

## Weak separability in coffee demand systems

DANIEL SELLEN

*The World Bank, Washington, USA*

ELLEN GODDARD

*University of Guelph, Canada*

(received May 1995, final version received August 1996)

### Summary

*Linear versions of the Almost Ideal Demand System are estimated for US and German coffee imports with the intent of testing for homothetic and non-homothetic weak separability and calculating elasticities. Three different separable groupings are tested and separability restrictions are rejected. Elasticities indicate both elastic and inelastic demand for coffee by country of origin, and also that roasters consider such coffees as both substitutes and complements.*

*Keywords: consumer demand, coffee, Almost Ideal Demand System, weak separability.*

### 1. Introduction

In demand analysis, weak separability implies that the marginal rate of substitution between two consumption goods in one group is independent of quantities of goods consumed from outside the group. In other words, there are no restrictions on substitution between goods within a group, and substitution between goods in different groups will occur only by a factor of proportionality characterised by the relationship between groups in terms of expenditure. Accordingly, consumers may be viewed as allocating total expenditure to a broad category of goods and subsequently apportioning expenditure among sub-groups, based on sub-group prices and expenditures. Weak separability, therefore, is a necessary condition for multi-stage budgeting.<sup>1</sup> More importantly, it makes possible use of conditional demand systems that avoid specification of the complete set of demand equations

theoretically attainable from the consumer's utility maximisation problem. In this way, the number of variables and parameters can be reduced to a manageable size.

The concept of separability of preferences, which originated in the work of Leontief (1947), has been widely used or implied in the econometric modelling of consumer demand (Blackorby, Primont and Russell, 1978). Although many empirical studies use demand systems for agricultural commodities, most have used weak separability as a maintained but untested hypothesis (exceptions are Pudney, 1981; Eales and Unnevehr, 1988; Nayga and Capps, 1994; Moschini and Moro, 1993; Moschini, Moro and Green, 1994). Most empirical studies reject separability restrictions when they are tested (Pudney, 1981).

Coffee, one of the world's most important traded commodities, has been the focus of dozens of econometric studies. However, coffee is rarely modelled in a demand system framework that recognises it as a heterogeneous good (exceptions are Goddard and Akiyama, 1989; Kalenda, 1991). In fact, roaster-buyers (and some consumers) are acutely concerned about what variety of coffee they acquire (Marshall, 1983; De Graaf, 1986). Varieties are typically divided into *robustas* (which are more acidic and higher in caffeine) and the *arabicas* (which are milder and more fragrant). Arabicas are further subdivided into *Colombian milds* (from Colombia, Kenya, and Tanzania), *unwashed arabicas* (mainly Brazilian), and *other milds* (the remainder - mainly from Central and South America). Consumers may also be concerned about the national origin of their coffee. Many, for example, express particular interest in the high-quantity product of Colombia or Jamaica. However, most coffees are sold as blends. These are carefully defined by roasters' recipes, but are responsive to changes in consumers' tastes and relative prices.

Exploration of the relationships within coffee demand suggests the usefulness of a demand system that employs multi-stage budgeting. However, no study has tested for separability within coffee demand. The objective of this paper is to determine an appropriate commodity aggregation within coffee demand by carrying out tests for non-homothetic and homothetic weak separability within a demand system. Results should contribute to understanding the nature of coffee demand by showing how coffee consumers allocate coffee expenditure. In doing so, the study will add to the small but growing body of empirical evidence on separability in demand for agricultural products. In addition, elasticities generated by the model will illuminate features of coffee demand. As others have done (Eales and Unnevehr, 1988; Nayga and Capps, 1994), a complete demand system is not specified. Therefore, results will be conditional on the correct but untested assumption that coffee in aggregate is separable from all other goods.

## 2. Testing for weak separability

To characterise weak separability, the utility function  $U(\mathbf{q})$  appears as a function of  $n$  sub-utility functions, such that

$$U(\mathbf{q}) = U_0[U_1(\mathbf{q}_1), U_2(\mathbf{q}_2), \dots, U_S(\mathbf{q}_S)] \quad (1)$$

where  $\mathbf{q}$  is the vector of consumption goods. Goldman and Uzawa (1964) show that this separable structure restricts the substitution possibilities between goods in different groups so that the Slutsky substitution terms  $S_{ik}$  between two goods in different groups are proportional to the income effects:

$$S_{ik} = \mu_{GH} \frac{\partial q_i}{\partial M} \frac{\partial q_k}{\partial M} \quad \text{for all } i \in G, \quad k \in H, \quad G \neq H \quad (2)$$

where  $\mu$  is a factor of proportionality, and  $G$  and  $H$  are separable commodity groupings. Assuming weak separability of the direct utility function, then

$$S_{jk} \frac{\partial q_i}{\partial M} \frac{\partial q_k}{\partial M} = S_{jk} \frac{\partial q_i}{\partial M} \frac{\partial q_k}{\partial M} \quad \text{for all } i, j \in G, \quad k \in H, \quad G \neq H. \quad (3)$$

From (3) it follows that testing whether commodity group  $H$  is separable from group  $G$  (and vice-versa) may be conducted with the hypothesis

$$S_{jk} \frac{\partial q_j}{\partial M} - S_{jk} \frac{\partial q_i}{\partial M} = 0 \quad (4)$$

where the test is based on a  $\chi^2$  statistic with degrees of freedom equal to the number of restrictions.

Tests for weak separability have relied on Wald Tests or Likelihood Ratio (LR) Tests. The former test, used by Eales and Unnevehr (1988) and others, is less cumbersome than the latter since it avoids estimating both restricted and unrestricted models. However, it has been demonstrated that the Wald Test is not invariant to how the nonlinear restrictions are specified (Lafontaine and White, 1986). For this reason the LR Test will be used, for which the test statistic is

$$\psi = 2(LR_{ur} - LR_r) \quad (5)$$

where  $LR_{ur}$  and  $LR_r$  are the values of the unrestricted and restricted log likelihood functions, respectively. It has been shown that the LR Test tends to over-reject in large demand systems so that the correction for size is appropriate. Monte Carlo simulations carried out by Moschini, Moro, and Green (1994) have shown that a corrected LR test statistic works well when testing for weak separability. The corrected statistic is

$$\psi^* = \frac{\psi}{KT} \left[ KT - \frac{1}{2}(N_{ur} + N_r) - \frac{1}{2}K(K+1) \right] \quad (6)$$

where  $K$  is the number of equations,  $T$  is the number of time-series observations, and  $N_{ur}$  and  $N_r$  are the number of parameters in the unrestricted and restricted models, respectively.

Three possible separable structures are selected *a priori* for testing (Table 1). These groupings are chosen based on quality differences described

Table 1. Characterisation of separable groupings tested

Variety	Country of origin		Index number	Separable groupings		
	United States	Germany		1	2	3
<i>Other milds</i>	Mexico	El Salvador	1	A	A	A
	El Salvador	Nicaragua	2	A	A	A
	Costa Rica	Honduras	3	A	A	A
	Guatemala	Guatemala	4	A	A	A
<i>Colombian milds</i>	Other	Other	5	A	A	A
	Kenya	Kenya	6	A	A	B
	Columbia	Columbia	7	A	A	B
	Tanzania	Tanzania	8	A	A	B
<i>Unwashed arabicas</i>	Brazil	Brazil	9	A	B	C
	Ethiopia	Ethiopia	10	A	B	C
	Côte d'Ivoire	Indonesia	11	B	C	D
<i>Robustas</i>	Thailand	Cameroon	12	B	C	D
	Uganda	Côte d'Ivoire	13	B	C	D
	Indonesia	Uganda	14	B	C	D
	Other	Other	15	B	C	D

in the literature (e.g. Marshall, 1983) and variety definitions of the International Coffee Organisation. Grouping 1 is based on two general branches separating *arabicas* and *robustas*. Grouping 2 separates the lower-quality *unwashed arabicas* from *robustas* and the remaining *arabicas*. Grouping 3 views *other milds*, *Colombian Milds*, *unwashed arabicas*, and *robustas* as separable groupings.

These alternative separable structures are tested to determine whether weak separability is supported in the cases of US and German (former West German) coffee demand. These countries are the two largest coffee importers, accounting for about 45 per cent of world consumption. To simplify the model in terms of exporters of Other Milds and Robustas, only the four largest exporters of each in the sample period are singled out, with residual suppliers captured in the 'Other' categories.

In formulating tests for weak separability, it is helpful to establish the correct number of non-redundant restrictions,  $R$ , which are determined by the formula

$$R = \frac{1}{2} \left[ m(m-1) - \sum_{s=1}^S m_s(m_s-1) - S(S-1) \right] \quad (7)$$

where  $m$  is the total number of goods and  $m_s$  is the number of goods in the

$s$ -th group ( $s = 1, 2, S$ ). Following Nayga and Capps (1994), the number of  $i, j$ , and  $k$  combinations for the three groupings described in Table 1 are shown in Table 2. Thus there are 49, 63, and 75 restrictions for Groupings 1, 2, and 3, respectively. Given our interest in obtaining an appropriate commodity aggregation, homotheticity of the sub-utility functions is also required to be consistent with one-shot utility maximisation (Green, 1976). Income elasticities within groups must therefore be equivalent, requiring the restrictions that

$$\frac{\partial q_i}{\partial M} \frac{M}{q_i} = \frac{\partial q_j}{\partial M} \frac{M}{q_j} \quad (8)$$

Thus the simultaneous imposition of homotheticity restrictions entails  $S(m_s - 1)$  additional restrictions, i.e.,  $(m_s - 1)$  restrictions for each sub-utility function in which homotheticity is imposed.

### 3. A model of coffee demand

Parameters are estimated with the Almost Ideal Demand System (AIDS), which is based on the flexible expenditure function known as the price-independent generalised logarithmic (PIGLOG) form (Deaton and Muellbauer, 1980). The AIDS model is attractive because it is simple to estimate and is compatible with demand theory; it satisfies the axioms of choice, aggregates over consumers without implying linear Engel curves, and can be used to test for homogeneity and symmetry. The linear form of the AIDS model is given by:

$$w_i = a_i + \sum_j c_{ij} \ln p_j + b_i \ln \left( \frac{M}{P} \right) + d_i t \quad (9)$$

where  $w_i$  is the budget share for coffee from country  $i$ ,  $p_j$  is the price of coffee from country  $j$ ,  $M$  is total expenditure on all coffee, and  $P$  is the expenditure-weighted price for all coffee, with  $\ln P = \sum_i w_i \ln p_i$  (the Stone index). A time trend variable,  $t$ , is included to capture steady movements of unmodelled variables. Since the system of expenditure share equations must sum to one, all but one of the equations are estimated. Restrictions from demand theory - homogeneity, adding-up, and symmetry - may be imposed on the AIDS model with the restrictions

$$\sum_i a_i = 1, \quad \sum_i b_i = \sum_j c_{ij} = \sum_i d_i = 0, \quad \sum_j c_{ij} = 0,$$

and  $c_{ij} = c_{ji}$ . Error terms are assumed to have a joint normal distribution with mean zero and constant covariance.

We conduct only local tests of separability. Although such a condition should hold everywhere, a global imposition of separability restrictions is

Table 2. Summary of weak separability tests

Grouping	i, j	k														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Grouping 1	1, 2	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	2, 3	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	3, 4	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	4, 5	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	5, 6	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	6, 7	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	7, 8	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	8, 9	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	9, 10	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	10, 11	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	11, 12	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	12, 13	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	13, 14	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	14, 15	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	Grouping 2	1, 2	*	*	*	*	*	*	*	*	*	*	*	*	*	*
2, 3		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
3, 4		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
4, 5		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
5, 6		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
6, 7		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
7, 8		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
8, 9		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
9, 10		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
10, 11		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
11, 12		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
12, 13		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
13, 14		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
14, 15		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Grouping 3		1, 2	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	2, 3	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	3, 4	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	4, 5	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	5, 6	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	6, 7	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	7, 8	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	8, 9	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	9, 10	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	10, 11	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	11, 12	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	12, 13	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	13, 14	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	14, 15	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*

Note: \* represents nonredundant test for separability.

extremely restrictive (Moschini, Moro and Green), so that tests will be applied at the mean as the point of approximation, having first scaled prices, income, and time to equal unity at the point. In addition, the shares are replaced by the estimated values, which correspond to the constant term in the AIDS model. In equation (9),  $S_{ik} = c_{ik} + w_i w_k$  and  $\partial q_i / \partial M = (b_i + w_i) / P_i$ , so that with normalised prices, at the mean, the weak separability restrictions in (4) take the specific form:

$$(c_{ik} + w_i w_k)(b_j + w_j) - (c_{jk} + w_j w_k)(b_i + w_i) = 0. \tag{10}$$

With income elasticities defined as

$$\frac{\partial q_i}{\partial M} \frac{M}{q_i} = \frac{b_i}{w_i} + 1, \tag{11}$$

the homotheticity restrictions in (8) take the form

$$\frac{b_i}{w_i} - \frac{b_j}{w_j} = 0. \tag{12}$$

The testing procedure is as follows. For benchmark estimates, we impose homogeneity and symmetry (which, in the presence of the adding-up restriction imposes homogeneity). We then check for negativity as a way to validate the model, since imposition of curvature conditions in large demand systems is very difficult, although possible in principle (Lau, 1978). Finally, we impose the restrictions in (10) to test for non-homothetic weak separability and subsequently add the restrictions in (12) to test for homothetic weak separability, comparing both results to those from the benchmark model.

### 5. Data

Annual trade data (in terms of quantities and value) are from the United Nations trade data system which uses the Standard International Trade Classification (SITC) No. 0711 for green coffee. The available sample period is 1962-1993 for the US and 1962-1990 for Germany. Producers are classified according to the dominant variety of coffee grown. Information about the variety of coffee exported from each country comes from the USDA's *World Coffee Situation*. Population and exchange rates are from the IMF's *International Financial Statistics Yearbook*. Prices used are import unit values derived from the trade data. Data limitations require that the roaster-importers of coffee are used as a proxy for the coffee consumer. For the tenets of demand theory to hold, it is assumed that marketing margins for all coffees are the same percentage of the price paid by importers. This condition will ensure that elasticities at the importer level are identical to those at the retail level.

## 6. Empirical results

The model is estimated with the full-information maximum likelihood procedure. For the unrestricted model, a total of 238 parameters are estimated in fourteen equations (parameters in the fifteenth equation are computed using the restriction of adding-up).

Validation of the model is presented by observing goodness-of-fit, the existence of serial correlation of the error term, and curvature properties of the utility function (Table 3).  $R^2$  values indicate satisfactory to good fit for most of the estimated equations, with the German model providing more explanatory power than the US model. Durbin-Watson statistics indicate that serial correlation is a problem in many of the equations in both models.<sup>2</sup> Table 3 also presents eigenvalues computed from the matrix of Allen-Uzawa substitution elasticities, which were calculated at the sample mean points. Negative eigenvalues indicate that the matrix is negative semi-definite. Two eigenvalues are positive in the US model, and one is positive in the German model. The concavity property, therefore, is not satisfied in either model.

Test results for weak separability appear in Table 4. Non-homothetic weak separability is rejected in both models for all separability structures tested, even when the corrected likelihood test statistic is considered. This implies that roasters – the proxy for coffee consumers – may take both variety and country of origin into account simultaneously when formulating their demands, rather than allocating expenditure to varieties at a stage prior to that in which they select by country of origin. When homotheticity restrictions are also imposed, the separability restrictions are similarly rejected in all cases. This suggests that commodity aggregation, as proposed in group-

Table 3. Validation statistics

Equation number	US Model		German Model	
	$R^2$	D.W.	Eigenvalue	Eigenvalue
1	0.72	1.02	-36.3	2.06
2	0.57	1.89	-29.1	1.28
3	0.74	1.35	-169.8	1.20
4	0.60	2.01	-87.0	0.86
5	0.15	1.80	-111.8	1.88
6	0.75	1.35	-80.0	1.68
7	0.72	0.87	-31.2	1.49
8	0.33	0.51	-48.8	1.25
9	0.45	1.98	12.5	2.02
10	0.40	1.13	-34.3	1.47
11	0.72	1.53	-30.5	2.15
12	0.43	1.58	-2.7	1.58
13	0.20	1.81	2.3	1.95
14	0.12	0.58	-14.8	1.34

Table 4. Results of weak separability tests

Separable groupings	Number of restrictions	Critical value ( $\chi_{0.5}$ )	US Model		German Model	
			$\psi$	$\psi^*$	$\psi$	$\psi^*$
<b>(a) Test for non-homothetic weak separability</b>						
1	49	66.34	144.62	71.18	180.56	79.37
2	63	82.53	184.76	93.82	248.86	113.70
3	75	96.22	205.34	107.02	252.41	119.06
<b>(b) Test for homothetic weak separability</b>						
1	62	81.38	190.40	96.45	214.85	97.88
2	75	96.22	217.44	113.32	289.86	136.52
3	86	108.60	234.20	124.83	298.98	145.01

ings 1, 2, and 3, are not appropriate for obtaining accurate demand estimates with this model.

Marshallian elasticities for the US and German models, with only symmetry and homogeneity imposed, appear in Table 5. In both models, all own-price elasticities have the correct sign and thirteen out of fifteen of these elasticities in each are statistically significant. Perhaps the most interesting result is how small these elasticities are. Econometric studies typically treat coffee as a homogeneous good, implying highly elastic export demands. In all cases found here, elasticities are less than 3.0 and in five cases less than unity. Of the 210 cross-price elasticities in each model, 109 (in the US model) and 100 (in the German model) were negative, reflecting (gross) complementary relationships. Signs on the compensated cross-price elasticities, which reflect net complementarity and substitutability, indicate slightly fewer complementary relationships: 102 (61 pairs of goods) in the US model, and 96 (48 pairs) in the German model. *A priori* expectations were that substitution relationships would dominate cross-price elasticities within varieties. This generalisation does not hold. Only six of the fifteen expenditure elasticities are significantly different from zero in each of the models. Coffees from different countries are viewed as both normal and inferior goods. Remaining estimation results – coefficients on trend variables and associated *t*-statistics – are presented in Table 6.

## 7. Conclusion

This study attempted to use weak separability tests to establish an appropriate commodity aggregation for use in a coffee demand system. Three different separable groupings selected *a priori* were tested, and separability restrictions were rejected, supporting Pudney's (1981) observation that separability is generally rejected. The implication for the modelling of coffee

Table 6. *Coefficients on trend variables*

Index number	US Model		German Model	
	Coefficient	t-statistic	Coefficient	t-statistic
1	0.003	13.57	-0.010	-4.96
2	0.001	5.29	-0.001	-0.35
3	0.001	8.36	-0.001	-0.17
4	0.004	9.75	-0.002	-1.07
5	0.002	4.62	0.007	3.34
6	0.001	3.52	0.002	1.28
7	0.006	7.43	-0.005	-1.11
8	-0.001	-1.67	0.001	0.63
9	0.004	3.23	-0.008	-1.54
10	-0.000	-0.94	0.002	0.51
11	0.000	0.51	0.001	0.61
12	0.002	6.18	-0.038	4.22
13	0.000	0.32	0.003	2.23
14	0.001	3.20	0.003	2.39

markets using this data set is that all producers should be included simultaneously in the demand estimation. Among the limitations of this study was the reliance on a single functional form (AIDS). Future work might consider other functional forms, other commodity aggregations within the broader coffee category, and tests to ensure that coffee is separable from all other goods.

Own-price elasticities suggest that even small producers of coffee may not face perfectly elastic demand curves. Although parameters estimated here are insufficient to establish total export demand elasticities, it is probably the case that many countries may not increase supply without adversely affecting export price. This points to the utility of supply-restricting policies such as the quotas established in International Coffee Agreements. Cross-price elasticities indicate the presence of complements among products of different countries. If correct, this suggests that producers may be limited in the ability to increase exports unless there are favourable changes in prices and supplies of coffees that are complementary.

Notes

1. Homothetic weak separability, in which expenditure elasticities within sub-groups are equal, is both a necessary and sufficient condition for multi-stage budgeting. This is often viewed as too restrictive, and the more general condition of non-homothetic weak separability has received more attention in the empirical literature.
2.  $R^2$  and Durbin-Watson statistics, when used in a system context, serve only as an approximation of goodness-of-fit and serial correlation problems. This is because system estimation in general does not minimise the error sum of squares, nor is it the case that the sum of residuals is zero for each equation (Berndt 1990: 468).

Table 5. *Uncompensated elasticities for US and German models*

	US Model	German Model
$p^1$	-1.06*	1.07*
$p^2$	0.59*	-0.90*
$p^3$	-1.78*	-0.57
$p^4$	-1.02*	-0.87*
$p^5$	3.28*	-0.69*
$p^6$	-0.86*	-0.52*
$p^7$	0.48	-1.76*
$p^8$	0.61	0.41
$p^9$	-0.88*	-1.05*
$p^{10}$	0.53*	-1.21*
$p^{11}$	-0.18	-0.42
$p^{12}$	-0.12	0.34*
$p^{13}$	-0.30*	0.18
$p^{14}$	-0.18	-0.42
$p^{15}$	-0.12	0.18
$p^1$	0.61	-0.48*
$p^2$	0.86*	-1.07*
$p^3$	-0.88*	-1.05*
$p^4$	-1.16*	-1.76*
$p^5$	-0.82	-1.45*
$p^6$	-1.30*	-0.52*
$p^7$	-0.75*	-2.70*
$p^8$	-1.04	0.61
$p^9$	0.34*	2.77*
$p^{10}$	-0.42	0.79*
$p^{11}$	0.18	0.38
$p^{12}$	0.34*	0.56*
$p^{13}$	0.34*	0.26
$p^{14}$	-0.42	0.56
$p^{15}$	0.18	0.73*
$p^1$	-0.12	0.18
$p^2$	-0.30*	0.73*
$p^3$	-0.18	-0.24
$p^4$	-0.12	0.18
$p^5$	-0.30*	0.73*
$p^6$	-0.18	-0.24
$p^7$	-0.12	0.18
$p^8$	-0.30*	0.73*
$p^9$	-0.18	-0.24
$p^{10}$	-0.12	0.18
$p^{11}$	-0.30*	0.73*
$p^{12}$	-0.18	-0.24
$p^{13}$	-0.12	0.18
$p^{14}$	-0.30*	0.73*
$p^{15}$	-0.18	-0.24

\* Asterisks indicate significance at the 5 per cent significance level.

A first-difference specification of both models was attempted in order to reduce serial correlation. Unfortunately, convergence problems made it impossible to achieve acceptable results. Thus, our test results must be viewed in the light of this specification problem.

## References

- Berndt, E. R. (1990). *The Practice of Econometrics: Classic and Contemporary*. New York: Addison-Wesley.
- Blackorby, C., Primont, D. and Russell, R. R. (1978). *Quality, Separability, and Functional Structure: Theory and Economic Applications*. New York: North Holland.
- Deaton, A. and Muellbauer, J. (1980). *Economics and Consumer Behaviour*. Cambridge: Cambridge University Press.
- De Graaff, J. (1986). *The Economics of Coffee*. Wageningen; Pudoc.
- Eales, J. S. and Unnevehr, L. J. (1988). Demand for beef and chicken products: Separability and structural change. *American Journal of Agricultural Economics* 70: 521–532.
- Goddard, E. W. and Akiyama, T. (1989). United States demand for coffee imports. *Agricultural Economics* 3: 147–159.
- Goldman, S. and Uzawa, H. (1964). A note on separability in demand analysis. *Econometrica* 32: 387–398.
- Green, H. A. J. (1976). *Consumer Theory*. New York: Macmillan.
- International Monetary Fund (1994). *International Financial Statistics, 1993*. Washington, DC: IMF.
- Kalenda, P. K. (1991). The Demand for Coffee and Product Differentiation by Product Characteristics and Country of Origin. M.Sc. thesis. University of Guelph.
- Lafontaine, F. and White, K. J. (1986). Obtaining any Wald statistic you want. *Economic Letters* 21(1): 35–40.
- Lau, L. (1978). Testing and imposing monotonicity, convexity, and quasi-convexity constraints. In M. Fuss and D. McFadden (eds), *Production Economics: A Dual Approach to Theory and Applications*, Vol. 2. Amsterdam: North Holland, 409–452.
- Leontief, W. (1947). Introduction to a theory of the internal structure of functional relationships. *Econometrica* 15: 361–373.
- Marshall, C. F. (1983). *The World Coffee Trade: A Guide to the Production, Trading, and Consumption of Coffee*. Cambridge: Woodhead-Faulkner.
- Moschini, G. and Moro, D. (1993). Food Demand System for Canada. Technical Report 1/93. Polish Branch Agriculture Canada, Ottawa.
- Moschini, G., Moro, D. and Green, R. D. (1994). Maintaining and testing separability in demand systems. *American Journal of Agricultural Economics* 76: 61–73.
- Nayga, R. M. and Capps, Jr, O. (1994). Tests of weak separability in disaggregated meat products. *American Journal of Agricultural Economics* 76: 800–808.
- Pudney, S. (1981). An empirical method of approximating the separable structure of consumer preferences. *Review of Economic Studies* 48: 561–571.
- USDA (various years). *World Coffee Situation*. Washington, DC: United States Department of Agriculture.
- Daniel Sellen  
Economic Development Institute  
Room M5-093  
The World Bank  
1818 H Street N.W.  
Washington, D.C. 20433  
USA

## Book reviews

**J. C. M. van Trijp**  
**Variety-seeking in Product Choice Behaviour: Theory with Applications in the Food Domain**

Mansholt Studies No. 1, Wageningen Agricultural University, 1995. ISBN: 90 6754 391 8, 209 pp., Price: Hfl 48.50.

This book addresses the issue of variety-seeking in people's choices of food products; specifically it is concerned with people's interests in variety seeking *per se* (variety-seeking behaviour), rather than in variety-seeking as a result of instrumental motives (derived varied behaviour). Here 'derived varied behaviour' refers to extrinsically-motivated changes in behaviour (e.g., due to situational factors) while 'variety-seeking behaviour' is 'the biased behavioural response by some decision-making unit to a specific item relative to previous response within the same behavioural category, or to a set of items consumed simultaneously, due to the utility inherent in variation *per se*, independent of the instrumental or functional value of the alternatives or items, and is a function of psychological processes' (p. 9).

The author (i) addresses a number of definitional and conceptual problems in the existing literature, (ii) develops his own hypotheses about the inter-relationships between variety-seeking behaviour, various products, situation and person factors, variation in food consumption and brand switching, and (iii) reports some empirical work addressing these hypotheses. Crucial to variety-seeking behaviour (as it is defined here) are the motives underpinning this behaviour: people's intrinsic interest in variety-seeking is related to relief from boredom, to attribute satiation and to satisfaction of curiosity. These issues are fleshed out with reference to the gap between people's 'optimal stimulation levels' and their actual level of stimulation, and how variety-seeking behaviour may help to meet 'a need for stimulation'.

The book is directed at those concerned with marketing – since the preamble sets the issues in the context of brand choice and brand loyalty – and the orientation adopted combines both marketing and psychological perspectives. However, many of the themes relevant to variety-seeking should be of interest to researchers in other disciplines: the author raises a variety of thought-provoking issues for those involved in the study of choice behaviour (more generally) and food selection (more specifically). Indeed, despite the ostensible product marketing angle, the VARSEEK scale that the author develops (a domain-specific measure for tapping consumers' variety-seeking tendency with respect to foods) does not directly relate to brands and products as such but more, it seems, to variation at the level of foods and meals. This apparent discrepancy is not directly addressed, nor is there much detailed discussion of the scale itself (other than the technical details of its relation to other scales and measures). Furthermore, the questionnaire items devised by the author to tap variety-seeking motives as distinct from other motives are not critically assessed in any great depth.

Texas A&M University Campus Libraries  
Courier



ILLiad TN: 374261

**Journal Title:** Policy Studies Journal

**Volume:** 3

**Issue:** Winter

**Month/Year:** 1974

**Pages:**

**Article Author:** Hermann, Charles F.

**Article Title:** What Decision Units Shape  
Foreign Policy: Individual, Group, or  
Bureaucracy?

**Call #:** H1 .P72

**Location:** evans

**Not Wanted Date:** 08/23/2004

**Status:** Graduate/Professional Student  
**Phone:** 979-458-8031  
**E-mail:** btaddese@bushschool.tamu.edu

**Name:** Binyam Taddese

**Pickup at PSEL**

1000 E University #901  
College Station, TX 77843



MOOREHEAD, W. S. (1974) "Operation and reform of the classification system in the United States," pp. 87-113 in Frauck and Weisband (1974b).

THOMSON, JAMES C. "How could Vietnam happen? An autopsy," pp. 98-110 in Morton H. Halperin and Arnold Kanter, eds., Readings in American Foreign Policy: A Bureaucratic Perspective. Boston: Little, Brown.

WISE, D. (1973) The Politics of Lying: Government Deception, Secrecy, and Power. New York: Random House.

WHAT DECISION UNITS SHAPE FOREIGN POLICY:  
INDIVIDUAL, GROUP, BUREAUCRACY?

Charles F. Hermann  
Ohio State University

Contending Perspectives. The surge in literature on bureaucratic politics has accelerated consideration of the role of governmental structures and processes in foreign policy. One such approach studies bureaucratic organizations (decision unit structures) and their processes (bureaucratic politics) to explain how organizational arrangements affect foreign policy outputs (e.g. Halperin, 1974; Hilsman, 1967; Neustadt, 1960). Policymakers, the bureaucratic perspective contends, normally work in the context of large and often competing bureaucratic organizations. With their outlook on international affairs shaped by their department or agency, these individuals struggle to establish policies that will protect, if not advance, the basic interests of their governmental unit. Thus the "resultant" (or content of policy) "is not chosen as a solution to a problem but rather results from compromise, conflict, and confusion of officials with diverse interests, and unequal influence" (Allison, 1971: 162). The advocates of the bureaucratic politics perspective assert that the process by which policy is made is not neutral, but has a profound impact on the resultant. A question of extreme importance if such insights are to be useful is, when, or under what conditions, will the bureaucratic players be a decisive force?

Other studies have underscored the impact of small group processes (e.g. Byars, 1973; de Rivera, 1968; Paige, 1968; Verba, 1961). For example, the psychologist Irving Janis (1972: 9) suggests that some major failures in American foreign policy decisions resulted from excessive concurrence-seeking among members of small, cohesive policy groups. Their decision process led to a "deterioration of mental efficiency, reality testing, and moral judgment." In contrast to the conflict and bargaining of bureaucratic politics, then, Janis attributes powerful effects to strongly shared norms and cohesion among the participants.

Still another perspective is introduced by investigators who study the policy process from the level of individual policymakers (e.g. George, 1969; Hermann, 1974; Ståssen, 1972). In this view policy depends upon individual characteristics such as operational codes, personality traits, or modes of conducting interpersonal relationships. As Barber (1972: 6) declares, "a President's personality is an important shaper of his Presidential behavior on non-trivial matters." In sum, a decision may be the manifestation of the personal characteristics of a key decisionmaker who is little affected by either the pulling and hauling of bureaucratic politics or the pressure of a small group to conform to its norms.<sup>1</sup>

These brief references to the effects on foreign policy of bureaucratic politics, small group dynamics, and personal characteristics reveal potential conflict among the alternative kinds of explanations they employ. Although simplified here and hence exaggerating somewhat differences in their explanatory mechanism, each contributes variously in explaining foreign policy: 2 (1) Any given perspective might not contribute importantly in accounting for behavior under any identifiable conditions. (2) The perspective might interact with one or more other elements which in combination produce a distinctive impact on behavior. (3) The perspective might have a direct and important effect under specified conditions. The balance of this article briefly explores the third possibility.

Limiting Conditions. Each perspective identifies a decision unit employing a more or less distinctive process. Bureaucratic politics involves participants from independent governmental organizations having autonomous goals. The participants adhere to their organization's goals and seek to further them. Action results from political bargaining and maneuvering among the bureaucratic players. Small group decisionmaking (of which "groupthink" is but one possible consequence) involves a set of individuals who interact--frequently face-to-face--and who share norms about appropriate group behavior. All members attach high value to the group and its abilities to perform decision tasks. Action results from group deliberation procedures that minimize lasting disharmony in the group. Finally, individual choices reflect the preferences of a single person regardless of whether the decisions are ratified by some collectivity. Action results from efforts of the individual to fulfill his basic motives, values, beliefs, attitudes, and modes of cognition.

Two basic conditioning variables may differentiate the circumstances under which these alternative decision units emerge. They are the nature of the situation and the stages of policy. By situation is meant the transitory elements of a government's environment associated with the occasion for decision. Elsewhere (Brady, 1973; Hermann, 1969, 1972) various specific situational properties have been described and their implications examined, but in this discussion they will be collapsed into crisis and noncrisis.<sup>3</sup> In a crisis the threat to major governmental goals results in the increased likelihood that high-level policymakers will become involved. Furthermore, the limited time for a decision in crisis and the importance of secrecy act to limit the overall number of participants. These characteristics predispose the decision process--with some important qualifications to be noted below--toward either small group or individual decision units. By contrast, in noncrisis situations, more people are likely to become involved but without officials from the highest levels of the government. Other things being equal, these features of a noncrisis tend to increase the participation of representatives from multiple bureaucratic organizations. High-level participation tends to minimize bureaucratic politics because such policymakers are less likely to identify their future careers with the well-being of one particular bureaucracy and are more likely to feel a direct, personal responsibility to the head of state who often can directly affect their tenure in office and/or the authority they exercise. When the time available for handling a policy issue is not constrained (as it is in a crisis), more bureaus have time for appraising the situation in terms of their own

interests and their expressions of desire to participate in the decision process can less readily be disregarded.

The stages of policy comprise a conditioning variable that refers to the sequence of activities that are involved in treating a policy problem. Various ways for classifying the decision process have been advanced but for this essay a simplified three-stage distinction will be used. First, is the problem identification and elaboration phase in which various intelligence and analysis activities play a central role. In societies with large and complex governmental structures, this stage normally involves bureaucratic organizations regardless of the situation. The second stage involves the activities associated with the actual decision or choice. It includes the enumeration and evaluation of alternatives as well as the selection of one. Implementation, as a third stage, involves those activities judged to be appropriate to carry out the preferred option. Different kinds of decision units can, and often are, involved in different stages of policy.

To evaluate more clearly the impact of the last two stages on the probable decision unit, an additional variable needs to be considered with reference to each phase. During the actual selection of an alternative (decision stage), it is important to establish how power is distributed among the participants. If there is an hierarchy in which one individual is dominant and all others are subordinate to him, then the individual decision unit tends to be dominate in both crisis and noncrisis situations. On the other hand, if there is a rough equality in the power of those participating in the choice selection (i.e. no person is in a position to dictate his choice regardless of the preferences of all the others), then the probable decision unit will be different in crisis than in noncrisis. In a crisis, the small number of high-level policymakers leads naturally to the small-group form of decisionmaking. For a noncrisis, the participants may meet in groups, but they will be representatives of different bureaucratic organizations. Bureaucratic politics will prevail.

Once a decision is reached, energy is directed to implementation. Some policies require verbal actions only whereas others entail physical resource allocation. The physical resources include both human and nonhuman resources and their utilization in foreign policy in any but the most minimal way involves considerable coordination, communication, and control. In brief, it requires the supervision of complex organizations. Because such assignments seldom appear neutral to the well-being of governmental agencies, they trigger bureaucratic politics to either obtain, avoid, or reinterpret the directive. In crises where political leaders recognize that the stakes are high for themselves and their regimes, efforts to control and limit bureaucratic initiatives contrary to the wishes of those who made the decision occur with more or less success. Without a crisis, however, the constraints on bureaucratic politics in the implementation of a decision are minimal.

Precisely because the decisionmakers in a crisis recognize the importance of maintaining control over the execution of their decision, delegation of actions requiring only verbal behavior is either nonexistent or restricted to trusted associates. The speech, negotiation, or message in a crisis is normally the product of one individual or a small group.

The variables considered in this essay do not give a clear picture of the probable decision unit responsible for implementing a verbal decision in a noncrisis. A general assumption has been that the attributes of a cohesive group are less likely to emerge when the participants are middle-level officials whose careers are based in different organizations. This assertion appears to stress interaction among bureaucratic organizations. But, if the stakes for any bureau, agency, or organization are low (little threat), then the possibility of a determined individual affixing his imprimatur on implementation increases. Similarly, if a small, cohesive group exists, it too could take over the execution of a decision.

#### FOOTNOTES

Janis (1972: 196) also notes that leadership personality may be an alternative explanation for behaviors he attributes to "groupthink," and proposes future research on internalized group norms vs. convergence on the leader's actual or putative desires.

Of course, many other elements have been either hypothesized or shown to influence certain types of foreign policy behavior. Much of the work on these three perspectives has focused almost exclusively on American policy. Serious challenges can be raised about their relative adequacy for other nations, requiring consideration of the impact of political regime differences, national attributes, and so on. In this essay, however, attention is restricted to alternative decision units operating within governments.

Crisis situations are those involving a high threat to goals of the government, short decision time, and surprise to the policymakers (Hermann, 1969). Here noncrisis is a residual category of all other situations.

#### REFERENCES

- ALLISON, G. (1971) *Essence of Decision*. Boston: Little, Brown.
- BARBER, J. D. (1972) *The Presidential Character*. Englewood Cliffs: Prentice-Hall.
- BRADY, L. P. (1974) *Threat, decision time, and awareness*. Unpublished doctoral dissertation, The Ohio State University (March).
- BYARS, R. S. (1973) "Small-group theory and shifting styles of political leadership." *Comparative Political Studies* 5 (January): 443-469.
- DE RIVERA, J. H. (1968) *The Psychological Dimension of Foreign Policy*. Columbus: Charles Merrill.
- GEORGE, A. L. (1969) "The 'operational code': a neglected approach to the study of political leaders and decision-making." *International Studies Quarterly* 13 (June): 190-222.
- HALPERIN, M. H. (1974) *Bureaucratic Politics and Foreign Policy*. Washington: Brookings Institution.
- HERMANN, C. F. (1969) "Crisis as a situational variable," pp. 409-421 in J. N. Rosenau (ed.) *International Politics and Foreign Policy*. New York: Free Press (rev. ed.).

- HERMANN, C. F. (1972) *International Crises*. New York: Free Press.
- HERMANN, M. G. (1974) "Leader personality and foreign policy behavior," in J. N. Rosenau (ed.) *Comparing Foreign Policy*. Beverly Hills: Sage.
- HILSMAN, R. (1967) *To Move a Nation*. New York: Doubleday.
- JANIS, I. L. (1972) *Victims of Groupthink*. Boston: Houghton Mifflin.
- NEUSTADT, R. (1960) *Presidential Power*. New York: Wiley.
- PAIGE, G. D. (1968) *The Korean Decision*. New York: Free Press.
- STASSEN, G. H. (1972) "Individual preferences versus role-constraint in policy-making." *World Politics* 25 (October): 96-119.
- VERBA, S. (1961) *Small Groups and Political Behavior*. Princeton: Princeton University Press.

THE JOINT CHIEFS OF STAFF: ACCESS  
AND IMPACT IN FOREIGN POLICY

Lawrence J. Korb  
U.S. Coast Guard Academy

The principal military input into the foreign policy process normally comes from the four man Joint Chiefs of Staff (JCS). This essay analyzes the role of the JCS in this process by discussing three interrelated areas: the sources of the Chiefs foreign policy preferences; the manner in which these preferences are conveyed to the key decisionmakers; and the impact of the JCS upon foreign policy. Most of the data for this analysis comes from interviews conducted with thirteen retired Chiefs in the period from 1968 through 1974.

Sources. The foreign policy positions of the members of the JCS are primarily the result of a desire to protect and enhance the interests and essence of their own services. During the post-SALT II debates over future U.S. strategic policy, the Chief of Naval Operations (CNO), Admiral Zumwalt, argued that the ICBM was becoming obsolete and that this nation ought to rely for deterrence on the Navy's SLBM. Air Force Chief of Staff, General Brown, countered with the proposition that his studies demonstrated that the Air Force's ICBM would be invulnerable through 1990. Since the interests of three military services are often not identical, the JCS sometimes deliver split opinions. However, when the Chiefs see that their splits will be capitalized upon by civilian officials, they usually compromise their differences and present a united military front to the civilian policymakers. During the 1960s, the JCS unanimously agreed that this nation needed a new manned bomber for the Air Force, nuclear powered aircraft carriers for the Navy, and an ABM for the Army even though some of the Chiefs had strong reservations about each of these systems. The JCS did this because they knew that Secretary of Defense McNamara was opposed to all three programs and would attempt to use dissent among the JCS to legitimize his own opinion.

When one looks at the backgrounds and responsibilities of the JCS, it is not surprising that service interests are the

source of their policy preferences. Since the establishment of the JCS in 1947, 30 men have been appointed to it. The average age of these officers at the time of their appointment was 54 with an average of 33 years of commissioned service. Only two men have ever been selected to the JCS before reaching their 50th birthday or with less than 30 years of service. Ninety per cent of the Chiefs have been graduates of either West Point or Annapolis at a time when these academies offered only a single-track, technical curriculum almost devoid of socio-humanistic courses. Only one of these officers had any post-graduate training outside of the military's own professional, staff, or War Colleges. All of the Chiefs have been combat-oriented line officers whose main accomplishment was demonstrated expertise in the weapons systems peculiar to their own services. Few of these men had any significant or extensive staff, joint, or nonmilitary experience. Finally, the advancement of all of these officers to the top ten positions in their services, from which the President usually chooses his Chiefs, is rigidly controlled by the services.

As a result of their 30 to 40 years of association with their service, most members of the JCS are unable or unwilling to rise above service particularism. All of the Chiefs, except the Chairman, wear two hats. In addition to being the principal military advisers to the policymakers, they are also the military heads of their own services, which they perceive as their primary role. In spite of a 1958 law that specifically directs them to give priority to their joint function, the service Chiefs devote most of their time and energy to running their own services. Admiral Radford, the only man to be selected for Chairman without having first served as service chief, was bitterly disappointed and spent much of his time as Chairman trying to run the Navy. Moreover, each time that a suggestion is made that the JCS formally divest themselves of their service responsibilities, the Chiefs resist it strongly.

Even if an individual officer were capable and desirous of rising above his service background when he reached the JCS, the political realities of his position make it nearly impossible to do so. Before each JCS meeting, service chiefs are traditionally briefed by their own service staffs rather than the Joint Staff. Members of the service view their military head as their "chief lobbyist" and look with great disapproval on any of his actions that might undermine their service position. When Admiral Denfeld, CNO from 1947 to 1949, accepted the decision of Secretary of Defense Louis Johnson to cancel a supercarrier, his admirals "revolted" and took the Navy's case to the public and the Congress, without Denfeld's permission, and Harry Truman fired Denfeld for losing control of his service (Hammond, 1963: 546).

The Chairman of the JCS, with no service responsibilities, is expected to rise above the parochialism of his service. However, members of his service still look to the chairman to represent their views and he usually does. Military leaders, recognizing this, have urged that the chairmanship be rotated among the three services. When Maxwell Taylor broke the rotation pattern by coming out of retirement in 1962 to succeed another Army general as Chairman, he incurred the wrath of officers of all the services. It is more than coincidence that the Navy emerged with the largest share of the defense budget during the Nixon administration when Admiral Moorer was the Chairman. Likewise, the Army prospered during the Kennedy and Johnson years when Army Generals Taylor