SOME SUGGESTIONS FOR QUANTIFYING THE MALTHUSIAN DILEMMA

By

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On probably no subject of importance today is more misinformation published than the world food supply situation. Depending on where we choose to look, we can find an "authority" to support the contention that the world has never been so well fed, or, conversely, that if things are bad now they are sure to grow even worse. Thus, on one extreme, we have such people as the Paddock brothers telling us that not only is world starvation imminent but that it is scheduled for 1975. At the other extreme are persons such as Colin Clark who in his two most recent books has gone almost so far as to deny even the existence of a world food problem. No less satisfying are the pronouncements of the FAO, the USDA, and, most recently, the President's Advisory Committee - all of whom set forth what we might call the conventional wisdom on the subject. This conventional wisdom is vague and overburdened with cliches for very good reason. The statistical evidence on which it draws permits little else. For much of the world, statistics on food matters are few, conflicting and often erroneous in the extreme. Indeed, it is no exaggeration to say that there is not a single low-income country in the world for which a reliable set of food production data exists.

In support of the last statement I would like to cite three examples. The first is from Mexico, a country which is widely presumed to have experienced rapid agricultural growth in recent years. The principal

crop of Mexico is maize. It occupies over half the cultivated area and contributes about 50 per cent of total food calories. Statistics for 1959/60, the most recent census year, indicate that maize production was then of the order of 5.6 - 5.7 million metric tons. In 1949/50, ten years earlier, the Census reported production to be of the order of 4.5 million tons, whereas the Ministry of Agriculture maintained it was only 2.9 million tons. Thus, you can have it either way. Depending on which "official" figure is accepted, you can prove either that Mexican maize production more than doubled during the decade of the 1950's, or did not even keep pace with population growth.

Equally confusing is the situation in India -- the home of one-seventh of mankind and, unfortunately, of even more than one-seventh of our agricultural statisticians. There has existed since the early 1950's a major controversy among Indian economists as to the level of food grain output. One set of estimates, that prepared by the Ministry of Agriculture and derived from acreage and crop cutting figures, suggests that grain production is now normally of the order of 80 million long tons. Estimates based on extrapolations of consumption data, mainly information collected during the nation-wide National Sample Surveys, on the other hand, indicate that it must be nearer to 90 or even 100 million tons. Analysis of the underlying evidence points to the 80 million ton figure as the more nearly correct one. But the same analysis also suggests that given the statistics now available, it would be a grave mistake to draw any firm conclusions about the rate of agricultural progress in India.

An even more chaotic situation obtains in Nigeria. Nigeria is Africa's most populous country, but by what margin is just about anybody's guess.

The 1952/53 Census counted 30.4 million persons, and, on the assumption that the rate of growth was 1.86 per cent per annum, the population in mid-1962 was officially put at 36.5 million. A special census in November of the following year returned the figure of 55.7 million, 20 million in excess of what had been anticipated. Politics are involved, and the debate as to where the true figure lies continues. Workers at the University of Ibadan say it's probably in the neighborhood of 45 million.

Estimates of Nigeria's cattle population diverge even further -- all the way from 4.3 to 15 million head.

The neglect of the food sector in the statistical series of most underdeveloped countries mirrors the semi-subsistence character of this segment of the economy, the difficulties of agricultural data collection, and, until recently, the lack of concern in official circles with food production and consumption. Colonial governments were assiduous data collectors, but commonly limited their activities to such enumerations as population counts, cadastral surveys, and tallys of international trade and government revenue. The interest of a colonial administration in such matters is obvious. But the collection of information from many scattered agricultural units was difficult at best and hardly seemed worth the pain. Despite the myriad of impressively bound statistical bulletins, national income accounts, and the like now published, the situation persists. In virtually every underdeveloped country the reporting of crop yields, harvested acreage, home consumption, marketings, and similar features of the food sector is still woefully inadequate.

Such a situation cannot, of course, be allowed to continue indefinitely. To be sure, it really doesn't matter whether the Paddocks and similar

people base their propaganda on fact or fiction. No harm can come from efforts to stimulate food production. But if planning is to proceed on a rational basis in advanced, as well as low-income, countries, it is urgent that individual food economies be quantified with some precision.

Ideally, this would call for priority to be given throughout the tropical world to the establishement of effective statistical reporting systems. But such systems are expensive in terms of both money and trained manpower. It would, I think, be unrealistic to expect much for many years to come.

This gloomy outlook need not, however, be occasion for despair. Rather, I think it should be taken as a challenge to utilize effectively such information as is available. And there is a great deal of scattered and unorganized material which, while not primarily concerned with food production and consumption, can be brought to bear on such questions. Agricultural research results, reports of administrative officers, nutritional surveys, trade statistics, population data, household budget surveys, and sociological, anthropological and geographical studies all contain information which can assist in establishing trustworthy food supply estimates. The problem is one of collecting and organizing this material in such a way that it can be analyzed and used to build up a reliable picture of the food economy.

There are three major tools which can be used to this end. They are the compilation of regional or national food balance sheets, the employment of consumption surveys and other indicators of utilization to estimate aggregate consumption, and the use of nutritional yardsticks to test the consistency of the results. None of these are new approaches. All have

been applied in the United States and Western Europe for a variety of purposes, including the retrospective construction of time-series data. In fact, the food balance sheet technique has been widely used in attempts to quantify the food economies of underdeveloped countries -- unfortunately, with not as much discretion as we would like. Both the FAO and the USDA have published balance sheets for most countries of the world. In a series of penetrating and devastating analyses of these publications, Helen Farnsworth and M.K. Bennett have pointed out the dangers of putting together estimates of national production and consumption hastily. If such exercises are to be at all valid, there is a need, a critical need, for painstaking scrutiny of the mass of underlying evidence and for cross checks and corroboration from independent sources.

The strategy of analysis I propose is outlined in the attached diagram. It is essentially a circular one. Figures of unknown reliability are fed into a framework wherein they can be distilled, refined and tempered, hopefully to be discharged as, if not a precise, at least a definable statistical set. I fully recognize that the approach is in no way a substitute for reliable and continuous data collection, but it does provide a legitimate summation of current evidence, and a starting point for future work.

A trinity denoted as the Consumption Approach, the Supply Approach, and the Consolidated Account form the cornerstones of this interlocking scheme. The Consumption Approach and the Supply Approach represent two independent methods of arriving at estimates of aggregate food availabilities. The essence of the division lies in keeping the two estimates separate, so that they may serve as a basis for independent cross checking.

Were the two approaches fused at an early stage in the analysis, this possibility would be lost and the result would be an undefinable amalgam of two different types of data. As well as built-in checks on each other, the independence of the Consumption and Supply Approaches also provides some clues as to the magnitude of error contained in the final Consolidated Account into which they are ultimately combined.

The heart of the Supply Approach is the food balance sheet, the mechanism through which information on production, trade, and disposition is equated in order to obtain an estimate of net quantities available for human consumption. It is important to sound some caveats about the technique. The net supply for human consumption, the final item in the balance sheet, is a residual figure and hence influenced by all the errors and omissions contained in each of the individual components of the equation. Reliability for the estimate of net supply can be claimed only if accurate information exists for all the components. This does not obtain even in nations with the best statistical information. In an underdeveloped economy, it is rare for more than a few of the separate items to be truly trustworthy -- trade data are the principal example. The approach then, can only be treated as a first step toward arriving at more positive conclusions.

By the same token, the estimation of aggregate food absorbtion through the Consumption Approach must also be treated as a preliminary phase of the analysis. The Consumption Approach consists of an effort to construct a reliable picture of national consumption patterns, and draws principally on nutritional surveys, household budget surveys, and other small-scale investigations. It is thus "micro" analysis, as contrasted to the "macro" analysis of the Supply Approach. Evidence of a micro character, although

it may well provide accurate and detailed information for individual persons or households, commonly gives rise to problems in creating a nationally representative picture. The bulk of the micro information available most often relates to minority groups which have received special attention because of their interest to nutritionists, sociologists, anthropologists or other investigators. Much nutrition work is confined to low-income families or particularly vulnerable age groups, such as pre-school children, among whom nutritionists see the most acute dietary problems. Anthropologists frequently investigate the more "interesting" but numerically less significant groups within a society; and household budget surveys are usually restricted to the urban population or industrial workers among whom interest on cost of living, employment, and wages focuses. Still, these materials can generally form the basis of a valid picture of aggregate consumption behavior if pains are taken to interpret them with a great deal of care.

The crux of the whole strategy lies in the meeting of the two independent analyses and in subjecting them to additional weighing and testing in the formation of the Consolidated Account. A key link in the process is the use of nutritive values for individual food items. These conversion factors enable the comparison of aggregate food supplies and utilization to be made in terms of a few common denominators, such as calories or grams of protein available per person per day. For nutritional or medical analyses, the choice of appropriate conversion factors is critical. It is less critical for our purposes. In fact, obtaining an accurate conversion factor is well nigh impossible given the heterogeneity of even apparently simple food commodities, and the lack of information on

local varieties, growing conditions, and milling methods. But since our focus is on the use of such factors as rational weights for assessing aggregates, these problems are not critical so long as the same factors are used in evaluating both the Supply and Consumption Approaches.

Although similarly imprecise, nutritional norms (the so-called "requirements" and "allowances") are also taken into consideration in the preparation of the Consolidated Account. But as such yardsticks can reveal only the grossest of errors -- for example, aggregate daily per capita availabilities of from 2100 to 2500 calories would probably seem acceptable for most tropical countries -- their principal value lies in the bases they provide for establishing ceiling and floor values between which the aggregates can be expected to lie.

An important part of the synthesis in the Consolidated Account is the establishing of judgement intervals around our final estimates, suggesting the range within which they can confidently be asserted to occur. The size of the expected error is as important as the figures themselves. Yet such information is seldom, if ever, published by compilers of aggregate statistics.

Once the Consolidated Account has been established, a new estimate of domestic food production can be derived by putting the balance sheet process into reverse. The probable error in these estimates will naturally be greater than those in the estimates of total food availabilities because any errors in our allowances for non-food uses, wastage, seed, and so-forth will be transferred back. Nevertheless, the final production estimates can be considered much more satisfactory than the original figures used in the Supply Approach, since they will now be consistent with established

aggregate supply and absorbtion and will be bounded by reliable confidence intervals.

The strategy, then, is nothing more than a rational attempt to analyze underdeveloped materials in a manner which will yield the maximum amount of reliable information. Such exercises are by no means unique to food economists or to students of the agricultural sector in low-income countries. They are common to all positive economic research. The search for meaningful statistics and for checking and corroborating research findings is a routine part of all scientific inquiry. In the present context, however, this kind of work demands considerable flexibility and ingenuity. We have found that the exact mechanics of investigation appropriate to one country and one set of problems can be totally unsuited for another. Thus in each of the studies which we have conducted to date, the student investigator has had to break considerable new ground.

Thus far my students and I have completed four such data evaluation studies: one in Malaysia, one in Ceylon, one in Mauritius, and one in Nigeria. The Nigerian study has already been published as a bulletin of the College of Agriculture, and the Ceylon paper is in press. The Mauritius study, which evaluates the broader problem of the validity of the food balance sheet as a parameter of tropical food economies, will be ready for editing in a few weeks. The Malaysia study, which was completed a couple of years ago, is being developed into a book manuscript. We hope this detailed (I might add rather dull) book will serve as a useful case example for other researchers to follow in evaluating and using underdeveloped statistics from other underdeveloped countries.

The approach to data evaluation we have devised allows us to come to

grips with only one of the problems which preclude reliable comments on the world food situation. In guiding these studies, I have been struck by the fact that even if we get fairly trustworthy estimates of food availabilities, country by country, we have precious little in the way of requirements against which to judge them. As their designers freely admit, and as their users just as frequently tend to forget, the various nutritional requirement formulae yield only approximations, and most probably rather poor approximations when applied outside of the advanced countries for which they were originally intended. Allowance of a sort may be made for national differences in body size, in climate, and in age/sex composition. But for energy expenditure, nothing. Tacitly we assume that people in low-income tropical countries expend the same amount of energy as our reference beings in the advanced temperate zone.

This is a critical assumption. Somewhere between 1200 and perhaps 1500 calories per day are needed by the average adult to maintain the vital processes of the body. But beyond that, the activity component is the most significant item determining the magnitude of his food requirements.

It hardly seems reasonable to assume that energy expenditures will be the same around the world. The conventional wisdom has the tropical farmer doing little but sit during much of the year, while his wife seems to be busy from dawn to dusk. Thus what might appear to be an inadequate diet may in reality be quite sufficient because the individual burns few calories. And what might seem by our standards to be adequate, may, in fact, be insufficient when much heavy work is in order.

A variety of explanations have been offered to account for the apparent lethargy of the tropical agriculturalist. These include poor

health, inadequate diet, the fact that a logical response to heat may well be just to sit, and also that a number of economic constraints may dictate a life of comparative inactivity. The validity in particular circumstances of most, if not all of these explanations can hardly be doubted, but beyond such rather trite generalizations we can hardly venture. Surprising as it may seem there is hardly any literature on activity patterns in agrarian, tropical societies. Agricultural economists in low-income countries seem less interested in gathering evidence on basic production phenomena than in devising new schemes to manipulate prices or to foist another cooperative on an unsuspecting peasantry or exchequer. As a result, we must still fall back on the "quest for food" chapters of ethnographic studies -- chapters which lack the precision and detail of preceding ones on sex.

It strikes me that to rectify this situation is a matter of the first order of importance. To this end I would suggest a new avenue of inquiry that would combine with the traditional American farm management survey features of the household budget survey, the food consumption survey, and the physiological survey. The idea would be to determine the energy balance among each of a mixed group of families (from both the consumption and expenditure side) and to relate it to the differing criteria of their economic activities. Recording would cover a full twelve months and involve all members of the household.

Such an investigation, let's face it, would involve no small investment in terms of manpower, money, and time. But compared with the totally new insights that the economist, the nutritionist, and the antropologist would derive from it, this cost would be small indeed. It would also be a

complex undertaking, and it would be idle to pretend that there are not a number of loose ends to be tied up before we are in a position to launch an integrated inquiry.

One such loose end is a short-cut technique for estimating a person's energy expenditure on a daily, weekly, or perhaps longer basis. This no longer presents difficulties in an advanced, temperate-zone environment. In recent years considerable information has become available on the metabolic costs of a wide range of activities and we have a reasonably clear idea about how urban man divides his day. Not so for tropical, agrarian societies -- the main societies in which a food problem is presumed to exist. So far as we can determine, only two energy expenditure/activity studies have been conducted among farming communities in the tropics. Both of these were done in West Africa some years ago and neither was sufficiently broad to provide useful common denominators.

A principal reason for this lack of information has been the near impossibility of obtaining reliable information on energy expenditure. The common practice until very recently was to record the energy costs of specific tasks with a respirometer and then multiply the resulting factors by appropriate time spans. The problems were many. The respirometer can be kept on the subject for only a few minutes, and its presence is hardly conducive to normal behavior. Moreover, time-span recording must be meticulously accurate in order to be useful. And to obtain meticulously accurate time-span data under primitive conditions is probably asking too much of both our subjects and our enumerators.

Recent advances seem to have changed all this. It has been demonstrated that for each individual there is a straight-line correlation

between heart rate and oxygen consumption which obtains for all activities except those that are exceptionally strenuous. Furthermore, advances in telemetry now permit heart rate to be transmitted to a recording device some distance removed by a sender no larger than an ordinary flashlight battery. In other words, it now seems possible to calculate energy expenditure for long periods of time while the individual follows his normal behavior pattern. In the place of the time-span/task approach, it appears that we may be able, with the aid of statistically sound sampling techniques, to substitute an approach to estimating calorie requirements that is quicker, cheaper, and more accurate.

All this is a little outside the field of the economist. However, with the generous assistance of the USDA and Cornell's Latin American Program, we plan to carry out an experimental energy expenditure study in the Caribbean this summer. If our work shows promise, I would hope that several of us here at Cornell might embark cooperatively on the integrated study that I mentioned. Once this study is in hand, I think we will be well on the way to overcoming the methodological difficulties which now preclude our saying much about the magnitude of the world's food problem, both present and future.

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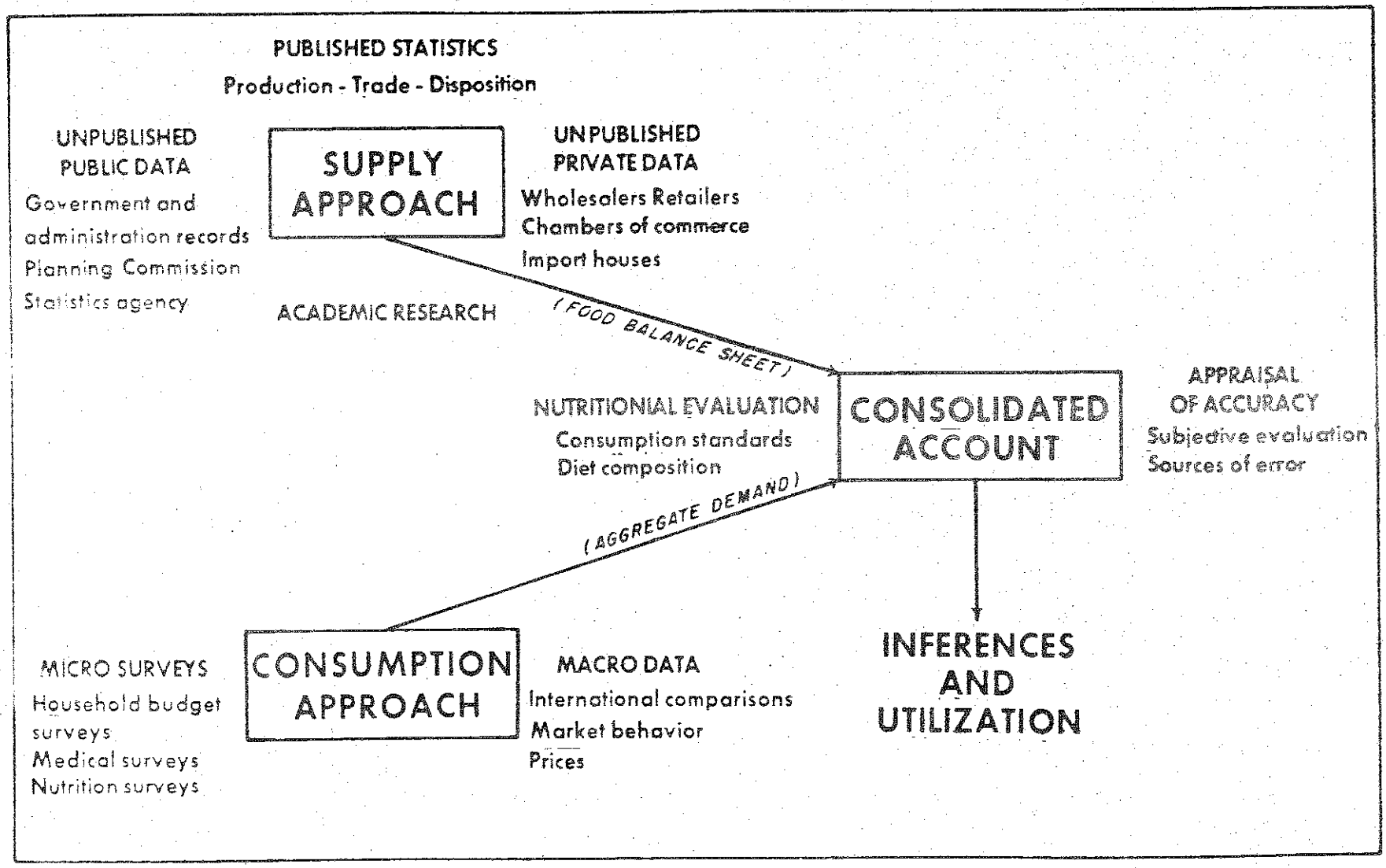
Note. We all learn from our students. In preparing this paper I have drawn heavily on the work, ideas, and words of Don Ferguson, Joe Jogaratnam, Dick Lockwood, Malcolm Purvis, and Emmy Simmons.


PUBLISHED STATISTICS
Production - Trade - Disposition
UNPUBLISHED PUBLIC DATA
Government and administration records
Planning Commission
Statistics agency
SUPPLY APPROACH
UNPUBLISHED PRIVATE DATA
Wholesalers Retailers
Chambers of commerce
Import houses
ACADEMIC RESEARCH
(FOOD BALANCE SHEET)
NUTRITIONAL EVALUATION
Consumption standards
Diet composition
CONSOLIDATED ACCOUNT
APPRAISAL OF ACCURACY
Subjective evaluation
Sources of error
(AGGREGATE DEMAND)
MICRO SURVEYS
Household budget surveys
Medical surveys
Nutrition surveys
CONSUMPTION APPROACH
MACRO DATA
International comparisons
Market behavior
Prices
INFERENCES AND UTILIZATION