"UNDERSTANDING MARKET DEMAND FOR AGRICULTURAL PRODUCTS THROUGH CONSUMER RESEARCH : The coffee example".

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ABSTRACT.

MARKET DEMAND FOR AGRICULTURAL PRODUCTS

THROUGH CONSUMER RESEARCH: The Coffee Example."

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A theoretical model of coffee consumption in the U.K. is proposed, which is estimated and used to examine the influence of habit formation and advertising in the period 1957-80. This work challenges both the assumption of symmetrical consumer response and the statistical source for measuring coffee consumption. The model allows for asymmetrical consumer reactions. Explanatory variables are: price of coffee and of tea, income, advertising and the strength of the coffee drinking habit. This work is original in terms of interpreting and quantifying product field advertising and habit formation; and for allowing a minimal threshold level of predictors.

Mistakes, repeated printing errors and unpublished changes in definitions were found in the statistics of domestic coffee supplies. Household coffee purchases estimated by the National Food Survey (N.F.S.) are consistently over-reported. Causes investigated provide grounds for correcting estimates by pooling N.F.S. with Family Expenditure Survey; the result is consistent with adjusted supplies. Advertising effect on demand is separated into two aspects. The first action increases sales by attracting new buyers, while protecting consumers from competitors' propaganda. The second action increases sales to habitual customers, while manufacturers are competing through advertising for a larger brand share. The transmission medium is a factor in both effects. The strength of the habit shifts market demand function. A routine way of thinking prevails under stationary conditions; yet shifts in the function occur in a non-stationary situation which initiates the problem-solving way of thinking. In the model, addiction can be either absolute or relative to changes in other factors.

All the evidence supports the general model proposed, which shows that a non-symmetrical functional effect prevails and demostrates the existence of an adjustment period. Irrefutably, coffee consumption depends on former consumption levels, coffee price, price-ratio tea to coffee, income and advertising.

A C K N O L E G M E N T S.

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L I S T O F A P P E N D I C E S.

LIST OF ABREVIATIONS USED IN THE TEXT.

A.G.B.	:	Audits of Great Britain Ltd.
A.I.D.A.	:	Awareness, interest, desire and action.
A.T.R.	:	Awarewness, interest and reinforcement.
B.F.D.	:	Branded food drinks.
B.M.R.B.	:	British Market Research Bureau.
B.S.O.	:	Business Statistics Office.
C	:	Covariance coefficient.
C.S.O.	:	Central Statistical Office.
D. of E.	:	Department of Employment.
D.W.	:	Durbin-Watson statistics.
E or ε	:	Elasticity.
E.I.U	:	Economist Intelligence Unit.
F.A.O.	:	Food Agricultural Organisation, O.N.U..
f.b.i.	:	Frequently bought items.
F.E.S.	:	Family Expenditure Survey.
f.m.c.g.	:	Fast moving consumer goods.
G.H.S.	:	General Household Survey.
G.I.V.E.	:	General instrumental variables estimation of linear equations with lagged dependent variables and first first order autorregressive errors.
I.C.A.	:	International Coffee Agreement.
I.C.O.	:	International Coffee Organisation.
I.T.V.	:	Independent Television.
M.A.F.F.	:	Ministry of Agriculture Food and Fisheries.
N.D.S.	:	National Drink Survey.
N.F.S.	:	National Food Survey.
O.A.P.	:	Old aged pensioners.
O.L.S.	:	Ordinary least square method.
O.P.C.S.	:	Office of Population Censuses and Surveys.
r	:	Partial correlation coefficient statistics.
r^2		
R	:	Coefficient of multiple determination.
R.P.I.	:	Retail price index.
S	:	Residual sum of squares.
Sa.E.	:	Sample error.
S.E.	:	Standard Error statistics.
s.p.t.	:	Stability of parameters test.
S.P.S.S.	:	Statistical Package of Social Sciences.
t*	:	t-ratio or test of statistical significance of parameters.
T.G.I.	:	Target Group Index.
X^2	:	Chi-square.

CHAPTER 1.

I N T R O D U C T I O N.

This research deals with two areas of Social Sciences: economics and marketing. Market demand forecasting and consumer market research, despite the fact that they have different objectives, deal with the same social phenomenon, but at different levels. Both are concerned with people's behaviour in the market, more precisely, consumption and demand. Economists deal with the study of the market demand for commodities, while marketeers deal predominantly just with the analysis of private brands'consumption in some sectors of the market. This is explained to a large extent by the origin of both disciplines. Economics developed from the construction of consistent theoretical models, while marketing has grown through the solution of practical managerial and commercial problems. However, one often reads about the failure in the application of particular economic policies, just as much as breakdowns in efforts to validate certain marketing practices which happened to be successful in particular circumstances.

This study attempts to integrate both disciplines through the analysis of the market demand for coffee in the U.K. and by the application of consumer market research categories and practice together with econometric procedures. In particular, all this is applied for the understanding of shifts in the market demand for a

frequently bought item, such as coffee.

Coffee is a commodity which has a paramount impact on the economies of many less-developed countries. Producers often apply contradictory policies of diversification and specialisation. Ninety per cent of coffee traded is consumed in developed countries. The dilemma is that although production can be increased fairly quickly, world consumption per person grows slowly. The U.S.A., the major drinker, is drinking less annually in the last twenty-five years from 16.8 to 13.3 lb per person. Naturally, attempts to increase or even to maintain coffee consumption in wealthy nations concerns at least 60 of the poorest countries. Major international efforts in this commodity have been oriented towards restricting the output traded rather than stimulating consumption.

Britain, although still the largest tea drinker, holds a remarkable potential for coffee consumption which has grown consistently since the end of the last world war. However it stopped in 1977 and 1978, while simultaneously tea drinking recovered from a long-term decline, at which point the price of both items reached the highest ever price.

How strong is the growing habit of coffee drinking and how strong is the declining habit of tea drinking? Will the loss of consumers due to high price levels be recovered when price return to past levels? Proper modelling helps to answer these

problems. A number of academic studies have tried to model coffee demand. Yet, their consumption data are drawn from the National Food Survey - N.F.S. - in which validity and consistency have not yet been adequately tested. These models have used biased statistical series as proxies of consumption. Detailed examination of these figures revealed that there has not been enough coffee available in the whole U.K. to be purchased at the rates estimated by the N.F.S.. Most of the theoretical background of these studies relies upon the assumption of a symmetrical consumer response to upward and downward price movements, disregarding the practical possibility of habit formation in coffee drinking. Consequently, in the published literature one finds low reliability, inaccurate estimates and sometimes, both.

This study aims at obtaining a sound explanation about causes of shifts in market demand function, in order to improve the forecasting power of commodity demand models. In particular, it tries to prevent theoretical misconceptions and empirical mistakes. Coffee drinking is a regular activity which may lead to addiction. Here the effect of habit formation over the demand function is explored. A habit implies a routine response, as opposed to the problem-solving process for deciding which and how much beverage to drink. At a certain frequency, regular drinkers try another beverage. The length of such trials is postulated as depending on various factors, namely price of coffee, consumers' income, price of tea, advertising and the strength of the habit.

Obviously the observation of the explained phenomenon requires special care. It is essential to ascertain the consistency and reliability of statistical series dealing with coffee consumption. The outcome of this will clear discrepancies between net supplies and reported household purchases. Then, only verified data for the 1957-80 period are used in estimating parameters of the model. The outcome substantiates the hypothesis of relative addiction function, which depends on changes in coffee price, consumers' income, relative price of coffee to tea, expenditure on T.V. coffee advertising and the ratio between the advertising on T.V. for coffee to tea.

Thus, the thesis has six major parts: Chapter Two reviews literature of theoretical and empirical studies concerned with coffee consumption. Chapter Three outlines how methodological aspects are resolved, detailing the theoretical framework and equations to be estimated and stating how data restrictions are solved. Chapter Four details audit tests carried out on sources for observing the explained variable. Chapter Five presents results of regression analysis and subsequent tests of validity. Chapter Six summarises major findings and attempts to draw conclusions out of the whole work.

CHAPTER 2.

R E V I E W O F L I T E R A T U R E.

Several studies have already tried to analyse the consumption of coffee in the U.K.. Yet, most of them have used just one of the various alternative theoretical approaches for explaining changes in the consumer behaviour for frequently bought items. This chapter intends to both provide a wide theoretical background for analysing the conduct of consumers, and to review the empirical work in this area. Thus, the outcome of this section is to identify and to explore problems which the relevant literature still does not account for. Two parts form this section: 2.1- Theories of consumer behaviour; and 2.2.- Empirical studies of coffee consumption in the U.K..

2.1.- THEORIES OF CONSUMER BEHAVIOUR.

Theoretical consistency is vital for designing effective models. Here I explore different but significant views dealing with the understanding of beverage drinking rationality. Since coffee drinking is a regular activity, particular attention is given to habit formation of frequently bought items and their possible impact on the overall market demand. Consumption is the result of the decision-making process which occurs in the individual psyche and it is interrelated with environmental factors such as price, income and advertising, as well as previous behaviour - if we

learn from our own experience. This review is concerned mainly with the identification of major causes influencing changes in consumption. Several disciplines have been concerned with consumer rationality, many sheding more light on the phenomenon and in various cases providing complementary explanations. Here I examine five models: the economic model, in particular the utility theory and recent versions of it; three psychological models, Freud's psychoanalytical, Pavlov's learning and the advertising effect; plus the sociological theory of reference groups.

Although the choice was necessarily limited, it comprises the most generally held views on this area and they are pertinent to the aim of this thesis.

2.1.1.- ECONOMIC MODEL. Consumer demand or utility theory is the most widely known explanation of consumer behaviour. Also included here are two cases, one when prices are held constant and another where market demand is split between preparation and actual consumption. The utility model assumes that purchasing is taken as the result of conscious rational economic calculations looking for a maximum benefit. Thus buyers seek to spend their income on those goods which offer them greater satisfaction or utility according to their tastes, income, relative prices, etc. The principle of diminishing marginal utility prevents the total consumer budget from being allocated to any one single item. Additional units of an item give a decreasing satisfaction to a consumer, so that at some point a marginal unit of some other

commodity will give him/her more satisfaction than extra units of the first one. This implies that the buyer already knows the relative utility derived from possible sets of combinations of goods. His/her income will be allocated to that bundle which gives the person the greatest utility. If consumption behaviour of any individual is independent of the conduct of others, market demand will be arrived at by adding together the demand of all individuals in that market. The availability of adequate information makes consumer efficiency easier by finding that optimal bundle. Yet, if information is inadequate, buying, although rational, is inefficient. A variant of the model occurs when a constant price is maintained. Quantity demanded then becomes a function only of income. Commodities could be grouped in three categories according to their income elasticity: inferior goods, necessities and luxuries. Consumption of inferior goods declines absolutely and relatively to income as the latter rises. F.A.O. (1971).

E = % change in D / % change in Y

where: D = consumption; Y = income; E = elasticity of income. Then if E<0 : the commodity is an inferior good; if E>0<1 : the commodity is a necessity; if E>1 : the commodity is a luxury. An exception is the Giffen effect, so that purchasing of a necessity increases as income drops.

An alternative explanation was proposed by Hogarty and Mackay

(1975). They assumed that consumers behave as firms. Their decision process is made up of two stages: home-production or preparation, and consumption. In the home- production stage, households determine an input combination that provides a given amount of the commodity at the least possible cost and given their knowledge of the production process. This first stage is a minimization problem. In the second stage the household determines the amount of commodities to be produced so as to maximise utility, subject to budget constraints. What really appears in the market is a derived demand function. This is a combination of both stages and depends on households' taste, current production technology for in-home preparation, price and income. Hogarty and Mackay suggest that substitution effects can be split into price fluctuations and cost reductions. This is more applicable to the U.S.A. than in the U.K. market. Regular or ground coffee drinking which is affected by the preparation technology is extremely popular in the U.S.A.. Although ground coffee drinking grew consistently during the period under study,it still does not make a significant impact in Britain, as soluble coffee is more popular. As consumers choose only among available stock when preparing a hot beverage, replacement rate should show the impact of that decision in the market place. Unless there are unusual circumstances - such as extreme weather changes, major price alterations, news of forthcoming scarcity,etc.- one can assume safely that purchasing indicates consumption under stationary conditions.

Some essential conclusions are drawn from the economic model. The lower the price of a product, the higher its sale, whereas the lower the price of substitute products, the lower the sales; but if the price of complementary items drops, the higher the sale. The higher the income, the higher the sale, provided that the item is not an inferior good.

Yet, Muller (1954) quoted by Kotler (1965), reported that not more than one in four buyers took any notice of the price. Market researchers believe that the model is a normative instead of a positive explanation of the actual consumer behaviour. Consumers are not likely to undertake economic analysis when making every purchase, particularly for a frequently bought item. Then, omissions of relevant variables in the specification of econometric models can lead to an anarchy of results in replicated research.

Yet, the economic model is usually accepted in policy-making areas and has already been used in several works. Some have modelled the demand for coffee in the U.K. and are analysed later in section 2.2. A wider view of consumer behaviour can be found with the help of other areas of Social Sciences, such as psychology and sociology which look at human beings from a rather different angle.

2.1.2.- FREUD'S PSYCHOANALITIC MODEL. This theory of unconscious motives assumes that humans are born with instinctive needs which they cannot satisfy by themselves. The initial comfortable union with the mother is painfully broken in infanthood as the child becomes an individual. We tend to get others to gratify our needs by intimidation, supplication or other mechanisms, according to their efficiency. Continued frustration leads to the adoption of more reliable means of meeting our needs. As the individual grows his/her psyche becomes more complex. At least three levels of this process may be distinguished: id, ego and super-ego. The id is a reservoir of strong drives and urges; the ego is the planning centre for finding outlets for the drives;the super-ego channels instinctive drives into socially accepted behavioural patterns and avoids the pain of guilt or shame.These three phases are in a constant dynamic relationship. Repression, rationalisation and sublimation can firmly channel drives and urges through these structures of the personality into a socially acceptable form of behaviour. The individual is affected by tensions of unsatisfied needs and defence mechanisms. Sometimes the ego cannot mantain the balance between the impulsive id and and the oppresive super-ego. That conflict forms values, beliefs and attitudes, which outline predispositions to respond in a favourable or unfavourable direction. Thus, individual conduct is not predetermined by external variables only. Since individual motivations are not obvious, behaviour will be unpredictable,

unless we are able to explain it properly. Originally id, ego and super-ego were thought as personality structures, yet neofreudian authors have taken them more as theoretical concepts.

Adler also incorporated the complexes, Erickson, the crises and Maslow the hierarchical order of needs.

Non-explicit motives affect coffee purchases. Thirty-five years ago in the U.S.A., housewives did not like to accept openly the fact that they were buying a given sort of coffee (Haire, 1950). Haire determined later that housewives believed that this sort of purchase went against the image women wanted to project as proper house-keepers. Haire was trying to identify and measure consumers attitudes towards soluble coffee at the introduction stage of this type of coffee in the U.S.A.. In fact, its purchase was influenced more by consumer values than physical characteristics and its price. At that time, American housewives did not openly accept that they were employing a ready-to-serve coffee. The real attitudes could only be revealed by the use of projective techniques, in this case the shopping list test. Then, in the U.S.A. coffee drinking was a form of intimacy and relaxation. Yet, soluble coffee represented a departure from the traditional percolated coffee, the making of which was socially thought of being synonymous with caring for one's family and was taken very seriously indeed (as tea making is in Britain). Otherwise, as Haire found, she was thought a dissolute woman.

Naturally, many people who use soluble coffee did not want this fact to be recognised openly, although they were in possession of this convenience type of coffee.

Modern marketing often uses elements of the Freudian model. Motivational and attitude studies are now basic factors for marketeers, Yet, psychological motives for one person may not be the same for others in the same market; those motives can be unstable to be of any use for predictive purpose at the market level.

2.1.3.-PAVLOV'S LEARNING MODEL. This theory originated in Pavlov's experiments on conditioned reflexes in dogs and by Thondike in cats. An individual's behaviour is the result of processes such as learning, discriminative perception and forgetting, which is explained in the stimulus response model by drives, cues and reinforcement. Drives are needs or motives derived from a strong internal stimulus impelling to action. There are primary drives such as hunger, thirst, cold, pain or need for sex. Also there are learned drives or socially desired drives. In general, a drive impels a particular reply but only in relation to a special set of cues. A cue is a weak stimulus in the environment or in the individual which determines when and where a subject responds. The absolute level as well as the relative intensity of cues is important for getting a response. However, a relative change in the intensity may become sometimes more compelling than its total range. Response is the individual

reaction to certain cues, given a constant level of the intensity of drives. But the configuration will not necessarily produce the same reaction in the individual, since past experience plays an important role. Reinforcement is the feedback obtained from a rewarding experience. Usually there is a natural tendency to repeat the same answer pattern when similar cues appear again. A habit already formed may be extinguished under lack of proper feedback. We forget easily already learned associations which have been weakened by no reinforcement. It is impossible to retain everything and yet it is always easier to repeat rather than to try something new.

This theory provides a useful ground for explaining both the formation of consumer habits and the effect of advertising on sales. Within a usual range of stable prices, income and advertising activity, there is a consumer habit for each product which is purchased frequently. Existing habits change only when these factors reach a non-stationary range, for the consumer has learned how to react to satisfaction. Thus, altering a habit requires a particularly conscious decision. Due to the "rational" nature of this last sort of decision, economic factors will be more likely to be taken into account.

The learning model is the source of theoretical explanations for the probable effect of advertising on sales. A new product launched into the market has to call the attention of consumers in order to break purchasing habits already created. Intensive and

extensive advertising campaigns have been used to break prevailing habits. On the other hand, advertising has also been used for maintaining another habit. Paradoxically, there is need for advertising both to stop and to maintain buying habit. This calls for a more detailed interpretation of the effect of advertising on sales, which is in the next model.

2.1.4.-UNDERSTANDING THE ADVERTISING EFFECT. Manufacturers and traders try to atract consumers' attention through advertising aimed at persuading them to buy their branded items. The coffee industry have spent £200 million on this activity over the last quarter of this century, which is remarkable since coffee is just 1.5% of the family food budget (MEAL Ltd., 1980). This accounted for 4.4% of the expenditure on food publicity. Most of this was to introduce the item to the British consumers in the fifties; afterwards for maintaining and eventually increasing brand shares of the market, rather than enlarging the overall coffee market. Nevertheless, coffee consumption rose from 0.14 to 0.52 oz of soluble coffee per person per week from 1957 to 1981.

Research into advertising has been oriented towards explaining how it may affect the market share of a particular brand. However, little empirical evidence shows how advertising can influence the whole product field. Yet, advertisers are never short of imagination for arguing about how advertising works. Two basically opposed views - the AIDA and the ATR models - are presented here.

This is followed by results of incidental studies concerning coffee advertising.

AIDA MODEL. In a simplistic and direct application of Pavlov's theory, media owners and advertisers have sustained this model for many years. Advertising makes people aware of the existence of a new brand. This is followed by the arousal of interest and the understanding of what it could do for the potential consumer. A strong desire or conviction is developed next, which is a necessary condition for the purchasing action: attention, interest, desire and action. So, the more a brand is advertised, the larger the expected sales (Colley, 1961). Yet, this is a self-evident and normative explanation of advertising action; it lacks internal consistency and obviously the necessary empirical evidence. Having taken this view to extremes, it would imply that no purchasing would take place without advertising. Palda's interpretation of AIDA was applied to research on hot beverages and is presented in section 2.2.- together with other empirical studies (Palda, 1964).

ATR MODEL. A different explanation of the effect of advertising and also based to some extent on Pavlov's ideas, is the ATR model. This emphasizes the effect of advertising on repeat- purchases (Ehrenberg, 1974). Given enough time, consumers will try all brands of a frequently bought item on the market. Once they become aware of the brand, next there may be a trial purchase. If the

experience is rewarding, advertising will reinforce the feeling that the brand is worth buying. Then, word-of-mouth, recommendations and repeat-buying may develop. A satisfied customer will seek reassurance and in particular advertising for that brand. Selective perception of advertising allows the buyer to find the post-purchase publicity in the media for that particular brand (Ehrenberg and Goodhardt, 1979a p.16.3). Advertising may create and strengthen awareness in new buyers,but often with difficulty. Yet,it reinforces any after-purchase satisfaction and thus acts as a lubricant, but not as the motive for buying (Ehrenberg and Goodhardt,1979b, p.16.4). In ATR consumers are convinced that their choice is correct after the purchase, not before as in AIDA. Advertising action is in fact mainly defensive; managers are mostly concerned with reducing rather than increasing their advertising budgets. The need for advertising is accepted only as a cost of staying in the market preserving certain achieved sales levels, by persuading satisfied customers to try again. However plausible, evidence supporting the ATR model has not yet been published.

Consistent with this view, the structure of the market concerned explains to a large extent the impact of advertising in a product field. This practice is at a maximum under oligopoly (Cable, 1972), which is the case for soluble coffee in the U.K..

SOME EMPIRICAL EVIDENCE. A long ad-hoc coffee advertising survey, purposely contracted by the International Coffee

Organisation, failed to draw any quantitative relationship. Most of the work deals with the application of standard practice for a publicity campaign (Communication Research Ltd., 1973). Yet, applied research into advertising relies mainly on the work of Palda (1964). The effect of advertising accumulates over a period of time, with a minimum level for having any impact Ball and Argawala (1969) and Cable (1974) applied it to hot beverages in the U.K. market. The former claimed in a disputable work (see section 2.2.- of this chapter) that advertising on tea has been a significant predictor of changes in tea consumption. The latter study however, in a more consistent analysis, concluded that advertising produced a depressing effect over the intake of instant coffee, by including an undefined "advertising interaction" factor among the predictors (Cable,1974,p. 19, Table 3).

SOME BEHAVIOURAL HYPOTHESES. The growing and massive practice of advertising, makes the question of causation for increasing sales irrelevant. The actual problem, I believe, is how to observe and assess advertising effectiveness. Thus I propose to split the effect on coffee sales into two aspects, both linked to the nature of consumption and competition. The first one is a defensive action of existing consumers; extra sales come from a subtle effect over consumers of substitute items. The second one is originated through the competition of manufacturers in the advertising arena.

Advertising is better received by some people than others. Through selective perception, occasional coffee drinkers (who are habitual tea drinkers) pay considerable attention to coffee advertising just after trying coffee. Thus, they are encouraged to try again at more frequent intervals and perhaps at an increasing rate. In a static situation, with no growth in sales, habitual drinkers drink regularly although at different rates, while recurrent drinkers drink infrequently at a low rate. Some repeat their trial so infrequently that within a certain short length of observation in consumption, they simply appear as non-drinkers. However the presence of this last cluster indicates that there are always some habitual tea-drinkers having a trial purchase and in drinking coffee. Therefore, the growth in coffee sales derived from the suggestive action of coffee advertising originates from additional intakes by occasional drinkers. These occasional drinkers are drinking coffee more frequently and at increasing rates. Even more susceptible to this kind of action of propaganda are those mixed drinkers who have tea and coffee daily. Conversely, it would be hard to interest a sole tea drinker to try any coffee. But when this person tries it, then he/she will be more exposed to advertising for coffee. This view implies that existing and regular drinkers are protected from the advertising of competing items.

The second action is the result of the nature of competition through advertising; extra sales come from an increase in

purchases by habitual customers. This action is caused by changes in the concentration of propaganda among manufacturers. Concentrated advertising in an industry among a few firms is aggression to potential new comers and is a formidable barrier to entering the market. Most branded advertising is carried out in defence of achieved market shares. Thus, major changes in the distribution of advertising among brands invite retaliation: market shares are at risk. On the contrary, a stable and evenly spread advertising means that the prevailing strategy is defensive: everybody respects a certain share allocation. A significant rise in advertising for a brand has a major impact in the product field. The result is that habitual drinkers pay more attention to their choice of beverage and they tend to consume more their usual brands, more frequently and at increasing rates. Ideally that view ought to also include a variable for changes in the quality of advertising as perceived by consumers - yet, there are enormous difficulties in implementing this last idea, particularly when the model is quantified through time-series, as intended here. These two main components of advertising action are plausible hypotheses which should be tested. Thus, they are explanatory variables in the general model proposed in Chapter 3.

2.1.5.- THE SOCIOLOGICAL MODEL. Economics and psychology consider consumers as individual decision-takers, in circumstances in which humans are social beings, living with other members of the group. Each individual is influenced by the the group and

eventually she/he also exercises some sort of influence upon them. This view was suggested by Thortein Veblen (1899). The degree of impact over the individual varies from a comparatively weak effect excercised by a large cultural group, to the stronger influence of subculture, ranging from a country to a small face-to-face group and the family.

People affect consumer behaviour in two major dimensions: vertical and horizontal. The latter ranges from regional, national and local units to smaller groups such as those with which we have daily contact as friends, neighbours and the family. However, vertical influences are exercised by the level of income,which may be determined by the division of labour and the relative power in a given social structure. The members of each stratum, being defined both horizontally and vertically, have the aspiration to ascend socially to the group they consider to be above them.

An individual tends to grow up thinking that his/her own consumption pattern is the only right one. Parents pass on their tastes, values, beliefs and culture to their descendants as the unique and correct conduct. Any other, they think is wrong. As people want to move up in the social scale, they make significant preparations for the event, adopting goals and ideas properly for that desired group and even anticipating a new consumption pattern of this reference group. Nevertheless, by no means all those who are prepared for the change will ever make the move.

Leibenstein (1950) tried to integrate social influences into the theory of demand. He divided the demand for consumer goods according to the motivation for consumption, into functional and non-functional. The former correspond to the price demand function or the economic model, while the latter is made up of qualities not inherent to the commodity itself, for example, external effects on utility, as well as speculative and irrational reactions.

Non-functional external effects are: the bandwagon, the snob and the Veblen effects, as well as speculative and irrational demand. The utility a consumer seeks in a commodity is enhanced or decreased owing to the fact that others are purchasing and consuming the same item, or owing to excessive price. The bandwagon effect increases the demand for an item because others are already consuming it; this represents for example the fashion demand. Vice-versa, snob effect is the decrease in demand caused by the fact that other people are also consuming. The Veblen effect is the conspicuous consumption; as prices rise, demand increases. Speculative demand refers to buyers'expectation for future price rises and consequently relies on the supply of an item.

In irrational demand, purchases are not planned or calculated, but are due to sudden urges, whims, etc., which serve no rational purpose. Any market is likely to include consumers subjected to a combination of these effects. Then, the market demand

function is a combination of them all. However each category may be so unstable that a person can buy some items under one influence, but others for different motives.

2.1.6.- INTEGRATING CONSUMER BEHAVIOUR THEORIES. Some have integrated different views of consumer behaviour. A remarkable effort was made by Katona (1953) studying consumers' rationality and purchasing patterns. He focused upon the decision-taking process, relating associative-learning with problem-solving. Associative-learning is the repetitive response to a similar set of stimuli, called a habit. Habits are formed to a large extent by past experience, frequency of repetitions, recency of the stimuli and the degree of success of previous reactions. The individual tends to repeat previous conduct under similar circumstances. Habits are to some extent automatic and inflexible, resulting from repetitive responses. This is not necessarily an irrational behaviour and may prove to be in many cases the most appropriate response. Furthermore, this sort of conduct tends to predominate in everyday life. Only if something extraordinary happens calling for more cerebral action than is necessary in habitual behaviour, does the problem-solving or the thinking process start.

The problem-solving process involves either a situation to resolve or a question to answer. Deliberation requires the following: understanding of the problem, information, reorganising and directing the information towards the solution of the problem.

Alternatives and consequences are weighted with the restriction of resources and urgency, so that a choice is made among the possible courses of action. The resulting action may be an entirely new one, never before attempted nor even copied from any other group.

However plausible, taking a new plan of action is of a rare occurrence, as people tend to act as they have already done. Thus, problem-solving is a clear deviation from habitual behaviour.

Rationality reflects adaptability to act in a way when circumstances demand it. Social Science research usually assumes that rational behaviour is already determined and consistent, conforming to a regular pattern. However life is more complex. Asymmetric response, for example was detected by Arak (1969), who established that coffee farmers are more willing to increase output than to decrease it when faced with similar price changes involving increases or decreases of the same magnitude. Similarly, habit formation may lead consumers to asymmetric reactions to coffee price changes of equal amount but of opposing signs. That is, if the price decreases, sales are expected to increase somewhat, but if the price increases then sales are expected to decrease at a lower rate.

Consumption tends to increase rather than to decrease under stationary conditions. That is, with small changes in explanatory variables which are within their usual range and with

changes in opposing directions. However, in a non-stationary situation (with larger and sustained changes in predictors) the response in consumption tends to be more symmetric. Therefore there is need for a minimal impact of changes in a predictor and for a certain period of adjustment, before alterations in a consumer habit could become evident. Applying all this to coffee consumption, there are two levels of habit formation affecting its drinking: absolute and relative addiction. With absolute addiction, current drinking is inflexible to changes in economic factors. This depends solely on former drinking levels. A reduction of drinking will only bring about a serious withdrawal symptoms, since there is a total dependence on the habit. With relative addiction, the drinking habit also depends on other factors which can be either economic such as price and income, and non-economic as advertising and previous levels of drinking. If absolute addiction exists, it can be found among sole and heavy drinkers. For example those having more than six cups of coffee a day. This last segment grew from 20 to 25 per cent of all coffee drinkers in ten years since 1969 (B.M.R.S in T.G.I.), at the expense of light coffee drinkers who were reduced from 50 to 43 per cent in the same period.

This view is complemented with my particular interpretation of predictors' action on the demand function for frequently bought items. The impact of advertising on sales is better assesed by separating it according to the source of the impact: this can come from either consumers of competing goods or from a rise in the

rate of drinking by habitual consumers. The first impact protects existing consumers and at the same time can capture new customers. The latter is competition through advertising with other manufacturers, and as a result existing customers drink more. Naturally, the effect of economic factors complements the model. These factors are prices of coffee and tea and income. This is completed with the effect of relative addiction which anticipates an asymmetric consumer response. Before specifying my own model, though, a review of applied research on coffee is necessary for identifying what variables have been already tried and their contribution towards the understanding of coffee consumption. This is precisely the content of the next section.

2.2.- EMPIRICAL STUDIES OF COFFEE CONSUMPTION IN THE U.K..

There are already several studies on modelling the demand for commodities. This section examines those studies which refer to coffee in this country. In each case, I review the theoretical model, sources of information used, results obtained, together with conclusions and the validation procedure followed. Most of those works are based on time-series of data, but a few are based on cross-sectional data. Naturally, some minimal coincidence is expected in replicated estimates for the same market and commodity with a similar of data base utilised, which is not the case. Two parts follows: cross-section and time-series studies.

2.2.1.-CROSS-SECTIONAL SECTIONAL STUDIES. By employing cross-sectional information, it is expected to obtain estimates of income elasticity of demand. Price and several other time-changing factors which may affect coffee consumption, are in this case held constant. The N.F.S., the F.A.O. and Rayner et al.(1972) have all published works of this nature.

National Food Survey. The annual report of the National Food Survey Committee contains estimates of price and income elasticity of demand for a large number of foods, including tea and coffee. N.F.S. uses a different set of data for estimating each of them. For income elasticity it uses blocks within the same year, while for price elasticity it employs unpublished monthly averages on six-year periods. Income elasticity is estimated through a doubled-log equation, which is quantified by multiple regression

analysis. Yet, there is no mention which procedure is followed for estimating regression parameters. (If the O.L.S. method is used, results are not screened for testing that method's assumptions).

Besides, N.F.S. home-size typology is non-exhaustive, there is a very low rate of response for income estimates and there is a divergent trend of basic demographics with respect to the population. Yet, N.F.S. is widely used, but always uncritically. Estimates of income elasticity for the quantity of hot beverages purchased are similar to those for the expenditure. Unlike coffee, tea elasticty is negative and decreasing: - 0.02 to - 0.19; soluble coffee, although a superior item, is inelastic, decreasing its response to income changes from 0.85 to 0.39; coffee beans are elastic and positive, yet with an inconsistent trend pattern.(See Appedices 1 and 2).

THE FOOD AGRICULTURE ORGANISATION. This agency of the O.N.U. is concerned with methodological aspects of estimates of the demand for commodities. The F.A.O. has prepared estimates of income elasticity of demand by countries for periodical projections of food consumption. For the U.K., F.A.O. followed a similar procedure used by the N.F.S. in estimating income elasticity. Yet, the F.A.O. also has used a wide range of mathematical models which are quantified through regression analysis, such as double-log and log-inverse. Results indicate a negative and inelastic tea elasticity, decreasing from -0.2 to -0.5 from 1960 to 1973. Coffee

elasticity, however tends to be positive but inelastic, decreasing from 0.8 to 0.4 in the same period. Different mathematical functions have little effect on the outcome. As the data for quantification were obtained from the N.F.S., all those reservations about that source should also be extended to the F.A.O. estimates. (See Appendices 3 and 4).

RAYNER A.J. et al. (1972). They studied in detail unpublished data of the N.F.S.. They tested two hypotheses,one about the proportion of unexplained variations of the demand for individual items and aggregated foods, particularly hot beverages. The other hypothesis states that frequently bought goods have a lower proportion of unexplained variations than the demand function for infrequently purchased items. These authors also studied the effect of socio-economic variables on the consumption of tea, coffee and milk, and the effect of regionality and family composition on consumption. They arrived at the following adult equivalent scale by family size: coffee expenditure = N1 + 0.85N2 + 0.65N3; tea expenditure = N1 + 0.36N2; tea purchase = N1 + 0.42N2; beverage expenditure = N1 +0.42N2; beverage expenditure = N1 + 0.45N2 + 0.19; food expenditure = N1 + 0.62N2 + 0.55N3; where in the home N1: number of people over 14, N2: number of people between 5 and 14, N3: number of under-fives.

The mis-interpretation of such calculations,in particular the exaggerated behaviour of under-fives is remarkable. Surely, the increased consumption of coffee in homes with people so young is

not due to any significant extent by toddlers drinking coffee. More likely, this is caused by the drinking habit pattern of home-tied mothers. Such adults probably have a mid- morning coffee. Results led to the authors to reject the regional effect hypothesis in the case of coffee.

They also found that income elasticity changes by social class. The average elasticity for the demand for coffee, is 0.52, which rises to 0.59 for professionals and white-collars, while for manual workers it falls to 0.49. However, the parameter for employees is smaller than its S.E.. (Rayner et al., Table 5.2.7).

The same occured with two parameters for the influence of family on coffee drinking.(p.77, Tables 5.1.1 and 5.1.5, op. cit.).

These findings substantiate, if anything, my own doubts about the unbalanced reporting by the N.F.S.. Naturally estimates of income elasticity based on cross-sectional data obtained from a survey such that non-respondents outnumbered respondents by 2 to 1, are not in agreement. The result is that for a similar item and period of time the N.F.S. found 0.80, the F.A.O. 0.98 and Rayner et al.(1972), 0.52.

2.2.2.- TIME-SERIES STUDIES. There are at least eight more studies investigating the consumption of coffee in the U.K. but their estimates are based on time-series data. They are the N.F.S., F.A.O. (1972), Ball and Argarwala (1969), Pollock (1971), Timms (1973), Cable (1974), Jones (1978) and Young (1980). In this section they are reviewed in terms of: theoretical formulation, source of information and estimates obtained - particularly income and price elasticity of demand. These aspects are afterwards summarised in order to isolate which explanatory variables are selected, how they are proxied and which ones have already being dropped on empirical grounds. The outcome of this section is vital for the formulation of a consistent model for explaining changes in consumer behaviour.

NATIONAL FOOD SURVEY. Also in annual reports of the N.F.S. estimates of price elasticity of demand are usually included. These estimates are the result of regressions of monthly series in six-year periods which are based on unpublished figures of their own survey. The explained variable is proxied through purchases per capita. Explanatory variables are the deflated coffee price and two dummy variables for seasonal and interannual shifts. Such data are adjusted to a double-log function. Recent grouping for the 1972-77 and for 1973-78 indicates that hot beverages are price inelastic. Soluble coffee has an elasticity of- 0.5 , ground coffee of - 0.4 and coffee essences are really elastic at - 1.7.

Tea is also elastic at -0.4. (See Appendix 5). N.F.S. estimates rely on a distorted source and their theoretical model is incomplely estipulated.

F.A.O. (1972). This organisation has also published estimates of the demand for coffee import demand, rather than the demand by the final consumer, as the N.F.S.. For the period 1950-69 two basic models were formulated, by assuming or not that importers substitute freely one variety for another. The first model, which accepts the assumption of variety substitution was specified as a system of four equations, each one for a variety of coffee and in double-log terms. The dependent variable was observed through the volume of coffee imported; predictors were coffee price - imports unit value, national income, cost of living index, population and price of a substitute - tea. Results for member countries of the O.N.U. turned out to be unreliable, inaccurate and with parameters of the wrong signs;this is also the case for the U.K..

The unrestricted model, which assumes a separated demand function by coffee variety, contains a simple linear regression equation between imports for each type of coffee; Brazils or Arabicas, Robustas, Extra Milds and Other Milds. Explanatory Variables are again income, population, cost of living and tea price. For the U.K. this model produces almost all its parameters of the wrong sign, except income. Many parameters were not significant and equations had a low coefficient of determination, showing that a large part of the fluctuations are not explained. (See Appendices

6 and 7).

BALL AND AGARWALA (1969). Although these authors aimed at studying tea drinking, they made frequent references to coffee so that they are usually quoted by more recent authors. Yet, they made methodological mistakes and omissions. They tried to isolate the effect of advertising on the demand for tea, by comparing regression results of unpublished figures of the domestic availability of tea. Regressors were the price of tea, income, unemployment rate and the generic advertising for tea. The dependent variable was proxied with data from the Tea Council for the period 1958-67. They used results based on N.F.S. for measuring the explained variable, because original calculations based on net supplies produced parameters of the wrong sign. Yet, they did not investigate causes of discrepancies between both sources of information. Naturally, N.F.S. -based estimates were also of the wrong sign for price and for income effect. (p. 210, Table 2a, op. cit.).

Advertising effect was instrumented using Palda's (1964) model of advertising goodwill. They tested various depreciation rates of the goodwill in equations where this and employment were the only predictors. Depreciation at ten per cent gave a slightly better fit and was used for another equation. The effect of income was disregarded because of alleged multicollinearity, but they included unemployment, the ratio coffee to tea advertising, time and time square. (See Appendix 12). From those results, Ball and

Agarwala concluded that tea advertising is a significant explanation for changes in tea drinking. (equation E, Appendix 8).

Regrettably nowhere in the publication there is mention of the mathematical form of the equations. There is no analysis of heteroscedasticity and of serial correlation. The true effect of advertising is likely to be far from the actual one, since predictors were not deflated and not detrended. Thus, this is a grossly mis-specified function, where time and time square, which explain nothing, are the only significant predictors. Both, the explained variable and most explanatory variables are inefficiently proxied.

They completed their work by calculating several linear equations between nominal household expenditure on tea and on coffee split by social class and by family composition, for the period 1957-66.

Authors concluded that with the exemption of the lowest income and the Old-age pensioners group, in all classes there has been a significant decline on tea expenditure, notably among young families. Yet, in all cases expenditure on coffee has been rising in circumstances that total drink expenditure did not change; results for class A are not reliable. A similar exercise, but for the quantity purchased did not yield a pattern. (See Appendix 13).

The published work of Ball and Agarwala is poor in presentation,

leaving crucial gaps on their actual method for specifiying and for estimating those models. The symbology and the definitions of some categories of households are also unclear.(See Tables 6, 7, 8, and 9 in op. cit.). Besides, there is no mention of the source of information from which price, advertising and unemployment were obtained. Finally, all that study relies on the uncritical use of the N.F.S., although these authors had evidence of serious discrepancies with domestic supplies.

POLLOCK G. E. (1971). Pollock constructed a model of the world demand for coffee in which the U.K. estimates were based on the price of coffee, the income and the trend. The log form of the model was insignificant. The linear version, however, gave all coefficients of the expected sign. Consumption per capita was measured as raw beans imported divided by the population aged 15 or older. The price of coffee was expressed as the import value,calculated from all imports divided by the volume imported. The income was assessed as an index with base 1958=100. Pollock best result for the period 1953-68 is (p. 105, op. cit.):

$$M/N = 2.6 - \underset{(0.6)}{0.009P} + \underset{(0.8)}{0.0009Y} + \underset{(4.0)}{0.182T} \quad ;$$

where R : 0.88 , ( ) : t* or t-ratio, M/N : consumption per capita, P: price of coffee, Y : income; T : time trend.

Thus, for Pollock time is the major cause of change in coffee

drinking, as for Ball and Agarwala (1969). Again this explains nothing but the need for detrending time-series. The effect under study was observed in that work by a proxy which omitted two important parts: adding imports of processed coffee and deducting re-exports of coffee. Besides both price and income are not deflated in the fifteen years series. Thus Pollock's results are affected by very large standard errors.

Pollock (1971) and Timms (1973) are the only ones who have not used the N.F.S. source for proxies of coffee consumption. Pollock employed imports of green beans only, making the measurement even more biased than the N.F.S.. Timms used net imports, which is more adequate for the U.K. situation.

TIMMS D. E. (1973). He calculated a world-wide model of coffee demand. The best results for the U.K. were obtained with a double-log function; explanatory variables are coffee price and income and the period studied is 1952-65, such that:

$$\log Q = -2.10 - \underset{(2.29)}{1.51} \log P + \underset{(5.31)}{2.23} \log C \ ;$$

where Q: net imports of coffee, P: deflated coffee price, C: deflated consumers' income per capita, ( ) : t* or t-ratio.

While selecting predictors, Timms dropped, on empirical grounds, the prices of cocoa, milk and tea. His final estimates are free

of linear autocorrelation of first order detected by the Durbin-Watson statistics. Tests for other econometric assumptions are not included in the study, leaving some doubts about the actual reliability, accuracy and stability of his estimates. Accordingly, coffee demand is elastic (-1.5) and income very elastic (+2.2). Yet, as series were not detrended, anything which grew steadily one year after another - such as income - may end up associated with coffee consumption. I suspect that these estimates are largely exaggerated, although coffee may have become less elastic to changes in price over the years than it used to be during the fifties and early part of the sixties. Then, coffee was in the introduction and growth stage of the product life cycle.

CABLE J. (1974). In a study commissioned by the former Board of Trade, he proposed a model for explaining the effect of advertising on the demand for soluble coffee. Cable assumed that consumers pass through a hierarchy of decisions, allocating first broad sums of money and later deciding it in more detail. Thus, drink expenditure is determined after food and before a subsequent distribution between coffee and tea. At both levels of decisions, consumption is determined by the income, price, advertising and "taste".

He proposed a system of equations for explaining hot beverages demand, which is stipulated in the Cobb-Douglas function.

Predictors are price of coffee and tea, advertising on coffee and on tea and income. Each single beverage is an equation of the system; by dividing them, he integrates the system. Later the effects on changes in product quality and of adoption of innovations are added.

A ratio for the diffusion of soluble coffee adoption is made up by dividing the number of instant coffee adopters by the number of tea adopters. That, Cable expected, should produce a non-symmetrical effect. Evenmore, Cable thought that this rate interrelated with the advertising effect.

The impact of product quality is observed by dividing the deflated average price - reported by the N.F.S. - with the brand leader price. ("Nescafe", in a two oz. tin). Surely other proxies can show better the effect of quality changes. The composition of soluble coffee has changed with respect to both the processing applied from hot-dried to freeze-dried and with respect to the composition of blends. Also progressively there has been an increasing proportion of Arabicas, Colombian Milds and Other Milds and a decrease in the proportion of Robustas in the composition of net supplies. Yet, the particular ratio implemented may capture a dimension of brand loyalty, if anything, instead of quality changes.

Cable also applied the Palda's model for advertising. He used

quarterly data for 1960-68. Price was proxied by N.F.S. average price paid and advertising through the media expenditure. Consumption was proxied by a measure from the N.F.S., yet it is not clear if it was either purchase or expenditure. Also there is no indication how proxies employed for the diffusion of innovation were measured, particularly the number of soluble coffee adopters.

Cable presented three sets of results: a) ignoring the effect of tea;b) a system of supply and demand; and c) a hot beverages demand function. He rejected the effect of advertising on coffee demand, which is in agreement with Ball and Agarwala (1969). Yet both made similar mistakes. In Appendices 10 and 11 are summarised his results for statistically significant models, a) and c).

All those observations already stated for N.F.S.-based studies are valid in this case. Moreover, the poor presentation of results obscured the validity of the work, both in the original paper and in the book published later, Cable (1975). For example in Table 1, p. 17 (op. cit) there appear new concepts as predictors which were not included in the description of the various models. They are "relative price" and "coffe quality index". Also I have doubts as to the meaning of the columns "ratio of constant quality coffee and tea prices" and "ratio coffee and tea quality indices" which appeared in Table 3, p. 19 (op. cit.), since they are not

clearly defined and there is no indication about their measurement procedure. Additionally the text is untidy and disorganised. As in many previous studies, no attempt was made to test whether the assumptions of the estimating method were met. Yet Cable did state some useful hypotheses which are partially considered for the design of a theoretical model, particularly the effect of tea price and of advertising on demand. Advertising effect measured as the ratio between coffee and tea advertising seems logical, although an incomplete approach. That, still does not account for any changes in the transmission medium nor in the absolute level of expenditure on this factor.

JONES G.T. (1978). Quite independently from any of the former studies, Jones prepared a set of conditional forecasts of demand at constant prices. He tried to build up an integrated demand model for several food items, based on an anti-time series principle. A model is specified in terms of a rate of freezer ownership and the effect of "vintage" trend. Two demographic factors are included for vintage: the age structure of the population - which is measured by changes in consumer units - and the date of birth of the representative houseperson. As the mean age of the houseperson remains constant, time is always on the move, but he/she is getting a year older each year. A dummy varying +1 each year represents that effect, which is justified on behavioural grounds. Through the life cycle new habits are easily acquired by young people and which will remain as they grow older.

Thus, Jones assumes that the rate of change in consumption by age groups in the past will explain future changes in consumption. That as an absolute principle it is absurd. Old habits would have ended as soon as a group of youngsters adopted a different one. Age may become an important factor in consumption, (Rayner et al.1972). But if Jones' view is left unrestricted, that is without any sort of limitation, then no young person would ever drink tea nor an old person drink coffee. Yet, the mixed-drinking of both tea and coffee occurs. Thus, Jones' model is so deterministic that it is self-defeating. Vintage per se is not a major cause of changes in consumption, but the effect of other factors. Should it ever become significant, it will only reveal the need for detrending, but it explains nothing. More realistically, the model can include the post-readoption of parent habit by their descendants at certain stages of the life cycle, as well as the rate of diffusion of innovations among the same vintage.

Jones used uncritically N.F.S. data for measuring both expenditure and purchase for the period 1972-75. Data were elaborated through a non-declared estimation procedure, which resulted in unpublished parameters. Yet, from them Jones obtained estimates of income elasticity. For soluble coffee it is inelastic, but positive (0.61), beans and ground coffee are positive and unity, while coffee essences are very elastic but negative (-1.29). The

study gives no chance of evaluation of its results: there is no indication of its accuracy and reliability; no traces of the method used and no mention of testing for any of its assumptions.

YOUNG T. (1980). His major contribution is more theoretical rather than empirical. He proposed an asymmetrical consumer response function applied to soluble coffee. The efect of habit formation on consumption is evident from different reactions to price changes. Upwards and downwards price movements lead to a differential response in absolute terms. For that aim, Young devised a method for modelling functional relationships. He modified the series of predictors, splitting them into upwards and downwards changes. At record low prices new addicts fall into the habit of drinking coffee. This will persist even if prices subsequently rise. Vice versa, at unprecedently high prices the consumer switches to a substitute and it becomes difficult for the seller to win back old customers. Besides, "normal demand" is generated by well-informed customers, yet many are unaware or disregard price changes. By extension, functional irreversibility is also applied to another explanatory variable, such income. Consumers tend to be attached to a certain standard of living, even though their income is reduced.

Young's procedure is a corrected version of Trail et al. (1978) and of Wolffram (1971) for the modification of explanatory variables, both alrady applied in the asymmetric modelling of

supply. Young aimed at kinking the demand function only if certain criteria about the minimum level of the series are met, in terms of peaks and troughs. The regression of six models tested his suggestions. They are four for the immediate adjustment and two for the long-term adjustment. The dependent variable is proxied through quarterly purchases of soluble coffee obtained from the N.F.S.. In the short-term set, the functions are symmetrical and as explanatory variables are the following: deflated N.F.S. average price paid, the per capita deflated income and three seasonal dummies. Other functions estimated were all asymmetrical. In one of them, the price series was decomposed into two variables following the Wolffram method of additive rises and decreasing changes. (Appendix 12).

Yet, it is sensible to think of a non-reversible demand function due to the strong habit of drinking coffee. Young's model starts considering what is actually happening in the consumption process for frequently bought items. However, statistical consequences of the particular proxying procedure proposed should be carefully analised. Young did not state his actual estimating method. Had he applied O.L.S. while using Wolffram's decomposition procedure, the results would have been void. The same Wolffram (op. cit p.357) warned that O.L.S. assumes reversibility of the relationships. Then, it is uncertain whether Young estimates are the desired Best Linear Unbiased Estimates (B.L.U.E.). Surely, other decomposition techniques need to be examined, such as: absolute and relative differences, frequency of extreme values -

e.g. standard deviation, detrending or even decomposing series through the spectral technique (Parik, 1971). Even lagged values also allow for some kind of asymmetrical response.

Consequently, although theoretically plausible, Young could not improve his results beyond the symmetrical function. His work is clearly exploratory and deserves further theoretical and methodological scrutiny, which is beyond the scope of this work.

2.2.3.- A SUMMARY OF EMPIRICAL STUDIES. A score of replications of demand function estimates for the same commodity and market produced an ample range of results, rather than a minimal coincidence. Thus, estimates of price elasticity for coffee demand in this country fluctuate from -1.5 to almost zero. By varieties it reaches -3.1 for Milds up to 1.78 for Robusta. Aggregated income elasticity also produced inconclusive outcome, ranging from zero up to 2.2.. It even reaches negative values when disaggregated. (See Table 1).

Two major reasons explain that disarray: mis-specification of models; and defective measurement of the explained phenomenon. The model is still mis-conceived. Researchers have already introduced several explanatory variables: coffee price; consumers' income; price of tea; indicators of life style, family size, unemployment, changes in coffee quality; advertising on both

TABLE 1

ESTIMATES OF PRICE AND INCOME ELASTICITY OF DEMAND

FOR COFFEE FROM REVIEWED MODELS

MODELS (1)	ESTIMATES OF - INCOME (2)	PRICE (3)	R^2 (4)	FUNCTION (5)	DEPENDENT VARIBALE (6)	PERIOD (7)	EQUATION (8)	D.W. (9)	REGRESSION (10)
NFS (1977)	N/S	-0.5(x)	0.23	A	C-2	1972-77c	C	N/A	A(P)
NFS (1978)	N/S	-0.6(x)	0.20	A	C-2	1973-78c	C	N/A	A(P)
NFS (1971)	N/S	-1.5(x)	N/A	A	C-2	1964-71c	C	N/A	A(P)
NFS (1976)	N/S	-0.5(x)	0.05	A	C-2	1969-76c	C	N/A	A(P)
NFS (1977)	N/S	-1.1(x)	0.18	A	C-2	1970-77c	C	N/A	A(P)
NFS (1978)	N/S	-0.9(x)	0.19	A	C-2	1971-78c	C	N/A	A(P)
FAO (1972)	-0.04	-3.1(x)	0.63	A	B-3	1950-69a	C	N/A	A(P)
	0.002	-0.01	0.51	A	B-4	1950-69a	C	N/A	A(P)
	-0.14(x)	-0.21	0.48	A	B-5	1950-69a	C	N/A	A(P)
	-0.16	1.78	0.62	A	B-6	1950-69a	C	N/A	A(P)
POLLOCK(1971)	0.00003	-0.0001	0.88	A	B-7	1953-68a	A	N/A	A(P)
TIMMS (1973)	2.2(x)	-1.5(x)	0.95	A	A-7	1952-65a	C	1.7	A(P)
BALL et al (1969)	0.23(x)	N/S	0.94	A	D-2	1957-66b	A(P)	N/A	A(P)
CABLE (1974)	1.3(x)	-0.6	0.95	A	C-2	1960-68b	C(P)	1.6	A
JONES (1978)	0.6	N/A	N/A	N/A	C-2	1972-77d	C(P)	N/A	N/A
YOUNG (1980)	1.13	-0.67(a) -1.33(b)	0.95	B	C-2	1960-77b	A(P)	2.04	N/A

(1): Sources as indicated in Appendix 13.
(2): Income elasticity
(3): Price elasticity; (a) with respect to price rises; (b) with respect to price falls.
(4): Coefficient of determination published or calculated.
(5): Functional relationship. A: immediate adjustment; B: lagged adjustment; C: system of equations.
(6): Dependent variable proxies. A: net imports; B: Imports; C: Household purchases; D: Household expenditure
Product nature; 1: total product field; 2: instant coffee; 3: Mild; 4: Other milds;
5: Brazils; 6: Robusta; 7: all green beans; 8: not specified.
(7): Period of estimates, such a: annually; b: quarterly; c: monthly; d: not stated.
(8): Equation. A: linear; B: semi-log base e; C: double-log; D: inverse-log.
(9): Observed Durbin-Watson statistics.
(10): Regression method. A: Ordinary Least Square Method; B: Others.

N/S: Not specified.
(x): denotes a t-ratio of at least two.
(P): Presumably.

coffee and tea; and time trend. For testing some particular behavioural views, authors have consistently dropped some explanatory variables which are later selected by another one, also on empirical grounds. That is, for example, tea price effect eliminated by Timms and by Young, but it is also selected by the N.F.S., the F.A.O. and Cable. None of the simultaneous equations turned out to be significant, they are the asymmetric-simultaneous response (Young), the supply and demand (Cable) and the inter-related coffee variety demand system (F.A.O.).

Also insignificant are the effect of advertising, the price of cocoa and of milk, the relative coffee price, a coffee quality index, the decomposed income, family size and composition, etc..

However, most authors selected coffee price and income as well as time trend.

All but Young assumed a symmetrical functional relationship, leaving no chance for considering the possibility of coffee drinking. Although Young started from a sound principle, he could not apply an effective procedure for proxies of addiction, compromising his work with the estimating method. Moreover, the analysis of advertising impact on demand deserves a better implementation, based more on behavioural rather than on normative views of its impact. A sound model must be general and allow for symmetrical and non-symmetrical replies.

A preliminary task is, however, the assessment of coffee

consumption statistics. The explained variable must be observed through reliable means, before attempting any analytical work. Yet, from the review it is clear that the most popular source used, the N.F.S., is suspected of biases. This due to both the large rate of non-respondents and the diverging characteristics of respondents with respect to the population.

Then, two methodological corollaries come out from the review. First, the mathematical form of equations usually have little impact in improving the fit of the relationships. F.A.O. demostrated that for a similar specification and instrumentation of variables, the estimates of elasticity of demand are similar in magnitude and in significance in a range of mathematical forms. (See Appendices 3 and 4). Thus most authors prefered the linear form. Second, all systems of simultaneous equations were unaminously disregarded as insignificant. Usually these estimates, however, are not detrended and not tested for serial correlation; thus, the time trend and any other series changing gradually over a period of time becomes significant, although they are meaningless from the behavioural point of view.

2.3.- CONCLUSIONS.

Faulty model specification and methodological deficiencies produced anarchy in estimates. Partial views of consumer behaviour have so far prevailed in applied research, leaving little scope for representing the actual behaviour and for integrating the effect of economic and non-economic factors on consumption. The analysis shows that models used assume a symmetrical response to changes in predictors. Yet, that view must be challenged for allowing the impact of habit formation in the drinking of a frequently bought and drunk item. Also there should be a minimal threshold level of predictors for isolating alternative modes of response: routine and problem solving. That was proposed by Katona (1953) and it is related to stationary and non-stationary market conditions of Ehrenberg and Goodhardt (1979a and 1979b). Advertising effect completes the model. Most studies into advertising effect on coffee demand are based on Palda's interpretation of the AIDA model, ending up with inconclusive or insignificant results. Yet, it is evident how manufacturers spend substantial sums on advertising publicty, which effect has not been properly modelled. In an attempt to account for this, I propose to separate the effect of advertisng into two aspects linked to consumption and competition. The

first action attracts new buyers, while protecting customers from competitors' propaganda. The second action increases sales to an habitual clientele, while manufacturers are competing through advertising for a larger brand share of the market.

Additionally, most models under study rely on data collected by the N.F.S., a source suspected of giving biased information. Thus, before any estimate of an improved model could be made, a statistical audit of coffee consumption figures is essential.

It is the aim of the next Chapters Three and Four to deal with all these problems. As a major outcome of this section a general model for explaining changes in coffee consumption is proposed in Chapter Three where it is detailed as well how explanatory variables are proxied. Chapter Four follows with an audit to coffee consumption figures, with the aim of improving the measurement effectiveness of the explained phenomenon. Then, the model is estimated and results presented in Chapter Five.

CHAPTER 3.

M E T H O D O L O G Y.

In the last Chapter there were isolated crucial theoretical and practical aspects limiting the effectiveness of models of coffee intake in U.K.. This section outlines my proposition for solving the former one by introducing an original general model for explaining coffee drinking together with the working hypotheses and equations as well as indicating how explanatory variables are proxied. The latter problem concerns the reliability in measuring the explained variable, and due to its extension and complexities it is treated in a separate Chapter - number four. Chapter Three also contains details of the procedure followed for validating such a general model, particularly the quantification, estimation and testing of the hypotheses.

3.1.- THE GENERAL MODEL.

A major problem detected in the literature reviewed is the limited theoretical scope of the models. Usually authors assumed a symmetrical consumer response, and yet there are behavioural grounds for obtaining asymmetrical behaviour if one considers the possibility of habit formation in the drinking of coffee. This

sort of statement affects the nature of the demand function with respect to its responsiveness to economic and non-economic factors, such as the prices of coffee and of tea, income, advertising and the strength of the habit. The general model tries to prevent such omission by allowing the existence of habits in the drinking of coffee.

The review also showed that advertising impact on demand - which has not been explained yet - has relied on normative rather than on behavioural views. A more behaviouristic intrepretation of advertising impact on sales is obtained by separating its action according to where the increase in sales came from: either competition or a rise in consumption by current customers. Both actions are derived from alternative management objectives with regard to the advertising practice: the maintenance of an existing market share - while protecting our own customers from competing propaganda; or open competition in the market place in advertising terms rather than in another decision variable.

All these ideas are integrated into a general model containing statements about the nature of its functional relationships, which are presented in the form of hypotheses, such that they can be tested as parameters of equations proposed for implementing the functions contained in the general model.

3.1.1.-<u>BASIC CONCEPTS.</u> The coffee market is made up of two

sub-markets: home and catering. The former is the subject of the general model. At home people drink a certain amount of hot beverages, which are already available by the periodical replenishing of stocks. naturally, factors affecting the decision which one and how much to drink are quite different in each sub-market.

In the home sub-market, under stationary conditions - that is, when explanatory variables fluctuate within their historical range, consumers of coffee can be observed from at least two relevant angles: the amount they drink and the nature of their drinking activity over a long period of time. By the amount they drink, consumers are either non-, light, medium or heavy drinkers. Also, by the nature of their drinking behaviour, people can be grouped into: sole drinkers of a close substitute (e.g. tea); mixed-drinkers having a different preference for a hot beverage according to the time of the day or the main beverage being served on each drinking occasion; and sole coffee drinkers, who exclude any other form of hot beverage.

All that is in the short-term and in a static situation. Yet, as the period of observation increases, coffee drinkers drink tea and even the sole tea drinker eventually tries coffee. The essential concept is that, in the long term, trials of a different item do take place, allowing for the possibility of more flexible behaviour. I hold that the understanding of shifts in consumer market demand relies on factors conditioning the repetition of

such trials, while changes within a given demand function are caused by alterations in the drinking rate of established customers.

The hot beverage drinking habit is reinforced by previous levels of intake. Tea and coffee are stimulants containing caffeine, a drug which may cause some kind of withdrawal syndrome at high and sustained rates of assimilation. The strength of the drinking habit builds up gradually, until it becomes an absolute addictive activity, insensitive to changes in other factors, but to former consumption levels. Yet, absolute addiction to coffee does not prevail in the market place. More widespread is the addiction relative to changes in economic and non-economic factors, such: price of coffee, consumers' income, price of a a close substitute like tea, the relative price of coffee to tea and the communication effort made by manufacturer expending on advertising for coffee and for tea.

My behavioural explanation for the impact of habit formation on demand is a personal interpretation of Katona's thinking process. A habitual response implies a routine way of deciding which one and how much hot beverage to drink. Opportunities for breaking a habit occur when factors affecting routine decision-making reach unusually critical levels. Then, it triggers the problem-solving way of thinking, which leads to significant changes in the conduct of many people, causing shifts in the market demand function. The impact of habit formation in coffee is such, that there is an

adjustment period for changes in exogenous variables to become apparent on subsequent alterations in consumption.

As anticipated, advertising effect on consumption is made up of two different components, according to where the increase in sales comes from, that is either existing customers or competitors. The first action is measured through the ratio of expenditure on coffee to tea advertising, while the second action is observed by changes in the concentration of advertising among competing manufacturers. An even clearer effect can be obtained by considering a different action by the transmitting media (press, T.V.). The choice of those predictors for advertising effect is apparently controversial. It could be argued that the less concentrated branded advertising becomes, within a product field, the greater are chances for effective competition among several firms through advertising, bringing about at the end an enlargement of the overall generic market; and converserly.

Television and press do not necessarily have a similar efficiency in communicating with the general public. Price differentials between media ought to make up for the gap. However, advertising cost is more guided by the supply and demand for space rather than by the marginal effectiveness between means of communication. However, advertising reaches consumer's attention with varied intensity according to the medium used. Thus, a trade-off prevails between medium and exposure. The time of exposure is

rigidly fixed by the manufacturer in a T.V. commercial, but the audience who receive is quite general. Yet, readers of printed advertising - who are already a particular sector of consumers, can spend as much time as they want being exposed to such propaganda. Paradoxically, while T.V. commercials are selectively perceived by a general audience for a fixed period of time (decided by the advertiser) printed advertisements are read by selected readers for a length of time decided by those actually receiving them.

Practitioners of advertising know that T.V. is a more powerful medium than any other one, but little is said about how much. T.V. viewing and readership of printed advertising are distributed unevenly; one half of those who read advertisements are also three quarters of heavy viewers of commercial T.V.. Yet, there is need for eighty three per cent of heavy readers of the press, to make up for a half of commercial T.V. viewers. Branded coffee is associated with media differential perception of advertising. Major consumers of the two brand leaders of soluble coffee are part of different audiences. Heavy buyers of "Nescafe" are the lowest viewers of ITV commercials; while heavy consumers of "Mellows" are mainly medium to heavy ITV viewers (Smith, 1981). Then, there are grounds for expecting a different impact of advertising on consumption according to the transmission medium, as competition also takes place in each of them. Medium-size and small producers may readily accept a certain status quo,

tolerating the predominance of one or a few manufacturers in advertising terms. The smaller advertiser may stress other sort of decision variables by reducing price, increasing retailers' margin, subsidising wholesale transport, or even producing better point of sale display material.

It may be also argued, however, that the more a company expends on advertising for its own brands for longer term, the more likely it is for that organisation to become highly skilled in performing that activity. Then it is sensible to expect a much wiser allocation of the advertising budget. For example, possible options are: a more effective media combination and schedulling, selective campaigns in priority regions, improved preparation and timing of campaigns and a refined assessment of advertising impact on sales. Other factors which expenditure does not measure directly, can also influence the effect of advertising on sales, like improved timing and concentrated exposures for the same annual budget. These factors, however are more likely to operate within short time units (like a month, a fortnight or a week) rather than annually as is observed in this model.

Each of these views about coffee consumption is stated as a working hypothesis, which is presented in a single equation. Dynamics is explicitly admitted on each function as time lags. These functions are estimated through multiple regression analyses fitted to a straight-line model. An earlier attempt to find a

better fit with other forms, gave no improvement. Double-log, semi-log and inverse log versions did not improve the significance; yet that is in agreement with F.A.O. (1972 and 1976) similar findings.

The model is implemented with explanatory variables described in section 3.2.- Two alterations are introduced to the linear model. The regression analysis applied was modified to eliminate the intercept parameter. Also absolute differentials of time were employed for detrending the series.

Lastly, this general model assumes that the demand function is identifiable from the market information - price and volume traded. Most authors share the view that demand remains relatively stable, while supply function tends to shift from one year to the next. In fact there are long-term cyclical trends in coffee production, marked by sustained periods of expansion which are followed by stagnation. In the short term, production fluctuates widely, largely due to periodic frosts in Brazilian crops and the biennial pattern of coffee trees' production (F.A.O., 1979 p.63). Furthermore, Cable already rejected the hypothesis of simultaneous determination of the supply and demand of the supply and demand functions. Nevertheless, some researchers have sustained just the opposite assumption in the preparation of sophisticated systems of the world coffee economy, in many cases with little meaning (Daly, 1958), (Lovasy and Boissoneault,1964), (Abaelu and Manderscheid, 1968), (Epps, 1970),

(Pollock, 1971), (Saylor and Freitas, 1974), (Edwards and Parikh, 1976) and (Singh et al., 1977).

Baumol (1972,pp 245-52) suggested that advertising is affected by a determination problem, as the advertising budget for a brand may be determined by the actual sales performance. Hence, two functions of advertising may appear: one as sales predictor and another as being determined by past sales. However, in the market of all brands there are several firms each with its own assortment of brands, and hopefully independently taking advertising decisions. In this model it is assumed that there is no collusion, as far as fixing advertising budgets is concerned, and thus advertising is treated as another exogenous variable.

3.1.2.- WORKING HYPOTHESES. The general model is summarised in ten functional relationships, in the form of traditional scientific hypotheses, such that they can be tested. Symbols used are explained both in the text as they appear and in Appendix 14.

HYPOTHESIS I : ABSOLUTE ADDICTION. The habit of coffee drinking may become so strong that such consumers are addicts. The amount of coffee demanded (A) is predetermined by previous levels of consumption and they are insensitive to changes in any other factor, such that:

$$A_i = f(A_{i-1}). \qquad (1)$$

Habit persistence is a characteristic of human behaviour. Pavlov and later Katona provided theoretical grounds for this view, particularly by the routine strategy for the thinking process. The addiction phenomenon is the extreme case in habit formation and it is a direct function. In the detrended version where

$$DA_i = DA_{i-1}$$

this in fact represent :

$$(DA)_i = a(DA)_{i-1} + a(DA)_{i-2} + \ldots A(DA)_{i-n} + Z_i$$

This by convenience of notation it is left as (2),

where Z = error term; a = parameter for DA lagged one period of time. Accordingly, its expected that the linear parameter is positive :

$$DA_i = a_1 * DA_1 + a_2 * DA_2 + \ldots + a_n * DA_n + Z_i \qquad (2)$$

The restriction over the lagged variables parameters is an overall direct effect, where more recent behaviour has a greater weight in current performance, which is represented by:

$a_@ = a_1 + a_2 + a_3 \ldots + a_n >= 0$; and that $a_1 > a_2 > a_3 > a_n \ldots > a_@ 1 2 3 n$

HYPOTHESIS II : PRICE RESPONSE . The quantity demanded for coffee depends on its price; it increases as the price falls, other factors except the addiction effect remaining constant. Undoubtly the most recent level of consumption achieved will have a greater weigh on current levels of drinking, rather than values from the remote past. Therefore for practical notation purposes in subsequent hypotheses this effect is symbolised by the variable $A_@$, keeping in mind that this may also include the effect of two or three lags, but if that was the actual outcome, the equation will include the corresponding detail. As the coffee price (B) falls, this commodity becomes cheaper relative to its substitutes. Thus it is easier for coffee to compete against alternative items for the household attention and preferences with

regard to beverages. Consequently, consumers replace one product by another in their budgets as price changes, in order to obtain a maximun utility. Obviously, this closely resembles the traditional economic demand or Marshall utility theory, except for including the effect of habit formation. This is an inverse functional relationship such that:

$$A = f(\underset{@}{A}, B) \qquad (3)$$

which in the detrended and modified linear equation is:

$$DA = a * \underset{@}{DA} + b * DB + \underset{i}{Z}\ ; \qquad (4)$$

where $b = < 0$.

Equation (4) assumes an immediate adjustment of the purchasing behaviour whenever a change occurs in a predictor. However an adjustment period permits an asymmetrical response to fluctuations in explanatory variables - upward movements lead to a different response from downward ones. This difference is not only in direction, but in the absolute amount of the response. However, by allowing for lags in the equation it is possible to admit an adjustment period of time for a change in price to become evident in modifying coffee consumption. The model allows for lags of three periods. Parameters of lagged variables offer more flexibility than the corresponding coefficients for the contemporary variable. Thus, temporary or short-term discrepancies are allowed, yet the overall sum of parameters of a variable is restricted by the contemporary expectation. This expands (4) to:

$$DA_i = a_@ * DA_@ + b_i * DB_i + b_1 * DB_1 + b_2 * DB_2 + \ldots\ldots\ldots + Z_i \quad ; \qquad (5)$$

which is restricted to :

$$b_i + b_1 + b_2 \ldots\ldots\ldots = < 0 = b_@$$

HYPOTHESIS III : INCOME EFFECT. Changes in household's income (C) are associated with modifications in coffee consumption. A direct function is expected; thus, as income rises, people buy larger amounts of coffee, and vice versa. This is when other factors are held constant, but for addiction and price effect, such that:

$$A = f(A_@, B, C) \qquad (6)$$

which in the particular case of the detrended and modified linear equation is:

$$DA = a_@ * DA_@ + b * DB + c * DC + Z_i \quad : \text{where } c > = 0. \qquad (7)$$

If a time lag for adjustment is allowed, then (7) is now:

$$DA_i = a_@ * + b_@ * DB_i + c * DC_i + c_1 * DC_1 + c_2 * DC_2 + \ldots . Z_i \qquad (8)$$

which is being restricted to : $c_i + c_1 + c_2 + \ldots\ldots > = 0 = c_@$.

The effect of changes in income indicates that a different quantity will be demanded at each price as income changes.

HYPOTHESIS IV : SUBSTITUTE EFFECT. A fluctuation in the price of a close substitute to coffee (such as tea) shifts the demand for coffee. As the price of tea rises, more coffee will be demanded. Existing tea buyers switch to coffee as a cheaper means of satisfying the need for a hot drink. Hence, the relationship is direct and the expected sign of the corresponding line is positive, such that:

$$A = f(A_{@}, B, C, D) \qquad (9)$$

$$DA = a * DA_{@} + b * DB_{@} + c * DC + d * DD + Z_i \; ; \qquad (10)$$

where $d >= 0$.

Allowing for an adjustment period , (10) is expanded to:

$$DA_i = a * DA_{@} + b * DB_{@} + c * DC_{@} + d * DD_{i} + d * DD_{i} + d * DD_{1} + d * DD_{2} + \ldots + Z_i \; ; \qquad (11)$$

which is restricted to:

$$d_i + d_1 + d_2 + \ldots\ldots\ldots >= 0 = d_{@} \; .$$

HYPOTHESIS V : RELATIVE PRICE EFFECT. Changes in the relative price of coffee to that of a close substitute - tea, (O), lead to significant alterations in coffee consumption, which is the interaction of two phenomena: substitution and net income effects.

The former is evident when under a reduction on coffee price (while the price of tea is unchanged) a person chooses to buy more of the relatively cheaper commodity and less of the other one. The latter effect, however occurs if he/she buys more of both beverages. That last alternative, although theoretically plausible, it is not particularly relevant in this case as both beverages do not add up to more than 0.8% of the household budget.

The functional relationship of O ratio with coffee consumption is inverse. Consequently, the sign of the parameter is negative.

B and D in the same function with O can be explained by two reasons. The restrictions to the parameters of function has been designed such that "b" and "d" can reach zero value. Yet their simultaneous presence allows for a more detailed testing of the consumer behaviour. This can reveal whether customers are actually geared by the actual price relationship with respect to a close substitute , or whether they are actually oriented in their purchasing decisions by the absolute level of both commodities. If the former case is true, then parameter "o " must be significant and larger than either "b" or "d" in absolute terms, and converserly. Therefore, the consumption function is left as:

$$A = f(A_{@}, B, C, D, O) ; \qquad (12)$$

where O = B / D

and in the particular linear version this is:

$$DA = a * DA + b * DB + c * DC + d * DD + o * DO + Z ; \quad (13)$$
$$\qquad\quad @ \qquad @ \qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad i$$

where $o = < 0$, which, allowing for an adjustment period of time it is expanded to:

$$DA = a * DA + b * DB + c * DC + d * D + o * DO + o * DO + ...$$
$$\quad i \quad @ \quad @ \quad @ \quad @ \quad @ \quad @ \quad @ \quad @ \quad i \quad i \quad 1 \quad 1$$

$$.....Z ; \qquad (14)$$
$$\quad i$$

restricted to: $o + o + o + ... = < 0 = o$.
$\qquad\qquad\qquad\quad i \quad 1 \quad 2 \qquad\qquad\qquad\quad @$

<u>HYPOTHESIS VI : EFFECT OF ADVERTISING ON COFFEE.</u> Advertising for a commodity is the communication effort by manufacturers towards consumers encouraging its consumption, and which is observed through the expenditure in the media. The larger the advertising budget, (E), the larger is the increase in sales. This hypothesis is an extrapolation of the AIDA model to product class level. More advertising will increase the awareness among consumers and therefore the interest in and willingness to buy that item will grow leading to the purchasing action; and converserly. Then, the function is direct and the linear regression parameter positive, such that:

$$A = f(A , B, C, D, O, E) \qquad (15)$$
$$\qquad\quad @$$

$$DA = a * DA + b * DB + c * DC + d * DD + o * DO + e * DE + Z ; (16)$$
$$\qquad\quad @ \qquad @ \qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad i$$

where e > = 0; and allowing for an adjustment period (16) is now:

$$DA_i = a * DA_{@} + b * DB_{@} + c * DC_{@} + d * DD_{@} + o * DO_{@} + e * DE_{i} + e * DE_{i} + e * DE_{1} + e * DE_{1} + e * DE_{2} + e * DE_{2} + \ldots\ldots + Z_i ; \quad (17)$$

which is restricted to:

$$e_i + e_1 + e_2 + \ldots\ldots > = 0 = e_{@} .$$

HYPOTHESIS VII : EFFECT OF ADVERTISING ON A SUBSTITUTE.

Balancing hypothesis VI, consumers receive in the market place messages for and against increasing consumption. A rise in advertising of a close alternative item depresses coffee consumption. Thus, increased advertising of tea reduces coffee drinking. This function is instrumented through the industry's expenditure in the media, (L), which expected parameter is negative, such that:

$$A = f(A_{@}, B, C, D, O, E, L) \quad (18)$$

This in the linear equation is :

$$DA = a * DA_{@} + b * DB_{@} + c * DC + d * DD + o * DO + e * DE + l * DL + Z_i ; \quad (19)$$

where l = < 0 ; and allowing for lags:

$$DA_i = a_i * DA_@ + b_i * DB_@ + c_i * DC_@ + d_i * DD_@ + o_i * DO_@ + e_i * DE_@ + 1_i * DL_i + 1_i * DL_1 + 1_1 * DL_2 + 1_2 * DL_i + \ldots Z_i; \quad (20)$$

and it is restricted to: $1_i + 1_1 + 1_2 + \ldots\ldots = < 0 = 1_@$.

HYPOTHESIS VIII : EFFECT OF ADVERTISING ON NON-COFFEE DRINKERS.

In a personal extension of the ATR model, I maintain that the effectiveness of manufacturers' communication effort is relative to that same activity but in competing product fields. The practice of advertising coffee product class has a suggestive influence over current tea drinkers and in particular over occasional coffee drinkers. It is postulated that an increase in coffee advertising relative to tea, raises the awareness about this item among infrequent and sole tea drinkers, encouraging other and more frequent trials of coffee drinking. The overall result is an increment in the quantity of coffee demanded, through a shift in the price function. Such action is proxied by the relative media advertising taking place between substitute product fields, as:

$$F = (E / U) * 100 \quad (21)$$

where E = coffe media advertising and U = Hot beverages media advertising. As F dimension grows, coffee drinking rises, then the expected parameter is positive, such that:

$$A = f(\underset{@}{A}, B, C, D, O, E, L, F) \qquad (22)$$

$$DA = \underset{@}{a} * \underset{@}{DA} + b * DB + c * DC + d * DD + o * DO + e * DE +$$

$$l * DL + f * DF + Z_i ; \qquad (23)$$

where f > = 0, and for lags:

$$DA = \underset{@}{a} * \underset{@}{DA} + \underset{@}{b} * DB + \underset{@}{c} * DC + \underset{@}{d} * DD + \underset{@}{o} * DO + \underset{@}{e} * DE +$$

$$\underset{@}{l} * DL + \underset{@}{f} * DF + \underset{i}{f} * DF + \underset{1}{f} * DF + \underset{2}{f} * DF + \ldots\ldots Z_i \qquad (24)$$

which is restricted to:

$$f + f + f + \ldots\ldots > = 0 = \underset{@}{f} .$$
$$i \quad 1 \quad 2$$

HYPOTHESIS IX: ADVERTISING EFFECT ON HABITUAL COFFEE DRINKERS.

The impact of advertising on consumption depends on the nature of competition among manufacturers. Favourable conditions for changing the rate of coffee purchases are created by altering the distribution of advertising on this commodity amongst suppliers. I hold that the concentration of advertising in one or in a few producers, it increases the likelihood of an effective specialisation in this activity, resulting in a growing awareness of this item and in the willingness to consume it by existing customers. Consequently, overall consumption rises by augmenting the rate at which coffee is purchased by habitual coffee users. This phenomenon is observed by an artificial variable for the

concentration of advertising practice, (J), such that:

$$J = (W / E) * 100; \qquad (25)$$

where W: advertising on coffee by the major manufacturer spender.

Since J function is direct, its regression parameter is expected to be positive:

$$A = f(A_{@}, B, C, D, O, E, L, F, J) : \qquad (26)$$

which in the linear form is:

$$DA = a * DA_{@} + b * DB_{@} + c * DC + d * DD + o DO + e * DE + + l * DL + f * DF + j * DJ + Z_i ; \qquad (27)$$

where $j >= 0$;

$$DA_i = a * DA_{@} + b * DB_{@} + c * DC_{@} + d * DD_{@} + o * DO_{@} + e * DE_{@} + l * DL_{@} + f * DF_{@} + j * DJ_{i} + j * Dj_{i} + j * DJ_{1} + j * Dj_{1} + j * DJ_{2} + ... Z_i ; \qquad (28)$$

and which is restricted to : $j + j + j + ... >= 0 = j_{@}$.
$i \quad 1 \quad 2$

HYPOTHESIS X : MEDIA DIFFERENTIAL ACTION. In a given product field, advertising action over consumption is more clearly perceived if analysed by the medium employed in transmitting these messages, rather than when aggregated in all media. Obviously, the T.V. advertising effect is different from that caused by other forms of communication. That difference is far beyond the price

of space and/or time used. In the case of coffee the action of commercial T.V. is (expected to be) greater than the same amount of money spent on printed propaganda. Thus, a larger T.V. advertising parameter is expected than the similar one, but for all media. In all media the function is (26) and for T.V. advertising only, this is:

$$A = f(A_{@}, B, C, D, O, G, J, K, P) \qquad (29)$$

Mirroring hypotheses VI to IX, the corresponding expectations about the parameters are:

HYPOTHESIS	MEDIA	T.V.	MEDIA vs. T.V.
VI : Expenditure on coffee advertising.	$e_{@} >= 0$;	$g_{@} >= 0$;	$g_{@} > e_{@}$
VII : Expenditure on tea advertising.	$1_{@} >= 0$;	$p_{@} =< 0$;	$p_{@} =< 1_{@}$
VIII: Effect on non-coffee drinkers.	$f_{@} >= 0$;	$i_{@} >= 0$;	$i_{@} > f_{@}$
IX : Effect on habitual coffee drinkers.	$j_{@} >= 0$;	$k_{@} >= 0$;	$k_{@} > j_{@}$

A summary of all the hypotheses, functions and equations which are part of the general model follows in Table 2.

HYPOTHESES, EQUATIONS AND PARAMETERS EXPECTATIONS

I. - ABSOLUTE ADDICTION:

$DA_i = a_1^* DA_1 + a_2^* DA_2 + \ldots\ldots Z_i$

where: $b_i + b_1 + b_2 + \ldots\ldots \leqslant 0.$

II. - EFFECT OF COFFEE PRICE:

$DA_i = a_1^* DA_1 + b_i^* DB_i + b_1^* DB_1 + b_2^* DB_2 \ldots\ldots Z_i:$

where: $b_i + b_1 + b_2 + \ldots\ldots \leqslant 0$

III.- EFFECT OF INCOME:

$DA_i = a_1^* DA_1 + b_i^* DB_i + c_i^* DC_i + c_1^* DC_1 + c_2^* DC_2 + \ldots. Z_i:$

where: $c_i + c_1 + c_2 + \ldots\ldots \geqslant 0.$

IV. - EFFECT OF PRICE OF TEA:

$DA_i = a_1^* DA_1 + b_i^* DB_i + c_i^* DC_i + d_i^* DD_i + d_1^* DD_1 + d_2^* DD_2 + Z_i:$

where $d_i + d_1 + d_2 + \ldots\ldots \geqslant 0.$

V. - EFFECT OF RELATIVE PRICES:

$DA_i = a_1^* DA_1 + b_i^* DB_i + c_i^* DC_i + d_i^* DD_i + o_i^* DO_i + o_1^* OD_i +$

$o_1^* DO_1 + o_2^* DO_2 + \ldots\ldots Z_i$; where: $o_i + o_1 + o_2 + \ldots\ldots \leqslant 0.$

VI.- EFFECT OF ADVERTISING ON COFFEE:

$DA = a_1^* DA_1 + b_i^* DB_i + c_i^* DC_i + d_i^* DD_i + o_i^* DO_i +$

$e_i^* DE_i + e_1^* DE_1 + e_2^* DE_2 + \ldots\ldots Z_i;$

where: $e_i + e_1 + e_2 \ldots\ldots \geqslant 0.$

VII.- EFFECT OF ADVERTISING ON TEA:

$DA_i = a_i^* DA_i + b_i^* DB_i + c_i^* DC_i + e_i^* DE_i + l_i^* DL_i + l_1 *$

$Dl_2 + \ldots\ldots Z_i$: where $l_i + l_1 + l_2 + \ldots\ldots \leqslant 0.$

VIII- EFFECT OF COFFEE ADVERTISING OVER NON-COFFEE DRINKERS:

$DA_i = a_1^* DA_1 + b_i^* DB_i + c_i^* DC_i + e_i^* DE_i + l_i^* DL_i + f_i^* DF_i +$

$f_1^* DF_1 + f_2^* DF_2 + \ldots\ldots Z_i$: where: $f_i + f_1 + f_2 + \ldots \geqslant 0.$

IX. - EFFECT OF ADVERTISING OVER HABITUAL COFFEE DRINKERS

$DA_i = a_1^* DA_1 + b_i^* DB_i + c_i^* DC_i + d_i^* DD_i + e_i^* DE_i + f_i^* DF_i +$

$j_i^* DJ_i + j_1^* DJ_1 + J_2^* DJ_2 + \ldots\ldots Z_i:$

where: $j_i + j_1 + j_2 + \ldots\ldots \geqslant o.$

X. - MEDIA DIFFERENTIAL ACTION:

This replicates hypotheses VI to IX and comparing with the corresponding parameters for T.V. advertising variables, expectations are:

EXPENDITURE ON OCFFEE ADVERTISING:	$g \geqslant 0$: $g > e$.
EXPENTIRUE ON TEA ADVERTISING:	$p \leqslant 0$: $p < 1$.
EFFECT OF ADVERTISING OVER NON-COFFEE DRINKGERS:	$i \geqslant f$: $i > f$.
EFFECT OF ADVERTISING OVER HABITUAL COFFEE DRINKERS:	$k \geqslant 0$: $l > j$.

NOTE: Symbols used are explained in Appendix 14

TABLE 2.

HYPOTHESES, EQUATIONS AND PARAMETERS EXPECTATIONS.

3.2.-MEASURING EXPLANATORY VARIABLES.

The earlier section of Chapter Three presented the general model for explaining changes in coffee consumption. The explanatory variables are: the price of coffee, consumers' income, the price of tea, the price ratio of tea to coffee, advertising on coffee and on tea, the ratio between advertising on both beverages and the concentration of coffee advertising amongst manufacturers. Naturally, variables stipulated in the model must be quantified so that functions can be estimated. This section explains how explanatory variables are proxied and briefly discusses other possible sources of information for observing the same variable. Afterwards in 3.3 follows an outline of the validation procedure.

COFFEE PRICE. (B). In this model the price of coffee is proxied through the average price paid for all types of coffee. This is obtained from the ratio expenditure on coffee as reported by the Family Expenditure Survey (F.E.S., Department of Employment) to "corrected coffee purchases"(A). (A) is in fact the explained phenomenon and its measuring procedure is detailed in the following Chapter Four. The price series is deflated by the Retail Price Index (R.P.I.) based on January 1980 = 100. A similar procedure is also applied to all other time series. See Table 3. The N.F.S. average price paid is less biased than either purchase or expenditure. The nature of distortions tends to cancel them out - as they are equally affecting both the

expenditure and the quantity purchased. This is substantiated in section 4.4. of this thesis.

Yet, other researchers have chosen the uncorrected average price paid for soluble coffee reported by the N.F.S., for observing the same explanatory variable. They have observed price through a source which I suspect it is biased and inacurate: (NFS), (Cable,1974), (Jones,1978) and (Young,1980).

INCOME. (C). Income is proxied by data obtained from national accounts prepared by the Central Statistical Office (C.S.O.); in particular this is the personal disposable income after taxes, deductions for National Insurance and net of transfers abroad. This is divided by the mid-year population and deflated by the R.P.I.; results are presented in £'s per person per week.(Table 4). In this case I am following the procedure of several researchers in this area: (FAO, 1972), (Timms, 1973), (Cable, 1974) and (Young, 1980). Other authors used different sources, like the unpublished N.F.S. household income; the index of national income and disposable income corrected by changes in consumer units. The first one was employed by the N.F.S.,but also by the F.A.O. (1972) and Rayner et al. (1972) ; Pollock (1971) decided for the index; and Jones (1978) tried with corrected disposable income. It was shown earlier that N.F.S. data for income is even more biased than their estimate of purchases; indices of income are obviously affected by its initial value; and Jones' procedure is too obscurely presented to be of

TABLE 3

ESTIMATION OF AVERAGE PRICE PAID

FOR ALL TYPES OF COFFEE

(in pence per ounce of green bean equivalent)

	(1)	(2)	(3)	(4)
1957	0.80	4.19	0.50	8.38
1958	0.85	4.32	0.54	8.00
1959	0.86	4.34	0.50	8.68
1960	0.95	4.75	0.54	8.80
1961	1.10	5.31	0.64	8.30
1962	1.29	5.97	0.70	8.53
1963	1.35	6.14	0.77	7.97
1964	1.33	5.83	0.70	8.33
1965	1.66	6.98	0.84	8.31
1966	1.59	6.41	0.79	8.11
1967	1.75	6.89	0.88	7.83
1968	2.01	7.56	1.00	7.56
1969	2.04	7,29	0.98	7.44
1970	2.41	8.09	1.14	7.10
1971	2.76	8.47	1.16	7.30
1972	3.08	8.83	1.33	6.64
1973	3.55	9.32	1.38	6.75
1974	3.89	8.78	1.38	6.36
1975	4.63	8.42	1.48	5.69
1976	6.55	10.23	1.50	6.82
1977	9.78	13.18	1.13	11.66
1978	10.66	13.26	1.20	11.05
1979	11.11	12.20	1.34	9.10
1980	11.85	12.74	1.30	9.80

NOTES: (1) = Expenditure on coffee in pence of each year per person per week. From "Family Expenditure Survey" Annual Reports. Department of Employment H.M.S.O.

(2) = A in pence of January 1980, deflated by the R.P.I.

(3) = Estimated consumer purchases N.F.S. - F.E.S. in oz. of green beans equivalent per person per week. From column E, Table 17.

(4) = Estimated average price paid in pence of January 1980 per ounce of green beans paid. (4) = (2)/(3)

TABLE 4.

ESTIMATING REAL PERSONAL DISPOSABLE INCOME

(1957-1981) (*)

(in £ of January 1980 per person per week).

	(1)	(2)	(3)	(4)	(5)	(6)
1957	15241	51.43	296	1552	-	29.84
1958	15962	51.65	309	1569	+1%	30.17
1959	16946	52.37	326	1647	+5%	31.67
1960	18245	52.37	348	1740	+6%	33.47
1961	19556	52.95	369	1783	+3%	34.29
1962	20456	53.27	384	1778	-0.3%	34.19
1963	21757	53.55	406	1846	+4%	35.50
1964	23341	53.89	433	1899	+3%	36.52
1965	25048	54.22	462	1941	+2%	37.33
1966	26630	54.50	489	1972	+2%	37.92
1967	27730	54.80	507	1996	+1%	38.39
1968	29713	55.05	540	2030	+2%	39.04
1969	31700	55.26	574	2050	+1%	39.42
1970	34856	55.42	629	2111	+3%	40.60
1971	38507	55.71	691	2120	+0.4%	40.77
1972	44205	55.87	791	2267	+7%	43.60
1973	51100	56.00	913	2396	+6%	46.08
1974	60686	56.01	1084	2447	+2%	47.06
1975	74707	55.98	1335	2417	-1%	46.67
1976	86382	55.96	1544	2413	-1%	46.40
1977	97748	55.92	1748	2356	-2%	45.31
1978	113300	55.87	2028	2522	+7%	48.50
1979	133336	55.82	2389	2622	+4%	50.42
1980	160123	55.95	2862	2662	+2%	51.20
1981	173781	55.95	3106	2578	-3%	49.57

NOTES: (*) Personal disposable income is the total personal income less U.K. taxes on income, national insurance contribution and net transfers abroad.

(1) Personal disposable income in £ million of each year.

(2) U.K. mid-year population in million of people. A and B as published in "Annual Abstract Statistics" C.S.O.

(3): (1)/(2) Personal income per capita.

(4) Real disposable income per capita. (3) deflated by R.P.I.

(5) Inter-annual changes in (4) in percentage.

(6): (4/52: Real personal income per capita per week.

any practical help.

Another readily available source for measuring the same efect is the Family Expenditure Survey. However, the same F.E.S. warns that households in the panel report a lower income than they actually receive. (Thatcher, 1968). This affects some groups more than others, particularly women in part-time employment, the high earners, as well as those in self-employment. (F.E.S.,1979, p.3).

PRICE OF TEA. (D). Tea price is measured as the average price paid by households for types of tea. The source is the N.F.S.. See Table 5.

PRICE RATIO COFFEE TO TEA. (O). This construct is made up with price of coffee divided by the price of tea, resuming into one variable the effect of the price relationship between coffee and its closest substitute. Details of the serie are in Table 5.

ADVERTISING (E, F, G, H, I, J, K, L). The instrumentation of advertising effect is in fact the integration of AIDA and ATR models extended from brands to product fields through eight variables: (E) coffee media expenditure on advertising; (F) ratio coffee to hot beverages media advertising; (G) expenditure on coffee T.V.advertising; (H) coffee press advertising; (I) ratio coffee to hot beverages T.V. advertising; (J) ratio manufacturer leader on coffee advertising to coffee media product field; (K) ratio manufacturer leader on coffee to coffee product field T.V.

TABLE 5

PRICE RATIO COFFEE TO TEA

(1957-1980)

	B	D	O
1957	8.38	10.92	0.77
1958	8.00	10.38	0.77
1959	8.68	10.19	0.85
1960	8.80	10.10	0.87
1961	8.30	9.60	0.86
1962	8.53	9.10	0.94
1963	7.97	8.90	0.90
1964	8.33	8.50	0.98
1965	8.31	8.10	1.03
1966	8.11	7.80	1.04
1967	7.83	7.60	1.03
1968	7.56	7.20	1.05
1969	7.44	6.90	1.08
1970	7.10	6.80	1.04
1971	7.30	6.60	1.11
1972	6.64	6.20	1.07
1973	6.75	5.80	1.16
1974	6.36	5.50	1.82
1975	5.69	5.00	1.14
1976	6.82	4.90	1.39
1977	11.66	8.30	1.41
1978	11.05	7.80	1.42
1979	9.10	6.50	1.40
1980	9.80	5.7	1.72

NOTES AND SOURCES:

B: Average price paid for coffee in pence of January 1980 per ounce of green beans. From Table 3.

D: Average price paid for tea in pence of January 1980 per ounce. From the corresponding N.F.S. Annual Reports.

O: B/D

advertising and (L) tea media advertising. In Table 6 are series of variables E, G, H, and L; and in Table 7 are variables F, I, J and K.

These series were obtained by elaborating data provided by J. W. Thomson Organisation Ltd., who allowed access to statistics on media advertising collected by two private firms, Legion Ltd. and Media Expenditure Analysis Ltd. (MEAL). The former source produced monthly data by brands for 1957 to 1967, while the latter source does the same since 1968. Expenditure figures on advertising by each private brand is aggregated by years and deflated by the R.P.I..

TABLE 6

EXPENDITURE ON COFFEE AND TEA ADVERTISING

(1957-1981)

(in million £ of January 1980 per week)

	(E)	(G)	(H)	(L)
1957	0.113	0.056	0.057	0.093
1958	0.116	0.058	0.058	0.087
1959	0.129	0.074	0.055	0.138
1960	0.181	0.103	0.078	0.182
1961	0.167	0.084	0.082	0.138
1962	0.189	0.117	0.068	0.160
1963	0.201	0.139	0.062	0.165
1964	0.164	0.104	0.060	0.161
1965	0.171	0.138	0.034	0.184
1966	0.128	0.100	0.028	0.195
1967	0.135	0.118	0.021	0.203
1968	0.087	0.070	0.017	0.189
1969	0.118	0.090	0.027	0.199
1970	0.147	0.124	0.023	0.233
1971	0.140	0.115	0.025	0.229
1972	0.139	0.125	0.014	0.095
1973	0.177	0.157	0.020	0.139
1974	0.151	0.109	0.041	0.145
1975	0.120	0.079	0.042	0.131
1976	0.138	0.096	0.042	0.124
1977	0.144	0.116	0.028	0.175
1978	0.140	0.110	0.030	0.169
1979	0.111	0.082	0.029	0.112
1980	0.201	0.171	0.030	0.217
1981	0.268	0.234	0.034	0.243

NOTES: (E): Expenditure on coffee media advertising.

(G): Expenditure on coffee T.V. advertising.

(H): Expenditure on coffee press advertising.

(L): Expenditure on tea media advertising.

SOURCE: Elaborated from data edited by Media Expenditure Analysis Limited and LEGION Limited.

TABLE 7

RATIO OF COMPETITIVENESS AND CONCENTRATION OF COFFEE ADVERTISING BY MEDIA. (1957-1981).

	TOTAL MEDIA		T.V. ADVERTISING			
	(F)	(J)	(M)	(I)	(K)	(N)
1957	55	49	112	49	42	117
1958	57	40	143	45	49	92
1959	48	32	150	48	52	92
1960	50	40	125	53	36	147
1961	54	30	180	52	42	124
1962	54	37	146	54	32	169
1963	55	25	220	54	27	200
1964	50	46	109	46	54	85
1965	48	27	178	48	34	141
1966	40	44	91	38	56	68
1967	39	20	195	40	15	267
1968	31	39	80	30	48	63
1969	37	46	80	35	41	85
1970	39	46	85	38	49	78
1971	38	45	84	36	50	72
1972	59	58	102	61	53	115
1973	56	38	147	55	38	145
1974	51	28	182	45	21	214
1975	48	25	192	40	26	154
1976	53	26	204	46	35	131
1977	45	28	161	46	30	153
1978	45	26	173	42	31	136
1979	50	33	152	48	37	130
1980	48	31	155	47	37	174
1981	52	31	168	52	30	173

NOTES:
(F): Ratio media expenditure on advertising for coffee to hot beverage advertising.
(J): Ratio coffee manufacturers leader media on advertising to coffee product field.
(M): Concentration and competitiveness of coffee media advertising: [(F)/(J)] x 100.
(I): Id. as (F) but for T.V. only.
(K): Id. as (J) but for T.V. only.
(N): Concentration and competitiveness of coffee T.V. advertising. [(I)/(K)] x 100.

SOURCE: Appendices 22, 23, 24, and 25.

3.3.- VALIDATION PROCEDURE.

This section details the path followed in quantifying, estimating and testing the hypotheses contained in the general model. Equations represent ideas to be tested and they are quantified by multiple regression analysis. These results are then screened according to theoretical, and quatitative criteria; the first one is made up of restrictions as well as modelling strategy and the second one involves the statistical evaluation. Thus, this section contains two parts: modelling strategy and quantitative evaluation.

MODELLING STRATEGY. Each one of the hypotheses I to X are implemented into a single equation. Having specified and estimated the most simple equation, where the sole predictor is lagged consumption (Hypothesis I), other explanatory variables are specified subsequently. Thus, other factors are included one at a time, following the priorities corresponding to the order in which the hypotheses are presented namely coffee price, income, tea price, price ratio and advertising. The effect of several lagged predictors is integrated by imposing restriction on their parameters. In particular, the Koyck's geometrical lag scheme is applied. This assumes that weights of past values in a variable decline in a continuous geometrical progression (Koutsoyiannis, 1978, p.305). Then more recent observations exert a greater influence over current levels of the dependent variable.

The modelling strategy applied through G.I.V.E. (Hendry and Srba, 1978) is a constant confrontation of several factors like: current specification, initial formulation and the corresponding empirical results. Results, in turn, are fed-back into a newly re-formulated relationship. Moreover, scrutiny of equations involved both theoretical and econometric criteria.

Equations already screened for autocorrelation are afterwards subjected to a confrontation of actual parameters obtained with their corresponding theoretical expectations. The technique for estimation used throughout is the Ordinary Least Squares Method. (O.L.S.).

QUANTITATIVE EVALUATION. Those estimated equations which are already free from serious autocorrelation and meeting the above restrictions are screened through statistical and econometric tests. The analysis is applied in the following hierarchical order: t* - ratio or test of parameters' statistical significance; S or the residual sum of squares; R^2 or the modified coefficient of multiple determination; C_{x1*x2} or the covariance between predictors; r_{y*xi} or the partial correlation coefficient; and D.W. or the Durbin-Watson statistics of serial correlation of first order. Details of each of these indicators and their formulae are described in Koutsoyiannis (1978). These tests were applied for both 5% and 1% of confidence - allowing for the corresponding degrees of freedom, which were defined by sample size and number of pameters being estimated in the equation.

Each possible outcome had different consequences in the selection of equations. Non-significant t*-ratios led to a detailed observation of the unrestricted version, searching to discover whether lagged variables a parameter appeared significant. If that was the case, then that lagged variable was incorporated in the initial specification. Equations which had all their parameters significant, on the other hand, had all their statistical performance recorded by their corresponding S, R^2, and D.W.. Attention was also paid to serious multicollinearity between two or more predictors. The computerised statistical package operated for this purpose, G.I.V.E., already contains an algorithm for detecting the presence of perfect multicollinearity announcing it explicitly and by stopping any further calculations. Serious multicollinearity was detected through the C statistics; if the association between two predictors appeared stronger than their individual correlation with the dependent variable, then, the latest explanatory variable which was added to the initial equation is eliminated. This decision is reinforced by isolating the explanatory variable which is closely correlated with the explained one, in terms of the partial correlation coefficient.

This empirical search procedure involved over 200 runs of GIVE and several preliminary others of SPSS in a PRIME main-frame computer. The result is a set of 20 "best" equations which are sound on both theoretical and statistical grounds and which were tested from the econometric point of view.

FORECASTING POWER EVALUATION. The G.I.V.E. algorithm assured

that those "best" twenty equations were free from serial correlation of first order as well as from severe multicollinearity. A further testing provided a econometric selection criterion: the test for stability of parameters. This is a post-sample predictive testing confirming the suitability of data to an appropriate model. The adequacy of the chosen model is in this case assessed by its ability to make accurate predictions outside the sample period. Thus a subset of the available data is retained for post-sample predictive testing; then results are compared.

For this test, four periods were retained. Several reasons support this choice, such as the length of: a complete cycle in the International Coffee Agreement and coffee policies; short-term annual fluctuations in world coffee production; and maturing of newly planted coffee trees. Results obtained from both regressions are compared and tested through the post-sample goodness of fit test, (Harvey, 1978, pp.180-3), which evaluates whether the differences obtained are due or not to random fluctuations or to other causes, such as: i) the observations in the sample and in the post-sample period are generated by different models, that is, a structural break; or ii) the model fitted to the sample is mis-specified.

The actual forecasting power of the "best" equations is tested through the X^2 or the chi-squared statistics, such that: if $X_o^2 < X_e^2$, then the sample and the forecasting values are generated by the same model; if $X_o^2 > X_e^2$, then it could either be

that a structural break or that the model is mis-specified - where X_o^2 is the observed X_o^2 and X_e^2 is the theoretical X^2.

As a result, different hypotheses were formulated into equations which are dynamically specified and assessed through explicit rules for meeting theoretical, statistical and econometric criteria. Final results are presented in Chapter five. Next follows an outline of the method followed for measuring the explained phenomenon.

CHAPTER FOUR.

MEASURING THE VARIABLE TO BE EXPLAINED.

The aim of this work is the modelling of coffee consumption in the U.K.. In Chapter Two the applicability of consumer behaviour theories for explaining coffee consumption is analysed and there is an assessment of empirical work already carried out for the U.K. market. A general model is deduced afterwards, which together with the methodology applied, is detailed in the the last Chapter. This unit outlines the procedure followed for measuring coffee consumption, the phenomenon under study. There are two sources for this purpose: continuous consumer surveys and domestic availability. Enough suspicion were raised in Chapter Two about the most popular source, the N.F.S., which has been employed often, but uncritically. Only in a few cases net imports from national accounts were employed, yet in none of these studies was a reconciliation of the several data sources even attempted. Naturally, before estimating any model it is essential to observe the phenomenon consistently and without measurement errors. Otherwise, results will be biased and inconsistent. (Koutsoyiannis, 1978, p. 260).

Trying to prevent such an outcome, this section analyses different sources, isolating major discrepancies and providing explanations

for them. Previously, however there is a need to understand the nature of the coffee drinking phenomenon, since domestic purchases and net imports are in fact complementary concepts. They are different phases of the flow of importing, processing, and the distribution of ingredients for hot beverages to the final consumer in which a number of organisations are involved.

Although the consumer drinks cups of a hot beverage and not necessarily predetermined quantities of certain basic ingredients, at a given dosage the amount of ingredient purchased for replenishing pantry shelves is an estimator of the volume of liquid drunk in terms of number of cups per day, and vice-versa.

Moreover, as all raw materials for coffee must be imported, net imports should be a good indicator of supplies moving into consumption, providing another independent estimator of consumption.

Two major sub-markets are in coffee drinking: domestic and catering. Factors affecting each of them are quite different, but obviously the latter one is also included in net imports. In a year, home drinking is made up by the number of cups drunk by people who are drinking at different rates and at certain frequencies. This activity is revealed in the demand for basic ingredients. By using realistic dosage rates in terms of the amount of the coffee ingredient used for preparing a cup of coffee beverage one can hope to assess the volumetric drinking and household purchases against net imports. Green beans is the

uniform measure for the three main types of coffee product: beans and roasted, soluble and essences.

On the other hand, consumers can be observed from two relevant angles: the amount they drink daily; and the nature of their drinking habits. Thus, they can be non-drinkers, light, medium and heavy drinkers. By their behaviour consumers can be grouped into: addicts to a close substitute, tea; mixed-drinkers having a clear preference of a beverage depending on the time of the day or according to the main beverage being served on each drinking occasion; and addicts to coffee who exclude any other form of hot beverages.

All these concepts are integrated in an audit of statistical sources of information aiming at consistently measure the variable under study. Consequently, this Chapter has five parts: 4.1.- Flow of Basic Ingredients; 4.2.- Consistancy of Domestic Supplies Statistics; 4.3.- Estimates of Consumer Purchases; 4.4.- Exploring Causes of N.F.S. Over-estimations; 4.5.- Correcting Coffee Purchases; and 4.6.- Conclusion.

4.1 FLOW OF BASIC INGREDIENTS.

Coffee statistics are based on various stages of the marketing chain: wholesale, retail and beverage. Each of these stages has it own peculiarities, which deserves a special mention. The wholesale market of coffee involves the imports of raw materials from tropical countries as green beans. Some imports were made

in soluble coffee in 1965 (7%), which grew to 46% in 1976. There has been a change in major suppliers over time, Uganda and Kenya are now substituted by Ivory Coast and Brazil for providing green beans. Brazil provides most of the soluble coffee. Liquid coffee imports, although playing a minor part, are growing fast, expanding its share of the market. Besides these major importers, there are a large number of countries contributing each one with a small proportion of coffee supply. U.S.A. and E.E.C. countries concentrate most of the world demand; a few transnationals carry out most of the distribution, processing and retail marketing of coffee around the globe. Major concerns are Nestle, based in Switzerland and General Foods with headquarters in the U.S.A..

Coffee is a tropical commodity which is harvested from trees in regions of moderate altitude. The size of the annual crop is greatly affected by drought and mild frosts. Two main species are grown commercially, Arabica and Robusta; the former predominantly in Latin America and the latter in Africa. Arabica coffee has a milder taste than Robusta, which contains a greater amount of caffein and is more resistant to harsh tree husbandry and weather conditions. According to the picking and the post-harvest practice Arabicas are further subdivided into Colombian Milds, Other Milds and Unwashed Arabicas or Brazils. Colombian Milds have the mildest taste and Robusta the most bitter. After harvesting the coffee beans is separated from the cherry in which it grows, and it is then called a green bean.

Once dried and selected, it is packed in sacks of 60 kg. ready for exporting. Central marketing authorities, large producers or even dealers export largely unprocessed coffee. Exceptionally, Brazil exports some increasing amount of processed coffee into the U.K.. Large manufacturers usually do not operate through dealers, but there are always important amounts of green coffee for re-sale to U.K. processors. Dealings in coffeee also occur in terminals or in future markets. The London market is used by U.K. dealers and small and medium sized manufacturers to hedge or insure against losses due to sudden price changes. (Price Commission, 1977). The processing of green beans is simple. Roasting releases taste and aroma, losing water; it takes 1.56 lb of green beans to obtain one pound of roasted coffee. Roasted beans are ground either by manufacturers or by consumers at home. This ground coffee quickly loses its aroma unless it is hermetically sealed just after grinding; that is why processors usually pack them in a vacun. The U.K. ground coffee market is highly concentrated, since only two manufacturers supply over 70 per cent of all sales.

Soluble coffeee is produced by five U.K. companies, although recently imports of soluble from Brazil are becoming progressively important. The soluble component from ground coffee is extracted by using hot water under pressure; afterwards the solution is dehydrated by spray-drying. Since the early seventies the freeze-dried method is an alternative which produces

better quality by preserving essential oils, aroma and original taste. (See Appendix 19). A survey by the Price Commission established an industrial conversion ratio of green beans to soluble coffee in weight of 2.6 : 1.

Processed coffee is sold by manufacturers mainly to wholesalers for distribution into this country, and to multiple retailers including co-operatives; 14 per cent of their product, however goes mainly to catering establishments. Wholesalers are the Co-operative Wholesale Society, the traditional delivery trade, cash-and-carry traders and "symbol" groups like Spar or VG. Independent wholesalers trade 32 per cent of coffee. multiples 53 and co-operatives 15%. This is not fundamentally different from other groceries. (Price Commision, 1977).

Commercial brands are either manufacturers' brands or own labels. "Nescafe" is made by Nestle, and "Birds" and "Maxwell House" are made by General Foods. Own label brands are made for major retailers and wholesalers under their own brand names: "St. Michael" is sold by "Marks and" Spencer and "Sainsbury" is sold by that chain of supermarkets. "Kenco", "Brooke Bond" and "Sol Cafe" are also own-labels, but based to a large extent on imported soluble coffee .

The flow of green beans from the time they leave their place of origin till they reach our homes takes between 28 to 33 weeks, which is staged in two parts: factory and home supplies. It

takes about 15 to 20 weeks to get a purchase contract already paid for to be delivered to a U.K. factory. Having left the factory, processed coffee reaches a home pantry-shelf in about 13 weeks.

International dealers get a net margin of 0.3 to 0.8%; they even declared a negative margin for 1975, according to the Price Commission. However, the processing of coffee gave between 8 and 17% of the selling price to manufacturers, which varies according to moves in the international coffee price. In the cost of processing coffee , royalties are from 1.6 to 4.3%, promotion and advertising 15 to 18% and raw coffee about 52 to 59%.

All this activity represents a value of about £160 to £200 million. (Appendix 20). Domestic distribution charges the consumers differently according to the participating agents: wholesalers charge 5 per cent, independent retailers 13% per cent, multiple retailers and co-operatives 11 per cent. Households buy over half of their coffee from multiple retailers (53%), one third from independent retailers (32%) and one sixth from co-operatives (15%). (PRICE COMMISSION (1977).) In brief, while the production of green beans and retail distribution of coffee are highly competitive activities, the international trade and the processing are concentrated in a few transnational organisations.

The understanding of the flow of basic ingredients is providing a

firm ground for devising tests of accountability of coffee consumption statistics. As all coffee drunk in the U.K. has to be imported either as raw material or as processed coffee, household consumption estimates can be compared with net imports, once allowances are made for the catering demand. Another independent control can be achieved by confronting these statistics with coffee drinking estimates, after allowing for dosage changes. In the following section applied the first test is applied to domestic supplies statistics, which is followed by an analysis of consumer purchases and the second test. Afterwards, causes of discrepancies are investigated and finally an improved series of the explained variable is produced.

4.2.- CONSISTENCY OF DOMESTIC SUPPLIES.

An essential part of the test of consistency for N.F.S. coffee purchases estimates is its comparison with domestic supplies. It is expected that annual household purchases per person are somewhat lower than per capita domestic availability or net imports, in order to make room for institutional and catering demand. Also, this should allow for fluctuations of stock at different stages in the distribution and processing chain. A common measure in all these stages are green beans or its equivalent which is contained in the processed product. For preventing the distortion effect of stock changes, this control has to be applied retrospectively for a number of years, twenty-five in this case.

Three sources provide information about domestic coffee supplies: the International Coffee Organisation (ICO); the Ministry of Agriculture (MAFF); and the Business Statistics Office (BSO). The I.C.O. has published continuously since 1970 annual and quarterly figures of "disappearance of green coffee equivalent" defined as imports of all forms, less exports in all forms and changes in inventories at port, public warehouses and manufacturers stocks (I.C.O. Quarterly Bulletin on Coffee, vol.3,

3, July-Sept.,1979, p.47). Independently, the Food Economic Unit of M.A.F.F. publishes annual estimations of "supplies per capita moving into consumption in the U.K.", which is a similar measure to disappearances.(Department of Trade and Industry, Trade and Industry, 14.12.1979 , p.576).

The B.S.O. together with the M.A.F.F. releases annual and quarterly "disposal of raw coffee equivalent", defined as home production and imports adjusted for changes in known stocks. Disposals includes uses in the manufacture of other foods,certain disposal for H.M. Forces and ingredients used in manufactured products which are exported; in the case of coffee it includes coffee used for all purposes, stocks of raw coffee in public warehouses and in transit to such warehouses, and since 1963, exports as well as manufacturers' stocks. (C.S.O., Monthly Digest of Statistics, Supplement, 1980, p.11 and 14).

Accordingly, these series can be made comparable by deducting re-exports from disposals and by expanding supplies per capita to the U.K.. Then disposal , supplies and disappearance should all coincide.

In Table 8 there is a summary of these three long-term series of coffee domestic supplies, such that they can be compared. During the seventies there appears to be a close agreement between M.A.F.F. supplies and I.C.O. disposals series, since discrepancies lie between 2 to 3 per cent. But in 1974 supplies

TABLE 8

COFFEE U.K.: ANNUAL DOMESTIC SUPPLIES

(1960-1979).

	A M.A.F.F. (1)	B I.C.O. (2)	C B.S.O. (3)	D (5)	E (6)
1960	0.65	N/A			
1961	0.65	N/A			
1962	0.83	N/A			
1963	0.89	N/A			
1964	0.77	0.91(4)		-18%	
1965	0.83	N/A			
1966	0.89	1.05(4)		-18%	
1967	0.95	N/A			
1968	0.95	1.03(4)		- 8%	
1969	1.11	N/A			
1970	1.34	1.36	1.08	- 2%	20%
1971	1.43	1.44	1.06	- 1%	26%
1972	1.36	1.38	1.02	- 2%	25%
1973	1.83	1.82	1.28	- 1%	30%
1974	1.43	1.34	0.93	6%	35%
1975	1.49	1.47	0.85	1%	43%
1976	1.43	1.40	0.86	2%	40%
1977	1.15	1.18	0.56	- 3%	51%
1978	1.29	1.27	0.28	2%	78%
1979	1.70	1.79		- 5%	

NOTES:

(1) Based on annual supplies of coffee moving into consumption. From Appendix 21.

(2) Based on annual disappearance of coffee divided by U.K. mid-year population. From Appendix 22.

(3) Based on annual disposals of raw coffee, discounted re-exports and divided by mid-year population. From Appendix 23.

(4) Based on a twelve month period from July to June.

(5) $\frac{A - B}{A} \times 100$.

(6) $\frac{A - C}{A} \times 100$.

are 6% over disposals and 5% in 1979. Regrettably it was not possible to obtain coherent I.C.O. figures for the sixties. B.S.O. disposal, after they have been corrected due to re-exports, increasingly under-estimate domestic supplies by 20% in 1970, 35% in 1974 and 78% in 1978.

These discrepancies show some inconsistencies in the B.S.O. figures, to the extent that it openly divorces its quarterly data from its own annual estimates, particularly from 1975 to 1979. The M.A.F.F. when asked about such discrepancies, confirmed that the concept applied for disposal in the case of coffee was changed, containing only imports of raw coffee adjusted for stock changes. Consequently, in spite of the published definition, in this series all the trade of processed coffee was left unaccounted for. Furthermore, published series of disposals are grossly mistaken; an error first made in 1975 has since been systematically repeated; additionally, in 1978 there is a gross printing error. (See note b in Appendix 23).

Naturally, in the long-term analysis it is less susceptible to measurement and definition errors to take the net supplies series, in estimating how much coffee was available for consumption in the U.K.. I.C.O. disappearances are intermittent and not long enough for the period under study. B.S.O./M.A.F.F. disposals have a different actual meaning from official publications. They are also subject to repeated printing errors. Naturally, only M.A.F.F. supplies series are left for control in the test of consistency.

Yet, before applying the test of correspondence of coffee purchases there is a need to examine M.A.F.F. supplies in order to ascertain whether those major isolated variations in coffee supplies are due to occasional speculative reactions of stocking-up or de-stocking by coffee traders; or alternatively, whether they are actually showing sudden alterations in consumer purchases. If those major changes in supplies indicate genuine fluctuations in consumption, then that should be noticeable in peculiar trade reactions. One can expect, for example, to find major shifts in inventories, prices, or even in advertising for coffee or for its close substitute, tea.

The analysis concluded that such changes are just speculative trade reactions, rather than alterations in consumption. By 1973 there came to an end the severe 1968 International Coffee Agreement, which established harsh conditions for buyers'

countries by controlling production, restricting the output traded and adding a levy on the trade. At that time there was anxiety as to whether the I.C.A. was going to be renewed and in what conditions; also producing countries were holding large stocks of unsold green coffee (Fox, B., 1973). Suddenly, Brazil, the major supplier announced a severe frost, threatening future world supplies (I.C.O., 1407/75, 1975). Next, a nominal I.C.A. was signed with a free-for-all market (p.3, I.C.O., 1979). Naturally, the trade over-stocked. (See Tables 9 and 10).

Therefore, for producing a control measure of purchases, those major alterations are corrected, both the extreme rise of 1973 and the subsequent fall the following year. Due to the nature of these critical values, a suitable procedure is to replace them by their arithmetic average (See Tables 11). Corrected supplies have been consistently increasing over the last twenty years; during the sixties, however they grew twice as fast as in the seventies. In the short-term these data can be affected by alterations of traders' decisions, which are not shifts in intake, such as to stock up or not to stock up, which is not effectively covered by M.A.F.F. system for reporting inventories. Nevertheless, these figures are reliable for long-term analysis - when the stock effect is negligible.

TABLE 9

EXTREME MAXIMUM VALUES IN COFFEE SUPPLIES. (1960-79)

	1961	1962	1968	1969	1970	1972	1973	1974	1978	1979
SUPPLIES (M.A.F.F.)										
- COFFEE (1)	-	+28%	-	+17%	+21%	- 5%	+35%	-22%	+12%	+32%
- TEA (2)	+ 7%	- 4%	- 3%	- 2%	-	- 3%	- 5%	+ 3%	- 9%	+ 7%
INVENTORIES										
a) Coffee (3)										
No.of weeks same year supply.	7	4	15	14	8	13	12	12	4	4
% Annual change (tons)	-	-29%	+47%	+ 9%	-29%	+26%	+20%	-25%	-11%	+25%
b) Tea (4)										
No. of weeks same year supply	19	20	30	24	27	24	23	24	30	28
% Annual change (tons)	-	+ 5%	+28%	-19%	+13%	-13%	-11%	+10%	-14%	- 2%
PRICE										
a) Retail Price										
Coffee (5)	N/A	N/A	N/A	-12%	- 3%	- 7%	+ 2%	- 4%	- 7%	-19%
Tea (6)	N/A	N/A	N/A	- 5%	- 3%	- 8%	- 9%	- 7%	-10%	-18%
b) Average price paid										
Instant Coffee (7)	-13%	- 7%	- 8%	- 1%	- 5%	-10%	+ 1%	- 7%	- 5%	-21%
Tea (8)	- 4%	- 6%	- 6%	- 4%	- 1%	- 6%	- 6%	- 6%	- 5%	-10%
MEDIA ADVERTISING										
Coffee (9)	- 8%	+12%	-36%	+35%	+25%	- 1%	+27%	-15%	- 3%	-21%
Tea (10)	-24%	+16%	- 7%	+ 5%	+17%	-59%	+46%	+ 5%	- 3%	-34%
Coffee and Tea (11)	-16%	+14%	-19%	+15%	+20%	-37%	+34%	- 6%	- 3%	-28%

SOURCES: Estimated from:
(1) Table 8
(2)(3)(4) Elaborated from C.S.O. "Annual Abstracts of Statistics;
(5)(6) Elaborated from "Gazette of Employment" D of E.
(8) From Annual Report of National Food Survey.
(9)(10) and (11) Appendix 17

TABLE 10

EXTREME MINIMUM VALUES IN COFFEE SUPPLIES

(1960-1979)

	1963	1964	1973	1974	1976	1977
SUPPLIES (M.A.F.F.):						
COFFEE (1)	+ 7%	-14%	+35%	-22%	- 4%	-20%
TEA (2)	--	- 2%	- 5%	+ 3%	+ 3%	-11%
INVENTORIES						
a) Coffee (3)						
N° of weeks same year supply	16	26	12	12	7	5
% Annual change (tons)	+320%	+48%	+20%	-25%	-	-40%
b) Tea (4)						
N° of weeks same year supplies	21	20	23	24	21	32
% Annual change (tons)	+ 7%	- 6%	-11%	+10%	- 7%	+33%
PRICE						
a) Retail Price(D.of E)						
Coffee (5)	N/A	N/A	+ 2%	- 4%	+13%	+81%
Tea (6)	N/A	N/A	- 9%	- 7%	-14%	+115%
b) Average price paid (N.F.S.)						
Instant Coffee (7)	- 5%	+ 4%	+ 1%	- 7%	+18%	+70%
Tea (8)	- 3%	- 4%	- 6%	- 6%	- 2%	+68%
MEDIA ADVERTISING						
Coffee (9)	+ 8%	-18%	+27%	-15%	+15%	+ 4%
Tea (10)	+ 3%	- 3%	+46%	+ 5%	- 5%	+41%
Coffee and Tea (11)	+ 6%	-11%	+34%	- 6%	+ 5%	+21%

Sources and Notes: As in Table 9.

TABLE 11

CORRECTING M.A.F.F. ANNUAL COFFEE SUPPLIES

(1960-1979)

(in ounces of green beans per person per week)

	(A)		(B)	
	oz.	Inter-annual change (%)	oz.	Inter-annual change (%)
1960	0.65		0.65	
1961	0.65	--	0.65	--
1962	0.83	+28%	0.83	+28%
1963	0.89	+ 7%	0.89	+ 7%
1964	0.77	-14%	0.77	-14%
1965	0.83	+ 8%	0.83	+ 8%
1966	0.89	+ 7%	0.89	+ 7%
1967	0.95	+ 7%	0.95	+ 7%
1968	0.95	--	0.95	--
1969	1.11	+17%	1.11	+17%
1970	1.34	+21%	1.34	+21%
1971	1.43	+ 7%	1.43	+ 7%
1972	1.36	- 5%	1.36	- 5%
1973	1.83	+35%	1.63(1)	+20%
1974	1.43	-22%	1.63(1)	--
1975	1.49	+ 4%	1.49	- 9%
1976	1.43	- 4%	1.43	- 4%
1977	1.15	-20%	1.15	-20%
1978	1.29	+12%	1.29	+12%
1979	1.70	+32%	1.70	+32%

NOTE: (1) Correction procedure:

	Original (A)	Corrected (B)
1973:	1.83	1.63
1974:	1.43	1.63
	2.26:2=1.63	

POSSIBLE CYCLES

	Average per oz	year %
1960-68	0.82	+ 5%
1968-74	1.15	+ 8%
1974-77	1.38	-11%
1977-79	1.38	+ 8%

SOURCE: Column A: From Table 8

4.3.- ESTIMATES OF CONSUMER PURCHASES.

This Chapter intends to produce an improved measure of the explained variable, coffee consumption, since the usual source - NFS - is suspected of bias. The last section produced a control series for studying NFS estimates and in this part they are applied in a test of consistency. Corrected coffee supplies indicate how much coffee is available for consumption in the country. By deducting the consumption of institutional and the catering sectors, one should obtain a safe upper limit of household purchases, which must be in agreement with NFS estimates of purchases for in-home consumption. This section seeks for such corroboration and investigates relevant discrepancies, mainly over-estimation; the next part explains why a the NFS can over-state households' purchasing behaviour; then follows the design of a suitable correcting procedure.

Previously, however, it is necessary to carry out three tasks: to widen the concept of purchasing, to analyse the series and to transform all the data into a common unit.

NFS consumer purchases are the average amount bought by reporting households in the panel. A rise in this indicator may originate in an increase in the quantity purchased either by existing buyers or by purchases of new buyers; the latter alternative does not require any alteration in existing buyers'

drinking rate. A fall in the average purchase, conversely, can be derived from either a drop in the drinking rate of established customers or from a net loss of consumers - who may have returned to tea drinking. This view is expanded by including as well as the average amount, the frequency of purchase, the size of package bought and the possibility of mixed-drinking of coffee and tea.

The selected houseperson in the N.F.S. sample is asked to record in a log-book each purchase as they enter the home. In the N.F.S. publication, coffee is split into its three main forms, ground, soluble and essences. Before 1960, however, essences and soluble appeared under one heading only (Appendix 25). Soluble coffee purchases expanded to almost four times, at an average rate of 13% per year. Four phases of five years each characterise this growth: an expansion at the begining; a slower growth (from 1965 the next five years at 9%); a reduced rise of 4% per year between 1970 and 1974; and stagnation during 1975 to 1979. In five opportunities there were rises of over 20%: 1978, 1968, 1965, 1963 and 1962. Two slight declines in purchases and one significant halt prevented a greater growth in soluble coffee purchases: -2% in 1975, -4% in 1964 and 30 per cent in 1977.

Beans and ground coffee purchases have on the whole remained steady over the last twenty years at about 0.10 ounces per person per week. Yet during the sixties there was an increase of 2% to 6% per year, which was followed in the seventies by a progressive decline of up to 4%. Coffee essences present another pattern,

declining definitively from 0.15 in 1960 to 0.02 fluid ounces in 1979, in a consistent fall of 4% per year. That reduction initiated fast at 5%; reaching a practical stagnation in 1965-69; later there was a continuing fall at 3 to 10% in the next two five-year periods. On the whole, soluble coffee grew consistently until 1977, beans and ground increased in the sixties but fell in the seventies, while liquid coffee is progressively declining.

These three types of coffee are reduced into a common unit according to their content of green beans by applying a conversion ratio. The Price Commission survey reports that this is: 1.5 : 2.6 : 1.5 for roasted soluble and essences, respectively. Yet, the I.C.O. uses another ratio: 1.19 : 3 : 1.5 , but it does not indicate how the ratio was obtained (I.C.O.,1978, p.50). The conversion ratio is likely to change in the long run due to alterations in the industrial efficiency. Then, an ideal conversion procedure ought to consider combining both ratios, the I.C.O. equivalence for the first decade, and the Price Commission ratio for the second decade. Yet, I have used only the second indicator, since possitively it is the actual result of an empirical finding. Thus, in Appendix 25 column A, NFS coffee purchases are reduced into their content of raw material or "green beans equivalents", which is readily comparable with corrected supplies.

Another possible reduction procedure may be the preparation dosage of the hot drink, but that involves a bold assumption over the type of coffee employed.

The test of consistency of purchases for in-home consumption, obviously needs to discount from the control series of corrected supplies a certain amount of coffee used by the catering sector. There are two approximated figures for the consumption of the coffee consumed out-of-the-home. That is about 14% of the coffee traded and between 14 and 18% of the coffee drunk. The first figure is a finding of a trade survey carried out by the Price Commission (1977). The second data is made up from two sources: an oral report by Mr. J. Philips from the National Drink Survey, (N.D.S. enquires about the drinks drunk "yesterday" from a sample of consumers); and an ad-hoc survey commissioned by the I.C.O. (Research Services Ltd.,1967). (Appendix 26).

Finally, it is expected in the short-term that N.F.S. variations will be smaller than corrected supplies - since purchases reflect millions of households, whose behaviour rarely leads to in-home stocks, unless they are affected by severe inflation or uncertainty in supply - the latter case may have occured in 1977. However, corrected supplies are the decision of a few traders, who are affected by factors other than the derived demand from retailers and caterers, such as foreign trade, uncertainty of future

supplies in producing countries,etc. Then, the span of changes in supplies is expected to be greater than in household purchases.

Results of such a test are in Table 12. In only six cases out of twenty the NFS estimations are smaller than the MAFF corrected supplies. Furthermore, in three out of those five years, supplies are not smaller than 4% of purchases - which obviously is a gross underestimation of the out-of-home market. In the whole period of time, in only two out of twenty cases purchases are smaller than supplies, by 12% in 1973 and by 15% in 1979.

Yet, since inter-annual changes in stocks might be concelling the catering sector share of the coffee market, two further scrutinies are carried out in order to account for that effect. In the first analysis I have assumed as valid, over twenty years, a gross estimate for the out-of-home share of the coffee supplies (using the Price Commission estimate). That gross rate is deducted from corrected supplies. By deducting from corrected supplies a gross estimate of the out-of-home market one can quantify the N.F.S. mis-reporting of purchases. In the second operation,on the other hand, the possible effect of changes in stocks is definetely eliminated by the use of accumulative analysis, taking in one block the whole period of time under study.

That systematic evaluation of NFS , revealed a systematic mis-reporting, which distorts household purchasing behaviour. In the sixties this is grossly exaggerated by over 32%, reaching

TABLE 12

UPPER TEST OF CONSISTENCY OF N.F.S.

COFFEE PURCHASES

(1960-1979)

	CORRECTED SUPPLIES (1)		HOUSEHOLD PURCHASE (N.F.S.) (2) (Total Coffee)		ESTIMATED OUT-OF-HOME PURCHASE (3)	
	oz.	GROWTH %	oz.	GROWTH %	oz.	% Of Supplies
1957			0.76			
1958			0.78	+ 3%		
1959			0.74	- 5%		
1960	0.65		0.74	-	-0.09	-13.9%
1961	0.65		0.75	+ 1%	-0.10	-15.4%
1962	0.83	+28%	0.82	+ 9%	-0.01	+ 1.2%
1963	0.89	+ 7%	0.94	+15%	-0.05	- 5.6%
1964	0.77	-14%	0.93	- 1%	-0.16	-20.8%
1965	0.83	+ 8%	0.95	+ 2%	-0.12	-14.5%
1966	0.89	+ 7%	1.02	+ 7%	-0.13	-14.6%
1967	0.95	+ 7%	1.05	+ 3%	-0.10	-10.5%
1968	0.95	-	1.19	+13%	-0.24	-25.3%
1969	1.11	+17%	1.29	+ 8%	-0.18	-16.2%
1970	1.34	+21%	1.35	+ 5%	-0.01	- 0.8%
1971	1.43	+ 7%	1.38	+2 %	0.05	+ 3.5%
1972	1.36	- 5%	1.47	+ 7%	-0.11	- 8.1%
1973	1.63	+20%	1.43	- 3%	0.20	+12.3%
1974	1.63	-	1.55	+ 8%	0.08	+ 4.9%
1975	1.49	- 9%	1.53	- 1%	-0.04	- 2.7%
1976	1.43	- 4%	1.55	+ 1%	-0.12	- 8.4%
1977	1.15	-20%	1.12	-28%	0.03	+ 2.6%
1978	1.29	+12%	1.31	+17%	-0.02	- 1.6%
1979	1.70	+32%	1.45	-11%	0.25	+14.7%

SOURCES: (1) From Table 11: Correct supplies per capita moving into domestic consumption.

(2) From Appendix 25: Column A: Purchase by households of all types of coffee.

(3) Made up by subtracting household purchases from corrected supplies (1) - (2) = (3).

up to 45% in 1968. Although during the seventies over-estimations are somewhat reduced, they usually range between 15 and 20 per cent; an exceptional low level of mis-reporting occurred in 1973 with 25% and an incidental minute under-reporting of 0.7 per cent occurred in 1979. (See Table 13). In aggregated terms this implies 32% over-reporting in the early sixties, which rose to 35 per cent in the second part of the decade; that was reduced to 13 per cent in the early seventies, but it went up again to 15% in the late seventies. This pattern in the second scrutiny by five-year periods, was corroborated. In the early sixties (1960-64) purchases exceeded supplies by 10%, which swelled to 16% in the following interval. Then a sudden switch occurred, to the extent that purchases were less than supplies by 3% in 1970-74 and only by 1% in the final part of the decade. Thus, during the sixties purchases exceeded supplies by 14% and in the seventies by 2%, leaving no room for any out-of-home consumption (See Table 14).

It is quite clear, from these figures, that there was not enough coffee available in the whole U.K. to be bought by British shoppers at the average quantities reported by the NFS. Conclusive evidence shows that over the last twenty years U.K. household purchases of coffee have been consistently over-estimated in that official diary survey. Naturally, this fact calls for an adequate correcting procedure in order to obtain a sound measure of the explained variable in the general model. Yet, adequate amendments to series of purchases can only be

TABLE 13

ASSESSING N.F.S. MIS-REPORTING OF COFFEE PURCHASES.

(1960-1979).
(in ounces of green beans equivalent per person per week).

	A	B	C	D	E
1960	0.65	0.56	0.74	0.18	32
1961	0.65	0.56	0.75	0.19	34
1962	0.83	0.71	0.82	0.11	15
1963	0.77	0.66	0.94	0.28	42
1964	0.77	0.66	0.93	0.27	41
1965	0.83	0.71	0.95	0.24	34
1966	0.89	0.77	1.02	0.25	32
1967	0.95	0.82	1.05	0.23	28
1968	0.95	0.82	1.19	0.37	45
1969	1.11	0.95	1.29	0.34	36
1970	1.34	1.15	1.35	0.20	17
1971	1.43	1.23	1.38	0.15	12
1972	1.36	1.17	1.47	0.30	26
1973	1.63	1.40	1.43	0.03	2
1974	1.63	1.40	1.55	0.15	11
1975	1.49	1.28	1.53	0.25	20
1976	1.43	1.23	1.55	0.32	26
1977	1.15	0.99	1.12	0.13	13
1978	1.29	1.11	1.31	0.20	18
1979	1.70	1.46	1.45	-0.01	-0.7

NOTES:

A = Corrected supplies of green coffee. From column 1, Table 11.

B = Deducted corrected supplies for in-home purchasing by deducting a 14 percent from A for catering and institutional consumption according to Price Commission Survey.
B = 0.86 x A.

C = N.F.S. household purchases of coffee. From Column A, Appendix 35.

D = C - B;

$E = \frac{D}{B} \times 100$

TABLE 14

CALCULATING THE ACCUMULATIVE OUT-OF-HOME COFFEE PURCHASES FROM N.F.S. DATA. (1960-1979).

(in ounces of green beans equivalent per person per week).

FIVE YEARS:	SUPPLIES (1) A	PURCHASES (2) B	OUT-OF-HOME PURCHASES (3) C	N.F.S. M.S.S. REPORTING D
1960-64	3.79	4.18	-10%	32%
1965-69	4.73	5.50	-16%	35%
1970-74	7.39	7.18	+ 3%	13%
1975-79	7.06	6.96	+ 1%	15%
DECADE:				
1960-69	8.52	9.68	-14%	34%
1970-79	14.45	14.14	+ 2%	14%

NOTES: A = Supplies of raw coffee equivalent moving into consumption. From Table 11.

B = Household purchases of green beans coffee equivalent. From Table 11.

$$C = \frac{A - B}{A} \times 100$$

D = Deducting 14% for catering and institutional sector, supplies are compared with N.F.S. purchases:

$$D = \frac{B-0.86 \times A}{0.86xA} \times 100$$

applied when one has understood the nature of that bias and determined its major causes. Thus the next section searches for causes of NFS mis-reporting.

4.4- EXPLORING CAUSES OF N.F.S. OVER-ESTIMATIONS.

Why can a diary-survey provide wrong results? Why does the NFS over and not under-estimates consumer purchases? There are a number of possible answers and perhaps the final distortion is the result of several interacting factors. Here I try to isolate just a few but major factors using the experience of the consumer market research discipline, in order to devise a corrective method for obtaining a series of consumer purchases compatible with M.A.F.F corrected coffee supplies.

A diary survey like any other study based on a sample from the universe is affected by three sorts of distortions: errors of selecting the wrong sample; bias in the sample representativeness; and mistakes in the recording, processing and interpretation of the data. These possible causes are investigated and each of them forms a part in this section.

Errors: They are the chance of obtaining an atypical sample - which could be omitted by repeating the sample until the whole population is covered. Responses to N.F.S. surveys come from a small part of those households in the initial sample. (See

Appendix 27). Also the effective sample differs from the population with respect to trends in the size of the family. The N.F.S. sample averaged 3.04 people per home in 1971 (N.F.S., 1972, p. 213, para. 11); this is increased to 3.12 in 1978 (N.F.S., 1979, Appendix A, Table 2, p. 152). Yet, the Census reported 2.88 persons per family in 1971, decreasing to 2.67 in 1979. (See Appendix 28). Thus homes of N.F.S. respondents are larger and growing in numbers, while the average British home is smaller and decreasing over a period of time. Therefore, N.F.S. increasingly under-weights purchases of smaller families and over-weights the behaviour of larger homes. This criticism is also substantiated by Kemsley (1976), who compared socio-economic attributes of respondents with non-respondents to the N.F.S. survey. He found that 1971 N.F.S. sample is distorted, over-weighting the incidence of larger families and of young couples, and under-weighting the conduct of the smallest size families, the elderly and of people with unconventional living, working or marital status.

Sampling errors on N.F.S. is twice and rarely three times the Standard Error (N.F.S., 1979, p.149). In practice, Sa.E. tends to increase in the last two decades and it is inverserly correlated with the amount of money spent on a particular hot beverage item. (See Appendices 29, 30 and 31 and Table 15).

Yet, derived sampling errors for NFS coffee purchase estimates are not large enough to explain an important proportion of the

TABLE 15

DERIVING N.F.S. SAMPLING ERRORS AFFECTING COFFEE PURCHASES ESTIMATES (1)

(Selected years).

	GROUND (1)	SOLUBLE (1)	ESSENCE (1)	TOTAL COFFEE (2)	N.F.S MIS-REPORTING (4)
1966					
Sa.$\bar{t}$	15.2	5.2	16.6	4.4	32%
P	(0.10)	(0.29)	(0.08)		
1970					
Sa.$\bar{t}$	15.6	4.4	16.2	4.2	17%
P	(0.09)	(0.42)	(0.06)		
1972					
Sa.$\bar{t}$	18.6	4.8	20.0	5.6	26%
P	(0.12)	(0.46)	(0.06)		
1973					
Sa.$\bar{t}$	17.4	4.8	22.6	5.0	2%
P	(0.09)	(0.47)	(0.05)		
1975					
Sa.$\bar{t}$	N/A	N/A	N/A	2.4(3)	20%
P	(0.10)	(0.50)	(0.04)		
1979					
Sa.$\bar{t}$	7.9(3)	2.3(3)	16.6(3)	2.2	-0.7%
P	(0.09)	(0.51)	(0.02)		

NOTES: (1) Doubled S.E. for N.F.S. estimates of purchases. From Appendix 29.

(2) Total $S\bar{t}$ sampling error for coffee purchases, aggregated by the proportion of coffee purchased for each type on each year. Sources in Appendix 33.

(3) Corresponds to $S\bar{t}$ for expenditure, since there was no information about $S\bar{t}$ for purchases.

N/A Not available.

Sa.$\bar{t}$: Sampling error;

P: Purchases in oz/person/week.

(4) N.F.S. mis-reporting purchases. From Table 13.

discrepancies under study. They are between 2.2 and 5.6% of the average estimate. Incidentally, S.E. for the average price paid is 3 to 7 times smaller than the actual S.E. for purchases or for expenditures of the same item.(Appendix 31). Paradoxically, rather inaccurate estimates may give a more reliable ratio. In fact, the nature of errors in the N.F.S. is equally affecting purchases and expenditure, cancelling each other out in the calculation of the average price paid.

Bias: They consist in distortions of population estimates - no matter how accurate these estimates may be - caused by lack of sample-representativeness. Many factors may originate bias, such as an inefficient sampling procedure, an out dated sampling frame, or a deficient mode of collecting data. Bias presence can be detected by comparing the composition of the effective sample with the population. Serious warning of bias are: non-representative samples; and non-respondents to the survey being of a special part of the population. Other sources of bias are less apparent like unreliable answers (i.e. due to social image effect) and mis-reporting behaviour (i.e. the respondent recording in the log-book the last purchase made instead of just the actual one as instructed). Next, two possible causes of major bias are examined: eventual distortions in the N.F.S. effective sample; and the possibility that N.F.S. informers mis-reported purchases.

There are strong suggestions that the NFS effective sample may not

resemble essential features of the population. Even though the NFS sample may have been initially drawn randomly, it actual data comes from a particular group of households. This is evidenced by the special nature of non-respondents detected by Kemley (1976), and by the departing trend of the sample average household size from the population, in the last two decades. As just stated when examing the sources of errors, families with large number of children are notably over-represented, while families with just one child or homes of only one person are clearly under-selected. Thus, over the last twenty years NFS effective sample size has increased slightly, while the actual British family size has been steadily declining. (See Appendix 27). The range of sample distortions and of investigated discrepancies in coffee purchases follows:

	N.F.S. Sample Distortions (A).	N.F.S. Over-estimations (B).
1960-64	3%	32%
1965-69	4%	35%
1970-74	7%	13%
1975-79	9%	15%

where (A) is obtained from Appendix 27 and (B) is obtained from Table 14. This indicates that in the long-run as sample distortions increase, over-estimations decrease. Naturally, the incidence of family size in the distortions deserves a further examination. This is to establish whether there are or not important differentials in coffee-purchasing by family size; and to determine how much of NFS over-reporting can be explained by

the demographic unbalance of the sample.

Two independent sources corroborate that coffee consumption varies to a large extent by demographic clusters; they are Rayner et al.(1972) and Hopkin and Ellis (1980). As reviewed in section 2.2.1. Rayner et al. even arrived at an adult equivalent scale, the interpretation of which I have disputed. Almost certainly home-tied mothers rather than their young children have a mid-morning coffee.

This view is confirmed by a one-week panel of households' drinking habits which was carried out by Hopkin and Ellis (1980) for the Water Research Centre. They found that the actual coffee drinking and the proportion of population drinking it in one week changes by both age and sex. Middle-aged men drank more coffee than any other males, although women of that age group are the largest drinkers. This changes among younger people: boys drink more coffee than girls, even though women over 18 drink more. The habit is more widespread amongst males. Obviously under-fives drink tiny amounts, children 1/8, boys 1/6 and girls 1/9 of adults' consumption. In only one annual report of the NFS (1978) in twenty which I could find, there are purchases by family size groups. By re-weighting them with the actual population composition, it is possible to grossly calculate the extent of the over-reporting which can be explained by the demographic imbalance in the NFS sample. After comparing that result with an adult equivalent scale for coffee drinking derived from Hopkin and Ellis, it becomes evident that the NFS over-states

coffee purchases by up to one third. (See Table 16). In brief, the impact of sample distortion is of great significance in the 1978 N.F.S. survey, to the extent that estimates of purchases in various family groups are affected. Yet, a correcting procedure for the periods of two decades should be based on the results of a large number of annual surveys, which unfortunately I could not obtain.

The second source of bias explored is the possibility of mis-recording purchases by people in the sample. Experienced consumer market researchers know that respondents to a survey may answer untruthfully. A household could easily mis-interpret questions. Yet, even if there is full understanding, there may be an over-reaction since his/her behaviour matters to somebody else. No matter how well prepared, tested and piloted a questionaire may be, there will always be such a risk. Sometimes consumers just do not want to openly disclose their actual behaviour. We already know that income questions usually provide unreliable answers and that they put the respondent on the defensive. Furthermore, social images of the "modern" and the "old" in certain groups are very strong, as Haire (1950) detected for coffee purchases, in the U.S.A..

The over-reaction of survey respondents is the tendency of panel members to report their last purchase - even though they were actually made before the panel period took place - rather than their actual conduct alone. This is an important cause of distortions when estimates are inferring a population parameter.

TABLE 16.

REWEIGHTED 1978 N.F.S. COFFEE PURCHASES BY FAMILY COMPOSITION (1)

FAMILY COMPOSITION ADULTS A	CHILDREN B	No. OF PEOPLE/HOME C	N.F.S. SAMPLE D	COFFEE PURCHASES E	POPULATION COMPOSITION F	PURCHASE RE-ESTIMATES G
1	-	1	6%	0.78	22%	0.1716
2	-	2	35%	0.76	27%	0.1026
3	-	3	8%	0.64	12%	0.01735
4+	-	5	3%	0.51		
1	1	1.2	1%	0.72	4%	0.0240
2	1	2.2	12%	0.52	26%	0.0554
2	2	2.4	17%	0.46		
2	3	2.6	7%	0.40	7%	0.0088
2	4+	3.0	2%	0.30		
3	1 or 2	3.3	7%	0.48	2%	0.0026
3	3+	3.8	2%	0.42		
TOTAL/AVERAGE			100%	0.51	100%	0.3823

NOTES: C = Number of adults equivalent per home. A + 0.2B. (Children taken as drinking 1/8th of adults drinking coffee.

D = Composition of N.F.S. effective sample of 1978.

E = Coffee purchases of soluble and ground and bean coffee on each family. Cluster in D (oz/person/week.

F = Family size composition of British population in 1978, from pp.77-86, "Social Trends", C.S.O. 1980.

$$G = \frac{E \times F}{C \times 100}$$

(1) Mean purchase by N.F.S. = 0.51 oz. Reweighted purchases: 0.37 oz. N.F.S. over-estimation: 33.4%

Thus, the longer the panel period is, the more reliable the results will be. Naturally, recorded purchases are much closer to the actual behaviour for items which are frequently bought, when the diary survey is long enough to allow for repeat-purchases in replenishing pantry shelves. Conversely, the shorter the time span of a survey is, the more likelihood exists of discrepancies between recorded and actual purchases. Furthermore, in order to prevent the effect of mis-reporting, market researchers have developed diary-surveys of progressively longer length, tending towards continuous consumer surveys.

Evidence for the hypothesis of the tendency to report the last purchase of coffee can be found by comparing estimates obtained for a similar commodity, but by a survey of a different diary length. This is precisely the case with the NFS and the Family Expenditure Survey (F.E.S.). The first one lasts for one week, the second one, two weeks; yet an even longer length would be desirable. Thus, on can expect that FES estimates will agree much closely with the M.A.F.F. corrected supplies of coffee - than with the NFS purchases.

Such comparison, however, presents a practical problem. FES only estimates expenditure, but not quantity purchased; yet this can be resolved by dividing expenditure by a price. That price has to gather two characteristics: to represent the average quality traded in a period of twenty years; and the price paid for all type of coffee. The NFS average price paid is suitable, since it has a smaller S.E. than either expenditure or purchase

estimates. Yet, NFS publishes detailed prices for each form of coffee, but what is needed is an average value for all types of coffees. Then, a special measure is devised in terms of pence paid for green beans equivalent, using NFS expenditure and purchases appropriately reduced. With this price, FES expenditure is divided in order to re-estimate coffee purchases.

As a result, purchases are initially compatible with MAFF corrected supplies, specially if one takes longer periods of time units than year after year. Thus, out-of home purchases in the sixties are 9% of supplies and 10% during the seventies. (See Table 17 and Appendix 32). The half decade analysis suggests a peculiar pattern growing from 11% to 20% in the first decade, but falling to 14% in the early seventies and declining up to 6% in the last half of the seventies. Furthermore, that pattern may be caused by shifts in purchasing habits and will be studied afterwards.

Thus, in decades, at least, more reliable estimates are in evidence on surveys of longer diary length. Yet, annually there still are twelve observations with an unrealistic outcome.

MISTAKES: In surveys, there can be slips in processing, coding or interpreting the data collected. Obviously, the NFS tries to take good care of the first two kinds of mistakes. However, there is a mistake on the coding of the N.F.S. data by the application of a non-exhaustive household size typology. Thus the N.F.S. leaves out some types of homes, such as those with four or

TABLE 17

CALCULATING THE CUMULATIVE OUT-OF-HOME COFFEE CONSUMPTION FROM N.F.S. AND F.E.S. (1960-1979)

	SUPPLY (1)	ESTIMATED HOUSEHOLD PURCHASE (2)	OUT-OF-HOME PURCHASE (3)	(4)
FIVE YEARS			oz.	%
1960-64	3.79	3.36	0.43	11%
1965-69	4.73	4.49	0.24	20%
1970-74	7.39	6.39	1.00	14%
1975-79	7.06	6.65	0.41	6%
DECADE				
1960-69	8.52	7.85	0.67	9%
1970-79	14.45	13.04	1.41	10%

SOURCES: (1) From Table 11

(2) From Appendix 32.

(3) (1) - (2)

(4) $\frac{(1) - (2)}{(1)} .100$

more children, in 1978. Moreover, until 1971, it did not even consider the possibility of one person homes, those of more than four adults and large families with four or more children. Additionally, the NFS survey setting has not changed for three decades, neglecting shifts in purchasing habits such as the frequency of purchase, the size of the package bought, the number and size of the package bought on each shopping trip and the number of shopping trips every year. Had buying habits remained steady in two decades, then those investigated discrepancies should also be stable; nevertheless this is not the case. I postulate that changes in buying habits alter NFS-reported purchases.

NFS-reported purchases of soluble coffee have trebled in two decades, yet this was not replicated in the proportion of people buying in one week, which follows another pattern. (See Appendix 33). The reliability of reported purchases, as shown earlier, is affected by the length of the diary. Important changes in the amount of a particular type of coffee bought, also bring about alterations in the purchasing habit. In particular, there are changes in the frequency of purchases (how often?), the size of the package bought (how large?) and in the number of packages bought per shopping trip (how many?). Thus, the longer the span of time for observing consumer behaviour, the larger the number of people who can be expected to report having bought an item. Therefore, surveys of increasing diary survey length should report a greater proportion of their respondents' buying.

Although scant information was gathered about declared purchases over one month, mainly from Mintel reports (Mintel Ltd.), a complete series of purchases in two weeks was obtained through unpublished data from the FES. Reports of purchases in one month are not continuous and are based on recalled information relying on consumer memory prompted during the interview; this, limits their validity. On the whole, both the NFS and the FES estimates of consumption followed a similar pattern in twenty years, although an exceptional departure occured with was the maximum value in these series. Purchases based on a two-week length reached their peak in 1972, which is two years later than the highest for one-week series. (See Table 18). The difference between both patterns is postulated as caused by shifts in the purchasing habit, which is substantiated next.

4.5- CORRECTING COFFEE PURCHASES.

After exploring possible causes of the NFS over-estimation in consumer purchases, errors and distortions in the N.F.S. effective sample, although they are significant, clearly cannot explain per se a large part of exceeded estimates. Yet, there is positive evidence of over-reactions by panel members, particularly in recording their last purchase instead of just their actual one. Naturally, this leads to mistakes in interpreting recorded purchases. Improved measures of coffee purchases should be based on such criticisms, but they also must agree with the independent control of net supplies. Furthermore, the

TABLE 18.

PROPORTION OF RESPONDENTS BUYING COFFEE AT VARIOUS INTERVALS. (1960-79).

	INSTANT COFFEE ONLY			ALL COFFEE		
	A. ONE WEEK	B. TWO WEEKS	C. ONE MONTH	D. ONE WEEK	E. TWO WEEKS	F. ONE MONTH
1960	18	N/A		29	N/A	
1961	21	N/A		32	37	
1962	23	N/A		32	40	
1963	24	N/A		31	40	
1964	23	N/A		31	39	
1965	24	N/A		31	42	
1966	25	N/A		31	40	
1967	25	N/A		32	42	90(5)
1968	27	N/A		33	43	
1969	28	N/A		35	42	
1970	30	N/A		35	44	89(6)
1971	29	N/A		34	45	
1972	28	N/A		33	46	
1973	27	N/A		31	44	
1974	26	N/A	83(1)	31	43	
1975	26	N/A		30	43	
1976	26	N/A	79(2)	30	42	
1977	22	N/A		25	36	
1978	30	N/A	79(3)	33	43	
1979	29	N/A	79(4)	33	45	

SOURCES:

A. : From N.F.S. annual reports reproduced in Appendix 33.

C.-(1): p.23 Mintel Report, May 1974, (obtained from a BMRB/Mintel Survey).

C.-(2): p.26, Mintel Report, February 1977 (obtained from a BMRB/Mintel Survey of sample size: 882 and field work Nov. 1976).

C.-(3): p.21 Mintel Report, March 1980 (BMRB/Mintel Survey; field work in Nov. 1978; sample size: 882).

C.-(4): p.21 Mintel Report, March 1980 (BMRB/Mintel Survey sample size : 908; field work in Nov. 1979).

D. : Elaborated by adding N.F.S. estimates of percentage of buyers in one week for all types of coffee. (See Note (7)).

E. : Elaborated from the number of household in the F.E.S., effective sample divided by the number of recording households buying coffee in the two weeks of the survey. That is an unpublished information kindly provided by the F.E.S.

F.-(5): p.21 Research Services Ltd., "International Coffee Survey": United Kingdom. Vol. I, 1969, Sponsored by I.C.O. (Field work: October 1967. sample size: 3.016).

F.-(6): p.16 Research Services Ltd., "International Coffee Survey": United Kingdom. Vol.IV, 1970, Sponsored by I.C.O. (Field work: October 1970. sample size: 1.402).

(7) NOTE: Column D. should be taken with extra care. If some household are buyers of both soluble and ground coffee in the same week, estimate exceed the actual ones.

correcting procedure should satisfy corroborations in similar commodities. Previously, however, it is necessary to analyse how purchasing habits in a frequently bought item (f.b.i.) affects measures in the recording of purchases, and what major shifts in coffee buying habits occured in the last two decades.

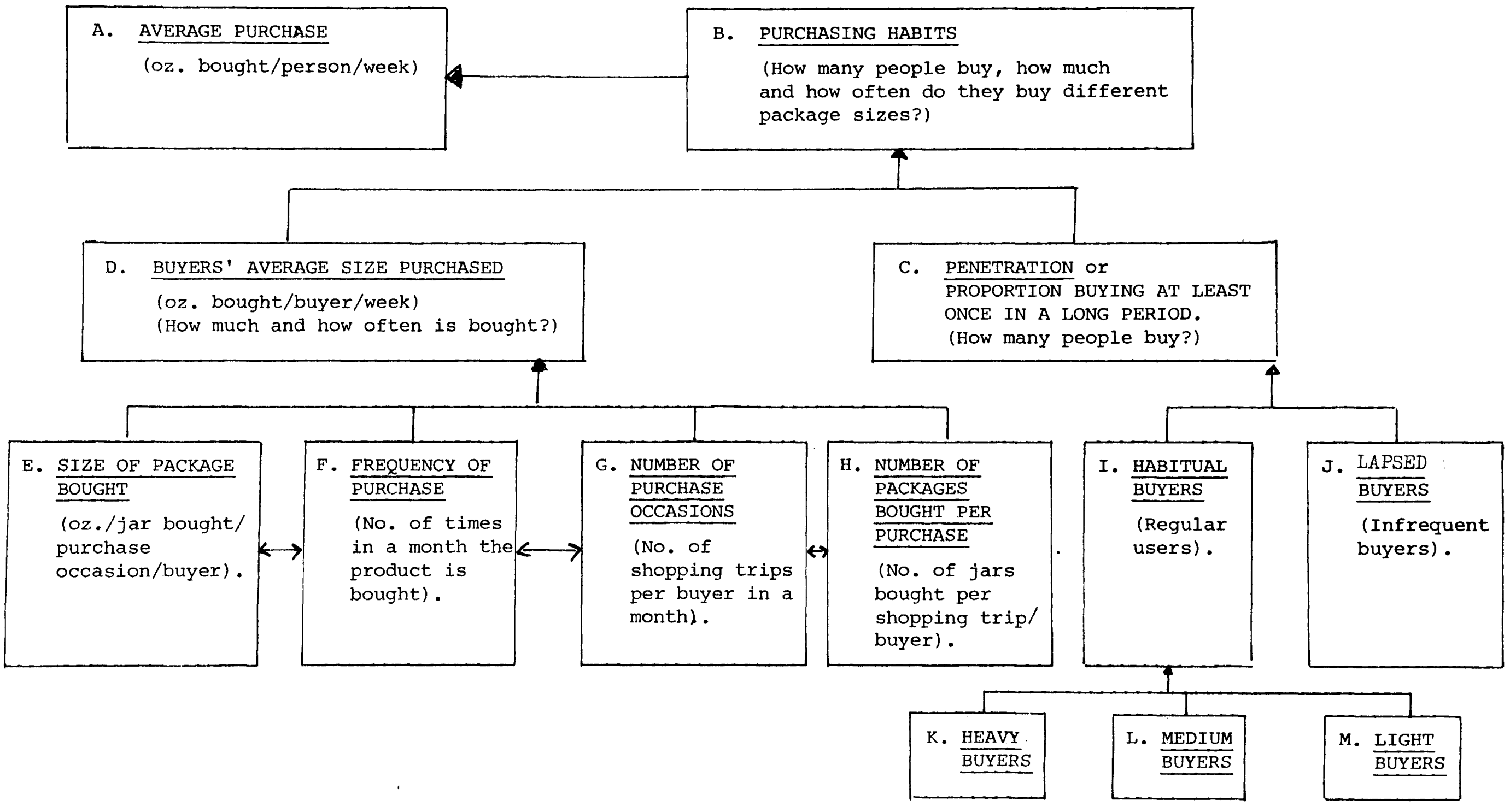
ANATOMY IN THE PURCHASE OF A F.B.I.. I suggest that the actual recording of the last purchase made in a diary survey is a function of the informer purchasing habit. A switch in the size or in the frequency of buying may lead to variations in what is actually recorded in the log-book, even if consumption is unchanged. These deviations can be assessed by assuming that shifts in buying habits precede bias in the recording of purchases in diary surveys of a length shorter than the minimum repeat-purchase interval.

The repeat-purchase idea introduced earlier in Chapter Two is here expanded further. That was developed by Ehrenberg and Goodhardt (1978) for the understanding of buyer behaviour of branded items, which I extend to a product field. This concept integrates several dimensions of consumer behaviour like: purchasing habits, penetration, buyers by frequency of purchase and average purchase size. Under stationary conditions of no growth in intake, the average purchase size becomes a function of the buying habit, if the observation length is long enough. This function is determined by the penetration among drinkers and by how often in-home stocks are replenished. Purchase penetration is the

proportion of consumers buying at least once within a period of time. Then, it becomes essential to identify in a survey both how much and how often the item is bought. Accordingly, consumers can be either habitual or lapsed, at several levels of intake. Habitual buyers are those purchasing at regular times, no matter how much they buy as long as they do it regularly; lapsed or infrequent buyers are those who from time to time try another hot beverage, i.e. tea addicts who "occasionally" buy coffee for an "unpredictable" trial.

The average purchase size, which diary-panels supposedly report, is a function of the pack size bought,(E); the frequency of purchase, (F); the number of purchase occasions or shopping trips, (G); and the number of units bought on each (G), (H). Thus, any change in dimensions C and E, F, G, or H introduces mistakes in the estimation of reported but uncorrected average purchase. (See Figure 1). Naturally, a rise in the average consumer purchase could be caused by either more people buying and/or additional purchases by existing buyers. An increment in the number of buyers implies that new buyers are trying out the product - at initially low amounts; they will remain also as tea-buyers and will buy smaller size packs. A rise in the quantity purchased by existing buyers, means that the proportion of medium and heavy drinkers grew at the expense of light ones. Then, as addiction to the commodity becomes stronger, both a preference towards larger packets sizes and an increase in the number of sole coffee drinkers are expected.

FIGURE 1 ANATOMY OF PURCHASES OF A FREQUENTLY BOUGHT GENERIC PRODUCT



CHANGES IN PURCHASING HABITS. Even under constant consumption, effective purchases can be mis-interpreted in a diary survey, even more in a growth situation such as coffee. Proofs can be deducted by studying the size of purchase, the number of drinkers and the actual drinking of coffee. The average purchase size of soluble coffee per buying occasion, derived from Attwood and AGB surveys, are suggesting that there has been a switch in household preferences. Purchases in two-ounce jars fell regularly from 20% in 1969 to 6% in 1975 and 1976; they then recovered slightly during the coffee price crisis in 1977 and 1978, but fell again later; the same occurred with the 4oz. jar. This consistent drop was made up by a corresponding rise in purchases of larger sizes, 8 oz. in particular.(See Table 19 and Appendix 34).

These changes in the pack bought are related to shifts in the purchasing habits, more precisely with repeat-purchase intervals.

For example, in 1972 , while the replacement of 4 oz. by 8 oz. jars was the greatest, the rate of purchasing in a two-week period was during that year the highest. Thus, that year as people bought increasing amounts of coffee as before, a large proportion of buyers switched to larger size jars from 4oz. to 8oz. tin, which naturally last longer, requiring a longer repeat-purchase interval.

The average purchase size presents a peculiar pattern in the last decade, which implies changes in buying habits. NFS estimates of purchases, which are subject to the "last purchase" effect, are

TABLE 19

ESTIMATION OF AVERAGE PURCHASE SIZE OF INSTANT COFFEE. (1969-1980)

YEAR	I. NUMBER OF JARS IN 100 OUNCES BOUGHT					II. NUMBER OF JAR IN 100 JARS BOUGHT					III. AVERAGE PURCHASE SIZE
	A	B	C	D	E	A	B	C	D	E	(F)
1969	10	12	4	0.3	26	38	46	15	1	100	3.9
1970	8	12	4	0.3	24	32	50	17	1	100	4.2
1971	6	11	5	0.5	23	29	48	21	2	100	4.4
1972	5	11	5	0.6	22	23	51	23	3	100	4.6
1973	-	-	-	-	-	-	-	-	-	-	-
1974	4	12	5	0.5	22	19	56	23	2	100	4.6
1975	3	12	5	0.7	21	15	58	24	3	100	4.8
1976	3	12	5	0.7	21	15	58	24	3	100	4.8
1977	4	14	4	0.6	23	18	62	18	2	100	4.4
1978	4	18	2	0.3	24	17	74	8	1	100	4.2
1979	3	17	3	0.3	23	13	73	13	1	100	4.5
1980	2	16	4	0.3	22	9	71	18	2	100	4.6

NOTES: II - Elaborated from Appendix 34 .

I - Elaborated from II :

A = 2 ounces jar;

B = 4 ounces jar;

C = 8 ounces jar;

D = 12 ounces jar and larger;

E = Total.

(F)= F is in average ounces per purchase.

(Total percentage of jars bought in 100 oz)/(Total number of jars in 100 oz bought), that is column E in Appendix 34 divided by column E in I.

surely not adjusted to prevent such a distortion. Naturally, an amendment to NFS series for over-reporting must consider information from a longer diary panel length, in order to allow for an increased repeat-purchase interval.

THE NUMBER OF BUYERS. This is another indicator of purchasing habits and is the number of buyers by the amount they buy. This can be estimated indirectly through figures of the number of drinkers from "Target Group Index" of the British Market Research Bureau. Yet that procedure assumes that large jars are bought in heavy-drinkers homes, while light-drinkers' homes buy in smaller packs. Thus, frequency of purchase becomes a function of changes in consumption. By exclusion then, switches in pack size in the short run (one or two years) may lead to further mis-reporting of consumption, which accentuates the impact of the "last purchase" effect.

T.G.I. actually records the declared number of cups of soluble coffee drunk daily on average for a year in the last decade. Those who are non-drinkers in T.G.I. survey, recalling not drinking coffee in the last six months, are part of infrequent drinkers. They add up to between 8 and 13 per cent of homes; the highest, which was in 1978, coincided with the coffee price crisis and the smallest with lowest coffee price. On the other hand, light drinkers, those drinking one or fewer cups per day, remained almost steady in the decade at 19 to 21%. However, medium drinkers' homes have declined steadily from 50 to 43% . Instead, the proportion of heavy drinkers, having over 6 cups, has

increased gradually from 20 to 25%; yet, an odd maximum appeared in 1975 with 26 per cent. (See Appendix 35).

In 1976, the low rate of non-drinkers was caused by an increase in the number of medium drinkers. Another peculiar rise in this group from 9 to 11%, in 1972, was made up by a slight drop in the number of light drinkers. This dynamics of coffee drinking is beyond changes in the average amount consumed, and it is due to shifts in the distribution in the frequency of drinking rates. Obviously, these changes in the market profile have their own impact on the frequency of purchase and on the jar size bought.

The market profile of coffee drinking by the amount drunk, shows all these effect together. About one half of soluble coffee is drunk in homes at a average medium rate of 3.5 cups per day; heavy drinkers, make up for 44%; and light drinkers consume about of 6% of the liquid intake. Along the decade of the seventies, the pattern is clear : the heavy drinkers' share grew from 38 to 47% up to 1975, declining slowly afterwards; the medium drinkers' importance fell from 56 to 47 per cent in the same period, but it recovered two points later and stagnated from then on. Light drinkers, whose weighting has been almost constant at 6 per cent of consumption, reduced their share by one point in 1972, just when the medium drinkers' percentage grew. Vice versa, in 1978 the light drinkers' share rose to 7%, which coincided with a one per cent fall in the proportion of heavy drinkers'. (Table 20).

Presumably heavy drinkers buy in larger size jars than and light

TABLE 20

PROFILE OF DAILY COFFEE DRINKING.

(1969-1979).

	MILLION OF DAILY CUPS				DAILY CONSUMPTION RATIO.		
	TOTAL	H	M	L	H	M	L
1969	55	21	31	3	38	56	6
1970	57	23	31	3	40	54	6
1971	59	25	31	3	42	52	6
1972	57	23	31	3	41	54	5
1973	58	24	30	3	42	52	6
1974	58	25	29	4	44	50	6
1975	61	28	29	4	47	47	6
1976	60	27	29	4	45	49	6
1977	61	28	29	4	46	48	6
1978	57	26	28	4	45	48	7
1979	61	28	29	4	46	48	6

NOTES: Elaborated from Appendix 35 based on TGI estimates.

Total Cups: in million of cups of soluble coffee drunk by households per day obtained by multiplying the number of household drinkers on each group by the media consumption on that range, as folows:

H = Heavy drinkers, 6 cups per day;

M = Medium drinkers, 3.5 cupers per day;

L = Light drinkers, 1 cup per day.

drinkers. In a particular segment of the market, changes in consumption affect the frequency of purchase, even if the average rate is not altered. Consequently, shifts in the size of the package bought distort the "last purchase" recorded in diary surveys. Thus, the most severe NFS mis-reporting occured in 1977 and 1978, when the intake was under-estimated by 14% the first year and over-estimated by about 31% the following year. At that time the consumption share of heavy and medium drinkers was reduced and this was partially balanced by a switch in favour of light and non-drinkers. Clearly, at that time there was a decline in the purchase of large size and a rise in small size jars.

Again this corroborates previous findings, reinforcing the view that during the coffee price crisis there was a significant shift in the frequency of coffee purchase which precedes a great distortion in the "last purchase" recorded. In order to reach categorical conclusions the method of correction should be also tested on the actual coffee liquid intake and on other items of the N.F.S., whereby results should corroborate the findings already obtained.

COFFEE DRINKING. By examining ad-hoc estimates of the actual drinking of coffee, one can obtain the essential reassurance of the dynamic observed both in consumption and in purchasing. For example, with a realistic dosage, liquid intake allows inferences about the amount of ingredients purchased. Hot beverage drinking estimated by the National Drink Survey has been steadily declining in the U.K. from 6.8 to 5.8 cups per day, in

fifteen years. This tendency affects tea, cocoa and food beverages, more than coffee. Instead, coffee drinking grew consistently from 1.0 to 1.6 cups per day, although with a different trend by types; soluble coffee really made up for the rise, while liquid coffee declined and ground coffee remained on the whole constant. (Appendix 36).

The National Drink Survey (Marketing Research Centre) which informs the recalled volume of coffee drunk "yesterday", by those over 10 years old, adds both the in- and the out-of-home intake. Yet, these series can be made comparable with N.F.S. purchases. This is possible by deducting the gross estimate of 14% of the Price Commission finding for catering and institutional demand, after transforming the series into liquid through a dossage rate detailed in Appendix 26 and allowing for the low drinking rate of those under 10 years. See Table 21. Volumetric discrepancies between N.D.S. and N.F.S., corroborate N.F.S. usual over-estimation of coffee purchases, although in 1977 and in 1978 there were cases of under-estimation.

An independent survey based on a one-week diary panel recording drinking behaviour in 1978, produced even lower rates of coffee intake. Hopkin and Ellis (1980) researched 1320 randomly selected households, obtaining a mean coffee drinking of 6.5 cups per person per week. However, the average of only those actually drinking coffee during the survey week rises to 10.4 cups. Evidently the actual drinking of coffee is a more stable

TABLE 21

VOLUMETRIC COMPARISON OF N.D.S. COFFEE DRINKING WITH N.F.S. COFFEE PURCHASES. (1965-1979)

	No. of cups drunk Per week (1)	No. of cups equivalent Per week (2)	(3)	Difference (4)
1965-66	5.88	4.94	5.42	+0.48
66-67	7.21	6.06	5.58	-0.48
67-68	7.21	5.98	6.51	+0.53
68-69	N/A		6.89	
69-70	8.19	6.80	7.35	+0.55
1970-71	8.4	6.80	7.70	+0.90
71-72	9.38	7.79	8.08	+0.29
72-73	9.31	7.82	8.09	+0.27
73-74	9.10	7.64	8.76	+1.12
74-75	8.82	7.41	8.57	+1.16
1975-76	9.45	7.94	8.70	+0.76
76-77	8.82	7.94	6.27	-1.67
77-78	9.17	7.89	7.49	-0.40
78-79	9.73	8.37	8.55	+0.18

NOTES: (1) From Appendix 36 in number of cups of coffee per person over 10 years old per week.

(2) Correcting (1) by inbalanced composition of population by assuming as almost negligent the consumption of this group. Based on Census data. Over 10's proportion in UK population as follows: 1965-66: 84%
1967-71: 83%
1972-76: 84%
1977-79: 86%.

(3) From column C Appendix 25 in coffee beverage equivalent, based on N.F.S. coffee purchases.

(4) = (3) - (2).

habit than the purchasing of ingredients. Consequently, there should be some changes in the dosage employed for preparing a cup of coffee at home, which may be linked to the development of freeze-dried soluble coffee in the late seventies. Nevertheless, N.D.S. reports of coffee drinking on the whole follow the pattern of corrected purchases; the 14% of coffee drinking out-of-home is in agreement with earlier estimates of 10% of supplies of green beans equivalents.

SOME FURTHER CORROBORATIONS.

As some aspects of the NFS amendment with F.E.S. data may still be inconclusive, I tried to obtain external confirmation on other f.b.i. of both the over-reporting of the NFS and of the compensatory effect of pooling F.E.S.-N.F.S. data. Tea purchase and expenditures on hot beverages estimated by both NFS and F.E.S. are the test cases for replication of the analysis.
A similar over-reporting by the NFS which occurred in the case of coffee purchases is expected. This will be corrected by merging F.E.S. with N.F.S. estimates.

NFS estimates on expenditure on all hot beverages - tea, cocoa, coffee and branded food drinks are all above those corresponding one but reported by the F.E.S.. The discrepancy is larger for items with smaller incidence in expenditure, like cocoa and branded food drinks, reaching about 33 per cent. Tea over-estimation lies between 4 and 8%. However, since 1975 that

gap is almost compensated by smaller increases in F.E.S. (See Table 22 and Appendix 37).

Tea supplies moving into consumption just exceed purchases estimated by NFS. However, in any case such difference cannot justify the tea consumed in the catering sector. (See Appendix 38). And yet by pooling NFS-FES estimates, the out-of-home demand becomes evident although there is still need for explaining some low values of 1965, 1973 and 1975 to 1979. (Appendix 39).

The analysis by decades is possively more conclussive, since it allows for stock changes in the marketing chain, which last more than two years. The catering sector consumed 7% of net supplies in the sixties and 4% in the seventies. Thus, NFS over-reporting coffee purchases is similar to tea purchases and to hot-beverage expenditure. Again, improved estimates are obtained by pooling together NFS with F.E.S. data.

Mintel Ltd. corroborates NFS over-estimation of household purchases of tea. Through retail audits and company sales, Mintel Ltd. calculated the catering sector at 14% of tea supplies. (p.4, Mintel Report, September,1976). Thus, a similar distortion in the purchases of others frequently bought items is expected, whenever they are reported by diary surveys of a diary panel shorter than the repeat-purchase interval.

<u>POOLING N.F.S.-F.E.S. ESTIMATES.</u> As just demostrated, external audit tests of NFS coffee purchases revealed a systematic

TABLE 22

QUINQUENIAL OVER-REPORTING BY THE N.F.S. OF EXPENDITURE ON HOT BEVERAGES. (1960-79).

I. EXPENDITURE:

	TEA		COFFEE		COCOA and BFD		TOTAL HOT BEVERAGES	
	NFS (1)	FES (2)	NFS (1)	FES (2)	NFS (1)	FES (2)	NFS (1)	FES (2)
1960-64	26	25	7	6	3	2	36	33
1965-69	20	19	9	7	3	2	32	28
1970-74	15	14	10	9	2	2	27	25
1975-79	14	14	12	12	2	2	28	28

II. RATE OF OVER-REPORTING:

1960-64	4%	14%	33%	8%
1965-69	8%	22%	33%	13%
1970-74	7%	10%	-	7%
1975-79	-	-	-	-

NOTES: (1) N.F.S. data from Appendix 36

(2) F.E.S. data from Appendix 36

(3) Rates of change $\frac{(1) - (2)}{(1)} \cdot 100$

over-reporting of households' buying behaviour. There has never been enough coffee available for domestic consumption to be bought at the rates reported by the NFS. Over-reporting is a function of many factors, such as: distortions in the effective sample of respondents; the tendency of panel members to record "last purchase"; and mistakes in interpreting changes in recorded purchases, particularly shifts in both purchasing and drinking habits. Relative mis-reporting in a f.b.i. depends on significant alterations in purchasing and in consumption habits.

Naturally, an appropriate corrective procedure should consider information of purchases from a diary setting of a length longer than the repeat-purchase interval. Yet, the setting of the N.F.S. diary has been one week throughout the life of this survey, and yet, this is not long enough to allow for repeat-purchase of a commodity with such a dynamic purchasing habit. Purchases of tea and expenditure on all hot beverages provide the corroboring evidence.

The method of correction of mis-reporting suggested earlier consisted of pooling together NFS-FES estimates. By employing a survey with longer diary-length (two weeks), a notable improvement in the consistency of purchase estimates is achieved. This allows, in the long term, for a sensible share of the catering sector in the consumption of raw materials. See Table 22a.

Yet, it is necessary to examine the possible consequences of this correcting procedure in statistical terms, particularly in the

TABLE 22a .

POOLING N.F.S. - F.E.S. ESTIMATES OF COFFEE PURCHASES. (1957 - 1980).
(in ounces of green beans equivalent per person per week).

	F.E.S. EXPENDITURE (1)	N.F.S. PRICE (2)	POOLED PURCHASED (3)
1957	1.91	3.84	0.50
1958	2.03	3.74	0.54
1959	2.07	4.14	0.50
1960	2.27	4.22	0.54
1961	2.64	4.13	0.64
1962	3.10	4.44	0.70
1963	3.25	4.25	0.77
1964	3.20	4.54	0.71
1965	3.99	4.73	0.84
1966	3.81	4.83	0.79
1967	4.21	4.79	0.88
1968	4.83	4.82	1.00
1969	2.04	2.08	0.98
1970	2.41	2.12	1.14
1971	2.76	2.38	1.16
1972	3.08	2.31	1.33
1973	3.55	2.57	1.38
1974	3.89	2.81	1.38
1975	4.63	3.14	1.48
1976	6.55	4.36	1.50
1977	9.78	8.63	1.13
1978	10.66	8.91	1.20
1979	11.11	8.32	1.34
1980	11.85	9.13	1.30

SOURCES : (1) Column A, Appendix 32.
(2) Column D, Appendix 32.
(3) : (1) / (2).

accuracy and in the standard errors of estimates. By pooling two surveys there is an increase in the sample size and yet, errors are not necessarily added. Basic features of both surveys indicate that the pooled S.E. lies between the two original standard errors. N.F.S. estimates are consistently higher than FES; S.E. as a per centage in the N.F.S. are equal to or greater than S.E. in the F.E.S.. The total error, therefore is significantly greater in the first than in the second survey. Consequently, the pooled S.E. may lie between the S.E. of both surveys. The sample size is increased in this case from seven thousand to fourteen thousand, raising the rate of effective response from 25 to 40%. Even with a similar S.E., the NFS variance is greater than in the FES. The derived S.E. for these pooled estimates of expenditure on coffee are calculated for selected years in Appendix 40. Results confirm the above deduction, showing that the pooled S.E. are higher than in the NFS only when the FES sample is smaller, which occurred from 1957 to 1966. From 1966 onwards, pooled SE are consistently smaller than in the NFS, lying above the corresponding SE found in the FES. Therefore, by pooling these two survey estimates - in order to correct N.F.S. over-reporting - inaccuracies are reduced. The improved series are not only more consistent, but more accurate.

In brief, the pooling of NFS-FES provides basic correction to N.F.S. over-reporting, although there is still scope for more detailed amendments to the NFS series. They can involve e.g. dynamics in the dosage and further adjustment for shifts in the frequency of purchase. However, such detailed corrections require

more extended data of both factors, yet the essential distortion is already accounted for. Thus, for the purpose of this research, the explained variable is definitively measured by the pooled data.

4.6.- CONCLUSIONS.

This Chapter aimed at obtaining reliable measures of the observed phenomenon: the consumption of coffee. To that end, domestic coffee purchases as reported by the National Food Survey are carefully examined. Preliminary analysis of this popular source of information for modelling coffee consumption indicated that NFS estimates should be challenged. An upper test of consistency derived from net supplies statistics - a part of national accounts data - was devised. Net supplies were studied in three sources: disappearances, disposals and supplies. Disappearances reported by the I.C.O. were in close agreement with supplies, although comparable figures covered just one decade. Disposals prepared by the B.S.O. are admittedly affected by un-announced changes in concepts definitions, mistakes and repeated printing errors.(4.2).

Supplies calculated by the M.A.F.F., although the most consistent of the net imports series, are distorted in their all time-highest in 1973 and in a low in the following year. This was caused by speculative trade reactions as a response to the

uncertain renewal of the International Coffee Agreement. Naturally supplies figures require a compensatory amendment.(4.2).

The upper test revealed that N.F.S. consistently over-estimates domestic coffee purchases. Unchallenged N.F.S. reports of purchase implies either the absurd non-existence of the catering demand or that households have been buying in two decades more coffee than has been available (4.3). By assuming a gross share for the catering sector determined by the Price Commission, it is evident that the NFS over-stated purchases by up to 45% in a year, reaching 34% in the sixties and 14% in the seventies. (4.3).

An exploratory examination of possible causes of NFS over-reporting concluded that sampling errors in the NFS although high, are not large enough for explaining a substantial part of such mis-reporting.(4.4). NFS effective sample is distorted with respect to population demographics; containing more larger families and fewer smaller families; therefore the average household size in the survey is becoming progressively greater than the average family size in the population by 3 to 8 per cent in the last two decades (4.4). This implies some sort of distortions in the estimation of coffee purchases, as they are associated with family composition.

The over-reaction to the NFS diary survey is partially explained by the tendency of panel members to report"last purchase". Shifts in buying habits - in particular frequency and size of pack bought - precede alterations in the recorded purchases in a diary

panel of a length shorter than the minimum repeat-purchase interval, even if the average consumption is constant (4.4). Thus, by pooling both the NFS with the FES - the latter with a diary panel of a double length, re-estimates are in agreement with MAFF supplies, leaving a significant and credible share for the catering sector. (4.4).

In the last two decades there have been significant changes in coffee purchasing habits, which are revealed by independent observations of the following factors: average purchase size; transfers in the ratio of heavy-, medium-, light- and non-drinkers' homes; and alterations in the average amount of coffee drunk (after allowing for dosage weakening during the price crisis). (4.4).

Coffee consumption is finally measured with re-estimates obtained by pooling NFS-FES results. The effectiveness of this procedure was tested in the re-calculation of both the expenditure on hot beverages and the purchases on tea. In both cases the NFS over-reports the actual behaviour, which can be improved by pooling both surveys.(4.4). Besides, pooled NFS-FES estimates are not more inaccurate than the original NFS figures, but are more accurate and more consistent.(4.5).

CHAPTER FIVE.

E M P I R I C A L R E S U L T S.

The general model presented in Chapter Three for explaining coffee consumption in the U.K. is described by equations which are estimated through multiple regression analysis. Measurements of explanatory variables are in the second part of that Chapter, while the observation of the explained phenomenon is justified in Chapter Four. This part discloses the results obtained from the analysis, which corroborates substantial parts of the general model outlined. The iterative search procedure described in section 3.3 finally gave twenty reliable equations which meet the three pre-established selection criteria: theoretical and quantitative.

Fifteen predictors are significant causes for explaining changes in coffee consumption. Of these one is a lagged endogenous variable, (lagged coffee consumption) six are exogenous variables; the rest are either lags of explanatory variables or of their differentials. The six are: the price of coffee; income; the price ratio of coffee to tea; expenditure on the T.V. advertising of coffee, both as an absolute level and as a ratio to the corresponding advertising of hot beverages. Delayed consumption is significant when lagged its time differential for

up to three periods, and also in its lagged but absolute value, dephased only by one period. Thus, regression results are used directly in the testing of each of the formulated hypotheses. Afterwards, internally validated results are confronted with those already published, particularly through the analysis of elasticity of demand, evidencing the superiority of results obtained. In the last section appear relevant implications of these findings for policy-making both in the short- and in the long-term in the field of manufacturing and distribution. Accordingly, this Chapter contains four parts: 5.1.- Regression results; 5.2.- Testing hypotheses; 5.3.- Estimating elasticity of demand; and 5.4.- Some managerial implications.

5.1.- REGRESSION RESULTS.

Measures of the dependent variable are devised for providing annual observations, not quarterly. Then, this explain why regression with quarterly data is insignificant. Yet, the outcome from annual data, 1957-1980, confirmed the general model. The best twenty equations obtained are all part of the general model and have passed the pre-stated tests. They are linear relationships. Other functional forms which were tried, such as double-log, semi-log, reciprocal and quadratic did not improve the results and are not therefore reported here.

As anticipated, one endogenous and six exogenous variables are

relevant, plus lags and differential values. Previous coffee consumption is significant as DA_1, DA_2, DA_3 and A_1. Coffee price is a relevant cause of changes in coffee consumption in its current detrended values and in lags of one period, as well as in its absolute values for one and two lags, such as DB, DB_1, B_1, and B_2. Income is also prominent in both its contemporary differential form and with lags of one and two periods, such as: DC, DC_1, and DC_2. Price ratio is influential in its first differential and when lagged once: DO and DO_1. The effect of advertising is significant only in its current and differential forms, and in both cases only for T.V.: DG and DI.

These best equations ranked by their increasing sum of errors, S, are clustered in four sub-groups. The first cluster i, has the lowest S and contains just three predictors: lagged consumption (A_1), price of coffee and advertising. The effect of the price of coffee appears in this cluster split into its differential (DB) and its absolute value, the latter having a first (DB_1) and second lag (DB_2). The effect of advertising is shown in this group by the ratio of T.V. advertising spend on coffee to hot beverages. (DI). This represents the action on consumers of substitutes and the differential effect of the choice of media.

Notably, both DB and DI appear in each one of the three equations of this group. The second cluster ii, includes ten variables, four of which are also in cluster i. Income and price ratio are

added into the specification.

Many of these variables are dropped in cluster iii, where two new ones are included, DB_1 and DC , yet there still remain DB and DI

In the fourth cluster, iv, DC and DC_2 are omitted, while DC_1, DG and B_1 are included.

Regression estimates of equations in cluster i, are in Table 23, and for clusters ii, iii, and iv are in Tables 24, 25 and 26 respectively.

In the twenty equations, the lowest residual of squares found is 0.0507 and the largest is 0.0696. The coefficient of multiple determination is satisfactory, ranging between 0.69 and 0.79 given that variables in all equations are in difference form rather than in their absolute levels.

In cluster i, the first equation is affected to some extent by autocorrelation and so are equations 8, 9, 12 and 13 in cluster iii, and 17, 18, and 20 in cluster iv. Four observations are retained for the post sample predictive test. By the value of chi-square obtained, it is evident that equations 7, 9, 13 and 18 have unstable parameters. According to the interval of confidence applied in the test, equations 1 and 14 are also affected at the 1% significance level, but not at the 5% level.

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TABLE 23

REGRESSION ESTIMATES OF ESTIMATIONS IN CLUSTER i.

	A1	DB	B1	B2	DI
MEAN DA=0.0361	1.0000	0.0617	8.0309	7.9996	-0.0826
EQUATION 1					
bi	--	-0.073	--	0.005	0.004
t*		(8.78)		(5.21)	(2.40)
S : 0.0507		$X^2_{(2)}$: 2.56		s.p.t.: $X^2_{o(1)}$: 3.59	
$\bar{R}^2$: 0.7898		-0.40			
D.W.: 2.72		t* : (1.84)			
EQUATION 2					
bi	--	-0.076	0.005	--	0.004
t*		(8.07)	(3.46)		(2.30)
S : 0.0536		$X^2_{(2)}$: 0.69		s.p.t.: $X^2_{o(1)}$: 1.53	
$\bar{R}^2$: 0.7897					
D.W.: 2.66					
EQUATION 3					
bi	0.037	-0.081	--	--	0.004
t*	(3.36)	(8.42)			(2.24)
S : 0.0542		$X^2_{(2)}$: 0.59		s.p.t.: $X^2_{o(1)}$: 2.05	
D.W.: 2.65					

NOTE: s.p.t.: Stability of parameters test.

TABLE 24

REGRESSION ESTIMATES OF EQUATIONS IN CLUSTER ii

	DA2	DA3	A1	DB	B1	DC	DO	DO1	DI
MEAN: DA:0.0361	0.0317	0.0287	1.000	0.0617	8.0309	0.9287	0.0413	0.0274	-0.0826
EQUATION 4 b_i:	0.252	--	--	-0.071	--	0.028	-0.144	-0.130	--
t^*:	(2.01)			(5.87)		(2.74)	(1.96)	(1.75)	
S :	o.0588		$X^2_{(1)}$:	0.175		s.p.t.: $X^2_{o(1)}$: 0.07			
$\bar{R}^2$:	0.7343								
D.W.:	2.57								
EQUATION 5 b_i:	--	--	--	-0.078	0.005	--	--	--	--
t^*				(7.50)	(3.13)				
S :	0.0588		$X^2_{(1)}$:	0.175		s.p.t.: $X^2_{o(1)}$: 0.26			
$\bar{R}^2$:	0.7343								
D.W.:	2.57								
EQUATION 6 b_i:	--	--	0.037	-0.083	--	--	--	--	--
t^*:			(3.07)	(7.85)					
S :	0.0592		$X^2_{(1)}$:	0.007		s.p.t.: $X^2_{o(1)}$: 0.34			
$\bar{R}^2$:	0.7312								
D.W.:	2.58								
EQUATION 7 b_i:	0.211	0.248	--	-0.080	--	--	--	--	0.004
t^*	(1.79)	(2.11)		(7.13)					(2.35)
S :	0.0586		$X^2_{(3)}$:	1.86		s.p.t.: $X^2_{o(1)}$: 19.74			
$\bar{R}^2$:	0.7610								
D.W.:	1.91								

NOTE: s.p.t.: Parameters stability test $X^2_{E(1)}$ at 5% : 3.84

$X^2_{E(1)}$ at 1% : 6.64

TABLE 25

REGRESSION ESTIMATES OF EQUATIONS IN CLUSTER iii

	DA1	DA3	DB	DB1	DC	DC2	DI
MEAN DA: 0.0361	0.0378	0.0287	0.0617	0.0313	0.9287	0.8113	-0.0826
EQUATION 8 b_i:	0.233	0.206	-0.064	--	0.020	--	--
t^*:	(2.20)	(1.77)	(6.66)		(2.59)		
S : 0.0593			$x^2_{(3)}$: 1.84			s.p.t.: $X^2_{o(1)}$: 0.23	
$\bar{R}^2$: 0.7144			α :-0.554				
D.W.: 2.48			t^* :(2.54)				
EQUATION 9 b_i:	0.225	0.268	-0.066	--	0.015	--	0.003
t^*	(2.31)	(2.33)	(7.39)		(2.05)		(1.96)
S : 0.0605			$X^2_{(4)}$: 2.30			s.p.t.: $X^2_{o(1)}$:17.25	
$\bar{R}^2$: 0.7680			α :-0.554				
D.W.: 2.44			t^* :(2.36)				
EQUATION 10 b_i:	--	0.203	-0.074	--	--	0.026	--
t^*:		(1.73)	(6.84)			(2.65)	
S : 0.0607			$X^2_{(3)}$: 0.054			s.p.t.: $X^2_{o(1)}$: 0.05	
$\bar{R}^2$: 0.7310							
D.W.: 2.43							
EQUATION 11 b_i:	--	--	-0.068	--	0.026	--	--
t^*:			(5.79)		(2.54)		
S : 0.0623			$X^2_{(2)}$: 1.25			s.p.t.: $X^2_{o(1)}$: 0.04	
$\bar{R}^2$: 0.7016							
D.W.: 2.20							
EQUATION 12 b_i:		0.242	-0.0581	-0.022	0.027	--	--
t^*:		(1.98)	(5.46)	(2.02)	(3.33)		
S : 0.0623			$X^2_{(2)}$: 1.86			s.p.t.: $X^2_{o(1)}$: 0.19	
$\bar{R}^2$: 0.7305			α :-0.421				
D.W.: 2.58			t^* :(1.85)				
EQUATION 13 b_i:	0.250	0.358	-0.071	--	--	--	0.004
t^*:	(2.40)	(3.10)	(7.62)				(2.46)
S : 0.0628			$X^2_{(3)}$: 2.17			p.s.t.: $X^2_{o(1)}$: 21.22	
$\bar{R}^2$: 0.7263			: 0.554				
D.W.: 2.12			t^* :(2.17)				

s.p.t. : Parameters stability test.

TABLE 26

REGRESSION ESTIMATES OF EQUATIONS IN CLUSTER iv

	DA1	DA3	DB	DB1	B1	DC1	DG	DI
MEAN DA: 0.0361	0.0378	0.0287	0.0617	0.0313	8.0309	0.8948	0.0050	-0.0826
EQUATION 14								
b :	--	--	-0.073	--	--	0.018		0.004
t^*:			(6.35)			(1.75)		(2.18)
S :	0.0632		$X^2_{(3)}$: 6.18			s.p t.: $X^2_{o(1)}$: 3.80		
$\bar{R}^2$:	0.7082							
D.W.:	2.29							
EQUATION 15								
b :	--	--	-0.086	--	--	--	0.856	--
t^*:			(7.05)				(1.96)	
S :	0.0655		$X^2_{(2)}$: 0.47			s.p.t.: $X^2_{o(1)}$: 1.61		
$\bar{R}^2$:	0.6705							
D.W.:	1.46							
EQUATION 16								
b :	--	--	-0.077	--	--	--	--	0.0035
			(6.58)					(1.83)
S :	0.0662		$X^2_{(2)}$: 0.47			s.p.t.: $X^2_{o(1)}$: 0.07		
$\bar{R}^2$:	0.664							
D.W.:	1.66							
EQUATION 17								
b :	0.684	--	-0.079	0.046	--	--	--	--
t^*:	(3.63)		(7.32)	(2.67)				
S :	0,0679		$X^2_{(1)}$: 0.249			s.p.t.: $X^2_{o(1)}$: 0.03		
$\bar{R}^2$:	0.6168		α :-0.611					
D.W.:	2.09		t^* :(3.05)					
EQUATION 18								
b :	0.271	0.303	-0.071	--	--	--	--	--
t^*:	(2.25)	(2.40)	(6.66)					
S :	0.0684		$X^2_{(2)}$: 2.23			s.p.t.: $X^2_{o(1)}$: 5.04		
$\bar{R}^2$:	0.6386		α :-0.525					
D.W.:	2.13		t^* :(2.33)					
EQUATION 19								
b :	--	--	-0.078	--	--	--	--	--
t^*:			(6.37)					
S :	0.0696		$X^2_{(1)}$: 0.0006			s. p t.: $X^2_{o(1)}$: 0.04		
$\bar{R}^2$:	0.6102							
D.W.:	1.75							
EQUATION 20								
b :	0.167	0.176	-0.071	--	0.003	--	--	--
	(1.54)	(1.58)	(8.36)		(3.13)			
S :	0.0558		$X^2_{(2)}$: 1.64			s.p.t.: $X^2_{o(1)}$: 0.42		
$\bar{R}^2$:	0.743		α :-0.580					
D.W :	2.57		t^* :(2.70)					

Thus the simplest relationship DA = f(DB) in equation 19, which represents the economic demand model, is improved by adding a dimension of advertising DI, in equation 16. This is improved still further by including income DC in equation 11. The best fit however, is achieved by also including the lags of the dependent variable.

5.2.- TESTING HYPOTHESES.

Hypotheses which form the general model described in section 3.1 are tested by means of the outcome of the best twenty equations. These equations meet theoretical, statistical and econometric criteria and are numered by their increasing S.

HYPOTHESIS I: ABSOLUTE ADDICTION. Parameters representing this proposition were not significant . This implies that shifts in coffee consumption cannot be explained only by its previous levels. Yet, when absolute addiction is rejected, the null hypothesis is accepted, which allows for some kind of non-absolute addiction, whereby past levels of consumption are one of many

other possible explanations. That is precisely the case in eight equations: 20, 17, 12, 10, 8, 6, 4 and 3. See Tables 23 to 25.

Differentials of lagged consumption, together with coffee price, produced a good fit which is improved by adding DI, DC, or DC in turn. An even better fit is gained with a lag of absolute consumption (A_1) or with the price ratio (DO).

HYPOTHESIS II : PRICE EFFECT. Consistently coffee price became a significant explanation for changes in its consumption. Nevertheless, in its simplest postulated form, this variable reached the lowest level in acceptance (equation 19, Table 25).

The outcome of this basic relationship can be improved by including another dimension of price, such as lags of the absolute level (B_1) and a variable of advertising, (DI). See equation 2, 5 and 16. Naturally, hypothesis II is accepted.

HYPOTHESIS III : INCOME EFFECT. Consumers' income is stated as

$c >= 0$; and $c_i + c_1 + c_2 + c_3 + >= 0$.

This is tested by means of the results of three equations: 11, 10

and 4. In equation 11 income and price are suitable explanations of shifts in coffee drinking. The fit is improved by laging income two periods (DC_2) and by adding DA_3. Even better results, compared with equation 11, are produced by including other factors to the function such as DA_2 or D.O and lags of price ratio, which is the case in equations 10 and 4 respectively.

HYPOTHESIS IV : PRICE OF A SUBSTITUTTE. The price of tea did not appear to be relevant to an explanation of shifts in coffee consumption. In the whole analysis, none of the parameters for the price of tea produced significant results.

HYPOTHESIS V : RELATIVE PRICE EFFECT. In spite of the outcome of hypothesis IV, the price ratio of coffee to tea is in fact a relevant cause. Yet, this occurs only in one equation, where the price ratio is specified together with the price of coffee, income and lagged consumption. See equation 4.

HYPOTHESIS VI : EFFECT OF ADVERTISING ON COFFEE. Media advertising on coffee is not relevant, according to the regression

results obtained. Therefore, media expenditure on coffee advertising is rejected. The same occured with the following: hypothesis VII (effect of advertising on a substitute), hypothesis VIII (effect of advertising on non-coffee drinkers) and hypothesis IX (advertising effect on habitual coffe drinkers).

HYPOTHESIS X : MEDIA DIFFERENTIAL ACTION. This view proposed to separate the effect of advertising on consumption according to the transmission medium. In particular, it suggests that T.V. is more effective than other means of advertising. Two dimmensions produced significant results: DG and DI. DG represents the expenditure on coffee publicity on commercial T.V. and it is specified together with the price of coffee in equation 15.

The second significant construct for T.V. advertising is DI, which stands for the effect on non-coffee drinkers. In the simplest equation (equation 16) it is combined with DB, but there is a poor fit. This is substantially improved by adding A_1 or B_1, throughout equations 3 and 2.

Summarising, the testing of the hypotheses postulated in Chapter Three resulted in:

Hypothesis I: Absolute addiction effect. Rejected. This is replaced by the relative addiction, supported by the outcome of

equations 20, 17, 12, 10, 8, 6, 4 and 3.

Hypothesis II: Price effect. Accepted. (Equations 19, 16, 5 and 2).

Hypothesis III: Income effect. Accepted. (Equations 11, 10 and 4).

Hypothesis IV: Effect of price of a substitute. Rejected.

Hypothesis V: Relative price effect. Accepted. (Equation 4).

Hypothesis VI: Effect of media expenditure on advertising. Rejected.

Hypothesis VII: Effect of media expenditure on advertising on a substitute. Rejected.

Hypothesis VIII: Effect of media advertising on non-coffee drinkers. Rejected.

Hypothesis IX: Advertising effect on habitual coffee drinkers. Rejected.

Hypothesis X: Media differential action of advertising. Accepted, particularly the expenditure on T.V. coffee advertising (equation 15) and the effect of coffee T.V. advertising on

non-coffee drinkers (equation 16, 3 and 2).

COROLLARY. Two propositions are deduced from this outcome: one relates to addiction and the other one concerns the existence of an adjustment period. The rejection of the absolute addiction view suggests the more realistic thought of the relative addiction. Changes in coffee consumption are only partly explained by previous levels of intake. This is supported by eleven of the best twenty equations: 20, 18, 17, 13, 10, 9, 8, 7, 6, 4 and 3. DA_1 and DA_2 produced low significance which increases with A_1. Thus, the absolute level of former coffee consumption is more important than differentials.

It is evident that a lagged response is necessary for changes in explanatory variables to exert any impact on the dependent variable. This occured with most of relevant explanations, like the price of coffee in both differential and on its absolute level, price ratio and income. The outcome is such that non-symmetrical functional effect prevails as habit formation in the market demand.

Naturally these findings must be compared with empirical results already published, in order to seek for external validity. This is carried out throughout the next section with the uniform measure of the elasticity of demand for each on of the explanatory variables concerned.

5.3.- ESTIMATING ELASTICITY OF DEMAND.

Demand elasticity measures causal relationships uniformly and provides a useful means of comparison with other studies, allowing for an external assessment of these results. In addition, the elasticity outcome can serve as an informed basis for commodity policy-making and stock management, as well as for prices and advertising decisions. In this particular model, elasticities are obtained by transforming estimates back to their original dimension from their differential forms.

There follows estimates of elasticity with respect to relevant predictors such as the price of coffee, income, previous consumption and advertising. Yet, in the following section there is a discussion about the implications of these validated elasticities for coffee consumption and for coffee as a commodity from the management point of view.

PRICE ELASTICITY. From the set of "best" equations, a rather stable estimate is obtained, fluctuating between -0.47 to -0.63 . The lowest value occurs when coffee price is the sole explanatory variable (equation 19); this is slightly increased as other variables are specified, such as income, previous consumption levels and advertising. In the long run, the range is even narrower, from -0.55 to -0.64. The former value is obtained when

price is lagged one period; the latter when price is lagged two periods, thereby providing the best fit (See Table 27, equation 1).

These estimates of price elasticity are within the range found only by the NFS and by Cable: they disagree with every other study. (See Table 1). I suspect that the concidence with NFS is incidental. Although NFS uses a similar procedure for a sightly similar period of time, even slightly different periods to those here produce quite a different outcome. In other words, the various results obtained by the N.F.S. are not consistent with each other. (See Table 1). Furthermore, NFS is a suspect source due to methodological queries already discussed. Cable's work however, can be used for comparing results; although he analysed just one third of the period of time employed here, his estimates correspond for elasticities of both price and income.

INCOME ELASTICITY.

Estimates of income elasticity are above unity - between 1.0 and 1.13 - in equations with parameters stable at 1% of confidence. If a lower confidence limit is accepted, income elasticity can become even less than unity, reaching the lower limit of 0.61 . In the simplest function income elasticity is 1.05 (equation 11).

As lags of coffee price and previous consumption are added, income elasticity grows to 1.09 (equation 12). The upper value is obtained when price ratio is also specified. (equation 4).

TABLE 27

ESTIMATES OF PRICE ELASTICITY.

EQUATION:	SHORT RUN	LONG RUN				OTHER
	DB	DB1	B1	B2	OVERALL	PREDICTORS
(19)	-0.63	-	-	-	-	-
(11)	-0.55	-	-	-	-	DC
(16)	-0.62	-	-	-	-	DJ
(12)	-0.47	-0.18	-	-	-0.64	DA3, DC
(5)	-0.63	-	0.04	-	-0.59	-
(2)	-0.61	-	0.04	-	-0.57	DI
(1)(x)	-0.59	-	-	0.04	-0.55	DI

(x) Equation with unstable parameters at 1% of confidence.

Unity is reached when income is measured through two-year lags. See Table 28 .

Similar estimates to those obtained with the "best fit" function, 1.13 , were also found by Young (1980); yet he obtained low significance with quarterly data for 1960-77. Cable (1972) produced an elasticity of 1.30 . (See Table 1). These two estimates may be considered similar given that specialist literature reports income elasticities of all signs and sizes: the F.A.O.(1972) published negative values, Pollock (1971) calculated a near zero elasticity, Ball et al. (1969) derived a positive but very inelastic one, while Timms' (1973) estimate rose to 2.2 . Yet it is evident that coffee consumption rises with income, which is substantiated by the direct findings of consumer surveys.

In four consecutive years, consumption increases consistently from income group A to D. (See Appendix 41).

ELASTICITY OF PREVIOUS CONSUMPTION LEVELS.

The outcome shows that relative addiction has a low effect on current consumption, which is evident in an inelastic elasticity.

This effect is proxied by one variable at a time, with lags of one, two or three periods of time. Elasticity decreases correspondingly from 0.66 to 0.18. Goodness of fit for each equation improves as other explanatory variables are included in the function, yet in this case elasticity decreases. A low elasticity of 0.004 is obtained if

TABLE 28

ESTIMATES OF INCOME ELASTICITY

EQUATION:	SHORT RUN DC	LONG RUN			OTHER PREDICTORS
		DC1	DC2	OVER ALL	
(14)(x)(x)	-	0.71	-	0.71	DB; DI
(12)	1.09	-	-	1.09	DB; DB1; DA3
(11)	1.05	-	-	1.05	DB
(10)	-	-	1.00	1.00	DB; DA3
(9)(x)	0.61	-	-	0.61	DB; DA1;DA3;DI
(4)	1.13	-	-	1.13	DB; DA2;DO; DO1

The test of parameters stability revealed that for forecasting purpose:

(x) Parameters in this equation have low estability at 5%

(x)(x) As (x) but at 1% of confidence.

only A_1 is used to observe the effect of the previous level of consumption. By accepting a level of confidence lower than 1% , the over-all relative addiction effect can be separated into its components: the partial effect of one, two or three periods of time lag. The best equation for one lag (equation 17) then gives an elasticity of 0.66 ; for two lags (equation 4) it is 0.23 ; and for three lags (equation 10) 0.18 . Long-term elasticity simultaneously for one and three lags is 0.41 (equation 8). (See Table 29).

Although in behaviourist oriented literature the importance of habit formation is usually mentioned, there is no empirical estimate of its effect for comparing these results.

ELASTICITY OF PRICE RATIO. The ratio of the price of coffee to that of tea is significant in just one function (equation 4). Here its effect is split into two variables: contemporary and lagged by one period. The outcome is a short-term elasticity of -0.16 and -0.30 in the long term.

The literature reviewed here does not mention the effect of this price ratio on coffee consumption.

ADVERTISING ELASTICITY.

Two variables represent the relevant effect on coffee consumption of advertising - television advertising in both cases. One is

TABLE 29

ESTIMATES OF RELATIVE ADDICTION ELASTICITY

EQUATION	LAGGED CONSUMPTION				LONG RUN	OTHER PREDICTORS
	A1	DA1	DA2	DA3		
(17)	-	0.66	-	-	0.66	DB,DB1
(12)	-	-	-	0.21	0.21	DB,DB1,DC
(10)	-	-	-	0.18	0.18	DB,DC2
(4)	-	-	0.23	-	0.23	DB,DC,DO,DO1
(3)	0.04	-	-	-	0.04	DB,DI
(18)(x)	-	0.26	-	0.27	0.53	DB
(13)(x)	-	0.24	-	0.31	0.55	DB,DI
(9) (x)	-	0.22	-	0.24	0.46	DB,DC,DI
(8)	-	0.23	-	0.18	0.41	DB,DC
(7) (x)	-	-	0.20	0.22	0.42	DB,DI

Parameter stability test indicated that:

(x): Equation with unstable parameters.

the expenditure on T.V. advertising on coffee, and the other one is the proxy for the effect on non-coffee drinkers, measured through the ratio of expenditure on coffee to hot beverages. The first variable is significant only in one function, the price of coffee being the other explanatory variable (equation 15). Thus, expenditure on coffee T.V. advertising has an elasticity is 0.092. The second variable is relevant in eight functions and in almost all of them it has a remarkably stable elasticity of 0.18 . (See Table 30).

These two findings are complementary, since there is a need for a minimal level of advertising in order to affect the demand for any commodity, particularly coffee. Yet the impact of coffee advertising on coffee drinking is not absolute, but is relative to similar publicity for close substitute items. When expenditure on coffee advertising is greater than that on tea, then sole tea drinkers and mixed coffee and tea drinkers will try coffee at increasingly frequent intervals. Furthermore, the impact of DG encourages a higher rate of intake in existing coffee drinkers, while substantial increases in DI exert a suggestive action over tea drinkers. However, this outcome seems to contradict to some extent review findings of Clarke (1976). Clarke identified, in the published literature he reviewed, a cumulative aggregate effects of advertising from 3 to 15 fifteen months. Yet delayed effects of advertising for lags of one, two and three years tested in various advertising hypotheses of this project, revealed them

TABLE 30

ESTIMATES OF ADVERTISING ELASTICITY.

EQUATIONS:	DG	DI	OTHER PREDICTORS
(15)	0.092		DB
(16)	-	0.16	DB
(14)(x)(x)	-	0.18	DB; DC1
(13)(x)	-	0.18	DB; DA1; DA3
(9) (x)	-	0.14	DB; DA3; DC
(7) (x)	-	0.18	DB; DA2; DA3
(3)	-	0.18	DB; A1
(2)	-	0.18	DB; B1
(1)(x)(x)	-	0.18	DB; B2

(x) : Equation with parameters unstable at 5% of confidence

(x)(x): Equation with parameters unstable at 1% of confidence.

all as insignificant. However, the question is still open for a shorter length of observations and for periods shorter than a year.

5.4.- SOME MANAGERIAL IMPLICATIONS.

As the purpose of this study is to contribute towards the understanding of consumer behaviour, these results should be an informed basis for improving the forecasting power of commodity demand models. This is essential for the design of sound long-term policies by producers and for improving managerial decisions of manufacturers and distributors. This section explains briefly some major implications for management of these findings. In the last twenty years coffee consumption has grown from 0.47 to 1.30 ounces of green beans per person per week. This three-fold rise is due to the causal effect of just a few factors: a drop in coffee price; an increase in income;a fall in the relative price of coffee to tea (coffee becoming cheaper than tea); an increase in industry expenditure both on coffee advertising through television and on relative publicity with respect to tea; and lastly, the accumulative effect of previous consumption due to the formation of drinking habits.

Coffee drinking is price inelastic in that, if the price falls by one per cent, there is a corresponding increase of 0.6% in the amount drunk. This short-term response is somewhat reduced to 0.55% in the long run, if the fall in coffee price remains for one or two years. At the mean of the variable involved, this implies that a fall of 0.089 pence per ounce brings about an increase in consumption of 0.00604 oz., which is an additional sale nation wide of 9.58 tons per week in the coffee market.

There is an inelastic relative addiction to coffee drinking, such that an increase in consumption in any one year will tend to remain to some extent, even if the market has returned to its initial conditions and the original causes of the rise no longer prevail. An explanation for this is that a part of the additional consumption is made up of "new" drinkers, that is, by people who previously drank mainly or solely other beverages like tea. As time goes by, these converted drinkers become accustomed to coffee and continue to consume it, in spite of rises in price or a reduction in coffee advertising or even a fall in income. The habit of drinking coffee is such that of a 1% rise in coffee consumption which remains for longer than a year, 0.2% continues even though original causes of the rise have disappeared. This figure doubles to 0.4% if the increase holds for more than three years. Thus changes in coffee consumption are asymmetrical in

relation to alterations in explanatory variables such as coffee price, income and advertising.

Coffee consumption is elastic to changes in income: a one per cent raise in income rises coffee drinking by 1.13% . Taking the average values for the period examined, this implies that an additional income of 40.6 pence per capita per week - £21.13 per year - brings about nation-wide sales of an extra 18.06 tons of coffee per week. There is also a decreasing long-term effect of changes in consumer' income, which lasts up to two years, with unitary elasticity. Naturally, people become accustomed to a new consumption pattern with increasing amounts of coffee in the daily diet, made possible by former rises in income. Subsequent falls in income, to initial levels will not bring back the original level of coffee drinking, at least for two years.

The price elasticity of -0.16 for the ratio of coffee to tea implies that for a fall of 1% in the ratio there is an increase in the demand for coffee of 0.16%. For falls to occur at the mean, there is either a rise in the price of tea to 7.63 pence per oz. or a drop in the price of coffee to 7.99 pence per oz., or a combination of these two basic factors. Such a 0.16% increased in the demand for coffee represents an additional sale of 2.55 tons per week. However, when the change in price ratio holds for at least a year, there is almost a two-fold gain in extra sales of 4.79 tons. Thus consumers are aware of the relative price of commodities and they respond positively to it. Furthermore, the

longer a favourable ratio remains, the greater is the increase in demand.

The impact of advertising on consumption has two components, both of which point to T.V. as the powerful media. One component is expenditure on advertising and the other is the relative advertising for hot beverages. In both cases the response is inelastic: 0.09 and 0.18 , respectively. Thus, at the mean of the series, an additional £ 1080 per week spend on coffee T.V. propaganda leads to a rise in sales of 1.44 tons; this is £ 4000 at the mean price, hence, the return is £ 3.7 per extra £ 1. A 1% rise in the second component can be achieved in any of three ways: by a decrease in £ 2300 per week on tea advertising, while coffee publicity is constant; or by a rise of £ 2000 in coffee advertising per week; or by a combination of both alternatives. Any one of these situations encourages an additional domestic consumption of 2.88 tons per week, which represents an extra sale of £ 8200 .

CHAPTER 6.

S U M M A R Y A N D C O N C L U S I O N S.

6.1.- SUMMARY.

The project and its major findings can now be summarised as follows. This study has aimed at modelling total coffee consumption in the U.K. for the period 1957-1980. A theoretical model is put forward, which is then estimated and used to examine the effect of economic and non-economic variables on coffee consumption over this period. Previous studies on coffee demand usually assume a symmetrical consumer response to changes in explanatory variables. This study challenges both the symmetry assumption and the statistical source used for estimation purposes. The model proposed allows for asymmetric consumer response. The explanatory variables of coffee drinking are economic such as the price of coffee and of a close substitute - tea - and consumers' income; non-economic factors are advertising and the strength of the coffee-drinking habit. This model is original in interpreting and quantifying the effect of two factors on consumption: product field advertising, and habit formation. The model also includes a lagged adjustment hypothesis and it allows for a minimal threshold level of predictors.

The second aspect that is challenged, concerns the data used.

The analysis of consumption statistics showed that domestic supplies (as in official national accounts) are plagued with mistakes, repeated printing errors and unpublished changes in definitions. Household coffee purchases reported by the National Food Survey are consistently over-estimated. However, these estimates are often taken uncritically in academic and business research and are used for decision-making by the government.

Major causes of bias are the large rate of non-response by certain types of households and the strong tendency of actual panel members to record the last purchase made (rather than only the actual ones during the diary-survey period), which interacts with changes in purchase size and frequency. Therefore, an improved set of data of the dependent variable is achieved by pooling N.F.S. with the Family Expenditure Survey, which is consistent with adjusted supplies.

Most previous research into the advertising effect on demand for coffee is based on Palda's (1964) interpretation of the normative AIDA model, ending up with inconclusive or insignificant results. Evidently manufacturers consistently spend substantial sums on advertising, the effect of which has not been explained. This study separates the advertising effect over a product field into two aspects linked to both consumption and competition. The first action increases sales by attracting new buyers into the market,while protecting consumers from competitors' advertising. The second action increases sales to habitual customers, while

manufacturers are competing through advertising for a larger brand share of the market. The former effect is proxied by the ratio of expenditure devoted to advertising on coffee to that on all other hot beverages; the second effect is measured by an indicator of advertising concentration. The transmitting media (press, T.V.) are a factor in both effects.

The strength of the habit causes a shift in the market demand function. Coffee-drinking is an addictive activity, such that under stationary conditions the routine way of thinking prevails in solving which and how much hot beverage to drink. Conversely, under non-stationary conditions significant changes in the demand function can occur by the initiation of the problem-solving way of thinking. The strength of the habit is observed through the effect of former consumption levels, both in relative and in absolute terms. Empirical results clearly indicate that the general model proposed in the study supports the contention that a non-symmetrical functional effect prevails in terms of habit formation in the market demand. It is evident that a lagged-response is necessary for changes in explanatory variables to exert an impact on the dependent variable.

Evidence shows that coffee consumption depends on former levels of consumption and on other factors,such as: coffee price, price-ratio tea to coffee, income and advertising. The trebled expansion in coffee consumption during the last thirty years or so, is due to a drop in coffee price, increase in income, falls in

relative coffee price (with respect to tea), increases in expenditure on coffee advertising on T.V. and on relative advertising (with respect to tea).

6.2- CONCLUSIONS.

According to the aim of this thesis, major findings are:

1.- A multidisciplinary view is necessary for understanding the rationality of consumer behaviour for frequently bought items. Habit formation and non-symmetrical functional effect should be considered together with price, income and price of a close substitute. Also advertising can be included, but splitting its impact amongst habitual and non-consumers of the item and according to the media used.(2.3).

2.- Inferences of the National Food Survey for a number of commodities are biased and likely to produce continuously distorted results, unless a corrective procedure is applied. Reasons are: the discrepancies in the trend between the actual and the effective sample family size; and the special nature of non-respondents which are in the initial sample. (2.2.1).

3.- N.F.S. and F.A.O. cross-sectional estimates of income elasticity of demand for a number of individual food items

are likely to be seriously biased. Statistical data used for the estimation comes from a sample which has lost its random properties, as not more than one third of those selected in the initial sample provide complete information about their private income.(2.2.1).

4.- Analytical studies of the demand for coffee in the U.K. based on time-series already carried out by the F.A.O., the N.F.S. and by several researchers differ notably in their empirical specification and mathematical form of equations. Frequently, explanatory variables rejected on empirical grounds by some authors, are selected by others. A common mistake is to measure the explained phenomenon with uncritical estimates of purchases reported by the N.F.S.. (2.2.3).

5.- Official statistics of domestic coffee supply calculated from national accounts - net imports adjusted by changes in declared inventories - are affected by mistakes, repeated printing errors and an unpublished change in concepts (4.2). Yet, the M.A.F.F. system of reporting declared stocks was not effective enough to show the over-stocking by traders in 1973, when the renewal of the International Coffee Agreement was uncertain. (4.2).

6.- The N.F.S. reports of household purchases of coffee for in-home consumption are over-estimated. In the

last two decades this reaches 45 per cent per year. Thus, purchases are consistently greater than corrected-net-supplies, leaving no share for the catering sector. (4.3). This is corroborated by similar over-reporting of both tea purchases and expenditure on hot beverages.(4.3). A search for possible causes of mis-reporting, conduces to the tendency of panel members to over-react stating their "last purchase" rather than only the actual ones during the diary-length. Thus, improved estimates were obtained by pooling together estimates from another consumer survey with a double diary-length: the Family Expenditure Survey, which has a two-week panel, and a less biased sample of respondents than the N.F.S. provides firm grounds for essential amendments. (4.3). Still remaining discrepancies can be explained through shifts in coffee-purchasing habits, particularly the frequency and size of purchase. (4.3).

7.- Empirical evidence obtained, rejected the view of absolute addiction. Yet, results strongly suggest the presence of habits in the drinking of coffee, which is characterised by an addiction relative to other factors, such as price, income price-ratio and advertising. (5.2).

Under stationary conditions consumers adopt the routine way of deciding which and how much hot beverage to drink. Conversely, in a nonstationary situation significant shifts in the demand function can occur by the triggering

of the problem-solving way of thinking. The strength of the habit is observed through the effect of former drinking levels, both in absolute and relative terms. (3.1.1).

8.- The price of coffee is a consistent relevant explanation of coffee consumption. Its influence can be segregated into short and long-term adjustments. The effect of income characterises coffee as a superior commodity. The relative price of coffee to tea accounts partly for shifts in coffee demand. Television advertising is also a relevant factor in two respects: one is the total expenditure by advertising on coffee, while the second is the ratio of coffee to a substitute for coffee. (5.2).

9.- There are grounds to believe that there is a medium differential action of advertising over consumption, beyond its cost. (5.2).

10.- The consumption of coffee is inelastic to changes in the price of coffee, to the relative price and to advertising; but it is elastic to alterations in income. (5.3).

11.- Short-term price elasticity is - 0.6 and long-term is - 0.55; the effect of price changes prevails over two

years. Former levels of coffee drinking are partial determinants of current consumption; a rise of 1% remaining for longer than a year, retains 0.2% of the additional quantity demanded and 0.4% if the rise holds for more than three years, (5.3), supporting the existence of an asymmetrical demand function.

12.- In the last twenty-five years, coffee consumption has trebled from 0.47 to 1.30 oz. per person per week. Five factors are the consistent cause: a fall in coffee price; a rise in consumers' income; a relatively cheaper coffee with respect to tea; a vigorous four-fold rise in T.V. coffee advertising; the fact that the coffee industry advertised more than the tea industry; and the existence of a strong relatively addictive habit of coffee drinking.

CHAPTER 7.

B I B L I O G R A P H Y

ABAELU, J. N. and MANDERSCHIED, L. V.: "U.S. Import Demand for green Coffee by Variety." American Journal of Agricultural Economics. Vol. 50 (2), 1968, pp. 232-242.

ARAK, M.: "Estimation of Assymetric Long-run Supply Functions: The case of Coffee." Canadian Journal of Agricultural Economics. 1969, pp. 15-22.

BALL, R. J. and AGARWALA, R.: "An Econometric Analysis of the Effects of Generic Adverting on the Demand for Tea in in the U.K.." British Journal of Marketing. Winter 1969, pp. 202-217.

BAUMOL, W. J.: Economic Theory and Operation Analysis. Prentice/Hall. Third edition. 1972.

BRITISH MARKET RESEARCH BUREAU: Target Group Index. Introduction volumen. 1976.

_____ : Target Goup Index. Annual report for a group of syndicated subscribers since 1969.

BUSINESS STATISTICS OFFICE: "Starch and Miscellaneous Foods." Business Monitor P.Q. 229.2 . Department of Trade Industry. H.M.S.O. (1972-1980).

CABLE, J.R.: "Market Structure, Advertising Policy and Intermarket Differences in Advertising Intensity." In K. G. Cowling (ed) Market Structure and Corporate Behaviour: Theory and Empirical Analysis of the Firm. Gray-Mills, 1972.

_____ : "Advertising, Quality and Commodity Demand: U.K. Household Consumption of Instant Coffee, 1960-68." Warwick Economic Paper # 57, October 1974. (Partially reproduced in chapter 8 of: Advertising and Economic Behaviour, edited by MacMillan Press, 1975).

CLARKE D. G.:"Econometric Measurement of the Duration of Advertising Effect on Sales." Journal of Marketing Research. Vol. 13, pp. 345-357. Nov. 1976.

CENTRAL STATISTICAL OFFICE: Annual Abstracts of Statistics. H.M.S.O., issues 1968 to 1981.

_____ : Economic Trends. H.M.S.O., issues 1979, 1982 and Anual Suplement 1981.

_____ : Monthly Digest of Statistics. Supplement. H.M.S.O. Jan. 1980.

_____ : Social Trends. H.M.S.O. 1980.

COLLEY, R.: "Defining Advertising Goals for Measured Advertising Results." Association of National Advertisers. 1961.

COMMUNICATION RESEARCH LTD.: Study of Consumer Attitudes in the U.K. affecting Coffee Consumption. Work commissioned by the International Coffee Organization. 4 Vols.,1973.

DALY, R.F.: "The demand for Coffee," from: Coffee Consumption and Prices in U.S.A.. Agricultural Economic Research, USDA Economic Service. Reprinted in: Price theory in action, ed. by Donalson Watson, Boston, 1969.

DEPARTMENT OF EMPLOYMENT: British Labour Statistics. 1886-1968. H.M.S.O. 1979.

_____ : Familiy Expenditure Survey. Annual reports. H.M.S.O.

_____ : Family Expenditure Survey. Information Pack. H.M.S.O., 1979.

_____ : Gazette of Employment. Monthly magazine, 1968-79.

DEPARTMENT OF TRADE AND INDUSTRY: Trade and Industry. Weekly magazine. (several issues).

ECONOMIST INTELLIGENCE UNIT: RETAIL BUSINESS. Monthly publication (several issues).

EDWARDS, R. and PARIKH, A.: "A Stochastic Policy Simulation model of the World Coffee Economy." Discussion Paper N# 28, University of East Anglia, 26pp, 1975. Partially reprinted in Americal Journal of Agricultural Economics, Vol. 58, 2, 1976.

EPPS, M. L.:"A Computer Simulation of the World Coffee Economy." PhD. dissertation, Duke University, 353 pp, 1970. Partially reprinted in chapter 4 in: Quantitative Models of Commodity Models, ed. by Walter Labys, Cambridge, Mass., Ballinger, USA, pp 107-137, 1975.

EHRENBERG, A.S.C.: "Repetitive Advertising and the Consumer." Journal of Advertising Research, Vol. 14, 2, pp. 15-34. 1974.

_____ and GOODHARDT, G.J.: "Sales out of purchases." Essay six in : Understanding Buyer Behaviour; by the same authors. Serie of essays prepared for J. Walter Thompson Co. and the Market Research Corporation of America. New York, USA. October, 1978.

_____ _____ : "Models of Change." Essay 13 in: Understanding Buyer Behaviour.(op. cit.).1979(a).

_____ _____ : "How Advertising Works."Essay 16 in: Understanding Buyer Behaviour. (op. cit.). 1979(b).

FOOD AGRICULTURAL ORGANISATION: Agricultural Commodities Projections 1970-1980. Vol. II, CCP 71/20. 1971.

---------- : Income Elasticity of Demand for Agricultural Products. CC8 72/WPI. 1972.

---------- : Income Elasticity of Demand for Agricultural Products. ESC/ACP/WD. 117 pp. March 1976.

---------- : F.A.O. Agricultural Commodity Projections 1975-1985. F.A.O. Economic and Social Development series, N # 16, 128 pp. 1979.

FOX, B. : "The World Scene. European Report." World Coffee Trade Journal, pp 62-63, May 1973.

HAIRE, M.: "Projective Techniques in Marketing Research." Journal of Marketing. Vol. 14, pp 649-56, 1950. Reprinted in: Consumer Behaviour. Edited by A.S. Eherenberg and F.G. Pyatt. Penguin, 1971.

HARVEY, A.C.: Econometric of Time Series. Oxford. 1978.

HENDRY, D. F. and Srba, F.: Technical Manual for G.I.V.E.: General Instrumental Variables Estimation of Linear Equations with Lagged Dependent Variables of First Order Autorregressive Errors. London School of Economics. October 1978. (Revised).

HOGARTY, T.F. and MACKAY, R.J.: "Some Implications of the New Theory of Consumer Behaviour for Interpreting Estimated Demand Elasticities." American Journal of Agricultural Economics. Vol. 57, pp. 340-43. 1975.

HOPKIN, S. M. and ELLIS, J. C.: "Drinking Water Consumption in Great Britain. A survey of drinking habits with special reference to tap-water-based beverages." Water Research Centre Technical Report TR37. June 1980. Partially reprinted in "What are drinking?", WATER, Vol. 38, pp 2-4. May 1981.

INTERNATIONAL COFFEE ORGANISATION: Long-term Historical Data on Production, Stocks, Exports and Prices of Coffee. 1407/75. Nov. 1975.

---------- : Basic Information, Objectives, Structure, History and Operation. 1979.

---------- : Statistics, Production, Stocks, Exports, Imports, Re-exports, Inventories and Disappearances. E.B. 1852/81. 20.1.1981.

---------- : Quarterly Statistical Bulleting on Coffee. (several issues).

JONES, G. T.: "Some Elements in a Forecast of Demand: Are your time series really necessary?" Journal of Agricultural Economics, Vol. XXIX, (3), pp 291-310. Sept. 1978.

KATONA, G.: "Rational Behaviour and Economic Behaviour." Psychological Review, Vol.60, (5), pp.305-17. 1953.

Reprinted in: The Environment of Marketing Management. Ed. by R. Holloway and R. Hancock. 1974.

KEMSLEY, W.F.F.:"Family Expenditure Survey.A study of differential response based on comparison of the 1971 sample with the Census." Statistical News (31),pp. 3-8. Nov.,1975.

_____ : "National Food Survey - a study of differential response based on comparison of the 1971 sample with the Census." Statistical News (35), pp.3-7. Nov. 1976.

_____ : F.E.S. Handbook on the Sample, Fieldwork and Coding Procedure. H.M.S.O. 1979.

KOTLER, P.: "Behavioural Models for Analysing Buyers." Journal of Marketing, Vol. 29, p 71. Oct., 1965.

_____ : Marketing Management. Analysis, Planning and Control. Prentice/Hall. 3rd Ed.. 1976.

KOUTSOYIANNIS, A.: Theory of Econometrics. An Introductory Exposition of Econometric Methods. The MacMillan Press Ltd.. Reprinted in 1978.

LEGION PUBLISHERS: The Statistical Review of Press and T.V. Advertising. Media Records Ltd. (1957-1967).

LEIBENSTEIN, H.: "Bandwagon, Snob and Veblen Effects in the Theory of Comsumer's Demand." The Quarterly Journal of Economics, pp. 183-207. May 1950.

LOVASY, G. and BOISSONNEAULT, L.: "The International Coffee Market." International Monetary Fund.Staff Papers, Vol. XI (13), pp. 365-87. 1964.

MARKETING RESEARCH CENTRE: "National Drink Survey." Six-monthly report for a syndicated group of members, since 1965.

M.E.A.L. LTD.: "Media Expenditure Analysis." Monthly report for private subscribers. (microfiche). 1968-1981.

_____ : M.E.A.L.: ten year trends. Leaflet. 1980.

MINISTRY of AGRICULTURE FOOD and FISHERIES: "Food Facts." Weekly newsletter. (several issues).

MINTEL LTD.:"Mintel Report." Monthly and special issues report for private subscribers. (several issues).

MUELLER, E.: "A Study of Purchases Decisions: The Sample Survey." in Consumer Behaviour: The Dynamic of Consumer Consumer Reaction. Ed. by Lincon Clark. N.Y., 1954.

NATIONAL FOOD SURVEY COMMITTEE: "Household Food Consumption and Expenditure." Annual Reports. M.A.F.F.,HMSO.(1957-80).

OFFICE of POPULATION CENSUSES and SURVEYS: Demographic Review. H.M.S.O. 1977.

_____ : "General Household Survey." Monitor series G.H.S. Issues 79/1, 29 May 1979 and 80/1, 27 May 1980.

PALDA, K.S.: The Measurement of Cumulative Advertising Effect. Prentice-Hall, Inc. 1964.

PARIKH, A. :"A Study on Coffee Prices - A Spectral Approach." Canadian Journal of Agricultural Economics, Vol. 19 (3), pp. 15-25. 1971.

PRICE COMMISSION: Coffee: Prices,Costs and Margins.Rpt.29. 1977.

POLLOCK, G.E. : An analysis of the Price and Production Effects of the 1963-70 International Coffee Agreement. PhD. thesis. The Ohio State University. 1971.

RAYNER, A. J. et al.: "A Cross-section Analysis of the Demand for Food, Milk and Beverages." pp. 76-105, Chapter 4 in: The Demand for Food. An Exercise in Household Budget Analysis, ed. by W.J. Thomas, Manchester University Press, 136 pp. 1972.

RESEARCH SERVICES LTD.: International Coffee Survey: United Kingdom. Work commissioned by I.C.O.. 1970.

SAMPSON, P. and MARSHALL, K.: "Improving the Efficiency of Research Methods used in Advertising Tracking Studies: A case history." ESOMAR, Congress Procedings, pp. 115-34. Oslo. 1977.

SAYLOR, R.G. and FREITAS, C.: (Price , Quality and Demand for Coffee), "Preco, Qualidade e a Procura do Cafe."Agricultura em Sao Paulo, vol. 21 (2), pp. 25-51. 1974.

SINGH,S. et al.: " Coffee Tea and Cocoa: Market Prospects and Development Lending." World Bank, Staff Occasional Papers, (2), 129pp. 1977.

SMITH, A.: "Choice between Media: Why Print Deserves a Better Break." Advertising Magazine, Vol 68, pp. 8-12. 1981.

THATCHER, A.: "The Distribution of Earnings of Employees in Great Britain." Journal of the Royal Statistical Society, vol. 131, serie A. 1968.

TIMMS, D. E.: "World Demand Prospects for Coffee in 1980." U.D.S.A., F.A.S. Economic Report N# 86. March 1973.

TRAIL, B. et al.: "Estimating Irreversible Supply Functions." American Journal of Agricultural Economics, vol. 60, pp. 528-31. 1978.

VEBLEN, T.: The Theory of Leisure Class.(First published in 1899,MacMillan). Reprinted by Allen & Unwin. 1970.

WOLFFRAM, R.: "Positivistic Measures of aggregate elasticities: Some Critical Notes." American Journal of Agricultural Economics, vol. 53, pp. 356-59. 1971.

YOUNG, T.: "Modelling Asymmetric Consumer Responses with an Example." Journal of Agricultural Economics. Vol. XXXI, pp. 175-85. May 1980.

APPENDIX 1

ESTIMATES OF INCOME ELASTICITY OF PURCHASE DEMAND FOR TEA AND COFFEE. N.F.S. 1960-1979.

YEAR OF ESTIMATE	COFFEE			TEA
	BEANS AND GROUND	INSTANT	ESSENCES	
1960(1)E	2.31	0.85	-0.62	-0.02
SE	N/A	N/A	N/A	N/A
t*				
1967(2)E	N/A	0.57	N/A	-0.05
SE		0.07		0.03
t*		8.1		1.7
1969(2)E	N/A	0.52	N/A	-0.14
SE		0.09		0.03
t*		5.8		4.7
1971(3)E	1.85	0.41	-1.35	-0.12
SE	0.39	0.08	0.46	0.03
t*	4.7	5.1	2.9	4.0
1976(4)E	1.68	0.38	-0.34	-0.14
SE	0.30	0.05	0.51	0.05
t*	5.6	7.6	0.7	2.8
1977(5)E	1.43	0.41	-0.28	-0.14
SE	0.66	0.07	0.26	0.06
t*	2.2	5.9	1.1	2.3
1978(6)E	2.02	0.47	-1.25	-0.14
SE	0.60	0.09	0.66	0.06
t*	3.4	5.2	1.9	2.3
1979(7)E	1.15	0.39	-1.34	-0.19
SE	0.30	0.07	0.93	0.06
t*	3.8	5.6	1.4	3.2

SOURCES:
(1) p 163 N.F.S. 1960.
(2) Table 19 p 93 N.F.S. 1970 and 1971.
(3) p 250 Table 2-B N.F.S. 1970-71.
(4) p 145 Table 2-B N.F.S. 1977.
(5) p 167 Table 2-B N.F.S. 1977.
(6) p 182 Table 2-B N.F.S. 1978.
(7) p 183 Table 2-B N.F.S. 1979.

NOTES:
E: Income elasticity (double-log model);
SE: Standard error;
t*: t-ratio.
N/A: Not available.

Estimates referred to are the quantity purchased by households.

APPENDIX 2

ESTIMATES OF INCOME ELASTICITY OF EXPENDITURE

DEMAND FOR TEA AND COFFEE. N.F.S. 1960-1979

	COFFEE			TEA
	BEANS AND GROUND	INSTANT	ESSENCES	
1960(1)	2.26	0.92	-0.59	0.03
1962(2)	2.19	0.77	-0.84	0.04
1965(2)E	1.56	0.80	-1.30	-0.10
SE	N/A	N/A	N/A	N/A
t*				
1971(3)E	1.90	0.39	-1.53	-0.12
SE	0.36	0.08	0.48	0.04
t*	5.3	4.9	3.2	3.0
1976(4)E	1.71	0.40	-0.48	-0.07
SE	0.29	0.06	0.47	0.05
t*	5.9	6.6	1.0	1.4
1977(5)E	1.52	0.43	-0.39	-0.10
SE	0.69	0.05	0.20	0.06
t*	2.2	8.6	2.0	1.7
1978(6)E	2.05	0.52	-1.28	-0.13
SE	0.53	0.08	0.61	0.05
t*	3.9	6.5	2.1	2.6
1979(7)E	1.28	0.43	-1.14	-0.16
SE	0.32	0.07	0.89	0.04
t*	4.0	6.1	1.3	4.0

NOTES:
(1) p 162, N.F.S. 1960
(2) N.F.S. 1967
(3) p 93, Table 19, N.F.S. 1970-71
(4) p 145 Table 2-B, N.F.S. 1976
(5) p 167 Table 2-B, N.F.S. 1977
(6) p 182 Table 2-B, N.F.S. 1978
(7) p 183 Table 2-B, N.F.S. 1979

E: Elasticity (double-log model)
SE: Standard error
t*: t - ratio
N/A: Not available

SE for 1960, 1962 and 1965 N/A
Estimates are referred to the amount of money spent by householders.

APPENDIX 3

COMPARATIVE ESTIMATES OF INCOME ELASTICITY OF EXPENDITURE DEMANDED FOR COFFE IN THE U.K. BY F.A.O. 1960-1973

MODELS: (5)	1960 (1)	1962 (2)	1972 (3)	1973 (4)
A. DOUBLE LOG				
B = E	0.77	0.82(X)	0.39(X)	0.38(X)
SB	0.26	0.21	0.09	0.06
t*(3)	2.96	3.90	4.33	6.33
B. SEMI-LOG				
B	5.00(X)	7.07	3.48	3.41
SB	1.64	1.83	1.09	0.63
E	0.93	0.98	0.45	0.40
t*	3.1	3.9	3.2	5.4
C. LOG-INVERS				
B	443.16	473.85	160.19	199.51
SB	173.74	147.03	58.75	45.69
E	0.82	0.82	0.37	0.38
t*	2.6	3.2	2.7	4.3

NOTES:

(1) p.168 Table II-8, F.A.O.: "Income elasticity of demand for Agricultural products". CC872/WP1 1972.

(2) p.170 Table II-10, F.A.O. 1972.

(3) p.21 Table 24, F.A.O.: "Income elasticity of demand for Agricultural products". ESC/ACP/WD 76/3. Working document of the commodities and Trade Division, March 1976. 117 pp.

(4) p.23 Table 26, F.A.O. 1976.

(X) Function with the best fit, selected by the highest t-ratio.

(5) E = Elasticities derived as in note 3, Appendix 4.

APPENDIX 4

COMPARATIVE ESTIMATES OF INCOME ELASTICITY OF QUANTITY DEMANDED FOR COFFEE AND TEA IN THE U.K. 1973 . F.A.O.

	TEA	COFFEE
CONSUMPTION		
(kg/caput)	3.2	0.9
DOUBLE LOG		
B = Elasticity	-0.47	0.36(X)
SE	0.23	0.09
t*	2.0	4.0
SEMI-LOG		
B	-2.47	0.54
SE	1.38*	0.14
Elasticity	-0.49	0.38
t*	1.8	3.9
LOG-INVERS		
B	-260.96)X)	187.72
SE	118.34	58.66
Elasticity	- 0.49	0.36
t*	2.2	3.2

NOTES:

(1) Source: p 24, Table 27, F.A.O.: "Income elasticities of demand for Agricultural products". Draft. Commodity Trade Division, ESC/ACP/WD. 76/3, March 1976, 117pp.

(2) Symbols as defined in Appendix 6.

(3)

Elasticity:	Functions:	M.P.C.	E
Linear:	$Y = A + B X + u$	B	$B \times \frac{X}{Y}$
Double-Log:	$\log Y = A + B \log X + u$	BY/X	B
Semi-Log:	$Y = A + B \log X + u$	B/X	B/Y
Log-Inverse:	$\log Y = A - B/X + u$	BY/2	B/X

where M.P.C. = Marginal propensity to consume; E = Elasticity with respect to income; Y = Purchase or expenditure; X = Income; u = Disturbance term.

APPENDIX 5

ESTIMATES OF PRICE ELASTICITY OF DEMAND FOR COFFEE AND TEA BASED ON TIME-SERIES. N.F.S. 1972 - 1978 (5)

	COFFEE			TEA
	GROUND	INSTANT	ESSENCE	
1972-1977 (1)				
E	-0.41	-0.52	-1.70	-0.43
SE	(0.13)	(0.05)	(o.49)	(0.10)
t* (3)	3.2	10.4	3.5	4.3
$\bar{R}^2$ (4)	0.12	0.62	0.18	0.23
1973-1978 (2)				
E	-0.45	-0.58	N/A	-0.45
SE	(0.13)	(0.16)	--	(0.09)
t* (3)	3.5	3.6	--	5.0
$\bar{R}^2$ (4)	0.18	0.2	--	0.31

NOTES: (1) p 172, Table 3-B, N.F.S. Annual Report 1977.

(2) p 188, Table 3-B, N.F.S. Annual Report 1978.

(3) t* - ratio estimated from: $t^*(6) = \frac{\hat{b}}{SE(6)}$

Since the model is a double-log, then the published elasticity is the $\hat{b}$ parameter.

(4) $\bar{R}^2$ = proportion of the mixture explained by the price elasticity, once seasonal or annual shifts are removed.

(5) The 1966-70 multiple regression results was not published by the N.F.S. because "it was found to be not significant". (p 92, Table 19, N.F.S. bi-annual report 1970 and 1971). Double log function: $Y = A_i + B_i + R_{pi} + E_i$

where A_i = monthly dummy; B_i = annual dummy;

p_i = price of the item; E_i = random term.

F.A.O. ESTIMATES OF DEMAND FOR COFFEE BASED ON TIME-SERIES. CONSTRAINED ESTIMATES IN A SYSTEM OF EQUATIONS. (1), (2).

	EXTRA MILD	OTHER MILDS	BRAZILS	ROBUSTA
Constant	206.2	82.8	-231.6	-132.3
SE	(260.8)	(108.0)	(166.2)	(290.3)
t*	0.75	0.77	1.39	0.46
Price M	-0.75	-0.43	-1.52	1.73
SE	(0.68)	(0.29)	(0.43)	(0.45)
t*	1.10	1.48	3.53	3.84
Price O	-0.43	0.47	0.76	-0.50
SE	(0.29)	(0.34)	(0.31)	(0.24)
t*	1.48	1.38	2.45	2.08
Price B	-1.52	0.76	-0.35	-0.33
SE	(0.43)	(0.31)	(0.54)	(0.36)
t*	3.54	2.45	0.65	0.92
Price R	1.73	-0.50)	0.33	0.55
SE	(0.45)	(0.24)	(0.36)	(0.52)
t*	3.84	2.08	0.92	0.96
N.I.	2.80	-0.18	-0.40	-2.12
SE	(1.05)	(0.46)	(0.67)	(1.12)
t*	2.67	0.39	0.60	1.89
P.O.P.	2.42	0.91	-5.96	1.72
SE	(4.06)	(1.70)	(2.59)	(4.58)
t*	0.60	0.54	2.30	0.38
C.O.L.	-20.12	-8.61	25.42	11.09
SE	(26.30)	(10.89)	(16.74)	(29.29)
t*	0.77	0.79	1.52	0.38
S.U.B.	-4.21	0.27	5.18	0.38
SE	(3.59)	(1.52)	(2.31)	(4.11)
t*	1.17	0.18	2.24	0.09

NOTES: (1) The model has four equations, one for each type of coffee, in a double-log form, estimated through a restricted generalised least square method.

Price M: Price of Extra Milds.
Price P.O. Price of Other Milds.
Price B: Price of Brazils.
Price R: Price of Robusta.
N.I.: National Income.
P.O.P.: Population.
C.O.L. Cost of Living index.
S.U.B. Price of substitute: Tea price.
t* t-ratio.
SE Standard error.

(2) From pp 26-29 F.A.O.: "A World Coffee Model". June 1972. CCP 72/WP.4.

APPENDIX 7

F.A.O.'s U.K. UNCONSTRAINED ESTIMATES FOR IMPORT DEMAND OF COFFEE INDEPENDENT EQUATIONS

	EXTRA MILDS	OTHER MILDS	BRAZILS	ROBUSTAS
Constant	-489853*	465.62	-20654.01*	18860.09*
Coefficients with respect to the price of:				
Extra Milds	-3.07**	0.88**	---	---
Other Milds	---	-0.0088	---	---
Brazils	---	0.55*	-0.21	---
Robusta	1.95*	---	---	1.78
Coefficients with respect to:				
Income	-0.04*	0.002	-0.14**	-0.16*
Population	0.10*	-0.01	0.42**	0.40
Cost of Living	6.73*	0.62	15.49	24.59*
Price of Tea	1.32**	0.21*	0.88	4.05**
R^2	0.63	0.51	0.48	0.62

SOURCE: p 31, Table I.2 F.A.O. "A World Coffee Model" June, 1972.

NOTES: Units: Imports (00) metric tons; import unit values: in US cents per kg.; National income: in national currency at current prices; population: in (000); cost of living: in percent.

(*): Denotes t*-ratio between 1 and 2.

(**): Denotes t*-ratio larger than 2.

BALL AND AGARWALA ESTIMATES OF ADVERTISING EFFECT ON U.K. DEMAND FOR TEA . (1),(2),(3).

	MODEL A	MODEL B	MODEL C	MODEL D	MODEL E	MODEL F
Explanatory Variables:	B_i	B_i	B_i	B_i	B_i	B_i
Time	-0.03 (5.0)	-0.02 (1.1)	-0.04 (2.3)	-0.04 (1.8)	-0.004 (1.3)	-0.008 (0.3)
$(Time)^2$	--	--	--	--	--	--
Unemp:	0.17 (6.7)	0.07 (5.8)	0.05 (2.9)	0.04 (3.7)	0.07 (6.0)	0.07 (4.6)
G.T.A.(5)(6)	--	0.01 (0.8)	0.01 (1.4)	0.02 (3.3)	--	--
B.T.A.(5)(7)	0.03 (5.8)	0.02 (3.0)	0.02 (2.3)	--	--	--
T.T.A.(5)(8)	--	--	--	--	0.02 (9.0)	--
T.C.A.(5)(9)	--	--	0.01 (2.3)	--	--	--
R.T.C.A.(10)	--	--	--	0.46 (2.9)	--	-0.09 (0.5)
Constant	2.5 (50.0)	2.5 (42.0)	2.8 (20.0)	3.8 (8.0)	2.5 (50.0)	2.9 (4.7)
$\bar{R}^2$	0.90	0.89	0.91	0.90	0.90	0.80
n	40	40	40	40	40	40

NOTES:

(1) Source: p 213, Table 5. Ball, R.J. and Agarwala R (1969), op.cit.

(2) The equations mathematical form was not explicited in the text. Presumably they are all linear.

(3) Dependent variable: Purchase in oz. of tea per capita per week, quarterly. (N.F.S.), in four quarters moving average.

(4) Unemployment: It was not mentioned how this was measured nor the source of information.

(5) Stock of Advertising: Calculated at 10% depreciation rate (L=0.9)

(6) G.T.A.: Generic tea advertising by the Tea Council in nominal terms.

(7) B.T.A.: Branded tea advertising in nominal terms.

(8) T.T.A.: Total tea advertising (nominal)

(9) T.C.A.: Total coffee advertising (nominal)

(10) R.T.C.A.: Ratio all tea to all coffee advertising: T.T.A/T.C.A.

-- : Negligible

( ): t* ratio = S.E./parameter.

APPENDIX 9.

TIMMS' ESTIMATES OF COFFEE CONSUMPTION IN THE U.K.(1)(2).

	MODELS		
	A	B	C
Parameter	-2.10	-4.27	-7.79
SE	N/A	N/A	N/A
t*	N/A	N/A	N/A
Price of Coffee	1.52	-2.15	1.38
SE	0.66	0.74	2.36
t*	2.3	2.9	0.59
Price of Tea	---	---	-1.56
SE			1.35
t*			1.16
Price of Milk	---	2.83	---
SE		1.81	
t*		1.56	
Price of Cocoa	---	---	0.45
SE			0.73
t*			0.62
Income	2.23	2.40	3.25
SE	0.42	0.41	0.99
t*	5.3	5.9	3.3
R^2	0.96	0.96	0.96
$\bar{R}^2$	0.95	0.90	0.84
D.W.	1.67	2.03	1.78

NOTES: (1) Equation A,B and C are multiple linear regression of double-log equations, which data cover 1952-1965.

t* = t-ratio.

(2) Source: p 68, Table 40 ed; Table A-8, Timms, D.E. (1973): "World Demand Prospect for Coffee in 1980". U.S.D.A., F.A.S. Economic Report N-86, March 1973.

APPENDIX 10

CABLE RESTRICTED ESTIMATES OF DEMAND FOR SOLUBLE COFFEE.

PREDICTORS:	Model A	Model B	Model C	Model D	Model E	Model F
	B_i	B_i	B_i	B_i	B_i	B_i
Constant	4.4 (4.2)	9.8 (8.7)	9.8 (8.7)	6.4 (3.2)	-0.3 (0.1)	0.57 (1.4)
R.C.P.	---	---	---	---	---	---
R.C.Q.C.P.	---	-1.8 (8.5)	-1.8 (8.5)	-1.4 (5.2)	-1.6 (4.6)	-1.8 (7.1)
C.Q.I.	---	-2.9 (6.2)	-2.9 (6.2)	-2.5 (4.9)	-2.6 (4.0)	-2.6 (5.6)
R.D.I.	1.5 (3.6)	1.0 (2.3)	1.1 (2.3)	2.1 (3.5)	0.8 (1.4)	0.8 (1.9)
A.G.	---	---	0.02 (0.6)	0.03 (1.1)	---	---
Time	---	---	---	0.01 (2.0)	---	---
1/r	---	---	---	---	-4.1 (0.5)	---
A.I.T.	---	---	---	---	---	0.2 (0.9)
R^2	0.94	0.95	0.94	0.95	0.95	0.93
F	109	105	88	86	78	116
D.W.	2.1	2.0	2.0	2.3	2.1	2.0

SOURCE: p.17, Table 1, Cable, J.: "Advertising, Quality and commodity demand: U.K. household consumption of instant coffee. 1960-1968". Warwick Economic Paper N-57, October 1974. 26pp.

NOTES: (1) B_i = Parameter of variable i.

R.C.P. = Relative coffee price.
R.C.Q.C.P. = Relative constant quality coffee price.
C.Q.I. = Coffee quality index.
R.D.I. = Real disposable income per head.
A.G. = Advertising goodwill (assumed λ = 0.05 per period).
Time = Time trend
A.I.T. = Advertising time interaction term.

(2) Model A to D are linear. Model E is log-reciprocal. Model F form was not explicated.
(3) Dependent variable: logarithm of instant coffe consumption per head, presumably in expenditure terms.
(4) Seasonal dummy coefficients were not reported.
(5) Regression estimated through the O.L.S. method.
(6) Values have been rounded.
r: rate of diffusion as time since introduction.
()= t*-ratio.

APPENDIX 11

CABLE UNRESTRICTED ESTIMATES OF DEMAND FOR SOLUBLE COFFEE.

	MODELS	
	MODEL J	MODEL K
VARIABLES	B_i	B_i
CONSTANT	-5.1 (3.1)	-5.2 (3.3)
R.C.Q.C.T.	-0.7 (1.7)	-0.6 (1.5)
R.C.T.Q.I.	-2.2 (2.9)	-2.0 (2.8)
R.D.I.	1.2 (2.0)	1.3 (2.4)
R.C.T.A.G.	-9.0 (6.7)	---
1/r	---	-33.5 (8.9)
A.I.T.	-27.0 (8.3)	---
T.C.D.	0.04 (0.6)	---
$\bar{R}^2$	0.95	0.95
F	71	78
D.W.	1.6	1.6
n	36	36

SOURCE: p 19, Table 3, Cable, J. : "Advertising, quality ..." 1974, op.cit.

NOTES: (1) B_i : Parameter of variable i;

R.C.Q.C.T.: Ratio of constant quality coffee and tea prices;

R.C.T.Q.I.: Ratio coffee and tea quality indexes;

R.D.I.: Real disposable income less non-drinks expenditure.

R.C.T.A.G.: Ratio of coffee and tea advertising goodwill at = 0.025;

A.I.T.: "Advertising time interaction term;

T.C.D.: Tea Council Dummy.

r: Rate of diffusion as time since introduction.

( ): t*-ratio.

APPENDIX 12

YOUNG LONG-RUN ESTIMATES OF DEMAND FOR COFFEE.

MODEL E			MODEL F		
PREDICTORS	b_i	t*	PREDICTORS	b_i	t*
CONSTANT	-0.039	0.8	CONSTANT	0.014	0.3
T.W.R.	-0.003	3.4	W.R.	-0.004	14.3
T.W.R.-1	-0.001	6.9	W.F.	-0.0003	0.3
T.W.R.-2	-0.0001	2.9	Lagged W.F.		
T.W.F.	-0.001	1.0	. W.F.-1	-0.0006	1.6
Lagged T.W.F.			. W.F.-2	-0.0008	2.3
. T.W.F.-1	-0.001	2.9	. W.F.-3	-0.0010	1.9
. T.W.F.-2	-0.001	2.7	. W.F.-4	-0.0011	1.9
. T.W.F.-3	-0.001	1.7	. W.F.-5	-0.0011	2.6
. T.W.F.-4	-0.001	1.5	. W.F.-6	-0.0010	2.7
. T.W.F.-5	-0.001	1.9	. W.F.-7	-0.0008	0.9
. T.W.F.-6	-0.001	2.2	P.C.D.Y.R.	0.0010	1.9
. T.W.F.-7	-0.001	0.6	D1	-0.0254	3.0
P.C.D.Y.R.	0.001	2.3	D2	-0.0278	3.3
D1	-0.026	3.1	D3	0.0056	0.7
D2	-0.029	3.3	LR b^+	-0.0041	
D3	0.007	0.8	L.R.b^-	-0.0067	
L.R.b^+	-0.004				
L.R.b^-	-0.008				
$\bar{R}^2$	0.95		$\bar{R}^2$	0.95	
D.W.	2.04		D.W.	2.08	
n	68		n	68	

SOURCE: p 184, Table 2, : YOUNG, T.: "Modelling asymetric consumer responses with an example". J. of Agricultural Economics. May 1980.

NOTES: TWR: Young transformed Wolffram; for Price Rise
TWF: Young transformed Wolffram; for price falls.
PCDYR: Income
D: Seasonal Dummies
LR b^+ Estimated long-run coefficient to Rising Price.
Linear Functions.

APPENDIX 13.

REFERENCE KEY TO MODELS LISTED IN TABLE 1. (1).

N.F.S. : Cross-section annual demand models. Reproduced in Appendix 2.

N.F.S. : Time-series price demand models. Reproduced in Appendix 5.

F.A.O. : Independent functions of demand for coffee by varieties. Reproduced in Appendix 7.

TIMMS : Import demand for coffee. Reproduced in Appendix 9.

CABLE : Consumer demand for coffee. Reproduced in Appendix 11, model B.

YOUNG : Asymmetric lagged adjustment for coffee demand. Reproduced in Appendix 12,model E.

Note: These particular models were selected or preferred by their own authors. Other models are refered in the Bibliography List.

APPENDIX 14 .

SYMBOLS USED IN THE GENERAL MODEL .

A: Coffee consumption

B: Price of coffee.

C: Consumer's income.

D: Price of tea.

O: Relative price of coffee to tea (B/D).

E: Expenditure on coffee media advertising.

L: Expenditure on tea media advertising.

F: Effect of coffee advertising over non-coffee drinkers:

$$(E/U) * 100.$$

J: Effect of coffee advertising over habitual coffee drinkers:

$$(W/E) * 100.$$

G: Expenditure on coffee T.V. advertising.

P: Expenditure on tea T.V. advertising.

I: Effect of coffee T.V. advertising over non-coffee drinkers:

$$(G/R) * 100.$$

K: Effect of coffee T.V. advertising over habitual coffee drinkers:

$$(S/G) * 100.$$

W: Expenditure on coffee media advertising by the top expender in a year.

V: Media advertising on coffee by smaller expenders: E - W.

U: Media advertising expenditure on hot beverages: E + L.

R: T.V. advertising on hot beverages: G + P.

S: Expenditure on coffee T.V. advertising by the top expender in a year.

Q: T.V. advertising on coffee by smaller expenders: G - S.

DA: First difference of variable A: $A_i - A_{i-1}$

DA_1: DA, but lagged one period of time: DA_{i-1}.

Z: Random variable or error term.

APPENDIX 15

RATIO ON CONCENTRATION OF COFFEE MEDIA ADVERTISING. 1957-1981.

	W	E	F
1957	2.88(N)	5.86	49
1958	2.39(N)	6.01	40
1959	2.17(G)	6.70	32
1960	3.75(N)	9.39	40
1961	2.61(N)	8.61	30
1962	3.52(N)	9.65	37
1963	2.64(N)	10.43	25
1964	3.90(N)	8.54	46
1965	2.44(G)	8.91	27
1966	2.90(G)	6.65	44
1967	1.42(N)	7.03	20
1968	1.77(N)	4.52	39
1969	2.79(N)	6.11	46
1970	3.52(G)	7.65	46
1971	3.25(N)	7.28	45
1072	4.18(N)	7.22	58
1973	3.49(N)	9.20	38
1974	2.15(N)	7.83	28
1975	1.55(N)	6.25	25
1976	1.88(G)	7.18	26
1977	2.09(N)	7.48	28
1978	1.88(G)	7.29	26
1979	1.93(N)	5.79	33
1980	3.27(N)	10.43	31
1981	4.26(N)	13.91	31

NOTES: W: Expenditure on media coffee advertising by the major manufacturer expender in that year, expressed in million £ of January 1980. From Appendix 17.

E: Total expenditure on coffee media advertising in £ 1980. From Appendix 24.

F: (W/E) x 100

( ):Manufacturer's of coffee: 'N': Nestlé; 'G': General Foods; 'B': Brooke Bond; 'L': Lyons.

APPENDIX 16

RATIOS ON CONCENTRATION OF COFFEE T.V. ADVERTISING. 1957-1981

	S	G	K
1957	1.20(N)	2.89	42
1958	1.47(G)	3.01	49
1959	2.02(G)	3.86	52
1960	1.90(N)	5,33	36
1961	1.84(G)	4.36	42
1962	1.94(N)	6.10	32
1963	1.96(N)	7,20	27
1964	2.94(N)	5.43	54
1965	2.44(G)	7.15	34
1966	2.90(G)	5,22	56
1967	0.91(N)	6.14	15
1968	1.77(N)	3.66	48
1969	1.93(N)	4.70	41
1970	3.15(G)	6.47	49
1971	2.98(N)	5.98	50
1972	3.41(N)	6.48	53
1973	3.12(N)	8.15	38
1974	1.20(N)	5.69	21
1975	1.07(G)	4.08	26
1976	1.72(G)	4.99	35
1977	1.78(N)	6.02	30
1978	1.78(G)	5.72	31
1979	1.60(N)	4.28	37
1980	2,38(N)	8.87	27
1981	3.67(N)	12.17	30

NOTES: S: Expenditure on T.V. coffee advertising by the major manufacturer expender, in million £ on January 1980. From Appendix 18.

G: Total expenditure on T.V. coffee advertising by all advertisers, in million £ of January 1980. From Appendix 24.

K: (S/G) x 100;

(N): Nestle;

(G): General Foods.

APPENDIX 17

EXPENDITURE ON COFFEE MEDIA ADVERTISING BY MAIN MANUFACTURERS. 1957-1981.

	N(1)	G(1)	B(1)	L(1)	N(2)	G(2)	B(2)	L(2)
1957	0.55	0.40	-	0.06	2.88	2.09	-	0.31
1958	0.47	0.45	-	-	2.39	2.28	-	-
1959	0.23	0.43	-	-	1.16	2.17	-	-
1960	0.75	0.11	-	-	3.75	0.55	-	-
1961	0.54	0.38	-	-	2.61	1.84	-	-
1962	0.76	0.31	-	-	3.52	1.44	-	-
1963	0.58	0.38	-	0.07	2.64	1.73	-	0.32
1964	0.89	-	-	-	3.90	-	-	-
1965	0.23	0.58	-	0.10	0.97	2.44	-	0.42
1966	0.17	0.72	-	0.07	0.69	2.90	-	0.28
1967	0.36	0.18	-	0.13	1.42	0.71	-	0.51
1968	0.47	0.03	-	0.08	1.77	0.11	-	0.30
1969	0.78	0.59	0.08	0.12	2.79	2.11	0.29	0.43
1970	0.77	1.05	-	0.04	2.58	3.52	-	0.13
1971	1.06	0.79	0.13	0.06	3.25	2.42	0.40	0.18
1972	1.46	0.69	0.08	-	4.18	1.95	0.23	-
1973	1.33	0.61	0.39	0.10	3.49	1.60	0.89	0.26
1974	0.95	0.48	0.49	0.16	2.15	1.08	1.11	0.36
1975	0.85	0.59	0.30	0.19	1.55	1.07	0.55	0.35
1976	0.57	1.21	0.56	0.08	0.89	1.89	0.88	0.13
1977	1.55	0.87	0.26	0.17	2.09	1.17	0.35	0.23
1978	1.36	1.51	0.64	0.14	1.69	1.88	0.80	0.17
1979	1.76	1.16	0.30	0.02	1.93	1.27	0.33	0.02
1980	3.51	2.49	2.68	0.36	3.27	2.32	2.49	0.34
1981	5.13	4.15	1.97	0.29	4.26	3.44	1.64	0.24

NOTES: N: Nestlé;
G: General Foods;
B: Brooke Bond;
L: Lyons.

SOURCES: (1) As in Appendix 24, in million £ of each year.
(2) In million £ of January 1980.

APPENDIX 18

EXPENDITURE ON T.V. ADVERTISING BY MAIN MANUFACTURERS. 1957-1981

	N(1)	G(2)	B(3)	L(4)	N(5)	G(6)	B(7)	L(8)
1957	0.23	0.20	-	-	1.20	1.05	-	-
1958	0.21	0.29	-	-	1.07	1.47	-	-
1959	0.06	0.40	-	-	0.30	2.02	-	-
1960	0.38	0.11	-	-	1.90	0.55	-	-
1961	0.11	0.38	-	-	0.53	1.84	-	-
1962	0.42	0.31	-	-	1.94	1.44	-	-
1963	0.43	0.35	-	-	1.96	1.59	-	-
1964	0.67	-	-	-	2.94	-	-	-
1965	0.19	0.58	-	-	0.80	2.44	-	-
1966	0.17	0.72	-	-	0.69	2.90	-	-
1967	0.23	0.18	-	-	0.91	0.71	-	-
1968	0.47	0.03	-	-	1.77	0.11	-	-
1969	0.54	0.49	-	-	1.93	1.75	-	-
1970	0.69	0.94	-	-	2.32	3.15	-	-
1971	0.97	0.60	0.10	0.03	2.98	1.84	0.31	0.09
1972	1.19	0.72	0.04	-	3.41	2.06	0.12	-
1973	1.19	0.45	0.34	0.03	3.12	1.18	0.89	0.08
1974	0.53	0.48	0.49	-	1.20	1.08	1.11	-
1975	0.44	0.59	0.28	-	0.80	1.07	0.51	-
1976	0.22	1.10	0.56	-	0.34	1.72	0.88	-
1977	1.32	0.73	0.30	-	1.78	0.98	0.40	-
1978	1.40	1.43	0.52	-	1.74	1.78	0.65	-
1979	1.46	1.03	0.20	-	1.60	1.13	0.22	-
1980	2.56	1.92	1.61	0.36	2.38	1.79	1.50	0.34
1981	4.42	3.80	1.70	0.29	3.67	3.15	1.41	0.24

NOTES: (1), (2), (3) and (4) As in Appendix 24, in million £ of each year. (5), (6), (7) and (8) are the corresponding (1), (2), (3) and (4), but presented in million £ of January 1980.

N: Nestlé; G: General Foods; B: Brooke Bond; L: Lyons.

APPENDIX 19

B.S.O. U.K.: COFFEE SALES BY MANUFACTURERS.

1957-1978

	Roasted Coffee		Liquid Coffee	Soluble Coffee			
	A	B	C	D	E	F	G
1973	7.9	0.4	1.8	N/P	N/P	N/P	38.8
1974	9.2	0.8	2.0	N/P	N/P	N/P	37.5
1975	10.0	0.8	1.3	33.8	4.1	0.2	38.1
1976	8.3	1.0	2.2	34.8	4.5	0.5	39.8
1977	6.4	1.5	2.1	26.8	2.8	0.3	29.8
1978	6.3	2.1	1.7	25.9	3.0	0.4	29.2

NOTES: (1) From Business Statistics Office, Business Monitor PQ 229.2, as appeared in quarterly issues, in thousands of tons.

A: Coffee roasted and ground.

B: Coffee and chicory roasted and ground

C: Coffee with fig, Viennese coffee.

D: Soluble coffee, spray dried.

E: Freeze dried soluble coffee.

F: Decaffeinated soluble coffee.

G: Total soluble coffee: D + E + F.

N/P: Not published.

APPENDIX 20

VALUE OF U.K. COFFEE MARKET. (1975-1977). (4)

(in £ million of each year)(1)

	1975	1976	1977
Roasted Coffee (2)	13.6	19.9	23.8
Liquid Coffee (3)	1.7	4.4	6.6
Soluble Coffee			
- Spray dried	82.8	120.3	156.0
- Freeze dried	10.5	17.4	24.2
- Decaffeinated	0.5	0.4	2.7
Sub total soluble	93.9	138.2	182.9
Total Coffee	109.2	162.5	213.2

(1) SOURCE: Adapted from p 23 E.I.U. "Retail Busines" No. 244, 1978, based on B.S.O. Business Monitors.

(2) Including roasted and ground and chicory.

(3) It is coffee with fig seasoning or Viennese coffee.

(4) These figures differ from the sources, i.e. p.16 "Mintel Report" March 1980.

APPENDIX 21

M.A.F.F.: ANNUAL COFFEE SUPPLIES MOVING INTO CONSUMPTION. 1960-1979. (1)

(in green beans equivalent).

	lb. per person per year.	oz. per person per week	Growth %
1960	2.1 lb (a)	0.65	
1961	2.1 lb (a)	0.65	—
1962	2.7 lb (a)	0.83	+27.7%
1963	2.9 lb (a)	0.89	+ 7.2%
1964	2.5 lb (a)	0.77	-13.5%
1965	2.7 lb (a)	0.83	+ 7.8%
1966	2.9 lb (a)	0.89	+ 7.2%
1967	3.1 lb (a)	0.95	+ 6.7%
1968	3.1 lb (a)	0.95	
1969	3.5 lb (a)	1.11	+16.8%
1970	2.0 Kg (b)	1.34	+20.7%
1971	2.1 Kg (b)	1.43	+ 6.7%
1972	2.0 Kg (b)	1.36	- 4.9%
1973	2.7 Kg (b)	1.83	-34.6%
1974	2.1 Kg (b)	1.43	-21.9%
1975	2.2 Kg (b)	1.49	+ 4.2%
1976	2.1 Kg (b)	1.43	- 4.0%
1977	1.7 Kg (b)	1.15	-19.6%
1978	1.9 Kg (b)	1.29	+12.2%
1979	2.5 Kg (b)	1.70	+31.8%

NOTE: (1) This is the national average of what disappeared into distribution. They are commodities from all sources including imports, less exports, wast and non-food uses taking account of stock changes which has been divided by mid-year U.K. population. No account is taken of wholesale or retail stocks. (British Business, Vol. 37, No. 11, 14 Dec. 1979).

SOURCES: (a) Table 233, p 209, C.S.O. Annual Abstract of Statistics 1970 No. 107.

(b) Table 931, p 262, C.S.O. Annual Abstract of Statistics 1981, No. 117.

APPENDIX 22

I.C.O.: U.K. ANNUAL COFFEE DISAPPEARANCES

1964 - 1979

(in green beans equivalent of all forms of coffee) (5)

	000's BAGS per year (6) (8)	U.K. POPULATION (in millions) (7)	lb/PERSON per year (9)	oz./PERSON per week (10)
1960	N/A	52.56		
1961	N/A	52.95		
1962	N/A	53.27		
1963	N/A	53.55		
1964	1.200 (1)	53.89	2.95	0.91
1965	N/A	54.22		
1966	1.400 (1)	54.50	3.40	1.05
1967	N/A	54.80		
1968	1.400 (1)	55.05	3.36	1.03
1969	N/A	55.26		
1970	1.847 (11)	55.42	4.41	1.36
1971	1.975 (11)	55.71	4.69	1.44
1972	1.891 (2)	55.87	4.48	1.38
1973	2.508 (2)	56.00	5.92	1.82
1974	1.841 (3)	56.01	4.35	1.34
1975	2.017 (3)	55.98	4.77	1.47
1976	1.929 (3)	55.96	4.56	1.40
1977	1.621 (3)	55.92	3.83	1.18
1978	1.741 (3)	55.87	4.12	1.27
1979	2.455 (4)	55.82	5.82	1.79

NOTES:
(1) From p 38, E.I.U. "Retail Business" No. 213, Nov. 1975, auoted from I.C.O. information, covering a 12 month period from July to June.
(2) 1972-1973: from Table II-52, I.C.O."Quarterly Statistical Bulletin on Coffee", Oct.-Dec. 1977, Vol. 1, No.4
(3) 1974-1978: from p 66, Table III-25, I.C.O.: "Quarterly Statistical Bulletin on Coffee" July-Sept. 1979, Vol.3,No.3.
(4) Table III-19, I.C.O.: E.B. 1852/81 "Statistics, Production, Stocks, Exports, Imports, Re-exports, Inventories and Disappearance" 20 January, 1981.
(5) Green beans equivalent are coffee in all forms reduced to raw material at 1.19 for roasted; 3.0 for soluble.
(6) Disappearance is net imports adjusted by changes in stocks at the beginning and at the end of the period and less re-exports. Stocks considered are green beans on transit at port level, as well as those held at manufacturers, and public warehouses as green beans; but excludes stocks of processed coffee.
(7) C.S.O.: "Annual Abstract of Statistics" H.M.S.O. (1979-1980).
(8) In bags of 60 Kgs. each. Coffee from all forms converted into green beans.
(9) 1 lb = 0.4536 Kg. (avoirdupois); 1 Kg. = 2.2046 lb.
(10) 1 lb = 16 ounces (avoirdupois)
(11) Estimated from quarterly data of imports, stocks, re-exports obtained from I.C.O. quarterly bulletins.

N/A: Not available.

APPENDIX 23

B.S.O.: U.K. ANNUAL DISPOSAL OF RAW COFFEE (1960-1979).

(in "raw coffee" equivalent).

	ANNUAL DISPOSAL (in 000's tonnes)	RE-EXPORT (000's tonnes)	NET-DISPOSAL (000's tonnes)	POPULATION (millions)	NET-DISPOSAL (oz/person/ week) (d)
1960	55 (2)			52.56	
1961	58 (2)			52.95	
1962	70 (2)			53.27	
1963	74 (2)			53.55	
1964	68 (2)			53.89	
1965	73 (2)			54.22	
1966	77 (2)			54.50	
1967	83 (2)			54.80	
1968	83 (2)			55.05	
1969	101 (1) (a)	8 (c)		55.26	
1970	100 (1)	12	88	55.42	1.08
1971	101 (1)	14	87	55.71	1.06
1972	97 (1)	13	84	55.87	1.02
1973	119 (1)	13	106	56.00	1.28
1974	102 (1)	25	77	56.01	0.93
1975	94 (1) (b)	24	70	55.98	0.85
1976	96 (1) (b)	25	71	55.96	0.86
1977	70 (1) (b)	24	46	55.92	0.56
1978	49 (1) (b)	26	23	55.87	0.28
1979	81 (1) (b)			55.82	

SOURCES: (1) p 259, Table 915; C.S.O.: "Annual Abstract of Statistics", 1981, N. 117.

(2) p 208, Table 222; C.S.O.: "Annual Abstract of Statistics", 1970, No. 107.

NOTES: (a) In the C.S.O. "Annual Abstract" 1970, appears for 1969: 99 (000's tonnes).

(b) These annual disposals do not match the average monthly disposals in a quarter which are extended to the year, and are as follows in thousand tonnes:
1975: 104; 1976: 97; 1977: 85; 1978: 78; 1979: 94
which is publised in C.S.O.: "Monthly Digest of Statistics", p 47, February 1981 and p 45, February 1980.

(c) Based on a 12 month period from July to June.

(d) 1 tonne = 1.000 Kgs; 1 Kg = 2.204 lb; 1 lb = 16 ounces; 1 year = 52 weeks.

APPENDIX 24.

MEDIA EXPENDITURE ON ADVERTISING FOR HOT BEVERAGES. 1957-1981. (1)

(in million £ January 1980).

	COFFEE			TEA			COFFEE AND TEA			
	(1) PRESS	(2) T.V.	(3) TOTAL	(4) PRESS	(5) T.V.	(6) TOTAL	(7) PRESS	(8) T.V.	(9) TOTAL	(10) GROWTH
1957	2.97	2.89	5.86	1.90	2.95	4.85	4.87	5.94	10.71	
58	3.00	3.01	6.01	1.17	3.73	4.50	4.17	6.73	10.50	- 1.8%
59	2.84	3.86	6.70	2.81	4.36	7.17	5.7	8.2	13.9	+32.4%
1960	4.06	5.33	9.39	4.76	4.68	9.44	8.8	10.0	18.8	+35%
1	4.25	4.36	8.61	3.00	4.17	7.17	7.3	8.5	15.8	-16%
2	3.55	6.10	9.65	2.97	5.34	8.31	6.5	11.4	18.0	+14%
3	3.23	7.20	10.43	2.44	6.15	8.59	5.7	13.4	19.0	+ 6%
4	3.11	5.43	8.54	1.96	6.40	8.36	5.1	11.8	16.9	-11%
1965	1.79	7.15	8.91	1.61	7.96	9.57	3.4	15.1	18.5	+10%
6	1.43	5.22	6.65	1.60	8.53	10.13	3.0	13.8	16.8	- 9%
7	1.07	6.14	7.03	1.47	9.09	10.56	2.5	15.2	17.8	+ 6%
8	0.86	3.66	4.52	1.22	8.62	9.84	2.1	12.3	14.4	-19%
9	1.41	4.70	6.11	1.44	8.91	10.35	2.9	13.6	16.5	+15%
1970	1.18	6.47	7.65	1.41	10.62	12.10	2.6	17.2	19.8	+20%
1	1.30	5.98	7.28	1.39	10.52	11.91	2.7	16.5	19.2	- 3%
2	0.74	6.48	7.22	0.84	4.10	4.94	1.6	10.6	12.2	-37%
3	1.05	8.15	9.20	0.57	6.64	7.21	1.6	14.8	16.4	+34%
4	2.14	5.69	7.83	0.68	6.68	7.54	2.8	12.6	15.4	- 6%
1975	2.17	4.08	6.25	0.71	6.09	6.80	2.9	10.2	13.1	-15%
6	2.19	4.99	7.18	0.65	5.82	6.47	2.8	10.8	13.7	+ 5%
7	1.46	6.02	7.48	1.90	7.19	9.09	3.4	13.2	16.6	+21%
8	1.57	5.72	7.29	1.05	7.76	8.81	2.6	13.5	16.1	- 3%
9	1.51	4.28	5.79	1.13	4.70	5.83	2.6	9.0	11.6	-28%
1980	1.56	8.87	10.43	1.15	10.11	11.26	2.7	19.0	21.7	+87%
1	1.74	12.17	13.91	1.36	11.29	12.65	3.1	23.5	26.6	+22%

SOURCES: Elaborated from M.E.A.L. Ltd., and LEGION figures on advertising expediture by brands.

TRANSFORMING N.F.S. COFFEE PURCHASES BY TYPES

INTO GREEN BEANS EQUIVALENT. 1957-1981

(in ounces and cups per person per week)

	BEANS AND GROUND (1)	SOLUBLE (1)	ESSENCES (1)(7)	TOTAL COFFEE EQUIVALENT		
				GREEN BEANS EQU.		BEVERAGE EQU.
				A (8) (4)	B (8) (5)	C (6)
1957	0.11	0.14(10)	0.15(10)	0.76	0.71	3.47
8	0.11	0.15(10)	0.15(10)	0.78	0.73	3.63
9	0.11	0.14(10)	0.14(10)	0.74	0.69	3.41
1960	0.10	0.14	0.15	0.74	0.77	3.44
1	0.08	0.16	0.14	0.75	0.79	3.64
2	0.10	0.20	0.10	0.82	0.87	4.10
3	0.09	0.25	0.10	0.94	1.01	4.87
4	0.11	0.23	0.11	0.93	0.99	4.67
1965	0.10	0.26	0.08	0.95	1.02	4.94
6	0.10	0.29	0.08	1.02	1.11	5.42
7	0.10	0.30	0.08	1.05	1.14	5.58
8	0.09	0.36	0.08	1.19	1.31	6.51
9	0.13	0.38	0.07	1.29	1.40	6.89
1970	0.09	0.42	0.06	1.32	1.46	7.35
1	0.10	0.44	0.06	1.38	1.53	7.70
2	0.12	0.46	0.06	1.47	1.63	8.08
3	0.09	0.47	0.05	1.43	1.59	8.09
4	0.10	0.51	0.05	1.55	1.73	8.76
1975	0.11	0.50	0.04	1.53	1.69	8.57
6	0.10	0.51	0.04	1.55	1.72	8.70
7	0.07	0.36	0.05	1.12(9)	1.24(9)	6.27
8	0.07	0.44	0.04	1.31(9)	1.48(9)	7.49
9	0.09(2)	0.51(3)	0.02(2)	1.45(9)	1.67(9)	8.55
1980	0.09(11)	0.54(3)	0.02(11)	1.57	1.19	9.03
1	0.09(11)	0.52(3)	0.02(11)	1.52	1.70	8.71

NOTES:
(1) Source: N.F.S. data as published in the Annual Report of the National Food Survey Committee: "Household Food Consumption and Expenditure". MAFF, HMSO.
(2) Unpublished information kindly provided in a letter by the MAFF.
(3) Table No. 1, MAFF: "Food Facts", 22 Sept. 1980 and April 1982.
(4) Converted into ounces of green beans equivalent based on Price Commission survey.
1 oz. green beans = 0.87 oz. ground/soluble (1:1.5:2.6).
(5) Converted into ounces of green beans equivalent based on an I.C.O. estimation of:
1 oz. green beans = o.84 oz. of ground = 0.33 oz. of soluble (1:1.19:3.0). (See Appendix 33).
(6) Converted into coffeee beverage equivalent in number of cups per person per week, based on N.D.S. estimation of:
1 oz. of soluble = 16 cups; 1 oz. of ground = 3 cups;
1 fluid oz. of essence = 6 cups. (See Appendix 33).
(7) Data in fluid ounces.
(8) For green beans yield into coffee essences (x1.50). I have assumed that 1 oz. of green beans gives 0.67 fluid ounces based on N.D.S. volumetric yield of essences into coffee beverage. (See Appendix 33).
(9) 1977-78-79. There was a mass launching of coffee substitute products like "Nescore" which were made up with soluble coffee (50-60%) and other products (barley, fig, etc.) Therefore conversion to green beans during those years are expected to be much higher than previous ones, over-estimating to some extent the usage of raw coffee.
(10) Essences and soluble coffee appeared together under one item in N.F.S. 1957-1959 reports. As in 1960 and 1961 soluble was equal to essences. I decided to split the published figure of 0.29; 0.30 and 0.28 by one half each.
(11) Beans, ground and essences data were estimated at the same amount for 1979.

A. Green beans equivalent in ounces/person/week, based on conversion of Price Commission.
B. Green beans equivalent in ounces/person/week, based on conversion from International Coffee Organisation.
C. Cups of beverage equivalent per person per day, based on conversion of National Drink Survey.

APPENDIX 25.

TRANSFORMING N.F.S. COFFEE PURCHASES BY TYPES INTO GREEN BEANS EQUIVALENT. 1957- 1981.

RATES OF REDUCTION OF COFFEE TYPES

A. INDUSTRIAL YIELDS :

	GROUND	SOLUBLE	ESSENCES
Price Commission (2)	1.15	2.6	N/A
I.C.O. (3)	1.19	3.0	N/A
Estimation			1.5 (4)

NOTES: (1) Units of green beans needed for manufacturing one unit of processed coffee.
(2) Price Commission Report: "Coffee: Prices, Costs and Margins", Report No. 29, May 1977, p 6.
(3) International Coffee Organisation: "Quarterly Statistics Bulletin on Coffee" No. 5, Vol. 2, Jan-March 1978, p.50.
(4) Estimation based on coffee beverage volumetric yield of essences: 1 fl. oz = 6 cups (NDS).

B. DOMESTIC DOSAGE FOR DRINK PREPARATION :

SOURCE OF INFORMATION	SOLUBLE	GROUND	ESSENCE
E.I.U. (1)	1 oz. = 11 cups	1 oz. = 2 cups	N/A
Tea Council (2)	1 oz. = 20 cups	1 oz. = 2 cups	N/A
N.D.S. (3)	1 oz. = 16 cups	1 oz. = 3 cups	1 fl.oz. = 6 cups
Nielsen (4)	1 oz. = 15 cups	N/A	N/A

SOURCES: (1) Economist Intelligence Unit: "Retail Business", No. 244, Special Report No. 1 "Coffee", June 1978 p 28. 4 oz. ground = 3 pints; 2 Oz. soluble = 1 gallon.
(2) Tea Council: unpublished information provided by a letter to the author, 18.7.1980. 1 lb of soluble = 324 cups; 1 lb. of ground = 12 pints.
(3) N.D.S.: unpublished oral information provided for this research, October 1980.
30 oz. soluble = 1 lb. ground = 8 fl. oz. essence
1 oz. soluble = 16 cups.
(4) Information from NIELSEN LTD., provided by the I.C.O. for this research, October 1980.
Units: 1 cup = 7 fl.oz; 1 gallon = 8 pints.
1 pint = 26 cups = 20 fl. oz., 1 lb. = 16 ounces.
N/A = not available.

APPENDIX 27

INITIAL SAMPLE, RESPONSE, AND COMPLETE ANSWERS IN THE N.F.S. 1960-1979

	INITIAL SAMPLE	EFFECTIVE RESPONSE	COMPLETED ANSWERS	PERCENT OF COMPLETED ANSWERS
	A	B	C	D
1960	16.300	8.891		
1	17.000	9.196	4.619	28%
2	17.000	9.205	N/A	
3	14.960	7.532	N/A	
4	13.363	7.464	N/A	
5	14.960	7.782	N/A	
6	13.615	7.566	N/A	
7	14.799	8.021	N/A	
8	14.707	7.888	N/A	
9	14.733	7.569	N/A	
1970	13.376	7.080	4.587	34%
1	14.318	7.444	4.514	32%
2	14.960	7.587	N/A	
3	14.960	7.406	N/A	
4	14.858	6.461	5.009	33%
1975	14.247	7.406	4.609	32%
6	14.372	7.516	4.554	32%
7	14.335	7.696	4.365	31%
8	14.388	7.173	3.952	28%
1979	13.700	6.832	4.485	33%

NOTES: A: Initial random sample; B: Effective response received; C: Number of households records with completed information about income and household composition and from which income elasticity was compiled.

D: $\frac{C}{A} \times 100$; N/A: Not available.

SOURCES: As appeared in the statistical Appendices A and B in the corresponding Annual Reports of the National Food Survey Committee. H.M.S.O.

APPENDIX 28

HOUSEHOLD SIZE IN POPULATION AND IN N.F.S. AND F.E.S. SAMPLES 1960-1979.

	N.F.S. (1)	F.E.S. (2)	POPULATION (3)	N.F.S DISTORT. (4)	F.E.S. DISTORT. (5)
(1951)			(3.14)(a)		
1960	3.12	3.04	3.10 (b)	0.6	-1.9
1961	3.22	3.03	3.09 (a)	4.2	-1.9
1962	3.12	3.03	3.07 (b)	1.6	-1.3
1963	3.11	3.02	3.05 (b)	2.0	-1.0
1964	3.19	3.06	3.03 (b)	5.3	1.0
1965	3.13	2.96	3.01 (b)	4.0	-1.7
1966	3.05	3.02	2.99 (c)	2.0	1.0
1967	3.07	3.04	2.97 (b)	3.4	2.4
1968	3.07	2.96	2.95 (b)	4.1	0.3
1969	3.05	2.96	2.92 (b)	4.5	1.4
1970	3.11	2.95	2.90 (b)	7.2	1.7
1971	3.04	2.90	2.88 (c)	5.6	0.7
1972	3.06	2.92	2.86 (c)	7.0	2.1
1973	3.04	2.82	2.83 (c)	7.4	-0.4
1974	2.99	2.83	2.79 (c)	7.2	1.4
1975	2.97	2.81	2.78 (c)	6.8	1.1
1976	2.98	2.75	2.76 (c)	8.0	-0.4
1977	3.01	2.76	2.71 (c)	11.1	1.8
1978	3.12	2.72	2.72 (c)	14.7	--
1979	2.84	2.70	2.67 (c)	6.4	1.1

SOURCES: (1) From "Household Food Consumption and Expenditure Annual Report". Household Food Consumption Committee, M.A.F.E. H.M.S.O., obtained from Appendix A, Table 2 or Table 3 in the corresponding annual report.

(2) From "Family Expenditure Survey". Department of Employment Annual Report. H.M.S.O. as follows: 1960 to 1968 was obtained from pp.382 to 383, Table 185 in "British Labour Statistics. 1886-1968", H.M.S.O., 1969 to 1978 data was obtained from the corresponding Tables of each annual report.

(3) Population average family size in Great Britain. Obtained from (a) Censuses; (b) Interpolations; (c) General Household Survey, as follows:

(a) Census: For 1951, 1961, 1966, 1976: p.13 Table 1.10, O.P.C.S. "Demographic Review". 1977. H.M.S.O.

(b) Interpolation: For 1960, 1962, 1963, 1964, 1965, 1967, 1968, 1969 and 1970; it was estimated through a straight line interpolation from the census/G.H.S. data.
I am grateful to Mrs. Brown from the O.P.C.S. for her specialised advice in this matter.

(c) G.H.S.: For 1966, 1972 - 1978 from: p.11 Table 2.1 O.P.C.S.: "General Household Survey". Series G.H.S. N-8 for 1979 p.1. Table 1, O.P.C.S.: "Monitors" G.H.S. 80/1, 27 May 1980.

$$(4) = \frac{(1) - (3)}{(3)} \times 100$$

$$(5) = \frac{(2) - (3)}{(3)} \times 100$$

APPENDIX 29

STANDARD ERROR FOR N.F.S. ESTIMATES OF QUANTITY PURCHASED OF HOT BEVERAGES (*)

	TEA	COFFEE			TOTAL	COCOA	B.F.D.	TOTAL BEVERAGES
		GROUND	INSTANT	ESSENCE				
1966 (1)	0.9	7.6	2.6	8.3	N/A	4.9	5.3	0.9
1970 (5)	1.10	7.8	2.2	8.1	N/A	5.2	5.2	0.9
1972 (2)	1.2	9.3	2.4	10.0	N/A	7.8	6.1	1.2
1973 (3)	1.3	8.7	2.4	11.3	N/A	6.7	6.9	1.2
1975 (4)	1.8	N/A	N/A	N/A	2.2	7.0	7.3	1.4
1976	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1977	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1978	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

(*) Note: This information is in percent and has not been published regularly in the Annual Report.
B.F.D. : Branded Food Drinks.

Source:
(1) Table 3-E, N.F.S. 1966 Annual Report.
(2) Table 15, N.F.S. 1972 Annual Report.
(3) Table 15, N.F.S. 1973 Annual Report.
(4) Table 13-A, N.F.S. 1975 Annual Report.
(5) Table 14-A, N.F.S. 1970 and 1971. A biannual report.

N/A: Not available.

APPENDIX 30

STANDARD ERROR FOR N.F.S. ESTIMATES OF EXPENDITURE ON HOT BEVERAGES . (1).

	1966	1972	1973	1975	1979
TEA	0.9	1.2	1.3	1.6	1.4
COFFEE					
Ground and beans	7.9	8.8	9.0	N/A	7.9
Instant	2.5	2.3	2.4	N/A	2.3
Liquid	7.5	9.3	10.6	N/A	16.6
TOTAL COFFEE	N/A	N/A	N/A	2.4	N/A
COCOA drinks	4.8	7.2	6.5	7.6	6.7
Branded food drinks	5.2	6.2	6.6	7.6	7.3
TOTAL BEVERAGES	0.9	1.2	1.2	1.4	1.3

SOURCE: As published in the respective Annual Reports of the "National Food Survey" MAFF, in the following Tables: 1966: Table 3-E; 1972: Table 15; 1973: Table 15; 1975: Table 13-A, 1979: Table 8-A.

(1) This information is in percent and it is rarely published in the N.F.S. annual reports.

APPENDIX 31

S.E. FOR N.F.S. AVERAGE PRICE PAID

(Selected Years)

		YEAR OF ESTIMATE: 1966 (1)	1972 (2)	1973 (3)	1979 (4)
COFFEE:					
- Soluble:	A	0.4%	0.5%	0.6%	0.7%
	B	6.5	4.8	4.0	3.1
	C	6.3	4.6	4.0	3.3
- Ground:	A	1.2%	2.9%	1.4%	1.8%
	B	6.3	3.2	6.2	4.6
	C	6.6	3.0	6.4	4.4
- Essences:	A	1.2%	2.3%	2.1%	3.1%
	B	6.9	4.4	5.4	5.7
	C	6.3	4.0	5.1	5.4
TEA:	A	0.3%	0.4%	0.4%	0.4%
	B	3.0	3.0	3.3	3.5
	C	3.0	3.0	3.3	3.5

SOURCE: (1) -A: From Table £-E in N.F.S., 1966. (2) -A: From Table 15 in N.F.S., 1972. (3) -A: From Table 15 in N.F.S., 1973. (4) -A: Frame Table 8-A in N.F.S. , 1979. Information about S.E. (%) of expenditure and of purchase estimates is taken from Appendix 28 and in Table 3.

NOTES:
- A: S.E. of average price paid, in % as appeared published in the above reference. This information is rarely included in the N.F.S. Annual Reports.
- B: Ratio S.E. (%) for purchase divided by S.E.(%) for average price paid (A).
- C: Ratio S.E. (%) for expenditure divided by S.E. (%) for average price paid (A).

APPENDIX 32

ESTIMATING COFFEE PURCHASES FROM THE COMBINED USE OF N.F.S. AND F.E.S. DATA. 1957-1980

(in ounces of green beans equivalent per person per week)

YEAR	F.E.S. EXPENDI-TURE.	N.F.S. EXPENDI-TURE/	N.F.S. PURCHASE/PRICE		ESTIMATED PURCHASE	CORRECTED SUPPLY	OUT-OF-HOME PURCHASE
	A	B	C	D	E	F	G %
1957	1.91	2.92	0.76	3.84	0.50		
8	2.03	2.92	0.78	3.74	0.54		
9	2.07	3.06	0.74	4.14	0.50		
1960	2.27	3.12	0.74	4.22	0.54	0.65	17%
1	2.64	3.10	0.75	4.13	0.64	0.65	2%
2	3.10	3.64	0.82	4.44	0.70	0.83	16%
3	3.25	3.99	0.94	4.25	0.77	0.89	14%
4	3.20	4.22	0.93	4.54	0.71	0.77	8%
1965	3.99	4.49	0.95	4.73	0.84	0.83	- 1%
6	3.81	4.93	1.02	4.83	0.79	0.89	11%
7	4.21	5.03	1.05	4.79	0.88	0.95	7%
8	4.83	5.73	1.19	4.82	1.00	0.95	- 5%
9	2.04	2.68	1.29	2.08	0.98	1.11	12%
1970	2.41	2.86	1.35	2.12	1.14	1.34	15%
1	2.76	3.28	1.38	2.38	1.16	1.43	19%
2	3.08	3.40	1.47	2.31	1.33	1.36	2%
3	3.55	3.67	1.43	2.57	1.38	1.63	15%
4	3.89	4.36	1.55	2.81	1.38	1.63	15%
1975	4.63	4.81	1.53	3.14	1.48	1.49	1%
6	6.55	6.75	1.55	4.36	1.50	1.43	- 5%
7	9.78	9.67	1.12	8.63	1.13	1.15	2%
8	10.66	11.67	1.31	8.91	1.20	1.29	7%
9	11.11	12.06	1.45	8.32	1.34	1.70	21%
1980	11.85	14.33	1.57	9.13	1.30		

NOTES:
- A: In current pence per person per week, from Family Expenditure Survey.
- B: In current pence per person per week, from N.F.S. Annual Report HMSO.
- C: In ounces of green beans equivalent per person per week, from Appendix 25.
- D: B/C .
- E: A/D .
- F: From Table 11 .
- G: $\frac{(F-E)}{F} \times 100$

APPENDIX 33

N.F.S. PROPORTION OF PANEL MEMBERS BUYING COFFEE. 1957-1979.

(Buying in one week)

	GROUND AND BEANS	POWDER	LIQUID	EXTRACTS AND ESSENCES (5)
1957	4	-	-	22
1958	4	-	-	23
1959	4	-	-	24
1960	4	18	7	
1961	4	21	7	
1962	4	23	5	
1963	3	24	4	
1964	4	23	4	
1965	4	24	3	
1966	3	25	3	
1967	4	25	3	
1968	3	27	3	
1969	4	28	3	
1970	3	30	2	
1971	3	29	2	
1972	3	28	2	
1973	3	27	1	
1974	3	26	2	
1975	3	26	1	
1976	3	26	1	
1977	2	22	1 (4)	
1978	2	30	1	
1979	3 (2)	29 (2)	1 (2)	

NOTES: (1) Source: As published in the Annual Reports of "National Food Survey" MAFF H.M.S.O.

(2) Preliminary unpublished information kindly provided by the N.F.S., M.A.F.F.

(3) Referred to purchases made by members of the panel during the week of the survey.

(4) Assumed, since in the 1977 report was not indicated.

(5) Extracts and essences appeared added these years.

APPENDIX 34

SOLUBLE COFFEE PURCAHSES BY PACKET SIZE

1969-80 . (1) (2).

PURCHASE BY PACKET (IN PER CENT OF WEIGHT)					TOTAL
YEAR	A	B	C	D	E
1969	20	46	31	3	100
1970	16	48	32	4	100
1971	12	45	37	6	100
1972	10	43	40	7	100
1973	N/A	N/A	N/A	N/A	N/A
1974	8	46	40	6	100
1975	6	46	40	8	100
1976	6	46	40	8	100
1977	8	57	28	7	100
1978	8	73	15	4	100
1979	5	67	24	4	100
1980	4	62	30	4	100

NOTES: (1): Information kindly provided for this research by the Marketing Research Centre based on consumer panels of ATTWOOD (1969 to 1972) and AGB (1974-1980).

(2): Expressed as percentage of total consumer purchases in weight.

A = 2 ounces jar.
B = 4 ounces jar.
C = 8 ounces jar.
D = 12 ounces jar.
E = Total.

APPENDIX 35

T.G.I.: ESTIMATING THE NUMBER OF HEAVY, MEDIUM AND LIGHT DRINKERS OF SOLUBLE COFFEE. 1969-1979.

(N⊥ in millions and %)

	N⊥	%	N⊥	%	N⊥	%	N⊥	%
1969	3.50	20%	8.85	50%	3.42	19%	1.94	11%
1970	3.85	22%	8.96	50%	3.26	18%	1.84	10%
1971	4.12	23%	8.89	49%	3.37	19%	1.65	9%
1972	3.90	22%	8.88	50%	3.19	18%	1.93	11%
1973	4.01	23%	8.66	49%	3.37	19%	1.61	9%
1974	4.20	23%	8.20	46%	3.66	20%	1.95	11%
1975	4.73	26%	8.23	45%	3.60	20%	1.56	9%
1976	4.42	24%	8.38	46%	3.81	21%	1.47	8%
1977	4.59	25%	8.15	45%	3.66	20%	1.83	10%
1978	4.25	23%	7.85	43%	3.80	21%	2.39	13%
1979	4.69	25%	8.26	45%	3.66	20%	1.91	10%

SOURCE: Elaborated from the private publication "Target Group Index", by the British Market Research Bureau, Annual report. This information has been kindly provided for this reasearch by the BMRB.

NOTES: Details of the methodology followed in T.G.I. syndicated survey are in Appendix 1 of that report. The survey period covers from April to March i.e., 1969: April 1968 to March 1969; 1979: April 1978 to March 1979.

A = Heavy drinkers	Declared drinking on average more than 6 cups of soluble coffee per day.
B = Medium drinkers:	Declared drinking on average drinking between 2 to 5 cups of soluble coffee per day.
C = Light drinkers:	Declared drinking on average less than one cup of coffee a day.
D = Non-drinkers:	Declared that nobody in the household drank coffe at home in the last six months.

Percentage calculated for each year by adding A + B + C + D = 100%

APPENDIX 36

N.D.S.: ESTIMATES OF HOT BEVERAGE DRINKING 1965-1979 (1) (2)

	COFFEE	TEA	COCOA AND FOOD BEVERAGES (3)	TOTAL
1965-1966(a)(c)	1.0	5.4	0.4	6.8
1966-1967(a)(d)	1.2	5.3	0.4	6.9
1967-1968(a)(e)	1.2	5.2	0.3	6.7
1968-1969(4)	N/A	5.1	N/A	
1969-1970(b)(f)	1.4	4.9	0.2	6.5
1970-1971(b)(f)	1.4	4.7	0.2	6.3
1971-1972(b)(f)	1.6	4.6	0.1	6.3
1972-1973(b)(f)	1.6	4.5	0.1	6.2
1973-1974(b)(f)	1.5	4.4	0.1	6.0
1974-1975(b)(f)	1.5	4.3	0.2	6.0
1975-1976(b)(f)	1.6	4.2	0.2	6.0
1976-1977(b)(f)	1.5	4.2	0.1	5.8
1977-1978(b)(f)	1.5	4.2	0.1	5.8
1978-1979(b)(f)	1.6	4.1	0.1	5.8

NOTES: (1) In number of cups taken "yesterday" in and out of the home per person by 10 year old's and over from
a) October - March;
b) October - September.

(2) Sources: National Drink Survey, carried out by the Marketing Research Centre and obtained from:
(c) Mintel Market Intelligence Report, May 1974, p 20.
(d) Mintel Market Intelligence Report, Ausust 1973 p.23.
(e) I.P.C. Ltd.: "Hot beverages: Coffee-Tea-Food drinks" 1977.
(f) These data were kindly provided for this research by Mr. J Phillips from the M.R.C. Details in Appendix 5.

(3) Including Cocoa, drinking chocolate and food beverages, but excluding milk on its own.

(4) N/A: No data available.

APPENDIX 37.

COMPARISON BETWEEN N.F.S. AND F.E.S. ESTIMATES OF EXPENDITURES ON HOT BEVERAGES. 1960-1979.

	N.F.S. (1)		F.E.S. (2)		N.F.S.-F.E.S.	
	A	B	A	B	A	C
1960	37.5		35.0		2.5	6.7%
1	36.4	-2.9%	34.5	-1.4%	1.9	5.2
2	35.1	-3.6	33.1	-4.1	2.0	5.7
3	35.2	-0.3	32.1	-3.0	3.1	8.8
4	32.9	-6.5	29.3	-8.7	3.6	10.9
1965	31.6	-4.0%	30.8	5.1%	0.8	2.5%
6	31.2	-1.3	28.8	-6.5	2.4	7.7
7	31.1	-0.3	27.7	-3.8	3.4	10.9
8	30.2	-2.9	27.5	-o.7	2.7	8.9
9	29.5	-2.3	26.3	-4.4	3.2	10.9
1970	30.2	2.4%	26.4	0.4%	3.8	12.6%
1	27.8	-8.0	26.4	-	1.4	5.0
2	25.5	-8.3	24.5	-7.2	1.0	3.9
3	23.9	-6.3	24.2	-1.2	-0.3	-1.3
4	23.9	-	23.1	-4.6	0.8	3.3
1975	21.1	-11.7%	20.7	-10.4%	0.4	1.9%
6	23.0	9.0	23.3	12.6	-0.3	-1.3
7	31.7	37.8	32.2	38.2	-0.5	-1.6
8	31.9	0.6	30.7	-4.7	1.2	3.8
9	28.7	-10.0	27.3	-11.1	1.4	4.9

NOTES: (1) Elaborated from N.F.S. annual reports.

(2) Elaborated from F.E.S. annual reports.

A: in pence per person per week.

B: in ratio of interannual change.

C: in ratio F.E.S. to N.F.S. : $\frac{\text{N.F.S. - F.E.S.}}{\text{N.F.S.}} \times 100.$

APPENDIX 38

ESTIMATING OUT-OF-HOME TEA CONSUMPTION FROM SUPPLIES AND N.F.S. PURCHASES. 1960-1979.

	A(1)	B(1)	C
1960	2.85	2.80	1.8%
1	3.05	2.84	7.4%
2	2.92	2.79	4.7%
3	2.92	2.82	3.6
4	2.85	2.69	6.0
5	2.71	2.61	3.8
6	2.71	2.64	2.7
7	2.78	2.70	3.0
8	2.71	2,59	4.6
9	2.65	2.52	5.2
1970	2.65	2,59	2.3
1	2.51	2.39	5.0
2	2.44	2.24	8.9
3	2.31	2,16	6.9
4	2.37	2.24	5.8
5	2.37	2.18	8.7
6	2.44	2.21	10.4
7	2.17	2.07	4.8
8	1.97	1.99	-1.0%
9	2.10	2.11	-0.5%

NOTES: (1) in ounces of tea per person per week.

A: Tea supplies moving into consumption. (MAFF).

B: Annual average household purchases of tea, in ounces per week.

From the respective Annual Report of the Household Food Consumption Committee, based on the National Food Survey. MAFF HMSO.

C: $\frac{A-B}{A} \cdot 100$

APPENDIX 39.

ESTIMATING OUT-OF-HOME TEA CONSUMPTION FROM SUPPLIES AND N.F.S. - F.E.S.POOLED DATA.

(In ounces of ten per person per week).

	A	B	C
1960	2.85	2.70	5.6%
1	3.05	2.75	10.9%
2	2.92	2,77	5.4%
3	2.92	2.69	8.6%
4	2.85	2,55	11.8%
5	2.71	2.69	0.7%
6	2.71	2,61	3,8%
7	2.78	2.48	12.1%
8	2.71	2.51	8.0%
9	2.65	2,50	6,0%
1970	2.65	2.37	11.8%
1	2.51	2,40	4.6%
2	2.44	2.25	8.4%
3	2.31	2.25	2.7%
4	2.37	2.27	4,4%
5	2.37	2.20	7,7%
6	2.44	2,39	2.1%
7	2.17	2.14	1.4%
8	1.97	2.00	-1.5%
9	2.10	2.06	1.9%

SOURCES: A: Supplies of tea from Appendix 38.

B: Corrected tea furchases by households obtained from F.E.S. and N.F.S. Pooled estimates as in Table 17.

C: $\frac{A-B}{A} \times 100$.

APPENDIX 40.

DERIVING S.E. FOR POOLED F.E.S.-N.F.S. ESTIMATES OF COFFEE EXPENDITURE. (1965, 1973, 1975).

		1965	1973	1975
N.E.S.:				
Sample: initial	(a)	14000	14.000	14.000
respondents	(b)	7000	7.000	7.000
% buying coffee	(c)	24	27	26
effective	(d)	1680	1.890	1.820
SE.coffee expenditure (%)	(e)	2.5	2.4	2.4
Derived variance	(f)	4200	4.500	4.400
F.E.S.:				
Sample: initial	(g)	5.000	11.000	11.000
respondents	(h)	3.300	7 000	7.000
% buying coffee	(i)	42	44	43
effective	(j)	1.400	3.000	3.010
SE. for coffee expenditure	(k)	3.0	2.1	2.3
Derived variance	(l)	4.200	6.500	6.923
POOLED N.F.S.-F.E.S.:				
Effective sample	(m)	3.080	4,890	4.830
Derived variance	(n)	8.400	11.000	11.323
Derived S.E.	(%)(o)	2.7	2.3	2.3

NOTES: S.E. = $\frac{S}{N(n-1)}$. Where S = variance; N = effective sample size;

S.E.= Standard error.

a) From N.F.S. Annual Reports.
b) From N.F.S. Annual Reports
c) From Table 28.
d) $\frac{b \times c}{100}$.

f) d x e .
g) h) k) From F.E.S. Annual Reports.
i) From Table 18.
j) h x i/100.
k) From Annual Reports of F.E.S.
l) j x k.
m) d + j.
n) f + l.
o) n/m .

APPENDIX 41

SOLUBLE COFFEE CONSUMPTION BY INCOME GROUPS <1>

<in ounces per person per week>

	INCOME GROUPS								
	A1	A2	ALL A	All B	ALL C	ALL D	E1	E2	AALL AVER-AGE
1975	0.96	0.70	0.77	0.62	0.56	0.55	1.27	0.83	0.65
1976	0.79	0.87	0.85	0.63	0.56	0.49	1.02	0.72	0.65
1977	0.64	0.68	0.67	0.46	0.46	0.40	0.72	0.39	0.48
1978	0.97	0.59	0.69	0.56	0.51	0.52	0.82	0.54	0.55

SOURCE: <1> National Food Survey Committee. Annual Reports. Income Groups correspond to the standard classification crossing both occupation and income. Income decreases from Group A to E.