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IMPORT DEMAND FOR MALT: A Time Series and Econometric Analysis

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Abstract

European Union (EU) dominance of the world malt trade is thought to be due to quality advantages and/or due to export restitutions. A Linear Approximate Almost Ideal Demand System (LA/AIDS) was estimated for four major malt importing countries: Japan, Brazil, Philippines, and Venezuela. Elasticities of substitution for malt among different sources were computed. Results show that malt imported from the EU is least substitutable with malt from other sources, and demand for EU malt is less responsive to changes in price. Expenditure elasticities indicate that the four importers spend proportionately more on malt imports from the EU compared to malt from other sources. For these reasons, the study concludes that price subsidy-based export expansion measures for non-EU malt may have limited effects.

Key words: Malt Import Demand, LA/AIDS, Export Subsidy, Substitutability.

Highlights

The European Union (EU) plays a dominant role in world barley malt exports. Importers' preferences for attributes of EU malt and the aggressive pricing practiced by the EU have been the factors. Recently, the United States, identifying barley malt as a value-added export item, targeted malt exports under the Export Enhancement Programs. This paper applies the familiar, Linear Approximate of the Almost Ideal Demand Systems, econometric tools that analyzes the effectiveness of this program by computing the substitution elasticities. In particular, time series data on quantity and value of malt exports from major exporters to four selected countries, namely, Japan, Brazil, Philippines, and Venezuela. Compiled and separate systems of demand equations are estimated for each importer. Substitution elasticities are computed using the estimated parameters of the demand systems.

The results show that, overall, the EU own price elasticities are less than one suggesting limited price response to a subsidy. Compensated elasticities with respect to the U.S. prices were larger than one for Japan and Philippines. However, the U.S. has only a small share in these import markets. The elasticity's substitution between malt originating from the EU and the other exporters were small implying limited degree of substitutability. On the contrary, malt originating from Australia, Canada, and the U.S. substituted better. These results suggest that price-oriented target program to gain market shares may not provide anticipated gains due to limited importer response.

The estimated expenditure elasticities also show the importers' commitment to EU malt. The estimated elasticities are all greater than one, implying that a greater share of incremental income is spent on malt originating from the EU. In contrast, the expenditure elasticity estimates for Australia were smaller than one suggesting that expanded total malt import expenditures, result in less than a proportionate increase in expenditure on Australian malt. This attests to the declining share of Australian market shares reported by a recent Grains Council of Australia study.

Results of the study support the view that importers' preferences for malt originating from different regions vary considerably. In this sense, price-oriented subsidy schemes as a target strategy to find market shares may not lead to long-lasting results. Instead more fundamental approaches that educate importers regarding the specific attributes of the malt produced in the United States may provide desired results. In this regard the market development strategies aimed at brewer education and provision of technical assistance may have more desirable impact in the longer run.

IMPORT DEMAND FOR MALT:
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Vidyashankara Satyanarayana, William W. Wilson, and D. Demcey Johnson**

Introduction

Malt is a major ingredient in beer production and is imported by most beer consuming countries. However, only a few countries produce malting-quality barley, including European Union (EU), Canada, Australia, eastern Europe, and the United States. The EU plays a dominant role in the world malt trade, with a 60 percent market share and has been able to maintain this share despite relatively high export unit values. Differences in the quality of malt from other sources, importer loyalty, and the EU's complex export restitution mechanism may have contributed to this dominance.

The United States was a major malt exporter in the earlier part of this century (Riley, 1989). The U.S. government has subsidized malt exports to target countries under the Export Enhancement Program (EEP), partly in retaliation to the EU export restitution schemes. The subsidy amount, since 1986, has exceeded $30 million, representing 5 percent of EEP expenditure on all value-added agricultural exports. Between 1985/86 and 1991/92, 41 percent of all U.S. malt has been exported under EEP. Targeted countries include Algeria, Brazil, Burundi, Cameroon, the Caribbean countries, Central American countries, Colombia, Iraq, Nigeria, Peru, Philippines, and Venezuela. Average EEP bonuses decreased substantially during 1989, but increased thereafter. Malt EEP bonuses remained around $100/MT until 1991 and subsequently increased to $140/MT. The subsidized quantity and the bonus level vary across countries.

Two important facts motivated this research. First, large price spreads are observed for malt from different sources. Second, the EU has been able to maintain high export volumes and high prices to foreign markets, particularly Japan and Philippines.[1] The high price/market share combination enjoyed by EU malt in these two countries may be due to inherent malt quality characteristics. These observations suggest that quality differences are critical to exporter

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*Research presented in this report is part of a major study on the world malt trade. Other research on the world and North American malt sector are available from the authors.

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[1]An interesting aspect of Japanese and Filipino malt imports is that the average c.i.f. price of EU malt is higher (by around US$30/t) than the weighted average of all c.i.f. import prices. In both cases the EU's market share is more than 30 percent.

competitiveness, and differentiation is pervasive in this trade. Quality differences[2] imply less than perfect substitutability and have important implications for exporter country promotion strategies based on price subsidies.

World trade in malt has been increasing at close to 3 percent per annum.[3] Japan, Brazil, the Philippines, and Venezuela are the major beer producers that depend on imported malt. All four countries are experiencing positive growth in beer production and malt imports. Brazil and Philippines have the highest growth rate in beer production while Brazilian and Venezuelan malt imports have grown the fastest. Japan, with the highest beer production and malt import levels, has had slower growth. These importers have relied on the EU, Canada, Australia, and the United States for their malt needs. European brewing techniques have been adopted in many parts of the world and have resulted in preferences for EU style malt. The United States has attempted to improve its status as a malt exporter through price subsidies. Australia has lagged behind the rest of the world in variety development (Grains Council of Australia) and, as a result, has lost part of its share in import markets, particularly in Japan. In contrast, Canada has focused more on variety development to satisfy preferences of foreign buyers.

The effect of exporter strategies that focus on price subsidies depends on the sensitivity of importers' response to price changes. This paper evaluates the potential efficacy of price-based export promotion programs. Substitution elasticities are computed for malt originating from different sources in four import markets: Japan, Brazil, Philippines, and Venezuela. The next section describes import market characteristics in terms of trends in imports, shares of exporters, and deflated unit values for these four countries. The following section outlines the LA/AIDS approach to trade flow analysis and estimation procedures, and presents model parameters, hypothesis test results, and elasticities computed from the estimated parameters. Finally, conclusions and implications are drawn.

Market Characteristics

This section is a brief overview of the import behavior of selected malt importers. Data used in this study include time series observations on malt flows and value. These were obtained and developed from the United Nations Commodity Trade Statistics in machine readable form for the period 1971 through 1990. Unit import values were computed from these data series. Major non-EU importers were selected for analysis based on the magnitude of malt imports in the past 20 years.

Figures 1 to 8 show data on market share and size and import unit values. Table 1.1

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[2]See Wilson and Johnson for an elaboration of these issues in the context of the North American market.

[3]Wilson and Satyanarayana (forthcoming) provide growth rate estimates based on the product life cycle for beer production and malt import demand for over 100 countries.

shows average import prices in each of these markets during 1985-1990. Among these four importers, Japan has the highest values for imported malt by about $80 to $100/mt. In contrast, values for the Philippines and Venezuela are substantially less. These price differentials are fairly large compared to other processed commodities, suggesting that issues related to quality differences are of fairly great importance in this sector.

Table 1.1. Import Prices in Major Malt Import Markets: 1985-1990

Exporter	***Importer***			
	Japan	*Brazil*	*Philippines*	*Venezuela*
	US *$/mt*			
EU	341	264	247	236
Canada	326		259	218
US	345		227	222
Australia	300		267	
Rest of World	334	282		231

Individual Market Observations

Japan. Japan is one of the largest malt importers with annual average imports close to 500 *tmt* (000 mt). Between 1970 and 1990 (excepting 1987), Japan was the largest malt importer. Japanese malt import shares have averaged more than 20 percent of world malt imports. The EU, Canada, Australia, and Czechoslovakia are the major sources of Japanese malt imports, with the EU having accounted for more than one-third, followed by Australia and Canada.

Among EU countries, France, the Federal Republic of Germany, and the United Kingdom are the major sources for Japan. However, some changes have occurred over time in the magnitude of malt imports into Japan from EU countries. In the early 1970s, France was a dominant source of malt. By the early 1980s, UK replaced France as the major supplier. In the late 1980s, Germany surpassed France and ranked next to the UK. Over time, malt exports from EU into Japan have trended upward, rising from 32 *tmt* in 1971 to approximately 300 *tmt* in 1990.

Japanese malt imports from the United States averaged 12 *tmt* per annum during the period. Canada accounts for a sizeable portion of Japanese malt imports with annual average

imports slightly more than 100 *tmt*. Like the EU, Canadian malt imports into Japan have been increasing. Australia has been losing its share in the Japanese market, particularly since the mid 1980s. Japan also imports malt from other countries, but relatively small amounts (averaging 55 *tmt*). These suppliers include Czechoslovakia, Poland, Finland, New Zealand, and German Democratic Republic (Figure 1).

The EU remains a dominant source of malt for Japan, averaging around 35 percent. Canada and Australia each have accounted for around 25 percent of Japan's total malt imports over this period. Between 1985 and 1990, Australia's share fell by about 10 percent, replaced by EU and Canada. The U.S. share is less than 5 percent and has been steady at 2 percent between 1987-90.

A comparison of import unit values (Figure 2) indicates that Australian malt, on average, is slightly cheaper than EU. In general, U.S. malt prices were higher than malt from other sources. Australia often received the lowest prices.

Brazil. The EU is the major source of malt for Brazil. Among EU countries, France, United Kingdom, Belgium, and Luxembourg account for most of these exports. The Federal Republic of Germany, Denmark, and the Netherlands have also exported malt to Brazil. Imports from the EU have increased from 25 *tmt* in 1970 to more than 200 *tmt* in 1990.

Imports from Argentina, Chile, and Uruguay show considerable inter-year variability. Annual average imports from these countries were around 100 *tmt*. Brazil also imports from Australia, Czechoslovakia, Canada, Poland, and Turkey. Annual average imports from other countries remained around 38 *tmt.*

Figure 3 shows the shares of different exporters to Brazil. Argentina, Chile, and Uruguay are aggregated. The EU has been the dominant supplier. The EU share has remained more than 30 percent except for 1987 when it dropped to slightly more than 10 percent. This drop was due to large lower-priced malt imports from Chile.

Figure 4 presents the import unit values paid by Brazil for malt. The EU price was the lowest in all years, except 1980 and 1987. Chilean malt prices to Brazil were abnormally low in 1987.

Philippines. The EU and Australia are the major suppliers of malt imports to the Philippines. Average imports from the EU and Australia have been 34 and 40 *tmt*, respectively. EU countries that export to Philippines include France, Belgium, Luxembourg and in recent years, Federal Republic of Germany and the United Kingdom. Canada and United States export around 4 *tmt* annually. Exports from Canada have declined, while exports from the United States has increased (Figure 5). The Australian share dropped to 30 percent in 1984, but increased dramatically the following three years.

Figure 6 shows malt import prices paid by the Philippines. Australian malt has been the lowest, while the U.S. prices are generally the highest. In recent years, malt import prices from different sources have converged.

Venezuela. The EU, Canada, and Czechoslovakia are major malt suppliers to Venezuela (Figure 7). Total imports from the EU have increased from around 25 *tmt* in 1970 to 143 *tmt*. France, Belgium-Luxembourg, the Federal Republic of Germany, and the UK are the major EU countries supplying malt to Venezuela. Imports from Canada were decreasing until 1979, but increased until 1985. Since 1985, no imports were reported from Canada. Czechoslovakia is another source of malt imports into Venezuela with a maximum import quantity of 22 *tmt.* Annual average imports from the United States were 8 *tmt*. Poland, Finland, and Australia are the other sources of imported malt. Imports from these sources have increased over time and totaled 24 *tmt* in 1990.

The EU is the major source of Venezuelan malt imports, although shares have varied considerably in recent years (Figure 7). Czechoslovakia, Canada, and the United States are other sources of malt imports for Venezuela and their shares have declined over time. Australia, Finland, and Poland, included in the other category, have gained shares in recent years.

The highest values were paid for malt originating from Czechoslovakia (Figure 8). In the early 1980s, EU imports were the cheapest. In last few years, imports from other sources, primarily Australia, Finland, and Poland, had lower unit values.

Empirical Model and Estimation Method

There are several important questions related to import demand for malt. One is the effect of income on imports and the composition of imports. The second is the degree of substitutability among malts from different origins. To address these questions, a specific functional form was used to estimate demand parameters for malt imports. Malt demand, though being a derived demand, is modeled assuming a constant margin in transforming malt into beer (primary demand). Thus the demand model estimates and the subsequent elasticities are based on this assumption.[4] In the first section, model estimation procedures are described. This is followed by presentation of empirical results, results of hypothesis tests, parameter estimates, and elasticities.

Model Specification

The AIDS specification is derived explicitly from a consumer cost minimization problem. It provides an arbitrary first-order approximation to any demand system and satisfies the axioms of choice perfectly (Deaton and Muellbauer, 1980). The estimating equation for a derived expenditure share I is

$$w_i = \alpha_i + \sum_{j=1}^{m} \gamma_{ij} \ln P_j + \beta_i \ln\left(\frac{X}{P^*}\right)$$

where w_i is the expenditure share of exporter I in total malt import value of a specific importer, P_j is the c.i.f. price per metric ton of malt paid by the importer to malt originating from source j; X is the total value of malt imports, and P^* is the Stone's Price Index (sum of lagged share-weighted log prices). Lagged budget shares are used as weights in constructing Stone's Price Index to avoid simultaneity (Eales and Unnevehr, 1988). Adding up, homogeneity, and symmetry are imposed through the following parameter restrictions:

$$\sum_i \alpha_i = 1,\ \sum_i \gamma_{ij} = 0 \text{ and } \sum_i \beta_i = 0;\quad \sum_j \gamma_{ij} = 0;\quad \text{and } \gamma_{ij} = \gamma_{ji}.$$

With the price index approximated by Stone's price index, expenditures are linear in parameters.

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[4]Alternatively, one could estimate malt demand directly using production theory treating malt as an input in beer production, but critical data to do so are not available for any of the countries analyzed in this study.

This is a sufficient condition for exogeneity of expenditure (LaFrance, 1991 and Edgerton, 1993). Hence, Zellner's Seemingly Unrelated Regression is the appropriate technique and was used for estimating the parameters of the demand system.

Both homogeneity and symmetry restrictions are imposed in the estimation process. Since the equations were estimated as a system, the restrictions are not tested individually. Instead, overall hypotheses regarding the restrictions were tested using an F test. This follows recommendations of Theil (1971) and Woodland (1986), who point out that in finite samples, the use of an F statistic (rather than a Chi-Square statistic) leads to rejection of the null hypothesis in a smaller number of cases. The specifics of the test in a system estimation context are discussed in Judge et al. (1985). The test statistic is defined:

$$\hat{g} = (R\beta - r)'\left\{R[X'(\hat{\Sigma}^{-1}\otimes I)X]^{-1}R'\right\}^{-1}(R\beta - r) \sim F_{(J,TM-K)}$$

where $\hat{g}$ is the test statistic, R is a matrix of restrictions of dimensions J (number of linear restrictions) by K (number of parameters in the system), β is the unrestricted SUR estimate, r is a vector of restriction constants, X is the design matrix, $\hat{\Sigma}$ is the cross equation covariance matrix, $\otimes$ is a symbol for Kronecker product, and I is an identity matrix of dimension equaling the number of observations.

An important objective here is to estimate the price, substitution, and expenditure elasticities of import demand. The elasticity formulas take a different form when Stone's Price Index is defined with lagged budget shares rather than the one considered theoretically correct, as proposed by Green and Alston (1990, 1991). Since these elasticities are functions of estimated parameters, they can be subjected to statistical hypothesis testing. Standard errors of these elasticities can be computed, based on the standard errors of the underlying parameter and the budget share that determine the elasticities.

Compensated elasticities (ξ^*_{ij}) and their standard errors ($SE(\xi^*_{ij})$) are computed as

$$\xi^*_{ij} = -\delta_{ij} + \frac{\gamma_{ij}}{w_i} + w_j \quad \text{and} \quad SE(\xi^*_{ij}) = \frac{SE(\gamma_{ij})}{w_i}$$

Substitution elasticities (σ_{ij}) and their standard errors ($SE(\sigma_{ij})$) are computed as

$$\sigma_{ij} = 1 + \frac{\gamma_{ij}}{w_i * w_j} \text{ if } i \neq j \quad \text{and} \quad SE(\sigma_{ij}) = \frac{SE(\gamma_{ij})}{w_i * w_j} \text{ if } i \neq j$$

Expenditure elasticities (η_i) and their standard errors ($SE(\eta_i)$) are computed as

$$\eta_i = 1 + \frac{\beta_i}{w_i} \quad \text{and} \quad SE(\eta_i) = \frac{SE(\beta_i)}{w_i}$$

Data Reconciliation

EU member countries are the major sources of malt for most importers. In a systems estimation context, it would be ideal to treat imports from each of the EU countries separately along with Non-EU sources. However, separate treatment would result in loss of degrees of freedom, leading to a larger sampling variance. Also, EU prices, due to Common Agricultural Policy, are highly collinear, which would affect the standard errors of the estimates. Hence, the 12 EU countries were aggregated, taking into account the timing of their entry into the Union.

One common problem encountered while estimating a system of import demand equations with time series data is the absence of imports from a particular source on a number of occasions. This results in zero expenditure share, and the corresponding price would be missing. This missing price is substituted by the predicted price obtained by regressing the price against a time trend for the years for which import transactions are positive.

Empirical Results

A separate system of import demand equations was estimated for each of the importing countries. For each importing country, a set of hypotheses was tested, the results of which are useful for further model specification. These are presented first followed by the estimated parameters.

Hypothesis Tests. Each equation system was subjected to a joint hypothesis test about the appropriateness of the restrictions. Specifically, the null hypothesis, $\mathbf{H}_o : \mathbf{R}\beta = r$ is tested against the alternative hypothesis, $\mathbf{H}_1 : \mathbf{R}\beta \neq r$ where R, β, and r are a matrix of linear restrictions, parameter vector, and a vector of constants, respectively. The computed F tail probability of the test statistic for each equation system is shown in Table 2.1.

The tail probabilities, which represent the risk of rejecting the null hypothesis when it is true, for Japan and Venezuela are less than conventional levels of significance and suggest that the error structures of the respective unrestricted models differ from that of the restricted model. These imply that the imposed restrictions are not supported by sample information. On the other hand, the computed tail probabilities of the Brazil and Philippines model are greater than conventional significance levels, and we fail to reject the null hypothesis, implying a better match between sample information and imposed restrictions.

Table 2.1. Results of Hypothesis Tests on Equation System				
	Japan	*Brazil*	*Philippine*	*Venezuela*
F-Stat	.0008	.29355	.66274	.02513
Result H:$_o$	Reject	Fail to Reject	Fail to Reject	Reject

Estimated Parameters and Statistical Results

Tables 2.2-2.5 show the estimated parameters and their t-values for each of the import countries. The lower triangle of the price parameter matrix and parameters of omitted equations are not reported, as parameters are obtained from restricted least square estimation. In these tables, α_i is the intercept of the i^{th} expenditure share equation, γ_{ij} indicates the parameter on price of source I, j, and β_i indicate the parameter on expenditure in equation I. γ_{ij} refers to the change in a budget share I for a unit proportionate change in price j, while β_i indicates the change in a share I for a unit proportionate change in expenditure.

In the case of Japan (Table 2.2), the price parameters in the EU equation for the EU and the United States show that their relation with EU shares is direct, while remaining parameters have a negative relationship to budget shares. Canadian and U.S. prices have positive effects in the Canadian equation, while Australia and ROW have negative effects. The U.S. share increases with an increase in EU, Canadian, and Australian import prices while it decreases with increases in own and ROW prices. The Australian own price parameter is positive, but the ROW price parameter is negative. Price parameters in Canadian and U.S. share equations are statistically more reliable than those in the remaining equations. The parameters on expenditure are all positive, except in the Australian equation. These estimates are also statistically reliable, with exception of those in the United States equation. The parameters for expenditure imply that Japan has a preference for malt imported from the EU and Canada over that from Australia and ROW.

Table 2.2. Estimates of Japanese Malt Import Demand Equations

Exporter	***Shares***	α_i	γ_{iEU}	γ_{iCAN}	γ_{iUS}	γ_{iAUS}	γ_{iROW}	β_i
EU	0.3604	-0.391 (-1.54)	0.057 (0.97)	-0.047 (-0.97)	0.008 (0.25)	-0.017 (-0.22)	-0.001 (-0.01)	0.121 (2.95**)
Canada	0.2091	-0.347 (-2.7**)		0.061 (1.28)	0.077 (2.2*)	-0.095 (-2.1*)	-0.004 (-0.11)	0.089 (4.31**)
U.S.	0.0277	-0.004 (-2.7**)			-0.189 (-3.9**)	0.142 (3.92**)	-0.038 (-0.97)	0.007 (0.48)
Australia	0.2805	0.935 (4.70**)				0.023 (0.27)	-0.053 (-0.94)	-0.106 (-3.29**)

Note: Figures in parentheses are the t-values.
* and ** refer to 5% and 1% significance levels, respectively

For reasons of parsimony, the import demand system for Brazil (Table 2.3) was restricted to three equations, comprising EU, South American countries, and Rest of the World (ROW). Own and South American prices have a negative effect on EU shares in the EU equation, while the ROW price has a positive effect. Expenditures in both equations have positive parameters, implying a direct relationship with the budget shares. All the parameters have low t-values, indicating a wider distribution around their means, making their precision suspicious. Also, the right-hand side variables are characterized by a high degree of multi-collinearity. The computed condition number was 343.[5] This data problem may be one of the reasons for high standard errors of estimates.

Table 2.3. Estimates of Brazilian Malt Import Demand Equations

Exporter	*Shares*	α_i	γ_{iEU}	γ_{iLAM}	γ_{iROW}	β_i
EU	0.4559	0.392 (1.31)	-0.223 (-0.87)	-0.019 (-0.48)	0.243 (0.92)	0.011 (0.19)
South America	0.3682	0.273 (0.87)		0.071 (1.62)	-0.051 (-1.41)	0.018 (0.31)

Note: Figures in parentheses are the t-values.

Table 2.4 presents estimates for the Philippines. The system included EU, Australia, United States, and Canada, with the Canadian equation omitted in estimation. Results indicate that a change in the EU price has a positive effect on EU's share, while remaining prices have a negative effect. The Australian share decreases with an increase in own and EU price, but increases with increases in remaining prices. The U.S. share is influenced positively by only the Australian price. The parameters on expenditure indicate a preference for EU and U.S. malt over Australian and Canadian malt.

Table 2.4. Estimates of Filipino Malt Import Demand Equations

Exporter	***Shares***	α_i	γ_{iEU}	γ_{iAUS}	γ_{iUS}	γ_{iCAN}	β_i
EU	0.4298	-0.277 (-1.44)	0.519 (1.44)	-0.290 (-0.89)	-0.095 (-0.78)	-0.134 (-1.08)	0.158 (1.22)
Australia	0.4774	0.894 (1.77)		-0.009 (-0.02)	0.179 (1.60)	0.119 (0.68)	-0.101 (-0.88)
U.S.	0.04648	-0.144 (-4.85**)			-0.095 (-0.85)	-0.02 (-0.39)	0.045 (0.73)

Note: Figures in parentheses are the t-values.
** refers to 1% significance level

[5]If the ratio of the largest to the smallest eigenvalue of the moment matrix is greater than 30, then a fair degree of multi-collinearity is said to exist among the regressors.

All prices in the Venezuelan demand system (Table 2.5), except for Canada and ROW, have negative effects on the EU's expenditure share. Czechoslovakia's share is positively influenced by own and U.S. prices. Canada, Czechoslovakia, and ROW prices influence the U.S. share directly. Both Canadian and ROW shares are negatively influenced by their respective own prices. A concern with these estimated parameters is that they have small t-values. Except for Czechoslovakia and the United States, the parameters on respective expenditures are positive. The expenditure parameter for the EU is positive and statistically significant, suggesting that Venezuela has a preference for malt imported from the EU.

Table 2.5 Estimates of Venezuelan Malt Import Demand Equations

Exporter	***Shares***	α_i	γ_{iEU}	γ_{iCZE}	γ_{iUS}	γ_{iROW}	γ_{iCAN}	β_i
EU	0.6613	-0.402 (-1.51)	-0.19 (-0.93)	-0.008 (-0.07)	-0.051 (-1.07)	0.082 (0.72)	0.151 (2.14^{*})	0.213 (3.68^{**})
Czechoslovakia	0.0957	0.37 (2.61^{**})		0.089 (0.92)	0.01 (0.41)	-0.033 (-0.50)	-0.075 (-2.04^{*})	-0.054 (-1.77)
U.S.	0.0893	-0.144 (-4.85^{**})			-0.007 (-0.23)	0.011 (0.39)	0.036 (1.50)	-0.14 (-4.84^{**})
ROW	0.0894	0.046 (0.29)				-0.063 (-0.65)	0.003 (0.29)	0.009 (0.26)

Note: Figures in parentheses are the t-values.

Elasticities

Compensated, substitution, and expenditure elasticities derived from the parameters of country-specific malt import demand systems are presented in Table 2.6 along with their standard errors.

Japan. All own compensated price elasticities for the Japanese models are negative, ranging from 0.39 (in absolute value) in case of the ROW to 8.12 for the United States. The response of shares to changes in own prices of EU, Canada, and Australia are all less than proportionate. The standard errors indicate that own price elasticities are all smaller than their corresponding elasticity estimates, implying a fair degree of stability in these elasticities. The exception is the ROW.

Malt from EU and Non-EU sources appears to be imperfect substitutes. However, the high standard errors on these elasticities limit their reliability. Results indicated the Japanese are more willing to substitute between Canadian and U.S. malt than malt from among other sources. The standard error indicates that this elasticity is quite stable. Also, substitution between

Australia and Canada, Australia and ROW, and United States and ROW show some degree of

complementary relationships. However, these are fairly weak since the standard errors show that these elasticities may not differ significantly from zero.

All expenditure elasticities are positive, ranging from 1.43 for Canada to 0.15 for ROW. Both EU and U.S. expenditure elasticities are greater than one. These imply additional expenditure on malt favors Canada, EU, and the United States at the cost of imports from Australia and ROW. The standard errors suggest that expenditure elasticities of EU and Canada are significantly greater than one while those with respect to Australia and ROW are less than one.

Brazil. The compensated own price elasticities for the Brazilian malt imports differ significantly from zero at the 10 percent level. At 0.44, the South American countries have the lowest compensated price elasticity, while both EU and the ROW have compensated elasticities of greater than one in absolute value. Malt from EU substitutes better with malt from ROW than that from South American countries.

Expenditure elasticities do not differ significantly from one, implying that additional expenditure allocations to malt imports would be shared equally among the three sources.

Philippines. The compensated own price elasticity of the Philippine imports with respect to the EU price is positive, but its standard error indicates that it is not significantly different from zero. The remaining own price elasticities for Canada, the United States, and Australia are all negative. Again the standard errors of these elasticities, with exception of the United States, do not permit strong inferences. Australian malt appears substitutable with both U.S. and Canadian malt.

Except for Canada, expenditure elasticities are all positive. The corresponding standard errors indicate that these do not differ significantly from one. The negative Canadian expenditure elasticity is significantly different from one. These expenditure elasticities show that the Philippines allocate a greater share of incremental expenditures on malt originating from the United States and EU compared to that originating from either Australia or Canada.

Venezuela. All compensated own price elasticities in the Venezuela system, except for Czechoslovakia, are negative and have a smaller standard error than the respective elasticity estimate. Canadian and ROW price elasticities are greater than one in absolute value, implying elastic price response. The U.S. elasticity is close to unity in absolute value while EU response is least elastic.

All cross-price effects are positive except for Czechoslovakia, ROW and Czechoslovakia, Canada. The elasticities of substitution demonstrate that malt originating from EU and Canada, and the United States and Canada are more substitutable than other pairs. The EU expenditure elasticity is significantly greater than one, while that of United States is negative, suggesting that Venezuela would increase expenditures on malt originating from the EU more than from any other source.

Table 2.6. Compensated (ξ_{ij}), Substitution (σ_{ij}), and Expenditure (η_i) Elasticities of Selected Malt Importer Demand

	Importers											
	Japan			Brazil			Philippines			Venezuela		
Exporters	ξ_{ij}	σ_{ij}	η_i	ξ_{ij}	σ_{ij}	η_i	ξ_{ij}	σ_{ij}	η_i	ξ_{ij}	σ_{ij}	η_i
EU(Own)	-0.49 (0.29)		1.344 (0.12)	-1.04 (0.56)		1.024 (0.12)	0.637 (0.84)		1.367 (0.30)	-0.63 (0.31)		1.322 (0.09)
EU-Aus.	0.23 (0.21)	0.829 (0.77)					-0.2 (0.76)	-0.41 (1.59)				
EU-Can.	0.07 (0.13)	0.358 (0.65)					-0.27 (0.29)	-5.74 (6.25)		0.293 (0.11)	4.563 (1.67)	
EU-Cze.										0.108 (0.16)	1.125 (1.72)	
EU-SA				0.326 (0.09)	0.885 (0.20)							
EU- U.S.	0.05 (0.09)	1.889 (3.37)					-0.18 (0.28)	-3.76 (6.06)		0.01 (0.07)	0.138 (0.81)	
EU-ROW	0.128 (0.16)	0.98 (1.29)		0.709 (0.58)	4.028 (3.30)					0.213 (0.173)	2.385 (1.93)	
Aus.(Own)	-0.64 (0.30)		0.624 (0.11)				-0.54 (0.83)		0.787 (0.24)			
Aus.-Can.	-0.18 (0.22)	-0.62 (0.78)					0.296 (0.37)	6.392 (7.976)				
Aus.- U.S.	5.646 (1.31)	19.96 (4.67)					0.423 (0.24)	9.1 (5.06)				
AUS-ROW	-0.1 (0.20)	-0.43 (1.63)										
Can.(Own)	-0.5 (0.23)		1.429 (0.10)				-0.19 (2.45)		-1.19 (91.11)	-2.75 (0.74)		0.618 (0.60)
Can.-Cze.										-0.72 (0.38)	-11.2 (5.98)	
Can.- U.S.	0.397 (0.17)	14.99 (6.10)					-0.39 (1.11)	-8.44 (23.97)		0.472 (0.27)	7.354 (4.23)	
Can.-ROW	0.152 (0.19)	1.16 (1.60)								0.101 (0.48)	1.578 (7.47)	
Cze.(Own)										0.03 (1.02)		0.431 (0.32)
Cze.- U.S.										0.197 (0.26)	2.202 (2.92)	
Cze.-ROW										-0.25 (0.69)	-2.84 (7.69)	
U.S. (Own)	-8.12 (1.76)		1.27 (0.56)				-2.34 (1.64)		1.977 (1.34)	-0.98 (0.313)		-0.61 (0.33)
U.S. -ROW	-1.31 (1.42)	-10 (11.60)								0.21 (0.31)	2.343 (3.44)	
SA(Own)				-0.44 (0.12)		1.049 (0.16)						
SA-ROW				0.04 (0.80)	0.206 (4.54)							
ROW(Own)	-0.39 (0.59)		0.147 (0.19)	-1.91 (1.57)		0.836 (0.29)				-1.62 (1.09)		1.104 (0.39)

*Figures in the parentheses are the standard errors computed from the estimated import demand system parameters.

Conclusions and Implications

EU dominance of the world malt trade is linked to differences in physical attributes and aggressive pricing through the export restitution mechanism. This paper sought to understand the role of these unobserved physical attributes via substitution elasticities computed from parameters of LA/AIDS. Time series on malt import quantities and unit values of Japan, Brazil, Philippines, and Venezuela were used to estimate parameters of import demand systems.

Estimates of price and expenditure elasticities can provide guidance for marketing strategies. The prospective effectiveness of price discounts in expanding exports can be judged from the price elasticities. Except for Brazil, the EU own price elasticities are less than one, suggesting limited import response to a price discount. Compensated own price elasticities with respect to U.S. prices were larger than one (absolute values) for Japan and the Philippines. This may be due to very small market shares of the United States in these markets.

Most of the substitution elasticities between the EU and other sources for the four importers were positive. Statistically reliable substitution elasticities greater than one were observed in the cases of the EU and ROW in Brazil, the EU, and Canada in Venezuela. These elasticities were negative in the remaining cases, although the large spreads on these elasticities did not permit malt originating from these sources to be labeled as complements. A reasonable degree of substitutability was observed in the case of Japan between malt originating from Australia and Canada and the United States. These elasticities suggested that malt originating from the EU is least substitutable with malt from other sources.

Expenditure elasticities can be used to derive implications of longer-term shifts in import sources, and therefore, should be useful in guiding longer-term market development strategies. Broadly defined, these would include market selection and development types of activities (e.g., MPP, TEA, etc.). Results also show regional preferences for malt from particular origins. Specifically, if η_i is consistently greater (less) than 1, there is a strong (weak) preference for malt from that particular origin. Strong preferences may evolve from non-price factors, such as, variety development, quality requirements of specific production processes, and promotional activities (including brewer training).

All expenditure elasticities were positive except for Canadian malt in the Philippines and U.S. malt in Venezuela. The EU expenditure elasticities were all greater than one, implying that a greater share of incremental income is spent on malt originating from the EU. Expenditure elasticities for EU malt for three of the four countries were about 1.3, suggesting relatively strong preferences. Australia's were all less than one, suggesting that expanded imports of malt resulted in a less than proportionate increase in Australian malt. Over time, this would suggest a longer-term decline in market share, as already observed in the market share figures and by the Grains Council of Australia. United States and Canadian malt expenditure elasticities (ηs) varied substantially across importers. Strong preferences for each were held in Japan and for U.S. malt in the Philippines. For others, the preferences were substantially weaker.

Taken together, these results present some interesting contrasts. Strong and fairly uniform preferences were indicated for EU malt. Australian expenditure elasticities indicated uniformly weak preferences, but those for North American malts vary across importers. These generally reflected uniformly strong preferences for EU malts, and uniformly weaker preferences for Australian malt (at least among the two countries in the study), and varied preferences for North American malts.

From a demand perspective, these results (including both expenditure elasticities and growth) have important implications for market development. U.S. market development efforts would likely have the greatest potential for growth in Japan (high elasticities and fast growth) and the Philippines. There have been minimal exports to Brazil, so it is hard to infer from past data on this market. Venezuela is a slow growth market and, in fact, has a weak preference for U.S. malt; thus, export expansion in that market is questionable. This explains why the EEP initiative in Venezuela, though one of the first, has not substantially increased.

The preference structure for Australian malt suggested that there may be some inherent quality (or other) issues related to the acceptability of its malt in these import markets. This could be due to varietal differences relative to those of other exporters (Grains Council of Australia). Strong preferences for EU malt illustrates the preferences for 2-rowed malts in the world market. This study suggested that the EU malt was less substitutable with malt originating from other sources. Price-oriented export promotional measures undertaken to capture markets presently dominated by the EU would be mitigated by this fact. Offering better substitutes by improving and matching qualities provided by the EU and educating importers about U.S. beer and malt techniques are alternatives that would be necessary for longer-term growth in exports.

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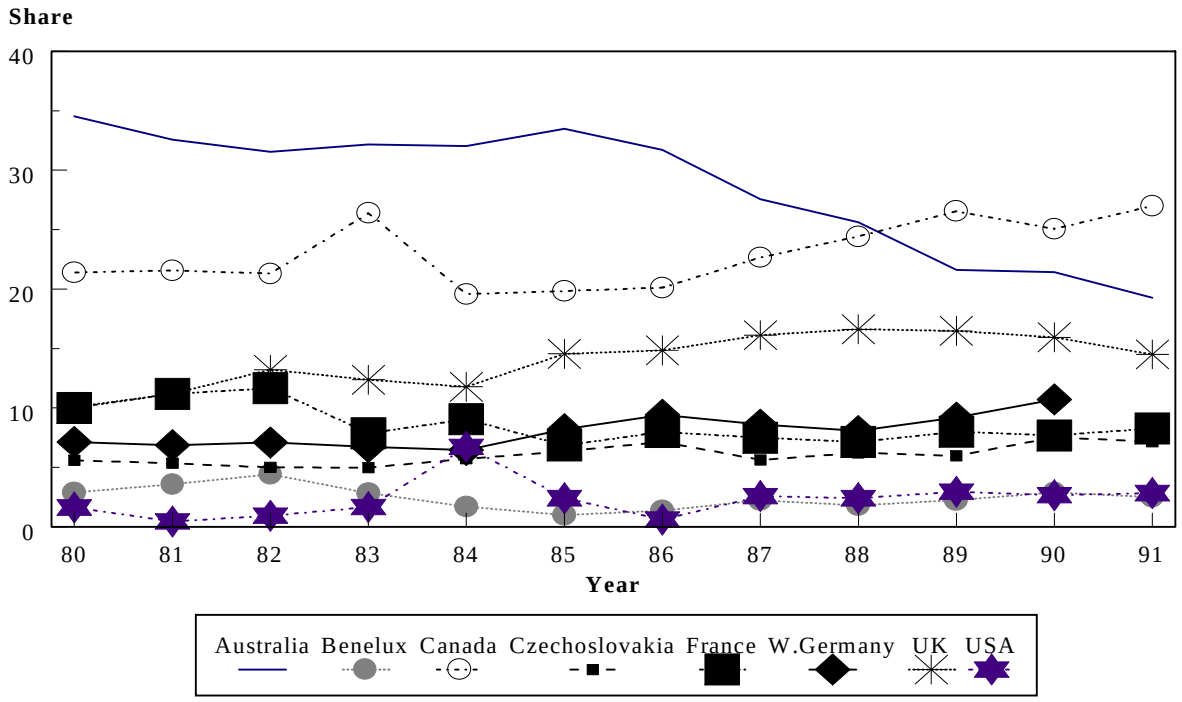

Figure 1. Exporter Shares in Japanese Malt Imports

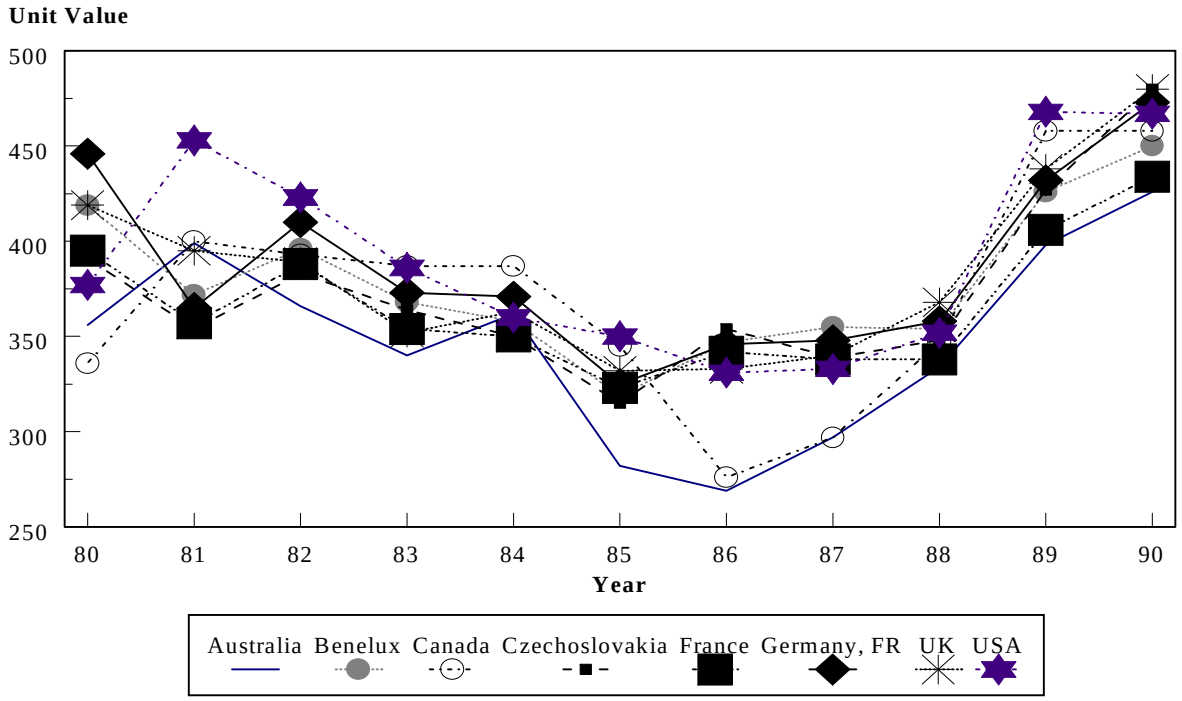

Figure 2. Malt Import Unit Values - Japan

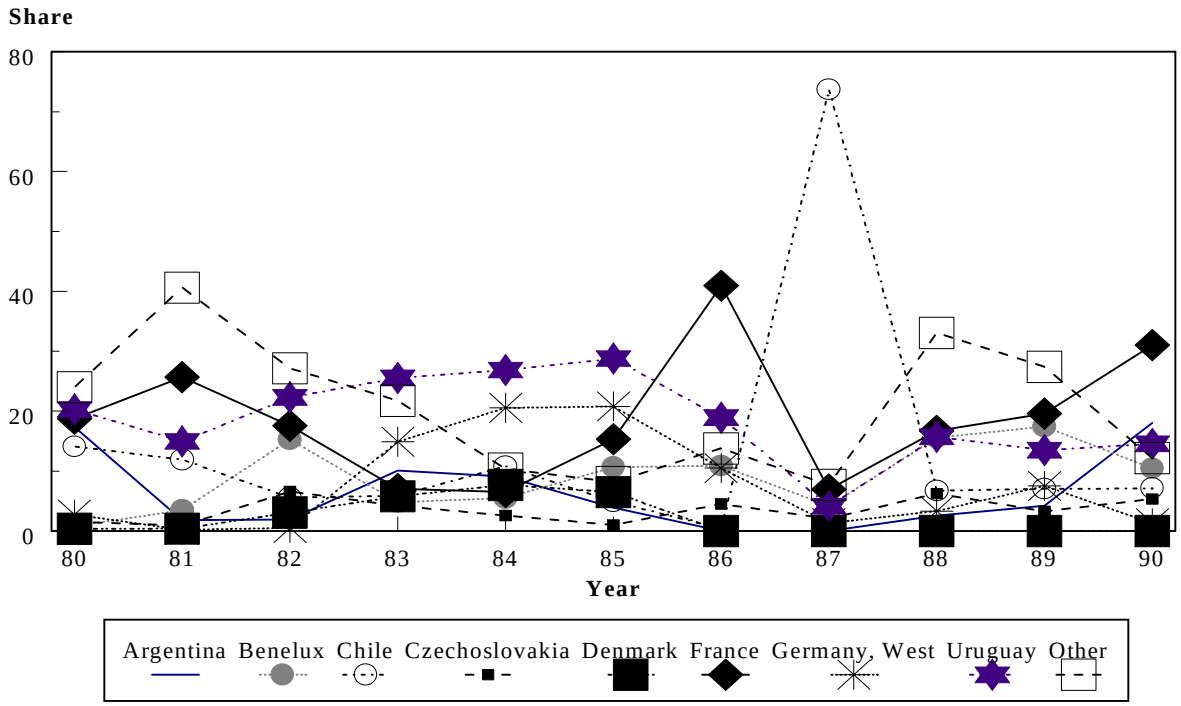

Figure 3. Exporter Shares in Brazilian Malt Imports

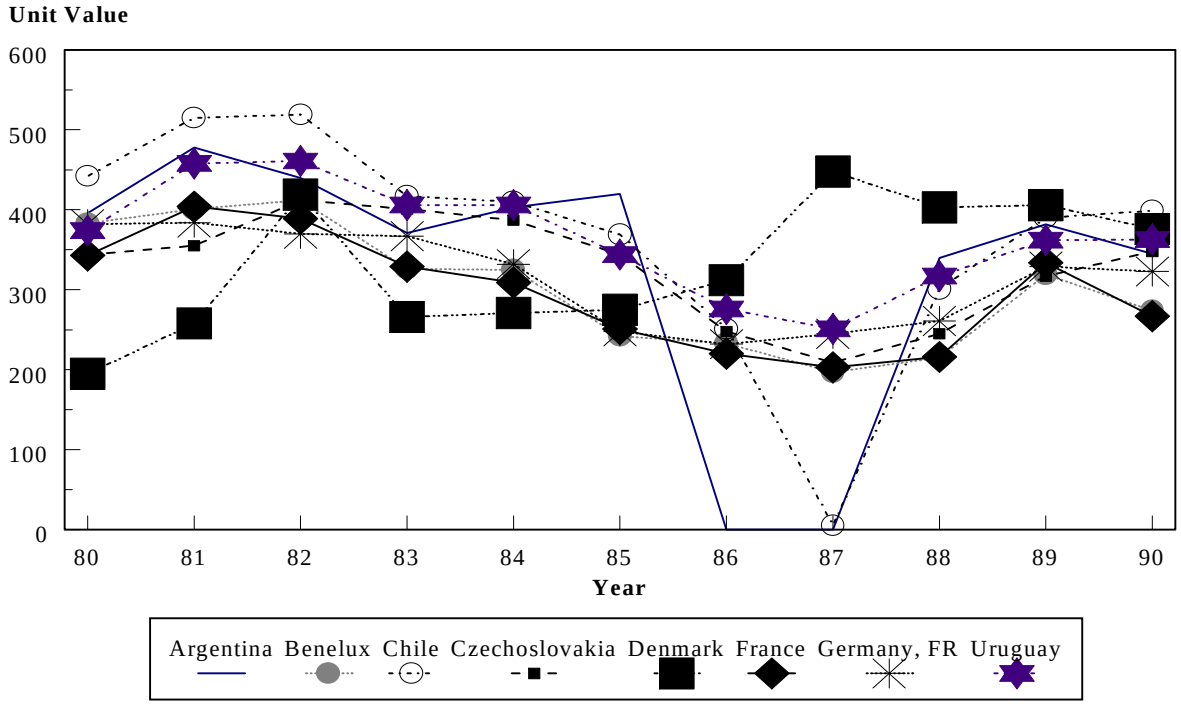

Figure 4. Malt Import Unit Values - Brazil

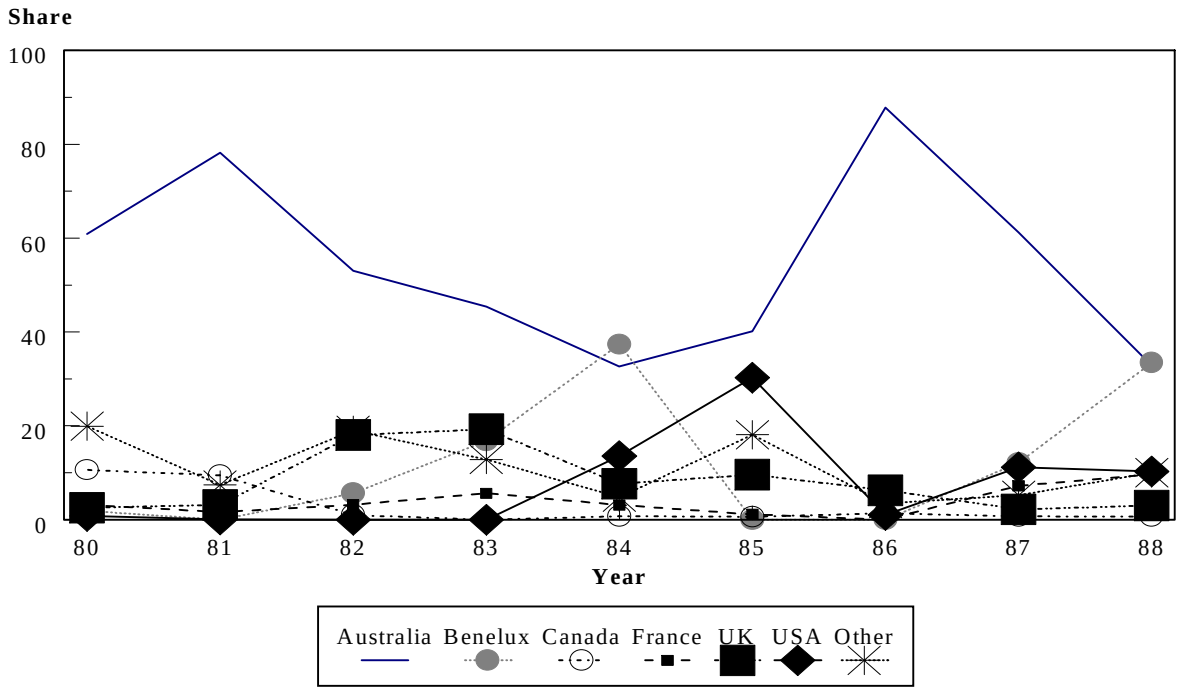

Figure 5. Exporter Shares in Malt Imports of the Philippines

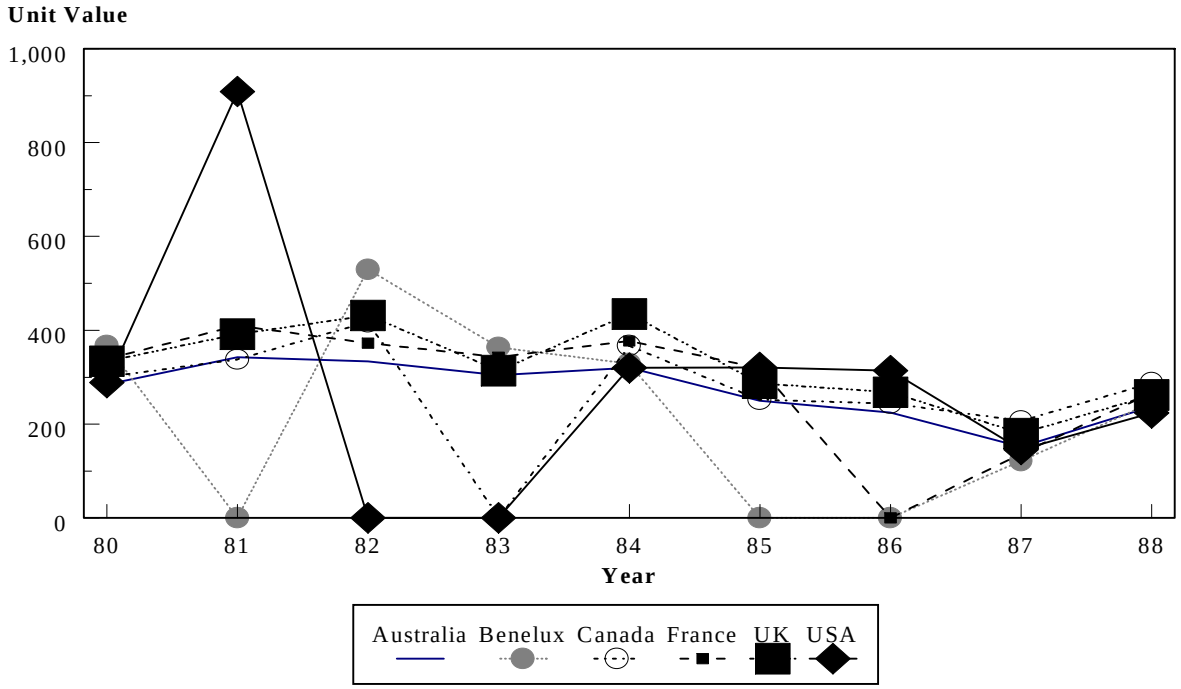

Figure 6. Malt Import Unit Values - Philippines

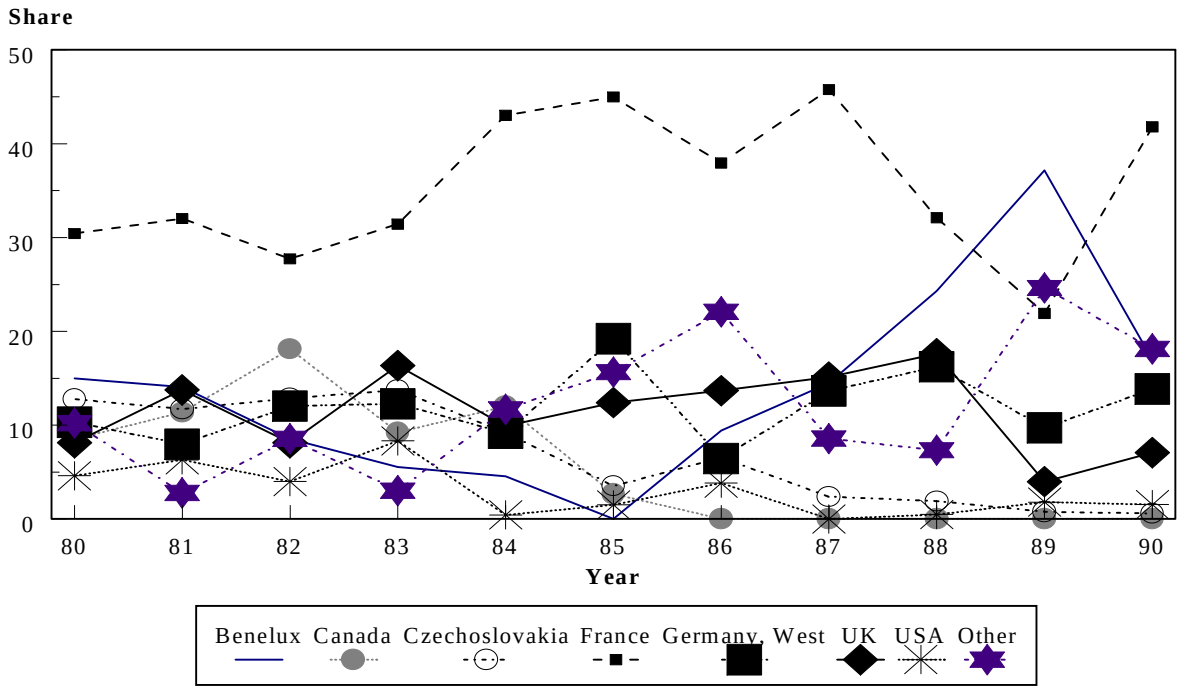

Figure 7. Exporter Shares in Malt Imports of Venezuela

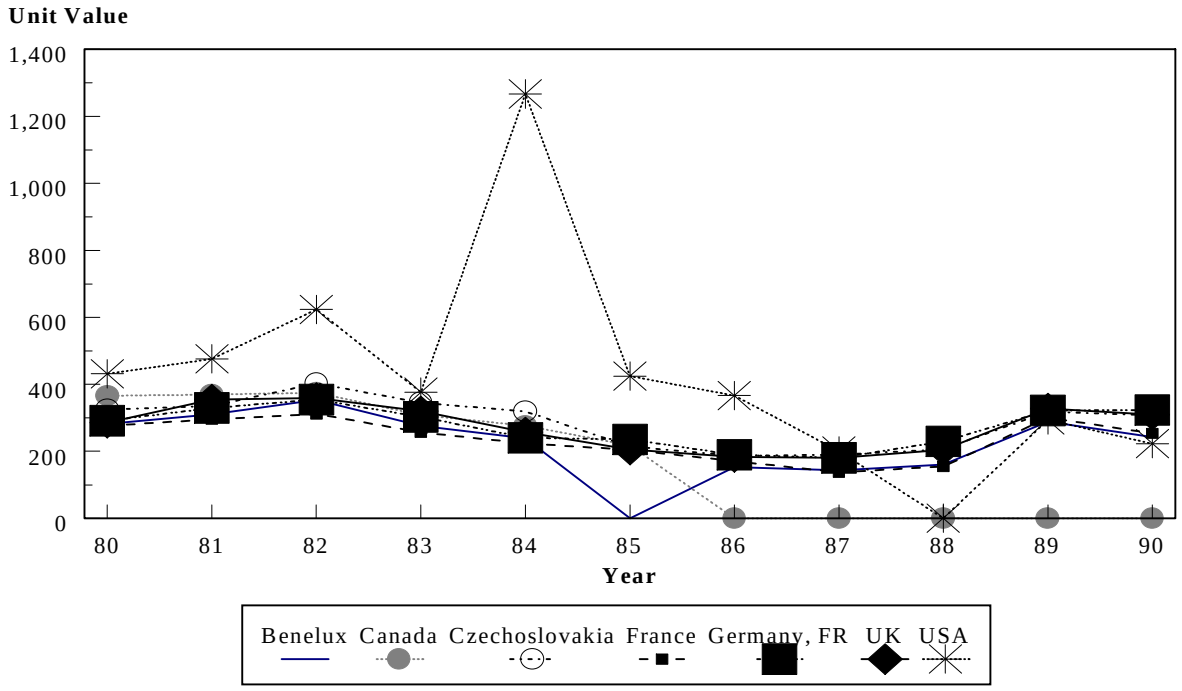

Figure 8. Malt Import Unit Values - Venezuela