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CHANGES IN THE DEMAND FOR FARM PRODUCTS

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IN order to analyse the changes in the demand for farm products they must be divided into food and non-food products.

Non-food products. Demand for these is influenced by two opposing factors. On the one hand *ersatz* products of mineral origin compete with non-food agricultural staple commodities (e.g. textiles). On the other, chemical industries are calling upon agricultural products for raw materials, opening new outlets for agriculture (e.g. cellulose, alcohol, furfural . . . from wood or other plant sources, protein from wood, soya, &c.). This trend is fostered by the fear of further lack of non-renewable resources and by the endeavour to find through chemical research new renewable sources of raw materials. In as much as energy should be found in the future from more direct use of natural renewable forces (e.g. hydro-electric power) or from an abundant supply of new mineral sources (e.g. atomic energy), coal and oil will be increasingly used as raw material in carbon and petrol chemistry and will enter into competition with agricultural commodities used in chemical industries.

It is difficult to forecast the aggregate change in demand for some of the non-food agricultural commodities. It seems that the only valuable indication derives from the fact that any increase in the standard of living should mean a greater increase in expenditure on non-food commodities and services. Such a finding was made in 1857 by Ernst Engel.[1] Studies in a survey of urban groups by the Institut National de la Statistique et des Études Économiques[2] show that when the weekly expenses by consumer unit rose from 3,340 to 12,700 French francs, the proportion spent on food dropped from 65·3 to 38·5 per cent., non-food commodities increased from 13·1 to 22·4, and services from 21·6 to 39·1. Using international comparisons, O.E.E.C. obtained a similar finding.[3] When the *per caput* national income (1950) rose from $388 (Italy) to $1,259 (U.S.A.) the

[1] Engel, *Die Vorherrschenden Generalzweige in den Gerichtsamtern mit Beziehung auf die Produktions- und Konsumtions-Verhältnisse des Königreichs Sachsen 1857*.

[2] Institut National de la Statistique et des Études Économiques, Bull. mensuel de statistique, sup. Jan., Mar., 1953, Paris.

[3] Gilbert et Kravis, *Études comparatives des produits nationaux et du pouvoir d'achat des monnaies O.E.E.C.* O.E.E.C. Paris, 1955.

percentage spent on food dropped from 55·2 to 28·9, while for non-food commodities it rose from 9·3 to 20·9 and for services from 35·5 to 50·2. The findings of these two surveys can be expressed on a triangle chart. When the links between the percentages (*A*, food; *X*, non-food commodities; *S*, services) are studied we find two similar systems of equation.

I.N.S.E.E.

$$\left.\begin{aligned} A+X+S &= 100 \\ 0{\cdot}04A+1{\cdot}63X-S &= 0 \end{aligned}\right\}(1)$$

O.E.E.C.

$$\left.\begin{aligned} A+X+S &= 100 \\ 0{\cdot}17A+2{\cdot}96X-S &= 0 \end{aligned}\right\}(2)$$

To complete the system it is enough to introduce a third relation between the percentage of expenses on *A*, *X*, or *S* and, for example, the national income *per caput*—the total living expenditure or disposable income. Graphically we can obtain a straight line as in diagram 1.[1]

Egon Glesinger proposed a 'wood standard' to express the non food commodities level of consumption.[2] 'The modern science of nutrition has developed standards for measuring human want. By translating food requirements into calories, proteins and vitamins, it has found a common denominator applicable to beef or potatoes, lettuce or ice cream. But what unit can function as a common denominator for the consumption of such disparate necessities as automobiles, books, underwear and houses? The answer is wood, for these and all other commodities involved in a complete standard of living can be made in whole or in major part from the forest.' Pursuing this further he proposed the following schedule in which various standards of living are correlated with various levels of nutrition.

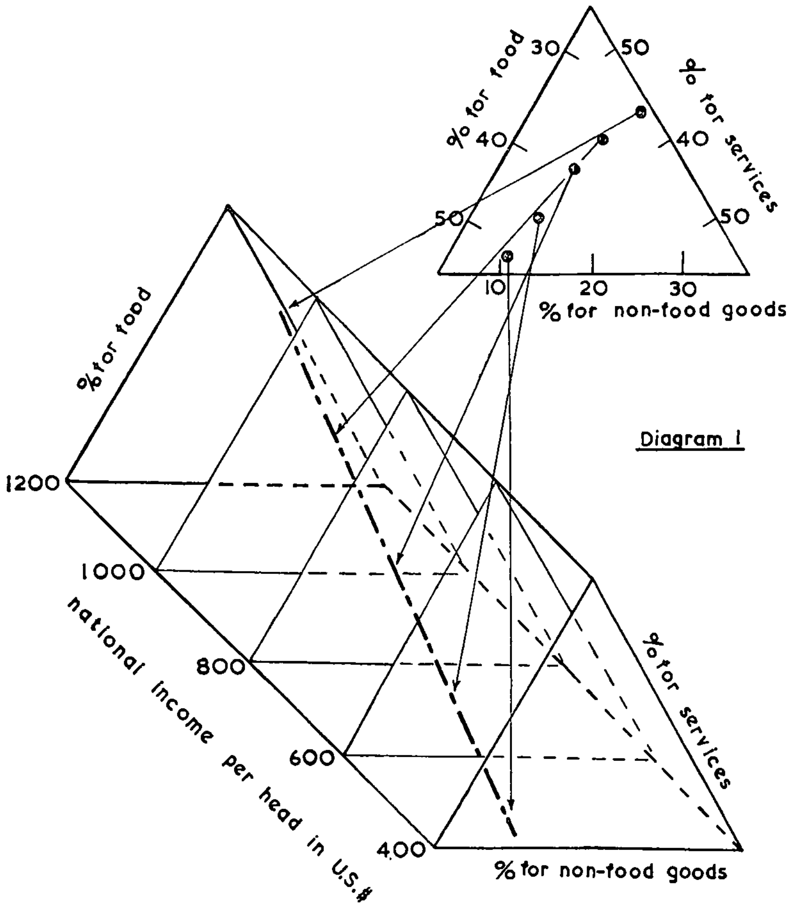
	Nutrition (*calories consumed per day*)	*Standard of living* (*tons of wood per year*)
critical . .	2,000	0·5
adequate . .	2,500	1·5
optimum .	3,000	3·5

Using one or other method of measuring or forecasting the consumption of non-food commodities as an aggregate, our problem is to find what will be the supply of farm products (including forest products as 'the forest is not a mine that eventually will be depleted, but a cropland. *Provided* trees are harvested as a crop and the forest is sustained by proper management, wood will forever yield all the

[1] Cépède et Lengellé, *L'Économie des besoins*, Paris, Juillet, Nov. 1956.

[2] Glesinger, *The Coming Age of Wood*, New York, 1949.

material the human race can conceivably require'[1]), and of non-farm commodities. This problem is not different from that of studying the demand for competing or complementary commodities. 'Schultz proposed comparing the coefficients of variation for the price and



supply ratios for two competing commodities to measure the degree of substitution.[2] If the two items were nearly perfect substitutes, the price ratios would be nearly constant, whereas the supply ratios would be expected to vary considerably. If the two items were complementary, the price ratios would vary more than the supply ratios. Thus the ratio of the coefficients of variation for the two ratios would vary between zero and one for substitute commodities

[1] Glesinger, *op. cit.*
[2] Schultz, *The Theory and Measurement of Demand*, Chicago, 1938.

and for complementary goods it would be greater than one.'[1] In view of the objections raised to this test by Charles C. Peters and Walter R. Voorhis,[2] Richard J. Foote and Karl A. Fox do not recommend the Schultz test and discuss methods which appear to them to be better. For the limited space allowed for this paper, no more can be done than to make reference to such discussions.

Food products. The demand for food products is somewhat easier to study because the need for food of each type is physiologically determined in strict limits between starvation and plethora. Such findings have been used in order to explain inelasticity of demand for food. 'One cannot have two stomachs', says a French proverb. As a matter of fact the first *world food survey*[3] showed average diets ranging from 1,904 (Korea) to 3,281 (New Zealand) calories a day at the retail level.

Aggregate demand for food. Nevertheless, in terms of agricultural production, the range is wider as the percentage of animal products increases when diet rises from 1,800 to 3,300 calories a day. Agricultural production is primarily plant production. Animal husbandry processes plant feedstuffs into animal products, a process of very low productivity. The number of calories of plant products consumed to obtain one calorie of animal products varies widely. It is rather low for milk, pork and poultry meat, higher for beef, more again for veal. In order to measure approximately the quantity of initial (i.e. vegetable) calories necessary to produce the food used in certain diets the first world food survey rated the calories from animal foodstuffs at seven times those from vegetable foodstuffs. In this way one can measure the quantity of agricultural production needed to secure a certain diet and consequently the corresponding aggregate demand for agricultural food products.

Using such a method we have shown that the so-called inelasticity of food demand even in terms of aggregate volume of farm products is less than is usually believed.[4] A diet of 1,800 calories may contain no more than 100 calories from animal foodstuffs, and the production needed to secure such diet will be $1{,}700+7\ (100) = 2{,}400$ initial (vegetable) calories. A diet of 3,300 calories may contain not less than 1,200 calories from animal products, and the aggregate demand for farm products will then be: $2{,}100+7\ (1{,}200) = 10{,}500$ initial calories. Instead of a range of 1 to 1·7 we found one of more than

[1] Foote and Fox, *Analytical Tools for Measuring Demand*, U.S.D.A., Jan. 1954.

[2] Peters and van Voorhis, *Statistical Procedures and Their Mathematical Bases*, New York and London, 1940.

[3] F.A.O. *First World Survey*, Washington, 1946.

[4] Cépède et Lengellé, *Économie alimentaire du globe*, Paris, 1953.

1 to 4. Table 126 in the *U.N. Statistical Yearbook 1957* shows that the percentage of calories of animal origin varies from 6 per cent. (Ceylon 1954, India 1954/55, Japan 1954) to 49 per cent. (New Zealand 1954), a very broad range indeed. L. Goreux[1] of the F.A.O. staff thinks that a rough estimate may be obtained in two ways. The first, being the primary input of calories derived from cereals and starchy roots and tubers, we may consider as having been done in *the State of Food and Agriculture 1957*[2] (fig. iii, 8), taking the ratio between the calory intake derived from cereals, starchy roots and tubers used (*a*) for human food, and (*b*) for all purposes. The ratio *a/b* varies from 0·13 (Canada 1951/2–1953/4) to 0·86 (Egypt 1951/2–1953/4), 0·88 (Venezuela 1951) and 0·89 (Cuba 1948/9). But such a limited basis does not take account of the importance of non-starchy feedstuffs used in animal husbandry which, though somewhat correlated with the previous ratio, varies considerably from one country to another mainly according to the role of grazing in animal feeding. But the total primary input of vegetable calories can be obtained only by using a coefficient of equivalence between animal calories and primary vegetable calories.

Goreux proposes secondly to 'guess the average coefficient of equivalence, K, relative to all calories of animal origin in all countries. The fraction, y, of calories consumed by humans relative to the total primary input of vegetable calories may be written as follows:

$$y = \frac{1}{1+(K-1)\,x} \tag{3}$$

x being the fraction of the calories of animal origin relative to the total number of calories of the human diet.' Goreux gives an example using $k = 10$ 'a value selected at random for illustrative purposes'. The calculation made both in the first world food survey and by ourselves used $k = 7$.

'If for a country i, the number of calories consumed *per caput* is Ci and the population Pi, and if Yi is the coefficient obtained from equation no. 3, the coefficient Y relative to the total number of calories obtained from all the n countries is given by equation no. 4.

$$\frac{1}{y} = \frac{\sum_{i=1}^{i=n} \frac{1}{yi} CiPi}{\sum_{i=1}^{i=n} CiPi}\,. \qquad (4)^3$$

[1] Goreux, *in lit.*, 1957–8.
[2] F.A.O. *State of Food and Agriculture 1957*, Rome, 1957.
[3] Goreux, *in lit.*, 1957–8.

Using such methods of measuring the aggregate demand for food we may study variations of such demand. Analysing the first world survey we found the following schedule:[1]

Calories consumed daily	*Initial calories per day average*
1,800	2,820
2,000	3,020
2,200	3,260
2,400	3,730
2,600	4,490
2,800	5,530
3,000	6,770
3,200	8,940

The dispersion may be shown by considering some examples from the survey.

	Relatively poor diets			*Relatively rich diets*	
	cal.	*init. cal.*		*cal.*	*init. cal.*
Java	2,040	2,280	Columbia	1,934	4,990
Manchuria	2,557	3,020	Puerto Rico	2,219	4,410
France	3,012	6,160	U.K.	3,005	8,100
Denmark	3,249	8,000	New Zealand	3,287	10,520

When a change occurs three hypotheses can be made:

(1) the change will be parallel to the average curve;

(2) the change will tend to minimize the deviation;

(3) the change will tend to create a deviation or exaggerate it.

It seems that hypotheses (1) and (2) may be used mainly if change is slow; but if something happens suddenly hypothesis (3) will be the more likely explanation in the short run.

For example, analysing what happened during World War II, for example, in France, we found that the diet went down more quickly in calories than in initial calories. After some time the reverse occurred, as the level of the diet in calories had to be maintained with a relatively low quantity of initial calories (diag. 2). When, on the other hand, a rapid increase took place, as during the first half of the nineteenth century in western Europe, the increase was less rapid in initial calories than would be forecast using the average curves (diag. 3). By considering population trend and level of income we may, by using such methods, forecast the aggregate demand for food products in terms of agricultural production.

Another approach would be to measure elasticity of total food

[1] Cépède et Lengellé, *op. cit.*

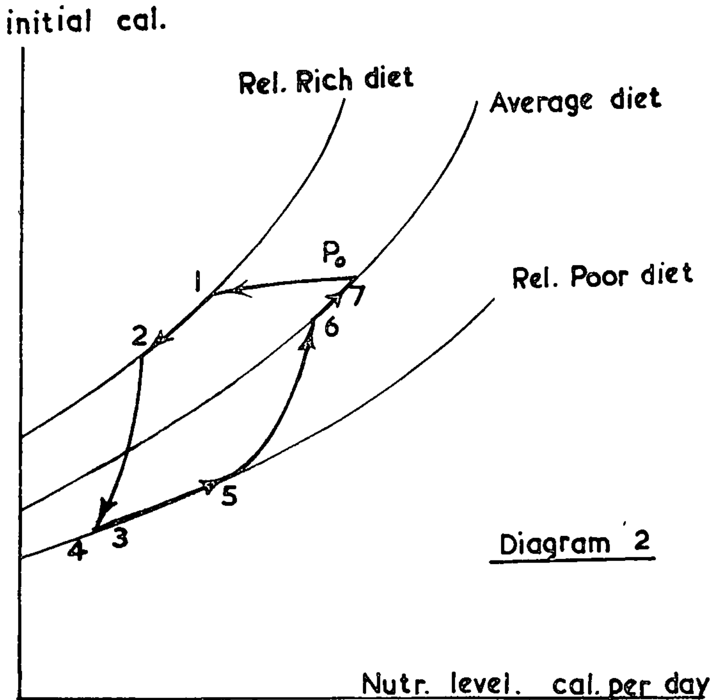


Diagram 2

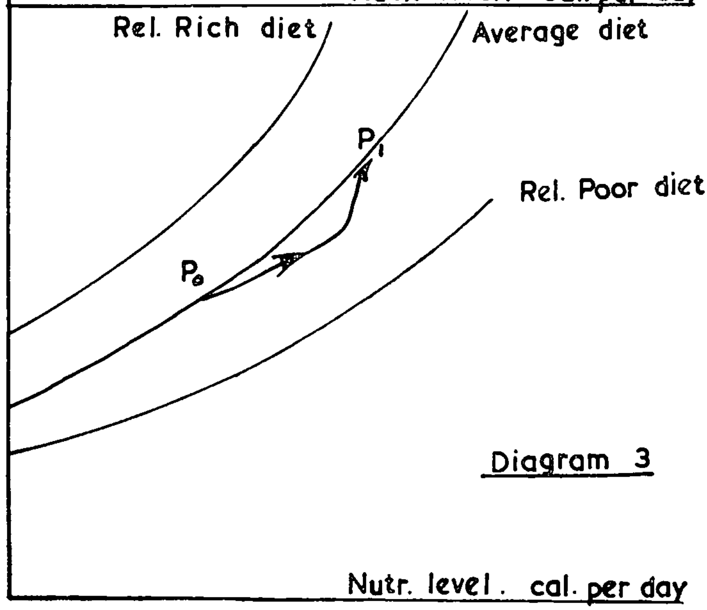


Diagram 3

expenditure relative to total living expenditure or disposable income.[1] This method is very useful for short-term studies dealing with a rather homogeneous group such as a nation undergoing no drastic changes, in which elasticity may be known with a reasonable degree of accuracy. In a more general study it is obvious that such complex data cannot be adjusted for very different conditions whereas the need for food expressed in calories and initial calories is physiologically defined with greater rigidity for every human being at a certain level of living.

Changes in demand for specific groups of food. Both approaches can be used with the same limitations: elasticity of expenditure in a certain group of foodstuff can be calculated in correlation with total living expenditure or disposable income.[2] Inside each group the problem of change in demand for specific foods may be dealt with by using the methods of studying demand for competing (or complementary) commodities already mentioned in relation to non-food farm products.

For studies dealing with a wider range of conditions and/or nutrition levels the method of using the volume of consumption of groups of foods may also be applied. It is obvious however that in so far as the groups of food considered are narrower, the accuracy of the forecast will be less precise as substitutions become easier.

Using three groups of food: animal products (P), fats and oils (L), and other (G) we devised in 1952 (1) a triangle chart similar to the one referred to above[3] P. Carrère and J. Carrie calculated the corresponding system of equations:

$$P+L+G = 100$$
$$0{\cdot}01G+1{\cdot}56L-0{\cdot}86P = 0 \qquad (5)$$

The deviations were used in order to characterize the type of diet in each different country of the world. Equation no. 5 shows incidentally the importance of animal products in the diet and gives more weight to the consideration of initial calories as a measure of the level of food consumption.

It may be useful, nevertheless, to analyse further, and in doing

[1] Goreux, *Perspectives à long terme de la consommation alimentaire*, Bull. mensuel économie et statistique agricoles, vi. 6, Rome, Juin 1957.

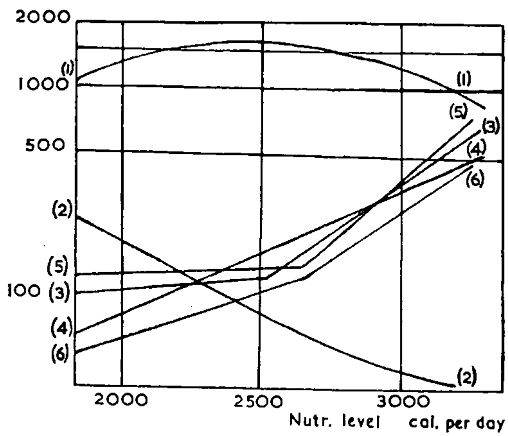
[2] Goreux, *Comparaison internationale des courbes d'Engel.* XIX[e] Congrès européen de la Société d'Économétrie, Luxembourg, Août 1957, and *Demand for Dairy Products in Some European Countries.* Provisional draft 1958, and *in lit.* 1957–9.

[3] Cépède, Lengellé, and Carrère, *Quelques données de la géographie alimentaire du globe. Études et conjoncture*, Paris, Jan., Fév. 1952, and Cépède and Lengellé, *L'Économie des besoins*, Paris, Juillet, Nov. 1956.

so to divide the different foods into three other groups, the curve of each showing quite different forms (diag. 4).

1. Pulses are practically alone in the first group, as consumption of such food declines not only in percentage but even in quantity when the level of nutrition increases.

2. Expensive food—we cannot say rich food because sugar, with few exceptions in producing countries (for example, Costa Rica and



(1) Cereals, starchy roots and tubers
(2) Pulses (3) Sugar (4) Fats and oils
(5) Meat (6) Milk

Diagram 4

Puerto Rico), must be included with fats, oils, and animal products under this heading—the consumption of which increases more than proportionally when the level of nutrition is rising. The semi-logarithmic chart shows that differences should be considered between specific groups of expensive foods.

3. Staple food—including starchy foods: cereals, roots, and tubers (further studies seem to show that alcoholic beverages may follow the same kind of trend), consumption of which increases and stabilizes itself, reaching a maximum at a level of about 2,500 calories consumed per day and decreasing when the nutrition level continues to rise, so that, at a high level of nutrition, consumption of such food is not higher and is often less high, than in a starving group.

In the analysis of the demand for different groups of food we may use methods for studying demand for competing (or complementary) commodities at a later stage and only explain and/or forecast the deviations which local and/or short time economic conditions (for example, prices) may cause on a specific market.

Other factors influencing changes in food demand. Changes in composition of population may influence the needs and consequently the demand for specific foods at a given economic level. Changes in the distribution of disposable income in a population will have similar effects; consequently one of the lines of action for a policy of welfare including a nutrition policy, may be to intervene in the distribution of disposable income in order to foster a demand more in line with a greater satisfaction of primary needs, of which food is the most important.

T. MISAWA, *Tokyo University of Education, Japan*

I propose to confine my remarks to the demand for food.

Professor Cépède analysed international data of *per caput* consumption of calories. According to him, there is a functional relationship between the number of calories and the number of initial calories consumed *per caput*; and a curve can be assumed which relates these two factors. He seems to attempt to forecast the aggregate demand for farm food products in terms of initial calories, corresponding to certain levels of living and certain sizes of population.

The idea is interesting; and my first question is this: What factors does Professor Cépède take as independent and dependent variables respectively? If I am not mistaken, he takes the *per caput* consumption of calories as the independent variable. It seems to me that in doing so he takes it for granted that the *per caput* number of calories is a sort of indicator that represents the level of living. The usual method in economic analysis of measuring changes in demand in relation to changes in the level of living is to measure demand changes relative to income changes. So the question here is, why does not Professor Cépède take income *per caput*—national income in this case—as the independent variable? If income were adopted instead of calories, changes in demand relative to changes in the level of living would be expressed in more exact economic terms.

With reference to the dependent variable—that is, initial calories —their number can represent demand for aggregate food products in so far as it is a common denominator of all kinds of food demanded. But food requirements include not only calories, but proteins, vitamins, minerals, and even refreshment, most of which are not included in initial calories. If a satisfactory common denominator is not available in physical terms, another way would be to introduce price terms.

My second point is about the objectives of Professor Cépède's study. Is his objective merely an international comparison of features of food demand or does he propose such a method of analysis as a step towards measuring long-term trends of food demand? If the latter, the demand elasticity approach would be useful.

Tentative calculation, using national income *per caput* and F.A.O. statistics of *per caput* calorie consumption of various nations, shows that the income elasticity of demand for food in terms of calories is 0·1. It is interesting to see that the figure is 0·4—four times larger—if food demand is expressed in terms of initial calories.

Dr. Ohkawa of Japan measured the income elasticity of demand, taking *per caput* national income revalued in international units as the independent variable on the one hand and value of food demanded *per caput*, estimated at the U.S. farm prices at a specific period, as the dependent variable on the other. This seems to be one line of approach to measuring changes in food demand relative to changes in income when international data are used.

A more accurate analysis of changes in demand is obtained when elasticity analysis is applied to a more homogeneous consumer group in a specific period. We find that even the same kind of food has a fairly wide range in income elasticity or expenditure elasticity of demand according to the group and also to the period. For example, the expenditure elasticity of consumption of food grains in all India in recent years is between 0·5 and 0·6 (0·6 in the rural part and 0·3 to 0·4 in the urban part) according to the publication we have just received at this Conference.

My tentative survey on the urban workers' food expenditure in Japan in 1954–6, shows that income elasticity of expenditure for all food is 0·3. As regards specific groups of food, it is from 0·7 to 0·8 for livestock products, 0·3 for both fish and vegetables, 0·1 for rice, the staple food, and minus figures (—0·4 to —0·8) for barley. The pre-war situations of food demand in Japan were studied by Dr. Ohkawa. According to him, in the 1930's income elasticity of expenditure in the urban worker's household was from 0·3 to 0·4 for all food, 1·1 to 1·7 for milk, 0·3 to 0·5 for fish, 0·3 to 0·4 for vegetables, and between —0·1 and 0 for rice.

As the figures show, there seem to have been changes in income elasticities of demand for all food and also for specific groups of food between the 1930's and 1950's in the Japanese urban worker's household. An analysis of such changes in elasticities between periods would be an aspect of the study of changes of demand which I cannot deal with here.

G. L. MEHREN, *The Giannini Foundation, California, U.S.A.*

Professor Cépède is a competent research analyst with a distinguished record and it is not for me to fortify his findings or even to substantiate them, but rather to raise those issues which are unresolved in his paper and which may provide appropriate bases for further discussion. This is a technical paper, a quantitative analysis, and an exercise in applied research. Consequently, I have classified the appraisal of his paper in terms of categories or criteria which I think must be applied to any quantitative, technical, applied research analysis at any time, in any place, and in any field of work.

First I have looked to the question which is being asked by the author. In quantitative research the question must be phrased quantitatively—in numbers. It must be an answerable question in the sense that given the same issue and the same data all competent research workers would reach essentially the same conclusion. The question should also be formulated in such a way that it is logically consistent with the measurement techniques used by the research analyst.

Next I consider the hypothesis. In research of this kind the hypothesis specifies the variables which are at issue. It specifies or assumes the interrelationships among them. Finally, it specifies the total system of relationships in the economy within which specific relationships are presumed to prevail.

After that, I consider the testing procedure, because in the end one either rejects or does not reject a hypothesis. I look therefore to the methods by which the results or the findings are adduced. I try to find a way by which the author determines the confidence or the reliability which one may ascribe to his findings. In terms of the methodology, I look towards the criteria by which he decides not to reject the fundamental hypothesis in terms of which he attempts to answer his question. Finally, in the patois of the Americans, one says, 'So what?' or, 'What difference does the study make?' To answer this one must say, 'Does the study make a contribution to research methodology? Does it contribute to the formulation of theory from which hypotheses are adduced? Does it add something new to measurement technique? Does it provide an adequate basis for policy and control by which some of the variables determining demand may be manipulated in order to obtain objectives? This, then, is the classification or the system within which I have tried to analyse the paper.

This is an unusual and provocative paper. Under most rigid conditions and with variables expressed in average, *per caput*, *per diem*, physical calories, the major question engaged by Professor Cépède may be phrased as follows: For a given (or assumed) change in 'consumption', what is the associated change in 'required production'? A hypothesis is developed by assuming average arithmetic ratios of human food output to animal feed input of vegetable origin; of consumption to total primary input of vegetable origin; and of animal product consumption to total food consumption. The hypothesis is apparently tested by relating human consumption to total farm output. The findings are apparently presumed to hold generally with deviations dependent upon temporal rates of change in consumption.

The question is significant, in terms of its potential contribution both to methodology and to policy; but it is narrowly defined and it is *not* the question at issue in analysis or projection of the relationships ordinarily subsumed under the word demand. The hypothesis appears to be largely empirical in its origin. There is no direct reference to the rich store of demand theory; nor is there apparent use of the immense literature of quantitative analysis of demand either in structuring the question for operational inquiry or in developing a fully testable hypothesis. There are also puzzling issues of methodology associated with the restricted nature of the question and the source of the hypothesis. There does not appear to be an unequivocal specification of the functions implicit in the inquiry, nor is there a clearly stated specification of the system within which the relationships are presumed to prevail. Consequently it is difficult to know or to appraise the methods by which the findings were adduced. No reference is made to reliability or confidence limits applicable to the findings. However, answers to the questions engaged surely open a fruitful area of questions. They may also provide a preliminary basis for associating production policies with specified changes in agricultural demand.

These observations are not disparaging or even critical. Demand is a difficult—and important—area for quantitative inquiry. Professor Cépède is at least as well aware as anybody of the difficulties and limitations of his procedures, and those of alternative methods as well. His is a successful paper in that it generates a series of specific operational questions. Their analysis should contribute to demand studies in all types of economies.

With respect to the major research question itself, does expression in physical terms of 'wants' and of associated total 'requirements' provide a basis for projection of demand? In a price economy of any sort, does aggregation so massive, and a question involving the gross relationships of only two variables, provide a precisely defined issue, or the basis either for quantitative measure of relationships or for indices of reliability with respect to results? Might not a question involving the determinants of demand and their quantitative interrelationships within a complete system be more useful both to methodology and to policy? Measure of needs in physical terms cannot at best—and then perhaps only by accident—do more than specify a single point in a demand system.

The issues raised with respect to the questions asked by the author are necessarily applicable to his hypothesis also. Most difficult in terms of operational research procedure is appraisal of the assumed interrelations of the major transformation ratios, and such subsidiary hypotheses as the 'wood' demand shifter; the various aggregative procedures; occasional implicitly stated food–non-food relations; the generalization of a single-equation relationship between caloric consumption (at unspecified price, income or preference levels and with no systematic demand-supply-income structures) and caloric output; and the physical transformation functions themselves. Is food demand really limited in a price economy between starvation and plethora in a narrow physical sense?

The paper is especially successful in provoking questions of methodology. Expression of 'wants' and aggregation of variables in calories may be dangerous. Indices with other weights than calories may perhaps be involved. Unspecified methods of application of rough tests for interrelatedness do not, in fact, measure food—non-food or other cross-relations of demand. Similar reference to 'consideration of population trend and level of income' does not indicate the measurement procedures which must actually be used for testing a given hypothesis. References to limitation of other methodology are largely expository. 'Wood' measures of non-food demands may overlook technical transferability and monetary productivity attributes. Physical transformation ratios may in fact vary with factor cost and product price.

The necessary conditions for expression of massively aggregated food and non-food demands in single-equation form are quite stringent. Cross two-variable functions are unlikely to meet those necessary conditions. Perhaps of most crucial importance, Professor Cépède has not indicated the criteria in accordance with which he has decided not to reject his hypotheses.

Pragmatically, the analysis may indicate the total output required to support given increases in consumption. It does not indicate the determinants of such output and therefore gives no effective bases for operational policy. It does not specify the determinants of consumption and thus again is not a basis for food policy.

Professor Cépède knows that changes in food demand will be associated with changes in input–output functions, factor costs, supply and income functions—perhaps in preference functions. The reverse is also true. Thus, a general system of relationships must ordinarily be structured to analyse changes in so large a part of any national economy. Demand theory and measurement are more advanced operationally than in virtually any other area of economics. Professor Cépède knows that there can be no forecasting or prediction of food demand or anything else. One may develop a system of relationships, assign magnitudes to all but one of them and then *project* its magnitude within the specified system and under the constraints of the constants. Work in this area is far advanced. The rather simpler methods used by Professor Cépède cannot yield such a projection. But they can outline, and in this instance have outlined, a simple and direct approach to another sort of problem. More important, Professor Cépède has stimulated inquiry into a series of operational issues relevant to demand research anywhere. How should one structure his question and his hypotheses? How does one measure interrelationships in demand? What difference do the findings make? It is possible that some methods of demand analysis and projection cannot be applied universally. But all must have an explicitly identified logical basis and the measurement techniques must be unequivocal. Professor Cépède has done this. His paper is important—well and successfully done.

L. E. SAMUEL, *Ministry of Agriculture, Tel-Aviv, Israel*

With regard to elasticity of demand for foodstuffs, we in Israel have experienced since 1954 a rapid shifting to animal proteins and away from carbohydrates. A survey of 6,000 families which gives not only their expenses but also the composition of their food provides the explanation. The upper income group, which constituted between 25 and 30 per cent. of the population, had an ample diet. The medium income group (some 45 per cent.) had an adequate diet, and the remainder a poor diet. However, during the last four or five years when the standard of living has been increasing steadily, the low income group has gradually become the medium income group, while the upper group has made still more money. This has resulted in so strong a shifting of demand in our markets that we have had to adjust production quickly to meet the new demand for animal proteins. Following this experience we have tried to link our nutrition policy with education on nutrition and with propaganda in favour of certain essential foods. In this respect we have faced the specific difficulty that during the last decade a very large proportion of immigrants have come from oriental countries. In our community today almost 50 per cent. of the people are from there. The others are from Europe and America. Therefore, we have the additional task of finding a national diet which will combine the food habits of all these different people. I would only add that in our experience, although we form a very small community, the elasticity of demand for food is very high.

D. BERGMANN, *Institut National Agronomique, Paris, France*

Professor Cépède mentioned essentially global demand for food and non-food products as well as demand for major groups of food commodities. He did not have time to consider demand for individual products. It seems obvious that in the latter case it is possible to influence consumption habits. Positive action can change the demand for some individual commodities.

Wine consumption in France can be used as an example. Recent studies of global consumption of ordinary wine during the past nine years have shown a high income elasticity of demand. Those studies —which, I think, were conducted carefully enough to satisfy Professor Mehren and the results of which were statistically tested— gave the following demand equation:

$$\frac{Q}{Q_0} = \left(\frac{R}{R_0}\right)^{0\cdot7}\left(\frac{P}{P_0}\right)^{-0\cdot12}$$

where Q is consumption of the year studied,
R is disposable income of the year studied,
P is the price of wine of the year studied,
and Q_0, R_0, P_0, the same quantities for the base year.

Now we are hoping in France that disposable income will continue to rise at a rapid rate, as it has done during past years. But if this equation holds for the future, there would result an increase in wine consumption which could have dangerous consequences for public health. Therefore one can hope that positive steps will be taken to change consumption habits. The statistical study of the past must help to influence the future.

M. CÉPÈDE, (*in reply*)

I had expected to meet more criticisms of the aggressive kind which so often characterize discussions among scientists, but it seems that I am required only to provide some explanations which I am very willing to try to do.

On the fundamental question posed by Dr. Misawa as to which are the dependent and which the independent variables, I would say at once that I do not consider daily consumption in terms of calories to be the independent variable nor, above all, to be the uniform basic measure. I would have fewer scruples if a diet were measured in vegetable calories, because to allow for the weights given to animal products I have introduced, and we reintroduce (whether desirable or not), consideration of protein, and the coefficients which we have obtained in equation 5 show the importance of animal products in the level of the ration. But there again if, temporarily, I take the level of diet measured in vegetable calories as an independent variable, it is because in some studies we have calculated degrees of correlation to test the hypotheses, and have shown that food consumption in terms of vegetable calories is closely correlated with the factors which determine human well-being (using real income measured in monetary terms as an index).

For example, there is a very close correlation between the standard of living measured in vegetable calories and the expectation of life at birth in the group concerned, and that seems to me the fundamental independent variable to choose in estimating standards of living—to know the chances a new born child has of reaching a certain age. The correlation of standard of living with vegetable calories is much closer than with definitive calories. Beyond this one would have to go into a long explanation of the studies which have been made—for example, on indifference curves within a certain group. There is a whole series of other models which we have tried to build which show that at a certain level in definitive calories one can have quite different levels in vegetable calories especially if they are calculated in monetary terms. I know very well that in all econometric work it is necessary to make a certain number of adjustments, but the danger even of these apparently legitimate adjustments is that one always ends up with finding a curve which fits the data. I do not know if these calculations are theoretically satisfactory, but I think it is more interesting for a calculation, if it is to result in action, to have in addition to its methodological interest a relatively simple kind of formula which can be used effectively for predicting. It is agreed, as Dr. Misawa has said, that we seek to make long-term predictions in our hypotheses, that we are dealing with aggregates of many variables, and that it seems at present very difficult for us to use simple classical measures of elasticities of cause and effect.

I wish to say to Professor Mehren simply that it is best that I should not try to show at what point we should become modest regarding the theoretical value of our work. I wish even to say to my friend Bergmann that I believe there are possibilities of action and that the relations we have discovered, the models which we have established, are not unsuitable and that propaganda and governmental action could modify behaviour. I would go even further and say we should pay our work its due respect—that is, we should see for ourselves that the models we have established satisfy data which one would never have believed could fit the same curve. It is remarkable that all seventy points of the worldwide investigation on nutrition could fall on a single curve with only such dispersion as is easily accounted for when we consider the different periods concerned. These are very different in certain cases—for example, we have tried to make a study of average levels of nutrition in Paris since the Middle Ages, and we find basically the same curves. I wish that by governmental action in redistributing income, by influencing prices, by propaganda and so on, we might suddenly find ourselves faced by completely different models. I would be glad to be able to calculate these completely different models—above all if we could leave this period which a certain economist (Marx) called the prehistory of humanity. It would then be possible to reach a period in which we could hope for a better and more efficient world.

But then one will no longer need models. If everything happens as it should, and if effective demand really corresponds with needs, and if supply really corresponds with the satisfaction of these needs, then truly I shall be ready to renounce this sort of effort; the work will have been finished.