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Sonderforschungsbereich 178 "Internationalisierung der Wirtschaft"

Diskussionsbeiträge



Juristische Fakultät Fakultät für Wirtschaftswissenschaften und Statistik

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An Econometric Analysis of West-German Coffee Imports

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GERD RONNING, KONSTANZ

ABSTRACT

The paper analyses German imports of green coffee using both descriptive statistical and econometric tools. As determinants of import demand we consider not only prices and income but also the structure of the German market of roasted coffee and two institutional arrangements which had considerable influence on German coffee imports. One is the International Coffee Agreement and the other is the Lome Convention.

West-German coffee imports which have grown steadily over the last three decades play an important role in world coffee demand. However, the demand structure differs from that of many other countries. In Germany high qualities have a much larger share of imports although the distribution of shares of export countries has changed, especially during the last ten years. A descriptive statistical analysis shows that this change has affected the shares of the four broad categories of coffee (Columbian Mild, Other Milds, Unwashed Arabica, Robusta), but also the distribution of shares within each category. Change of import shares within categories has mostly been confined to the two 'medium' qualities (Other Milds and Unwashed Arabicas) where ACP countries have increased their exports to Germany since enforcement of the Lome Convention in 1975. Most ACP countries in the two other categories (Columbian Milds and Robustas) have not experienced such a positive development. On the contrary, Indonesia which does not belong to this group has become one of the most important exporters of Robusta coffee to Germany during the last ten years. Quotas set by the International Coffee Agreement have favoured countries exporting unwashed coffees (with Brazil as the dominant exporter). This had especially severe effects for Germany which prefers washed coffees.

Using annual data for the period 1966 to 1987 an hierarchical import allocation model is estimated where at the upper level demand for the four types of coffee is determined whereas at the lower level country-specific demand is explained. Beside the usual explanatory variables in econometric demand systems we also consider the effect of ACP membership and the influence of quota set by the International Coffee Agreement. Estimation results based on Deaton and Muellbauer's 'Almost Ideal Demand System' show that price and income reactions are quite different for the four qualities. We test the hypotheses of separability with respect to the four types of coffee and find this hypothesis to be acceptable. This allows us to estimate subsystems which determine country-specific demand for certain types of coffee. Contrary to theoretical considerations ACP membership has some influence on the countryspecific import demand structure.

AN ECONOMETRIC ANALYSIS OF WEST-GERMAN COFFEE IMPORTS

GERD RONNING, KONSTANZ¹

1. INTRODUCTION

The world coffee market is one of the largest agricultural markets. Coffee is produced mostly in LDC's many of which receive a considerable share of income from coffee exports. It has become one of the most important (non-alcoholic) beverages at least in industrialized countries although health considerations have hindered a further increase of per capita consumption in some countries during the last decade. This is true in particular for the United States² which absorb approximately one third of total coffee exports followed by West Germany which consumes about 10 %. However, the composition of imports differs a lot between these two countries.³ Moreover, it has changed over time. In this paper we consider the German coffee import⁴ structure and factors influencing it. Beside economic variables such as prices and national income institutional factors like the International Coffee Agreement (ICA) or more general trade agreements have to be taken into account. With respect to the latter the Lome convention which started in 1975 has had some impact on the coffee market as will be shown below.

Most studies so far have analysed total import of coffee for a certain country. Parikh (1974) estimated a simultaneous equation system of imports and exports based on monthly, quarterly and yearly data. He also considered the effects of inventories and of quotas set by the International Coffee Agreements. Imports of European countries were only taken as an aggregate. A much more refined approach based on a micro-economic model was taken up

- 2Additionally, strong price competition in this country led to lower qualities of coffeee which induced many consumers to switch to other beverages.
- 3See Mwandha, Nicholls and Sargent (1985, table 6.4 and appendix 16) for the import composition of the US and of European countries in 1980. For example, Columbian Milds represented 48 % of German (net) imports whereas the corresponding figure for the US was only 19 %.
- 4We are really interested in the 'disappearance' of coffee for Germany. Even if we consider net imports which adjust for re-exports these two flow variables differ by the amount of change of inventories. See the discussion in section 2.1.

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by Palm and Vogelvang (1986) who presented results for single importing countries including West Germany. In particular they considered future prices in order to model the price formation. A special characteristic of their work was an identical specification for all countries. Quarterly data were used throughout. Akiyama and Duncan (1982) have estimated and projected the world coffee market for some subgroups of European countries. It is worth mentioning here that their estimation results based on yearly data differ from those obtained by Palm and Vogelvang with respect to price effects and income elasticities⁵ which could be due to aggregation (over time and countries).

Any analysis of the coffee market cannot neglect the influence of institutional factors. Various measures of price instability indicate that in relation to other commodities the price of coffee has been rather stable over time⁶ although International Coffee Agreements have been valid only for some intervals and export quotas have been effective during even less time⁷. This indicates that the agreements have mainly followed the market conditions and 'cannot be expected to stabilize market prices in the face of a long-term imbalance between supply and demand' (Akiyama and Duncan 1982, p. 37). On the other hand the more general trade agreement of Lome has had considerable impact on the coffee market at least from a German point of view. A special arrangement allowed the so-called ACP countries⁸ to export coffee to Germany free of import duties⁹. Clearly the consequences of this arrangement can only be analysed if one discriminates between ACP and non-ACP members. This is possible in our analysis since each export country is considered separately. Empirical research is based on yearly data which to a large extent avoid the problems arising from seasonal effects¹⁰ and which show more clearly the medium-term development of the market.

In this paper we focus on the German import structure, that is we are interested in the import shares of the various coffee producing countries and the causes for their changes with regard to West-Germany. We therefore estimate an econometric demand system which takes those influences into consideration. Besides the usual explanatory variables, income and prices, we also recognize the influence of institutional factors such as the International Coffee Agreement and the Lome convention. In order to keep the analysis tractable we assume that German importers follow a two-stage procedure in determining their imports: In a first stage they fix demand for the four types of coffee (Colombian Milds, Other Milds, Unwashed Arabicas and Robustas) and in a second stage demand for a certain type is distributed over the corresponding countries. Of course, this approach is only legitimate if separability assumptions are met which have to be tested.

- 5Palm and Vogelvang (1986, pp. 461-462) found an insignificant coefficient for the income variable and an significant price effect whereas Akiyama and Duncan (1982, p. 12) obtained an significant coefficient only for the explanatory variable income regarding most groups of countries.
- 6See, for example, Newberry and Stiglitz (1981, pp. 287-292).
- 7Quota schemes were effective from 1962 to December 12, 1972, from October 1, 1980, to February 19, 1986, and from October 6, 1987 until the present(summer 1989).
- 8ACP abbreviates "A"frican, "C"aribean and "P"acific. For a list of ACP countries exporting coffee see table 2.1 below.
- 9See Hasse and Weitz (1978, p.148) and Jahresbericht (1977, p.11). The rate of the import duty on green coffee is 4.5 % ad valorem.
- 10Akiyama and Duncan (1982, p.11) who also use yearly data point out that the 'coffee year' varies over regions and in no case matches with the calendar year. In this version of the paper we use data for the years 1966 to 1987.

The paper is organized as follows: Section 2 contains a descriptive analysis of German coffee imports and import prices. We also give a short characterization of the German domestic market for all kinds of roasted coffee. Section 3 describes the econometric approach. Following Winters (1984,1985) in section 3.1 a two-stage import demand structure is specified, section 3.2 discusses the modelling of institutional arrangements in demand systems, section 3.3 describes the data and the remaining subsections present the estimation results. Section 4 adds some concluding remarks.

2. THE GERMAN COFFEE MARKET

2.1 German Import Structure

The list of the 27 most important coffee exporting countries¹¹ is given in table 2.1 which also indicates the type of coffee produced¹² as well as ACP membership. Note that with the exception of Papua New Guinea all ACP members are African countries. Figure 2/1 shows that since the start of the Lome agreement in 1975 the import quantity share¹³ of ACP countries has increased considerably. The most dramatic development happened with Other Milds (see figure 2/2) which represent approximately one third of total German imports. Import shares of all four types are given in figure 2/3. Colombian Milds have gained continuously at the expense of Other Milds covering now almost 50 % of total German imports. Unwashed Arabica has regained the position it held twenty years ago whereas Robusta shows a constant level over the whole period.

The distribution of shares within each type is not presented in detail in this paper. However, the following characteristics should be mentioned: All three countries producing Colombian Milds kept their share with Colombia as the dominant exporter. As already mentioned above, ACP countries (notably Burundi, Papua-New Guinea and Rwanda) have gained a large import share of Other Milds. This share rose to more than 50 % in 1985. Within the group of Unwashed Arabicas the ACP member Ethiopia has increased its share to almost 20 % at the expense of Brazil¹⁴. For the lowest quality, Robusta, the situation is comparable to that for the highest quality: Import shares have remained constant with the exception of Indonesia. This country which is not an ACP member has become one of the largest exporters (together with the ACP members Ivory Coast and Cameroun) of this type of coffee for Germany.

¹¹Each country in that list had in at least one year during the years 1966 to 1987 an import quantity share greater than one percent.

¹²We presume that each country produces only one type. This seems to be an appropriate assumption for most countries for the past, but not for the future. For example, Brazil has started growing Robusta (about 3-4 million bags in 1986, personal communication Frieder Rotzoll). The ranking of the four types in table 2.1 corresponds to the quality ranking. Imports from Bolivia cover both Washed and Unwashed Arabicas so that this country equally well might be attached to the group of Other Milds. We followed the grouping of ICO statistics in 1977 (table I 1).

¹³We distinguish between 'quantity based shares' and 'value based shares'. The latter will be referred to just as 'shares'.

¹⁴For the years 1986 and 1987 Ethiopia reached more than 30 % of imports of Unwashed Arabicas.







TABLE 2.1: LIST OF COUNTRIES

Type of Coffee	ACP Members [§]	Other Countries	
<u>Columbian Mild</u> s	Kenya, Tanzania	Colombia	
<u>Other Milds</u>	Burundi, Papua-New Guinea [#] , Rwanda	Costa Rica, Ecuador, El Salvador, Guatemala, Honduras India	
Mexico,		nonduras, maia,	
		Nicaragua, Peru	
Unwashed Arabicas	Ethiopia	Brazil, Bolivia	
<u>Robusta</u>	Angola [#] , Cameroun, Guinea, Ivory Coast, Madagascar, Togo, Uganda, Zaire	Indonesia	
 Notes: § Membership became imports (see Jahresbe # Papua New Guinea j 1977 p. 13). Angola h 	effective in July 1975 with res richt 1976 p.11). oined the agreement in May 19 has become an ACP member or	spect to German coffee 977 (see Jahresbericht nly in 1986 (personal	

So far we have used figures related to gross imports, that is without adjusting for the quantities which were re-exported. Such figures which show the breakdown by countries are only available for the last two years (1986/87) ¹⁵. Table 2.2 compares the import quantity shares of net imports and gross imports for these two years. The table shows that for higher qualities the net shares are larger than the gross shares. This is true in particular for Colombia. On the other hand countries producing Robusta coffee have mostly smaller shares of net imports. This reveals that the data which we use in our analysis and which have been used, e.g., in figures 2/1, 2/2 and 2/3, are biased towards lower qualities. This should be observed also in section 3 where estimation results are based on gross imports.

¹⁵ Only the imported quantities but not the import values are available. See Jahresbericht (1987). There are also imports and re-exports of decaffeinated, roasted and soluble coffee which, however, are negligible in comparison to the trade in green coffee.

TABLE 2.2: COMPARISON OF GROSS SHARES AND NET SHARES

		1986		1987
	gross	net	gross	net
in	% of tota	l imports		
<u>Colombian</u> <u>Milds</u>				
Colombia	38.06	42.84	33.87	36.69
Kenya	5.65	5.69	6.34	6.84
Tanzania	3.98	3.58*	4.59	5.19
Other Milds				
Burundi	2.26	2.18*	2.33	3.38
Costa Rica	2.46	2.80	2.31	2.44
Ecuador	0.60	n.a.	0.54	n.a.
El Salvador	6.04	5.59*	5.57	5.69
Guatemala	2.58	2.68	2.05	2.24
Honduras	1.32	0.52*	0.62	0.58*
India	0.71	0.64*	0.59	0.49*
Mexico	1.66	1.00*	1.56	0.98*
Nicaragua	1.09	1.31	0.97	1.02
Peru	0.59	n.a.	0.22	n.a.
Papua-NG	4.64-	5.04	3.68	4.23
Rwanda	3.75	3.78	4.00	4.50
Unwashed Arabicas				
Bolivia	0.07	n.a.	0.03	n.a.
Brazil	8.64	8.56*	6.55	5.70 *
Ethiopia	3.70	3.74	4.42	5.06
Robustas				
Angola	0.03	n.a.	n.a.	n.a.
Cameroun	1.80	1.59*	3.89	3.52*
Guinea	0.16	n.a.	0.66	n.a.
Indonesia	3.38	2.53*	3.54	2.76*
Ivory Coast	1.97	0.71*	4.14	2.32*
Madagascar	0.18	n.a.	0.35	n.a.
Togo	0.29	n.a.	0.18	n.a.
Uganda	1.11	o.83*	1.65	1.46*
Zaire	1.74	1.23*	1.56	1.14*
total of bags(x10 ⁶)	9.45	7.55	10.23	8.12

* indicates that net share is smaller than gross share.

2.2 Prices

This subsection describes the behaviour of prices of green coffee as seen from a German importer's view. Since German import prices are not available from statistical sources, we use import unit values derived from the ratio of import value to import quantity for each year which are both published by the German Statistical Office. The same procedure was used in order to obtain prices for the four types of coffee. The corresponding time series during the time 1966 to 1987 are presented in figure 2/4. The upper part shows quotations in dollars and the lower those in Deutschmark. Due to the declining dollar the price increase¹⁶ around 1977 was less severe for quotations in Deutschmark. After 1980 the situation was different: The variability of the exchange rate led to more volatility in the Deutschmark prices.

Import prices for single countries in most cases vary around average price (of a certain type). However, there are interesting exceptions shown in table 2.3 ¹⁷. It is well known that Kenya coffee is of top quality which would explain the high price. Ethiopia, too, produces (unwashed) coffee of high quality. For Colombia quality considerations might be dominated by the very agressive marketing concept of this country leading to lower prices. Similar considerations hold for Brazil. No explanation is at hand for the successful price strategy of Zaire.

TABLE 2.3: HIGH PRICE AND LOW PRICE COUNTRIES

Type of coffee	above average	below average
Colombian Milds: Unwashed Arabicas Robustas	Kenya Ethiopia [§] Zaire ^{&}	Colombia Brazil [§]
Notes: § converse relation	n in 1975. & below	average in 1977.

¹⁶The extreme price increase in 1977 was caused by a severe frost in Brazil which destroyed most of the crop of that year.

¹⁷ For each country we calculated the ratio of value shares to quantity shares. This equals the ratio of a country's price to a quantity weighted average price. More formally, $(p_i q_i / \sum p_j q_j) / (q_i / \sum q_j) = p_i / \mu_p$ where μ_p is the weighted arithmetic mean of prices with weights $q_j / \sum q_j$, that is quantitity based shares. A high (low) price country shows values greater (less) than 1 for all years with regard to this measure.



2.3 The German Coffee Market

Roasted coffee in Germany usually consists of a composition of the four types of coffee. Roasters try to keep the shares fixed. Therefore substitution takes place only between imports from countries exporting a certain type. German roasted coffee contains large shares of high quality coffees (Colombian Milds, Other Milds) in contrast to most other countries. This is partly due to a rather high tax on coffee which is related to quantity. This reduces price differentials between high quality (strictly speaking, highly priced) coffees and lower qualities¹⁸. Consumption of soluble coffee has grown steadily although its market share is still much smaller than in other countries. For example, in 1986 it amounted to 6.4 % of total consumption¹⁹. This is one reason for the still very low import share of Robustas which preferably are used in the production of soluble coffee.

The supply structure of the German coffee market has changed drastically since World War II and in particular during the last twenty years. Traditional roasters selling coffee through food retail stores lost market shares when other roasters started distribution through own branches. At an increasing scale also food chains offered their own brands making one of them the largest supplier of roasted coffee in 1986²⁰. The increasing competition led to a declining profit margin. This could be illustrated by plotting the price ratio of roasted coffee and import coffee which is, however, not done here.²¹ The special character of coffee consumption in Germany is also illustrated by its strong positive trend therewith disregarding at least partially the dramatic price variations. Since in our econometric analysis we consider import and not consumption , it should be added here that total import showed the same trend during the observation period (1966 - 1987).

¹⁸Since 1953 the tax has been kept at DM 3.60 per kilogram. In the Sixties this rate more than doubled the import prices (cif Hamburg). During the last years prices (cif Hamburg) were at a level between DM 6.00 and DM 10.00 which still implies an increase of import prices by two thirds and one third, respectively. Compared to this the above mentioned additional charge of the import duty (4.5 % ad valorem) is of minor importance.

¹⁹Jahresbericht (1987 p.13).

²⁰Süddeutsche Zeitung, August 7, 1986. Although this development meant an increasing concentration of supply, the statistical indicators published by the German Antitrust Commission ('Monopolkommission') (market share of three/ten largest suppliers, Herfindahl coefficient, coefficient of variation) show a declining concentration. This unexpected result might be due to the omission of sales by chain-owned roasteries.

²¹The margin has been especially small when prices were reaching a peak.

3. AN ECONOMETRIC MODEL OF IMPORT DEMAND

3.1 Specification of the Model

Import of coffee from a certain country has always to be considered in connection with imports from all other countries. A demand system provides the appropriate frame. However, a direct approach which includes all countries simultaneously is not advisable. Rather one should start from some assumptions about separability of utility between groups of countries. In the case of coffee a straightforward application of this idea leads to the assumption of separability between the four types of coffee. Following Winters (1984, 1985) a two-stage²² procedure in determining demand of coffee from the different countries may be assumed: In a first stage import demand for the four types is allocated, and in a second stage the demand is distributed over the countries exporting a certain type of coffee. A crude test of the separability assumption²³ can be incorporated into the estimation of a subsystem. As shown by Winters(1984, p.246) the assumption of separability should be rejected if prices of other groups show significant influence. We also consider the demand system for the four groups, that is the first stage in the budgeting decision.²⁴

For our empirical work we use Deaton and Muellbauer's(1980) 'Almost Ideal Demand System' (AIDS) which allows imposition of demand-theoretic restrictions in an easy manner. We write this model as follows:

$$\mathbf{w}_{i} = \alpha_{i} + \sum_{k} \theta_{ik} \log(\mathbf{p}_{k}) + \beta_{i} \log(E/P) , \ i=1,..,r.$$
(3.1)

 w_i denotes the import (value) share of category i where i could be either a type of coffee or an import country within a certain subgroup. p_k denotes the price²⁵ of coffee from category k. E denotes total expenditure for coffee and therefore equals total value of coffee imports if demand for types is analysed whereas in the analysis of subgroups E equals import value of a certain type. P is a price index which depends on unknown parameters. It can be, however, approximated by the weighted geometric mean of prices (Deaton and Muellbauer 1980 p. 316) where weights are given by the import shares. α_i, β_i and θ_{ik} are unknown parameters which satisfy the usual adding-up restrictions in share equations. Furthermore demand theory asks for homogeneity and symmetry restrictions which imply further constraints onto the

²²Strictly speaking we have a three-stage procedure since the amount of the budget spent for coffee has to be determined first.

²³An exact test has to consider restrictions concerning the Slutsky matrix. See, for example, Deaton (1986 p. 1814). However, this is only feasible if the system is small since all equations have to be estimated simultaneously. To the author's best knowledge there is only one study which pursued this approach, Eales and Unnevehr (1988), who consider 5 commodity groups. In our case estimation of all 27 equations is impossible so that twostage budgeting has to be employed as"..the only sensible way to deal with very large systems..."(Deaton 1986 p. 1816).

²⁴Problems with the estimation of such 'demand functions for commodity composites in terms of total expenditure and composite price indices'are discussed in Deaton (1986 pp.1815-1817).

²⁵As already mentioned before we use unit values as prices both with regard to single countries and groups of countries.

parameters. See Deaton and Muellbauer (1980 p. 314). All estimation results reported below have been obtained with these demand-theoretic restrictions imposed.

Income (expenditure) elasticities e_i and price elasticities ϵ_{ii} for model (3.1) are as follows:

$$\mathbf{e}_{i} = 1 + \beta_{i} / \mathbf{w}_{i}, \quad \epsilon_{ii} = (\theta_{ii} - \beta_{i} \mathbf{w}_{i}) / \mathbf{w}_{i} - \delta_{ii}$$
(3.2)

Both e_i and ϵ_{ij} depend on the shares w_i and therefore vary over time if time series data are used²⁶. Note that we base formulae of price elasticities on the approximate version of AIDS.

3.2 Institutional Arrangements and Import Demand Systems

As already mentioned in sections 1 and 2 two major institutional aspects have to be taken into account when considering the German coffee imports. One is the International Coffee Agreement (ICA) and the other is the Lome convention concerning ACP countries. This subsection briefly discusses possible impacts on the German import demand structure as given by the demand system specified above.

Since 1975 coffee imports from ACP countries were free of import duty which can be interpreted as a price reduction. In section 2 we already illustrated the increased share of ACP members (see figures 2/1 and 2/2) due to this advantage. However the **demand** structure should not be influenced by this fact, that is elasticities should be unaffected. In order to test this we added a dummy with ones from 1975 onwards to the demand system (3.1); the corresponding coefficients should be nonsignificant in all equations 27.

The ICA fixes export quotas which have to be respected by all exporting and importing countries subscribing this agreement. See Herrmann (1988). However, it has been in effect only during subperiods (1962 to December 1972 and October 1980 to February 1986). Comparison of export quotas during these time periods and export shares during other periods shows that countries exporting **unwashed** coffees are favoured by the quota settlement.²⁸ Of course, this increases prices of **washed** coffees. German imports as shown in figure 2/3 mirror this fact: The import share of Unwashed Arabicas has been considerably higher during years in which quotas were in effect, that is imports of (expensive and unavailable) washed coffees had to be substituted for Unwashed Arabicas. Therefore the import demand structure could be different under the two regimes at least with respect to the four coffee types. We test this by adding a dummy with ones during years in which quota were in effect.²⁹

 $^{26\}delta_{ij}$ denotes the Kronecker delta which equals 1 if i=j and zero otherwise.

²⁷This procedure considers only changes of the contant terms α_i . The small number of observations did not allow an analysis of possible interactions.

²⁸See, for example, export shares 1986/87 and export quotas 1987/88 as shown in an unpublished graph provided by Frieder Rotzoll with letter dated September 26, 1988.

²⁹See the appendix for the exact description. Again we were unable to specify interaction terms.

3.3 The Data

We use yearly data of imports for those 27 coffee producing countries which are most important for German imports. See Table 2.1. The aggregate of these countries is considered as 'total imports', that is we completely disregard imports from small countries which are however negligible ³⁰. Our data cover gross imports which are compared to net imports for some years in table 2.2. Import values are given in Deutschmark (no tax or duty added). We use unit values as import prices for the single countries and apply the same procedure to obtain composite price indexes for the four types.

Our data set contains data for the years 1966 to 1987. A dummy indicating ACP membership and another dummy measuring the influence of quota agreements were included in some estimations (see sections 3.4 and 3.5). Additionally we used the following variables for which empirical results are reported in section 2.3: Price of roasted coffee (yearly average) and the corresponding consumed quantity per household were taken from a survey of households conducted by the German Statistical Office. Exact sources for all variables are given in the appendix.

3.4 Results for Coffee Types

Estimation results regarding the demand for the four different types should reflect the fact that substitution between the four categories is restricted due to differing flavour and quality. Figure 2/3 already indicated that the share of (all) Milds, Unwashed Arabicas and Robustas has not much changed over time, that is the composition concerning these three categories remained quite stable over time. There has been ,however, a change within the group of Milds: Colombian Milds gained at the expense of Other Milds (see figure 2.3).

The demand for the four types has been estimated by means of model (3.1) with symmetry, homogeneity and adding-up imposed³¹. The implied elasticities are displayed in figure 3/1. Expenditure elasticities (with the exception of 1984 for the case of Other Milds) show the expected positive sign but marked differences in magnitude: Other Milds and Robustas are classified as 'normal' goods whereas Colombian Milds and Unwashed Arabicas are 'luxury' goods, that is higher expenditures for coffee favour the two more homogeneous groups indicating a possible aggregation bias. All own-price elasticities have a negative sign with Colombian Milds being most sensitive to price changes. From cross-price elasticities we see that both substitutional and complementary relations between types show up. As far as substitution between "neighbouring" types is observed it is in accordance with our a priori expectations. However, this is only the case for Other Milds. With regard to magnitude the high (positive) cross-price elasticities of Unwashed Arabicas and Robustas with respect to price changes of Colombian Milds are noteworthy.

³⁰For example, in 1985 total import of green coffee amounted to 8,688,932 bags whereas our 'total' is 8,513,983.

³¹Adding-up was enforced by deleting the last equation. We used iterative 3SLS for estimation. All computations for this version of the paper were done on a PC using Micro-TSP.





Figure 3/1

(C = Colombian Milds, O = Other Milds, U = Unwashed Arabicas, R = Robustas)

We mention in passing that expenditure elasticities and all own-price elasticities differ considerably between types of coffee. Therefore our results indicate that price and income reactions with respect to the various types of coffee are quite different. This should be contrasted with earlier results in the literature which were based on the aggregate of total German imports.³²

Addition of the quota dummy results in a highly significant positive coefficient for Unwashed Arabicas whereas coefficients for all three other types have a negative sign.³³ This confirms the empirical observation that Brazil (and the two other countries of this group) profit from the quota agreement. However all elasticities keep the same sign and magnitude except for cross-price elasticities relating Unwashed Arabicas and Robustas. If furthermore the ACP dummy is added the corresponding coefficient is nonsignificant in all equations and elasticities are altered only marginally. Therefore both institutional arrangements seem to influence the import demand structure only slightly.

3.5 Results for Country-Specific Demand

Under the assumption that coffees from different countries of the same type are almost identical in their characteristics the estimation results should above all show strong substitutive cross-price reactions. For each coffee type we estimated model (3.1) with symmetry, homogeneity and adding-up imposed. For the largest group (Other Milds, 12 countries), however, estimation of (3.1) under constraints was impossible.³⁴ Also in the group of Robustas we aggregated the three countries with smallest shares (Guinea, Madagascar, Togo - henceforth abbreviated as GMT) to arrive at an acceptable number of equations. Unfortunately it is impossible to report all results in detail. We therefore stress only the points which are worth special mentioning.

Our first task is to test whether estimation of subsystems is legitimate, that is whether the **separability assumption** holds with respects to partioning between types of coffee. As indicated in section 3.1 we add prices from other types as explanatory variables. Following Winters (1985 pp. 339-340) we used relative prices since otherwise an additional price variable could be"...significant more because it breaks the homogeneity constraint than because separability is violated". We added all three price ratios to the subsystems concerning the two smaller groups (Colombian Milds, Unwashed Arabicas). In both groups the assumption of separability could be accepted since none of the coefficients showed a pronounced influence.³⁵ For the group of countries producing Robusta we added the price ratio of each other group separately (the inclusion of all three variables exceeded the maximal number of parameters). The assumption of separability was strongly confirmed for

³²See the discussion in section 1.

³³Due to lack of space detailed results will not be reported here.

³⁴The maximal number of parameters in Micro TSP using iterative 3SLS is 52 whereas we would need 88 coefficients for the group of 12 countries producing Other Milds. See, for example, Ronning (1988 p.69).

³⁵All t-ratios are less than 2.0. Since multicollinearity might be the cause of this result we also specified each price ratio separately. Here the price of Unwashed Arabicas had some influence on imports from Colombia (t-ratio of 2.1).





(1 = Colombia, 2 = Kenya, 3 = Tanganyika)





(1 = Bolivia, 2 = Brazil, 3 = Ethiopia)

this type of coffee since none of the coefficients was significantly different from zero.

We now turn to the estimation results for the three subsystems considered. Following the procedure already used for the aggregates in section 3.4 we estimate (3.1) with demand-theoretic constraints imposed. We then add dummies concerning the quota agreement and the Lome convention in order to see whether this changes the demand structure.

Elasticities for the Colombian Milds are displayed in figure 3/2. All three expenditure elasticities are positive and all three own-price elasticities have the expected negative sign with Kenya showing the highest elasticity. The cross-price elasticity regarding Kenya and Tanganyika coffees are substitutes due to their rather similar quality whereas relations with Colombia are mostly complementary indicating the greater heterogeneity of coffee from this country when compared with the two others. Addition of the quota dummy altered the results only marginally whereas the ACP dummy resulted in a highly significant coefficient which increased shares of the ACP members (Kenya and Tanganyika) and decreased the share of Colombia. It also reversed signs for cross-price elasticities regarding Colombia and Kenya from complementarity to substitution whereas the substitutive relation between Kenya and Tanganyika remained. Although we cannot exclude the possibility that the ACP dummy catches up some influences not explicitly considered we also have to face the possibility that the Lome convention has also had some impact on the demand structure. One could think, for example, of political pressure to increase imports from the less developed ACP countries.

The results for Unwashed Arabicas are given in figure 3/3. Elasticities regarding Bolivia are volatile which is due to the extremely small share of this country for almost all years considered. Therefore we concentrate on results for Brazil and Ethiopia the latter being an ACP country which has gained in import share at the expense of Brazil, in particular during the last five years (1983-1987). Ethiopia has both higher expenditure elasticity and own-price elasticity than Brazil. Cross-price elasticities for the two countries are positive although very small indicating a substitutive relation. ³⁶. The addition of ACP dummies reduced the share of Brazil to the advantage of Ethiopia whereas the quota dummies had an reversed effect. Simultaneous specification of both types of dummies left the advantage almost totally with Ethiopia with a significant coefficient for the two countries in all three cases. For the last mentioned specification the elasticities were not much altered with the exception of cross-price elasticities relating Brazil and Ethiopia which now show a negative sign. However, again the elasticities are near to zero. Interpretation of results for this group seem to be much more difficult due to the heterogenity of countries collected in this group.

Finally we summarize the estimation results regarding the group of **Robusta** producing countries which would take too much space if presented here in detail. The estimation of (3.1) under demand-theoretic constraints gives greatly varying expenditure elasticities for all countries. For the aggregate of Guinea, Madasgascar and Togo (GMT) these elasticities are negative throughout whereas Cameroun, Indonesia and Ivory Coast show the (expected) positive sign for all years. All seven countries have the (expected) negative sign regarding own-price elasticities with imports from Ivory coast and the GMT group being least price sensitive.³⁷ The inclusion of quota dummies altered the picture only marginally whereas the

³⁶The coffees imported from Ethiopia are of considerably higher quality than those imported from Brazil (Frieder Rotzoll, personal communication). This might be the reason for the very small cross-price elasticities.

³⁷The elasticity for Angola shows very large (negative) values due to the very small import

addition of ACP dummies led to substantial modifications: Angola and Uganda showed highly significant negative coefficients and the equations regarding Cameroun and Indonesia have highly significant positive coefficients. Please recall from section 2.1 that Indonesia is not an ACP member which therefore should show a negative sign due to its price disadvantage after enforcement of the Lome convention. The argument reversed applies to the results for Uganda. Evidently the ACP dummy does catch up not only the effects of this trade agreement. However the import demand structure in terms of elasticities is almost completly unimpressed by the inclusion of ACP dummies. This might be taken as an indication of the "robustness" of this market segment which plays only a minor role in German imports. See section 2.3.

5. CONCLUDING REMARKS

The paper shows that demand reactions of German coffee importers differ considerably among the four types of coffee. Income (expenditure) elasticities are larger for the more homogeneous groups (Colombian Milds and Unwashed Arabicas). The demand for Colombian Milds has highest price sensitivity as measured by own-price elasticity. The 'medium quality' Unwashed Arabicas is a substitute to all three other types whereas the three other groups show complementary relations with at least one other type of coffee. The paper also gives results regarding country-specific import demand for three of the four types of coffee after having found that the assumption of separability with respect to types of coffee could be accepted.

Our descriptive analysis shows that ACP membership has had an influence on the German import structure. There is also some evidence that ICA quota when effective favoured countries exporting unwashed coffees with Brazil as the most important exporter among them. However, these institutional arrangements should leave demand reactions unchanged. See section 3.2. The estimates from the econometric demand system show however that a dummy intended to describe ACP membership had indeed some influence, particularly with respect to country-specific demand reactions.

Our analysis might be criticized for not taking account of other variables such as inventories and future prices. However the main goal of this paper is the analysis of country-specific import demand and the influence of institutional aspects which can be studied only in such a desaggregated approach. Country-specific data for the two variables just mentioned are not available. Even for our less ambitious approach we had to compromise concerning the data used. In particular we used gross imports instead of net imports. It would be nice to have the latter and also information about the inventories, preferably for monthly or quarterly intervals. However such data do not seem to be available. One could also think of an extension of our analysis based on monthly data (which are available). However as explained in the paper seasonality then would become a serious problem which we wanted to avoid.

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Appendix: Data sources

- Import quantities and import values of green coffee: Fachserie 7 Reihe 2: Außenhandel nach Waren und Ländern. Statistisches Bundesamt Wiesbaden.
- (Net) import of green coffee (kilogram) per capita: Jahresberichte.
- Dollar/DM exchange rate: Monatsberichte der Deutschen Bundesbank. Deutsche Bundesbank Wiesbaden.
- Price of roasted coffee: Fachserie 15 Reihe 1: Einnahmen und Ausgaben ausgewählter Haushalte (Haushaltstyp 2). Statistisches Bundesamt Wiesbaden.
- ACP membership: Goybet (1982 p. 1). Additional information concerning Papua New Guinea: Jahresbericht (1977, p.13).

Time intervals for which ICA quotas were effective: Jahresberichte.

The two dummies were constructed as follows (1966 to 1987, 21 observations):