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VARIATION IN FOOD CONSUMPTION: SOME ASPECTS OF MEASUREMENT AND EMPERICAL FINDINGS FOR THE NETHERLANDS

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Abstract.
This paper is concerned with variation in food consumption. The concepts of variation and variety seeking in consumption are reviewed briefly. Simple measures of variation in food consumption are proposed which are applicable to consumer/household panel data. Essentially they are based on the number and the share of brands/varieties in total consumption of a product. They are crude in comparison to other measures of variation which are developed in the literature (Pessemier and Handelsman,1984; Handelsman, 1987). However, they have the advantage of being easily applicable to consumer/household panel data. Analyses of variation in consumption of meat products, cheese and bread in the Netherlands suggest that the proposed measures are useful in monitoring developments in and in analysing basic aspects of variation in the consumption of food products.

1. Introduction.

Food consumption has reached a high level in Western countries. Various factors, amongst others health consciousness, limit further growth of per capita food consumption, in particular of the quantity consumed. Consumers increase food expenditure yet by improving quality of consumption. As a result food quality has become very important to food marketing (see e.g. Steenkamp, 1986). Quality of food consumption can be improved also by more variation in consumption. Variation in food consumption will not be pursued for hedonic reasons only. It is

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important from the nutritional point of view as well, since it contributes to a balanced food diet.
Foregoing aspects of the affluent western society stimulate research on variation in food consumption. A proper analysis of variation in food consumption has to be based on adequate measures of this phenomenon. In this respect it is important to be aware of the distinction between variation, as a characteristic of the consumption history of a consumer/ household, and variety seeking, as a consumer characteristic which influences consumption in conjunction with other variables, like attitudes and income. Appropriate measures of variation and variety seeking are necessary for an analysis of consumer behaviour in this respect.

This paper is concerned with variation as a characteristic of food consumption of a consumer/household. First, the concepts of variation and variety seeking are elaborated and measures of variation and variety seeking are reviewed briefly. Afterwards, some measures of variation in food consumption are proposed. Variation in consumption of meat products, cheese and bread in the Netherlands is analysed then as a function of socio-economic and purchasing characteristics of households. On the basis of these analyses conclusions are drawn about which factors influence variation and about the usefulness of the proposed measures of variation.

2. Variation and variety seeking in consumption : some highlights from the literature.

Variation in food consumption originates from various factors, like variability in shopping habits, variability in consumption situations, price consciousness of a consumer, the relevance of the product to the consumer and variety seeking of consumers. An overall measure of variation in consumption comprises the influence of these and other factors causing variation in consumption. As a result it does not

provide accurate information about the effect of variety seeking on consumption, i.e. on the variation in consumption when there is no external change in the purchasing environment of a consumer. Hoyer and Ridgway (1984) point out that variety seeking is only one determinant of exploratory purchasing behaviour. According to these authors exploratory behaviour can also result from the type of decision strategy, from dissatisfaction with current brands/products, from situational and normative variables, and from stochastic choice processes.

Variety seeking has been studied extensively (McAlister and Pessemier, 1982; Hoyer and Ridgway, 1984; Kahn, Kalwani and Morrison, 1986, Handelsman, 1987). It is argued by many authors that the concept of variety seeking in consumption originates from psychological theory (Pessemier and Handelsman, 1984). Farquhar and Rao (1976) suggested that variety seeking behaviour results from a consumer's attempt to find a balance of product attributes that optimizes utility. McAlister (1982) argues that variety seeking of consumers is the result of satiation with a product's attributes. Jeuland (1978) contends that variety seeking proceeds from a decline of preference for a product when a consumer accumulates experience with behaviour. However, experience fades if one goes for some time without enacting that behaviour. Givon defined variety seeking behaviour as induced by the utility the consumer derives from change itself, irrespective of the brands she switches to or from (Givon, 1984). Hoyer and Ridgway argue that: 'individuals with a high need for stimulation will be more likely to engage in variety seeking than those with a low need for stimulation' (Hoyer and Ridgway, 1984).
Variety seeking as a factor influencing consumption in its own right has been operationalised in different ways. Differences in consumers' optimum stimulation levels, as measured by Raju (1980), revealed differences on factors, which are proposed by McAlister and Pessemier (1982) " as the basic components of intrapersonal direct motives for varied behavior" . Givon introduced a variety seeking parameter, V,

into a stochastic buying behaviour model being a first order Markov process (Givon, 1984). McAlister (1982) defined preference for an item in a Dynamic Attribute Satiation model of variety-seeking behaviour: '.. as the sum of the contributions to preference made by each of the attributes'. Kahn a.o. (1986) introduced parameters for classifying types of variety seeking and reinforcement behaviour into stochastic zero-, first- and second order consumer behaviour models.

Measures of total variation in food consumption seem useful too. For instance, quantitative knowledge about variation in food consumption per household or per consumer, might be helpful in market segmentation. Measures of variation seem also useful in analysing the contribution of different factors to total variation in food consumption.
A crude measure of variation in consumption is the number of different brands/varieties of a product purchased in a specific time interval. The coefficient of entropy has been proposed as a measure of varied consumption behaviour, which accounts both for the number of brands/ varieties and for the relative importance of different brands/ varieties of a product. Another measure of variation in consumption is the similarity/dissimilarity of items purchased in a specific product class.
Pessemier and Handelsman (1984) introduced a more complex measure of varied behaviour called Index of Temporal Variety (ITV) which is composed of three elements:'.the percentage of realized dissimilarity; ...the percentage of realized entropy,...; ..... the extent to which bunching is absent...'. Recently Handelsman proposed an index of varied behaviour the Varied Behaviour Measure (VBM), which accounts for '.how the consumer's experience with a brand decays over time.' (Handelsman, 1987). Basic elements of this Varied Behavior Measure (VBM) are '... temporal variety, records how the purchase sequence varies over time.' and '..the degree of perceived structural variety (difference) between brands in the purchase sequence that a consumer perceives within the maximal structural variety of his or her perceptual space of the product class and its brands (Handelsman, 1987).'

ITV and VBM are sophisticated measures of variation,which require a great many data, being often available on an ad hoc basis only. In order to analyse variation in food consumption regularly, it is convenient to dispose of a measure of variation which can be applied to continuous market data, like household panel data. Such a measure is indispensable for monitoring variation in consumption systematically. It will have to be more simple than the ones proposed by Pessemier and Handelsman. We will address this question in the following sections.

3. Measures of variation in food consumption, some proposals.

3.1. Conceptual aspects of measuring variation in consumption.

Variation in food consumption is concerned with diversity and change in food consumption. It seems a useful concept since it tells something about the stability of consumption, and consequently about the stability of the market. Measures of variation in consumption should offer the opportunity to describe and analyse consumption and markets of a specific product. Preferably they should be suitable to analyse the impact of variables, like socio-economic and purchasing variables, on variation in consumption. In developing measures of variation the following points have to be considered.

- Any measure of variation has a time dimension. The number of different types of a product consumed by a household differs with the time period considered. For instance, the average number of fresh vegetables consumed by dutch households was 19 in 1984 on a yearly basis, but only 3 to 4 on a weekly basis (Produktschap voor Groenten en Fruit, 1986). Seasonality is another time related aspect of variation in food consumption.
- Variation in food consumption is influenced by a many variables. As a result, research questions with respect to variation in food consumption may influence the appropriateness of the measure of

variation to be used. For instance, the objective of monitoring variation in consumption as against the objective of explaining variation in consumption can make different demands upon measures of variation.

- Preferably, variation in consumption should be measured from individual consumption histories. Unfortunately in many instances only purchasing histories of households are available. Purchasing histories are suitable for measuring variation in consumption if the products purchased are consumed during the interpurchase time. This often happens to be the case in food consumption. Housewives, being the most important decision maker in purchasing food, possibly have a strong influence on variation in food consumption at the household level.
- The relevant product set for which variation in consumption has to be measured will have to be defined clearly. For instance, a brand manager might be interested in the variation in the consumption of brands of a specific product,like the brands of coffee, while a marketing manager of a dairy company might be interested in the variation in consumption of different types of cheese.

One might argue that the relevant set of a product consists of the brands/varieties a consumer is aware of. In that case the relevant set varies between consumers. However, marketers may be interested in variation in consumption as related to all brands/varieties of a product supplied to the market. In that case the relevant set consists of all brands/varieties of a product supplied to the market. Such a definition of the relevant set makes sense only, if consumers are aware of the different brands/ varieties in the market and if they are able to buy them. This condition requires that total market supply of a product can be classified meaningfully in a limited number of varieties.

3.2. Some measures of variation in food consumption.

In this section simple measures of variation in food consumption are proposed which hopefully deliver meaningful information on variation at low costs.

- **NJ, the number of different brands/varieties of the relevant product set J, chosen by a consumer/household in a specific period.**

NJ is a naive measure of variation. It reflects the notion that variation in consumption increases, when the number of brands/ varieties chosen from a relevant product set J is increasing.
NJ, the number of brands/varieties chosen by a consumer/ household from a relevant product set is a crude measure of variation. A person who sticks to one brand of coffee or one variety of vegetables clearly varies less in consumption than a person who switches between two or more brands/varieties. However, two consumers, both consuming two varieties of a product, differ substantially in variation if in the one case both varieties have an equal share of 50%, but in the other case one variety has a share of 5% and the other a share of 95%.
Also, since NJ consists of integers only, it has limited discriminative power. This might be a problem in the case of few brands/varieties in the relevant product set.

- **ANJ, the average of NJ(i), the number of brands/varieties chosen by a consumer/household in period i, adjusted for the variance of NJ(i), for i= 1...n : ANJ = MNJ + 1/{S²J +1} for**

  $S^2J = \Sigma_{i=1}^{n} [NJ(i) - MNJ]2/(n-1)$,

  $MNJ = \Sigma_{i=1}^{n} NJ(i)/n$, for n being the number of periods

  NJ(i)= the number of varieties of a relevant product set J chosen by a consumer/household in period i.

Given a specific value of MNJ, ANJ is greater when the number of brands/varieties consumed per period differs less over time, i.e. when S^2J is smaller. The measure ANJ values stability of variation in a positive way.

Like NJ, also ANJ does not take into account the share of a brand/ variety in the total consumption of the relevant product set J.

- **Two well known measures of concentration, the Herfindahl-Hirschman index and the Coefficient of Entropy can be used as a measure of variation in consumption.**

The following well known measures of concentration might be useful as a measure of variation in consumption :

$HHJ = \Sigma_{j=1}^{k} [MJ(j))]^2$, the Herfindahl-Hirschman index.
for MJ(j) being the share of brand/variety j in the total consumption of product set J and k the number of brands/varieties in the relevant product set J.

This measure takes into account both the number of brands/varieties consumed and the share of these varieties in total consumption.
HHJ is one in the case of no variation and decreases mostly if the number of brands/varieties in the relevant set increases, at least if the share of the brands/varieties in total consumption is equal.

$EJ = \Sigma_{j=1}^{k}[-MJ(j)\ln(MJ(j))]$, the Coefficient of Entropy.
for MJ(j) being the share of brand/variety j in the total consumption of the relevant product set J and k the number of brands/varieties in the relevant product set J.

EJ is zero, when MJ(j) is 1. It increases when the number of brands/ varieties of the relevant product set J, which is actually chosen by a consumer/ household, is increasing, at least if consumption of the brands/ varieties is equal.
In order to standardise this entropy measure between 0 and 1 the entropy measure EJ is divided by EJ max., the maximum entropy, given the number of brands/ varieties in the relevant set:
ECJ=EJ/EJmax., EJmax being the entropy for MJ(1)=MJ(2)=...=MJ(k)=1/k

In case the relevant product set is defined as the number of brands/varieties of a product set J a consumer/household is aware of, say k, and if there are Z moments of choice from the relevant set J, the maximum entropy will be realised for $MJ(j) = 1/m$ and $m = Min.\{k,Z\}$ (Pessemier and Handelsman, 1984). This measure ECJ is one of the elements of the measure of varied behaviour, I.T.V., as developed by Pessemier and Handelsman (1984).

- **UJ, the number of brands/varieties chosen by a consumer/household from a relevant product set J, adjusted for differences in the share of the brands/varieties by the variance of the quantity consumed of these brands/varieties:** $UJ = NJ + 1/(S^2J + 1)$, for
  NJ the number of brands/varieties chosen from the relevant product set J in a specific period by a consumer/household,
  $S^2J = \Sigma_{j=1}^{k} [QJ(j) - (\Sigma_{j=1}^{k} QJ(j)/k)]^2 /(k-1)$
  $QJ(j)$ = the quantity consumed of brand/variety j by a consumer/household in the specific period,
  k = the number of brands/varieties in the relevant product set J.

The definition of UJ implies that $NJ \leq UJ \leq [NJ+1]$; variation in consumption is larger when the number of brands/varieties consumed is larger, irrespective of the share of different brands/varieties in total consumption of product J.
When all shares are equal, S^2J is zero and variation in consumption is maximum, given NJ. In order to exclude $UJ = \infty$ for $S^2J = 0$, 1 is added in the denominator. More difference in the share of brands/varieties in total consumption causes an increase of S^2J and as a result a decrease of UJ.
If there are data available for n periods, say n weeks, a reliable estimate of UJ per period, say a week, can be established by inserting $NJ^* = \{\Sigma_{i=1}^{n} NJ(i)\}/n$ for NJ and $S^2J^* = \Sigma_{j=1}^{k} [Q^*(j) - \Sigma_{j=1}^{k} Q^*(j)/k]^2/(k-1)$ for S^2J, where $Q^*(j) = \{\Sigma_{i=1}^{n} Q(i,j)\}/n$.

- **A Lisrel approach to the analysis of variation in food consumption.**

One might argue that variation in food consumption is a conceptual non-measurable variable. In that case variation in food consumption could be analysed by a Lisrel model (see for instance Jöreskog and Sörbom,1979). In applying this model, variation in consumption is considered to be a latent structural variable which is related to other latent structural variables. Structural relationships are estimated with the help of a measurement model in which structural variables are related to observed variables, being indicators of the structural variables. In this way a Lisrel model offers the opportunity to combine in one analysis a number of measures of variation, which are considered as indicators of variation in consumption.

4. An analysis of variation in consumption of meat products, cheese and bread in the Netherlands.

4.1. Research questions.

Variation in consumption of some important food products at breakfast and lunch is analysed on the basis of Dutch household panel data. The analysis concerns bread, meat products and cheese. The following points are investigated:

- convergent validity of the measures of variation proposed in section 3.2;
- is variation in food consumption a general characteristic over products, or is it product specific ?
- the relationship between variation and socio- economic, and purchasing variables respectively.

The analysis is performed on the basis of multivariate statistical techniques. Models, variables, statistical methods and results of the analysis are reported in section 4.3. The analysis implicitly tests the usefulness of the simple measures of variation proposed in section 3.2.

4.2. Data.

We disposed of household panel data on consumption of meat products, cheese and bread, made available by the Dutch market research company N.I.A.M. Data were not collected specifically for the purpose of analysing variation in consumption. The available data concern a representative national sample of 1962 dutch households. They consist of purchase histories for bread during week 11 and week 12 of 1984, and for meat products and cheese during week 11 up to week 14 of 1984 inclusive. This period did not include special days and weekends, like Eastern.

Our data concern purchases and not consumption. In the case of meat products, cheese and bread, variation in purchasing probably will be highly correlated with variation in consumption, at least if data refer to periods of a week or longer.

On the basis of purchasing histories per household, a data set on a weekly basis has been produced. The variables used in our analysis are reported in Table 1.

Table 1.

Household panel data used in the analysis of variation in consumption of meat products, cheese and bread in the Netherlands (Data refer to individual households, if not indicated otherwise. Time period of observation is week 11 up to week 14 of 1984 for meat products and cheese; week 11 and week 12 of 1984 for bread)

QM = per capita consumption of meat products per 2 weeks in 100 grams

QC = per capita consumption of cheese per 2 weeks in 100 grams

QB = per capita consumption of bread per 2 weeks in 100 grams

SHFM = shopping frequency for meat products per 4 weeks

SHFC = shopping frequency for cheese per 4 weeks

SHFB = shopping frequency for bread per 2 weeks

TSHM = types of shop where meat products are purchased during 4 weeks

TSHC = types of shop where cheese is purchased during 4 weeks

TSHB = types of shop where bread is purchased during 2 weeks

PM = average price paid for meat products in guilders per 100 grams during 4 weeks

PC = average price paid for cheese in guilders per 100 grams during 4 weeks

PB = average price paid for bread in guilders per 100 grams during 2 weeks

SC = social class. 1 = upperclass A, 2 = class B .... 5 = lower class (standard classification of the market research company; the measurement on an interval scale is a rough approximation)

D = district. 1 = Amsterdam, Rotterdam, The Hague; 2 = otherwise

HS = size of household, i.e. number of household members

NM = number of varieties of meat products purchased over a period of 4 weeks (8 types are distinguished)

NC = number of varieties of cheese purchased over a period of 4 weeks (10 types are distinguished)

NB = number of varieties of bread purchased over a period of 2 weeks (5 types are distinguished)

HHJ = Hirschman Herfindahl index (see section 3.2) calculated over a period of 4 weeks (meat products and cheese) and of 2 weeks (bread), (J = M(eat Products), C(heese), B(read))

ECJ = Coefficient of entropy (see section 3.2) calculated over a period of 4 weeks (meat products, cheese) and of 2 weeks (bread), (J = M(eat products), C(heese), B(read))

ANJ = Measure of variation (see section 3.2) based on weekly data over a period of 4 weeks (meat products and cheese) and of 2 weeks (bread), (J = M(eat products), C(heese), B(read))

UJ = Measure of variation (see section 3.2) calculated on the basis of weekly observations of NJ and QJ over a period of 4 weeks (meat products and cheese) and 2 weeks (bread), (J = M(eat products), C(heese), B(read))

UJ(1)= Measure of variation UJ (see section 3.2) on the basis of NJ and QJ over a period of 4 weeks (meat products, cheese) and of 2 weeks (bread)

The relevant product set J consists of a limited number of varieties each representing a broad category of meat products, cheese and bread, respectively. Therefore it seems justified to define the relevant product set as all varieties distinguished in the data set on total consumption of product J.
The analysis was confined to variables reported in the consumer household panel. They were not collected specifically for the purpose of analysing variation in consumption.

4.3. Measurement and analysis of variation in consumption of meat products, cheese and bread in the Netherlands.

4.3.1. Measurement of variation in consumption of meat products, cheese and bread in the Netherlands.

Variation in consumption of meat products, cheese and bread has been determined by the measures of section 3.2. Correlation coefficients between variation, as determined by different measures, are high. They are reported for meat and cheese in Table 2. Results for bread are similar and are not reported because of shortage of space.
Correlation coefficients between UJ,NJ and ANJ are in many instances larger than 0.80. Since UJ and ANJ are extensions of NJ, this is not surprising. It suggests that NJ, the number of varieties, dominates the variance component in UJ and ANJ.

Table 2.

Correlation coefficients between variation in consumption of meat products and cheese by Dutch households in 1984, calculated by different measures of variation [1] (N = 1962).

	Meat					
	UM	NM	ANM	HHM	ECM	
UC		0.89	0.98	-0.35	0.84	UM
NC	0.80		0.83	-0.35	0.96	NM
ANC	0.88	0.66		-0.34	0.77	ANM
HHC	-0.13	-0.15	-0.03		-0.43	HHM
ECC	0.74	0.93	0.56	-0.43		ECM
	UC	NC	ANC	HHC	ECC	
	Cheese					

1) For explanation of UM ... ECM and UC ... ECC the reader is referred to section 3.2. and Table 1.

ECJ is stronger correlated with UJ,NJ and ANJ than HHJ. In particular correlation coefficients of ECJ with NJ are substantial: for meat products and cheese larger than 0.90. Correlation coefficients of HHJ with UJ, ANJ (except for cheese) and NJ are statistically significant, but in absolute value substantially smaller than 0.50; in the case of bread, they are somewhat higher.

Foregoing results suggest convergent validity between ECJ and UJ, NJ and ANJ.

4.3.2. Is variation in consumption a general or a product specific concept?

It is analysed whether variation in consumption is a general concept for meat products, cheese and bread as a whole. For that purpose canonical correlation analyses were performed with alternative sets of criterion variables. In Table 3 the canonical correlation analysis for {ANJ, ECJ}, as criterion variables - ANJ being the adjusted number of varieties consumed and ECJ, the adjusted measure of entropy as defined in section 3.2, (J=M,C,B) - is reported. These results are in agreement with canonical correlation analyses, using other measures of variation as a criterion variable. Shortage of space prevents reporting more results.
The first three roots had canonical correlations of 0.56 or higher (Table 3). Criterion variables and predictor variables with high loadings on the first root are in particular related to cheese, variables with high loadings on the second root are in particular related to meat products and those with high loadings on the third root are variables related to bread.

Table 3.
Canonical correlation analysis of variation in consumption of meat products, cheese and bread of Dutch households in 1984 [1)].

Variables	1		2		3	
Criterion Set	Weight	Loading	Weight	Loading	Weight	Loading
ANM	.19	.49	.95	.86	-.35	-.14
ANC	.88	.98	-.51	-.20	-.12	-.02
ANB	.07	.33	.13	.35	1.27	.85
ECM	.01	.35	.03	.64	-.12	-.18
ECC	.05	.52	-.05	-.12	-.04	-.07
ECB	-.02	.19	.04	.26	-.35	.41

Table 3. Continue

Explained Variance		28.8%		23.2%		15.8%
Predictor Set						
SHFM	.09	.49	.57	.74	-.15	-.08
SHFC	.84	.97	-.46	-.20	-.17	.00
SHFB	.02	.35	.02	.31	.51	.69
HS	.20	.32	.34	.29	.03	.22
SC	.02	-.06	.01	.02	-.03	-.01
QM	.12	.23	.51	.61	-.42	-.33
QC	.13	.44	-.19	-.30	-.08	-.10
QB	.02	.19	.13	.25	.57	.60
TSHM	-.02	.19	-.08	.32	-.03	-.08
TSHC	-.06	.40	.05	-.05	.13	.09
TSHB	.00	.18	.01	.08	.14	.33
PM	.02	-.06	.15	.01	-.14	-.06
PC	.09	.12	-.06	-.09	-.04	-.13
PB	.01	.00	.06	.03	.32	.22
Explained Variance		13.9%		10%		8.6%
Canonical Correlation		.89		.80		.56
Redundancy Coefficient		.11		.06		.03

N = 1962

1) The reader is referred to Table 1 for the meaning of variables.

Canonical weights and canonical loadings are highest for SHFJ, the number of times the household is visiting a shop to purchase product J (J=M,C,B). Canonical weights are substantial in the case of QJ, quantity consumed, and HS, size of the household. Other predictor variables contribute little to the canonical correlation.

The results suggest that variation in consumption is not a general household characteristic over the products analysed, but product specific.

4.3.3. Factors affecting variation in consumption of meat products, cheese and bread.

A Lisrel model has been applied to analyse variation in consumption of meat products, cheese and bread separately. It was assumed that the structural variable 'Variation in consumption' using NM and ECM as measurement variables, is influenced in a positive way by the structural variables 'Relevance of the product', 'Variability in shops' and 'Price relevance'. Since we disposed of household panel data only, measurement variables of the explanatory structural variables were proxies. The results of the Lisrel analyses were not statistically reliable. The suitability of the Lisrel procedure to analyse variation in food consumption on the basis of this type of data could not be demonstrated.

Regression analyses using 'Variation in consumption' as a dependent variable were more successful. It was hypothesized that variation in consumption per household depends on: a) shopping frequency, since every time a housewife is visiting a shop for buying a specific food product she has to decide about the variety to be choosen; b) the level of consumption, since it is expected that heavy users are more involved in a product and for that reason will consume more varieties than light users; c) the price level, since a higher average price paid for product might increase willingness to switch to different varieties of the respective product; d) district of the country, since people in the urbanized part of the country might be more innovative and more variation prone than households in other parts of the country; e) household size, since variation per household may increase with the number of household members; f) social class,because of more purchasing power and more appreciation of variation in food consumption in a

higher social class ; g) the number of different shops visited by a consumer, since a different type of shop often implies a different assortment of brands/varieties in a product class; h) variation in bread consumption, since consumers might like specific combinations of bread and meat products or cheese.
In the absence of a specific hypothesis about the mathematical form of the relationship between variation and the explanatory variables we assumed a linear relationship.

Apart from differences in the coefficient of determination the statistical results of the regression analyses per product are, generally speaking, similar with respect to significant influences of explanatory variables. We limit our report to regression analyses of variation as measured by UJ and ECJ (Table 4). The regression equations with ECJ as a dependent variable have substantially lower fit than the equations with UJ as a dependent variable. This might be caused by the fact that ECJ is measured over a period of four weeks and UJ refers to a one week period (see Table 1); actually the same regression analysis using UJ(1), which is related to a four weeks period (see Table 1), as a dependent variable, had about the same fit as regression analyses of ECJ. Our discussion is confined to the regression analyses having UJ as dependent variable (see Table 4)
SHFM (frequency of visiting a shop for buying meat products), HS (size of household) and QM (consumption of meat products per capita) have a strong positive influence on variation in consumption of meat products. Variation is somewhat greater when higher price meat products are purchased. The positive influence of social class on variation is weak and not statistically significant.

Table 4.
Regression analyses of variation in consumption of meat products, cheese and bread as a function of shopping characteristics, consumption level and socio-economic characteristics of Dutch households in 1984 (β coefficients reported; values within brackets are t values). [1)]

	DEPENDENT VARIABLE					
	UM	UC	UB	ECM	ECC	ECB
SHFM	0.45	-	-	0.30		
	(21.11)			(10.46)		
SHFC		0.77			0.30	
		(38.03)			(10.29)	
SHFB			0.15			-0.03
			(5.52)			(-1.21)
QM	0.39			0.31		
	(19.45)			(11.73)		
QC		-0.16			0.11	
		(- 8.63)			(3.97)	
QB			0.21			0.21
			(8.71)			(8.06)
PM	0.13			0.05		
	(8.35)			(2.59)		
PC		0.15			0.13	
		(8.91)			(5.57)	
PB			0.27			0.24
			(12.12)			(9.83)
D	0.04	-0.03	-0.01	0.06	-0.07	-0.02
	(2.83)	(-2.32)	(-0.44)	(2.85)	(-3.15)	(-1.05)
HS	0.34	0.13	0.26	0.21	0.03	0.20
	(18.29)	(7.35)	(10.96)	(8.38)	(0.95)	(7.65)
SC	0.02	0.00	-0.02	-0.003	-0.03	-0.01
	(1.16)	(0.03)	(-0.82)	(-0.14)	(-1.23)	(-0.37)
TSHM	-0.05			0.07		
	(-2.72)			(3.05)		
TSHC		0.04			0.22	
		(2.17)			(8.84)	
TSHB			0.20			0.23
			(8.81)			(9.56)
ANB	0.06	0.02		0.03	0.01	
	(3.96)	(1.32)		(1.61)	(.60)	
R^2	0.65	0.67	0.30	0.38	0.29	0.18
$\bar{R}^2$	0.65	0.67	0.30	0.38	0.29	0.17

N = 1532

1) The reader is referred to Table 1 for the meaning of the variables.

The influence of explanatory variables on variation in consumption of cheese is similar to this influence in case of meat products, except for the variable per capita consumption, which has a smaller, even negative, influence. Possibly, heavy users purchase large pieces of one type of cheese, which enhances consumption of the same variety. Such a practice seems less common for meat products. Variation in consumption of bread has no influence on variation in consumption of cheese. Regression analyses of variation in consumption of bread have smaller coefficients of determination than those of meat products and cheese. Nevertheless a great many explanatory variables have a statistically significant (at the 5% level) influence. Like for the other products, there is a substantial positive influence of family size and of per capita consumption on variation in consumption. Frequency of visiting a shop for purchasing bread has a positive influence on variation in bread consumption, which is somewhat less than in the case of meat products and cheese. Variation in consumption of bread seems stronger influenced by the average price paid and by the number of different types of shop visited than in the case of cheese and meat products. Possibly, variation in consumption of bread is greater if a household is purchasing higher priced bread, which often is sold by special bakeries.

5. Conclusions.

- Statistical analyses of variation in food consumption suggest convergent validity between the measures of variation ECJ, NJ, ANJ, and UJ.

- Variation in consumption of meat products, cheese and bread appeared to be product specific.

- Differences between households with respect to variation in consumption could be explained in particular by frequency of

shopping for the product, and to a lesser extent by per capita consumption and size of the household.

- Regression analyses suggest that the proposed measures NJ, ANJ, UJ and ECJ are useful in analysing some basic aspects of variation in food consumption. They are similar with respect to the main factors influencing variation. Nevertheless, UJ and ECJ seem preferable as a dependent variable since they are based, contrary to other measures, on both the number and the share of different brands/ varieties consumed in the relevant product set J.

- Our empirical analysis suggests that analyses of variation in food consumption on the basis of household panel data contribute to the understanding of this phenomenon. Since for practically every food product consumer/household panel data are available on a regular basis, monitoring of some basic aspects of variation in food consumption seems possible at reasonable costs.

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