the opposite direction—toward reducing the information supplied with their international tables: the most fully annotated balance sheets of FAO appeared in 1949 (*8*), of the Department of Agriculture in 1951 (*14*). What is needed is more factual information about the origin, coverage, basis, and quality of the data, the factors responsible for incomparabilities, and the magnitude and basis of "judgment adjustments."

To sum up. It is time to make clear to all users of national food supply and consumption estimates that current international tables present a mass of incomparable "estimates" (*7A; 15–18; 36*) ranging all the way from valueless personal guesses to cross-checked estimates of high quality. It is time for the originating agencies to stop showing side by side, undescribed, such extremely different and incomparable figures—time to substitute for the invisible motto, *caveat usitator* (let the user beware), the more appropriate *juvetur usitator* (let the user be helped). It is time to give up the unscientific false concept that the nutritional status and food deficits of underdeveloped countries can be appraised by comparing inadequately based food consumption "estimates" (partly guesses) with estimates of "nutrient requirements" (also partly guesses). Finally, it is time to concentrate on checking and improving the "underdeveloped" food statistics of the less developed countries and on using the improved data for purposes more suitable than those currently stressed.

CITATIONS

1 M. K. Bennett, "Per Capita Wheat Consumption in Western Europe," *Wheat Studies of the Food Research Institute*, March 1935.

2 Hans v. d. Decken, *Entwicklung der Selbstversorgung Deutschlands mit landwirtschaftlichen Erzeugnissen* (Germany, Reichs— und Pr. Min. für Ernährung u. Landwirtschaft, *Berichte Uber Landwirtschaft*, N. F. Sonderheft 138, 1938).

3 Benedetto Barberi, "Indagnine statistica sulle disponibilita alimentari della popolazione Italiana dal 1922 al 1937," *Annali di Statistica* (Italy, Inst. Cent. di State.), Ser. VII, Vol. III, 1939.

4 Fernand Baudhuin, "L'Alimentation de la Belgique: Les données du problème en cas de blocus," *Bull. l'Inst. Rech. Écon.* (Univ. Cath. de Louvain), Aug. 1939.

5 U. S. Dept. Agr., War Food Admin., *Food Consumption Levels in the United States, Canada and the United Kingdom: A Report of a special Joint Committee set up by the Combined Food Board* (April 1944); and *Second Report of a special Joint Committee set up by the Combined Food Board* (Dec. 1944).

6 R. J. Hammond, *Food: The Growth of Policy* (History of the Second World War, U.K. Civ. Ser., 1951).

7 Food and Agriculture Organization of the United Nations (FAO), *World Food Survey* (1946).

7A ———, *Second World Food Survey* (1952).

8 ———, *Food Balance Sheets* (April 1949).

8A ———, *Food Balance Sheets, Second Issue* (1955).

8B ———, *Food Supply, Time Series* (1960).

9 Werner Klatt, "Comment on the FAO World Food Survey" (mimeo., n. d. [1947?]).

10 M. K. Bennett, *The World's Food* (New York, 1954).

11 U.S. Dept. Agr., Bur. Agr. Econ., *Consumption of Food in the United States, 1909–48* (Misc. Pub. No. 691, Aug. 1949).

11A ———, Agr. Mktg. Serv., *Consumption of Food in the United States, 1909–52* (Agr. Hdbk. 62, Sept. 1953).

12 ———, Bur. Agr. Econ., *Consumption of Agricultural Products* (processed, 1941).

13 ———, Off. For. Agr. Relations, *World Food Situation 1946* (Feb. 1946), and subsequent annual issues.

14 ———, *Agricultural Production and Food Consumption in Western Europe* (Agr. Mono. 10, July 1951).

15 ———, For. Agr. Serv., *Food Balances in Foreign Countries: Part I: Estimates for 16 Countries of Western Europe* (FAS-M-100, Oct. 1960).

16 ———, *Food Balances in Foreign Countries: Part II: Estimates for 12 Countries in the Far East* (FAS-M-101, Oct. 1960).

16A ———, *Food Balances, Consumption Year 1955–56 for Countries in South Asia, East Asia and Oceania* (mimeo., Oct. 1957).

17 ———, *Food Balances in Foreign Countries: Part III: Estimates for 20 Republics of Latin America* (FAS-M-104, Nov. 1960).

17A ———, *Food Balances, Consumption Year 1954–55 for Twenty Latin American Republics* (prepared for the Internatl. Coop. Admin., mimeo., May 1957).

18 ———, *Food Balances in Foreign Countries: Part IV: Estimates for 28 Countries of Africa and Western Asia* (FAS-M-108, Feb. 1961).

18A ———, *Food Balances, Consumption Year 1953–54 for Turkey, Iran, Iraq, Lebanon, Syria, Israel, Jordan and Egypt* (prepared for the For. Op. Admin., mimeo., Dec. 1954).

19 ———, Bur. Agr. Econ., *The Agricultural Estimating and Reporting Services of the United States Department of Agriculture* (Misc. Pub. 703, Dec. 1949).

20 ———, Agr. Mktg. Serv., *Supplement for 1956 to Consumption of Food in the United States, 1909–52* (Supplement for 1956 to Agr. Hdbk. 62, Sept. 1957).

21 FAO, *Methods of Collecting Current Agricultural Statistics* (March 1955).

21A ———, *Report on the 1950 World Census of Agriculture, Vol. II: Census Methodology* (1958).

22 ———, *Handbook for the Preparation of Food Balance Sheets* (April 1949).

23 J. M. Cassels, "Objects and Scope of the Conference," *Conference on Food and Agricultural Statistics* (Emergency Econ. Comm. for Europe, mimeo., London, Sept. 17–22, 1945).

24 Nigeria, Dept. Stat., *Report on the Sample Census of Agriculture 1950–51* (1952).

25 W. O. Jones, *Manioc in Africa* (Stanford, Calif., 1959).

26 A. R. Prest and I. G. Stewart, *The National Income of Nigeria: 1950–51* (Gr. Brit., Col. Off., 1953).

27 U.S. Dept. Agr., For. Agr. Serv., *Food Balances, 1953, for Angola, Belgian Congo, Kenya and Nigeria* (mimeo., 1955).

28 R. Galletti, K. D. S. Baldwin, and I. O. Dina, *Nigerian Cocoa Farmers: An Economic Survey of Yoruba Cocoa Farming Families* (Nigerian Cocoa Mktg. Bd., Oxford, 1956).

29 B. F. Johnston, *The Staple Food Economies of Western Tropical Africa* (Stanford, Calif., 1958).

30 K. E. Hunt, *Colonial Agriculture Statistics: The Organization of Field Work* (Gr. Brit., Col. Off., 1957).

31 B. M. Nicol, "Nutrition of Nigerian Peasant Farmers, with Special Reference to the Effects of Vitamin A and Riboflavin Deficiency," *Brit. J. Nutr.* (Cambridge), Vol. III, No. 1, 1949.

31A ———, "The Nutrition of Nigerian Peasants, with Special Reference to the Effects of Deficiencies of the Vitamin B Complex, Vitamin A and Animal Protein," *Brit. J. Nutr.* (Cambridge), Vol. VI, No. 1, 1952.

32 ———, "The Calorie Requirements of Nigerian Peasant Farmers," *Brit. J. Nutr.* (Cambridge), Vol. XIII, No. 1, 1959.

33 Thomas Shaw and Gilbert Colville, *Report of Nigerian Livestock Mission* (Gr. Brit., Col. Off., 1950).

34 F. R. Irvine, "Supplementary and Emergency Food Plants of West Africa," *Econ. Botany,* Jan.–March 1952.

35 W. R. Bascom, "Yoruba Food and Cooking," *Africa* (Oxford), Jan.–Apr. 1951.

36 U.S. Dept. Agr., For. Agr. Ser., *The World Food Deficit: A First Approximation* (March 1961).

36A ———, Econ. Res. Serv., *The World Food Budget 1962 and 1966* (October 1961).

37 United Nations, *Demographic Yearbook 1959* (New York, 1959).

38 ———, *Statistical Yearbook 1959* (New York, 1959).

39 FAO, *Production Yearbook 1959* (1960).

40 ———, *Food Composition Tables—Minerals and Vitamins for International Use* (March 1954).

41 U.S. Dept. Agr., *Composition of Foods Used in Far Eastern Countries* (Agr. Hdbk. 34, March 1952).

42 B. S. Platt, *Tables of Representative Values of Foods Commonly Used in Tropical Countries* (Gr. Brit., Med Res. Coun., Spec. Rep. Ser. 253, 1945).

43 FAO, *Trade Yearbook 1959* (1960).