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Sea Transport Demand in the Mainer Spanish Ports

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SEA TRANSPORT DEMAND IN THE MAIN **SPANISH PORTS**

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SEA TRANSPORT DEMAND IN THE MAIN SPANISH PORTS

Table of contents

	Pages
1. Introduction	3
2. Function Of The Demand Of Maritime Transport	
2.1. Methodology Note	5
2.2. Spanish Port Traffic Data	8
3. Function Of The Demand Of General Merchandise	10
4. Function Of The Demand Of Solid Bulk	15
4.1. Function Of The Demand Of Solid Bulk In Relation To Dry Cargo Tramp Time Freight Index	18
4.2. Function Of The Demand Of Solid Bulk In Relation To Dry Cargo Tramp Trip Freight Index	20
5. Function Of The Demand Of Liquid Bulk	21
6. Conclusions	25
7. Appendixes	28
8. References	42

1. INTRODUCTION

It's essential to study the economic systems, to analyse and predict how the demand works, and transport is not an exception. Forecasting demand is necessary to organise good planning of the services needed in a certain area, as well as to introduce an appropriate price policy.

Transport demand is derived as it responds to the needs of individuals and merchandise mobility. Its flow changes through time, depending on economic growth, the country's transport system and the current general economic situation (Martin & Román, 1999). Transport demand is determined by the relationship between infrastructure, services provided and its management.

The demand of maritime transport service is also, as is the rest of the transport subsector, a derived demand. It's directly related to the demand of merchandise that needs to be transported by sea, so that they can be consumed by the corresponding countries' economies. In this way, the demand of maritime transport service can be considered a part of the other merchandise production process (McConville, 1999). The level of commerce by sea determines the amount of transport needed by this means and the required cargo space. The objective is to concentrate on the demand by tonnage, so that the goods can arrive to the end consumer with the lowest price increase due to sea transport, hence minimizing its repercussion on the final price, guaranteeing the best conditions in terms of safe and quality in cargo handling.

As well as the demand of maritime transport for the merchandising of goods, there are two other types of demands in this port industry: the speculative demand of tonnage, based on the expectations of the financial advantages of buying vessels to resell them in the short term, and the demand of passengers who desire to make a trip, whether it be long or short distance. However, we are going to concentrate on the demand that emerges from international merchandise trade and which needs to be transported by sea to get to the end consumer.

The maritime transport industry can be analysed by dividing it into two big groups: The Liner terms maritime transport industry and the bulk industry. In each one,

the kind and size of vessels used differs, due to the big differences in the handling of the transported goods as well as its presentation. The objective of any ship company must be to offer quality and safe service with the lowest cost as possible (Stopford, 1999).

ORGANIZATION OF THE PAPER

The objective of the present paper is to analyse the incidence of maritime transport price and Spanish output in the amount of maritime transport services in demand in the main Spanish ports, breaking it down according to the presentation of merchandise type (general merchandise, solid bulk and liquid bulk). The period that we are going to study mainly goes from 1993 to 2003.

The empirical expression of the function of demand for each service is going to be elaborated, with the assumption of a *ceteris paribus* clause, in other words, the quantity of maritime transport services in demand is a function of price, considering that the rest of the variables that influence the amount in demand remain constant (concretely, Gross Domestic Product).

The relationship between the quantity in demand and national output is going to be examined in only a descriptive way, given that the previous supposition *ceteris paribus* do not allow us to analyse the relationship between both variables in an empirical form through the function of demand .

This paper is structured in the following way. First, we analyse the function of demand in a generic way and the concrete form of the function that it's going to be used, is determined. Secondly, the relationship between Spanish total port traffic and Spanish GDP is also analysed, as well as the participation of the different forms of merchandise's presentation in national port traffic.

In the following sections, the function of demand for each type of traffic (general merchandise, solid bulk and liquid bulk) is analysed. First, the relationship between the maritime traffics and national output that is shown in a descriptive way, and secondly, the relationship between this type of traffics and the corresponding price

indexes that are shown empirically. Finally, the results obtained from the previous analyses for each type of traffic are expressed in the conclusions.

The statistical sources that we have used are mainly: the reviews of maritime transport from United Nations Conference on Trade and Development (UNCTAD) and monthly informational reports of State Port Authority and statistical yearbooks from National Accounting of National Institute for Statistic (INE).

2. FUNCTION OF THE DEMAND OF MARITIME TRANSPORT

2.1 METHODOLOGY NOTE

The mode employed in regard to transport demand can be done under two different approaches: the aggregate or the disaggregated. Most of the studies can be done under either approach; the selection will depend on market conditions, its reach and available resources.

The classic or conventional methodology is the aggregated one, where the input is aggregated variables that represent the behaviour of a group of individuals (Martín & Román, 1999). This model is expressed through a functional relationship as follows:

$$Y=f(x) + E$$

Where Y is the endogenous or dependent variable that our model hopes to explain, it's a continuous variable and is explained by the functional relationship f, through a series of independent or explanatory variables of different nature. This relationship cannot be an exact one, so we introduce an error term E. In many cases the relationship can be a functional-linear one (Coto Millán, 88 & 99), where the estimate would be done by the square minimum method, although the method is also valid for non-linear functions like the semi-logarithmic ones or the double logarithmic ones. In other methods with more complex forms the principles of maximum verisimilitude will be applied.

On the other hand, disaggregated demand models are probabilistic models that intend to represent the individuals' behaviour in a particular way, in which the dependent variable is discrete and reflects the individual's behaviour; the problem analysed being the result of a set of individual choices. Each individual will choose in a rational way and with perfect information the option that maximizes its utility, the main restrictions being individual income and time. There are different interpretations of random utility model, but the most accepted is as follows:

$$U_{iq} = V_{iq} + E_{iq}$$

Where U_{iq} is the utility function of an alternative i , for an individual q , which is expressed as the sum of an observable or representative component V_{iq} and of one of random nature E_{iq} . From this, we establish a set of hypotheses that allow us to propose different econometric models, the most used ones being mainly the multinomial logit, the hierarchical log and the multinomial probit.

The model which is going to be followed in this study is the aggregated demand model, due to the fact that we assume that the demand for merchandise maritime transport in Spanish Ports is basically the result of the demand of general merchandise on a worldwide scale as well as national output, more than that of the decisions of a group of individuals.

The amount of sea transport in demand is going to be analysed dividing it into three service groups: general merchandise, solid bulk and liquid bulk, due to the fact that statistics are broken down in this way by United Nations Conference on Trade and Development (UNCTAD) and by The State Port Authority. Along these lines, the function could be expressed as follows (Coto Millán, 88 & 99):

$$Q_{it} = f(Y_t, P_t)$$

Where Q_{it} is the amount of maritime transport for merchandise in demand i and for the year t . This variable should be measured in tons per mile, as we would express the tonnage according to the distance travelled, but maritime transport statistical data in Spain is not available in this form, only in tonnes.

In regard to the quantity of maritime transport services in demand, we assume it's a function of the national total output or income for the year t Y_t , and also a function of a price vector P_t , where the corresponding service price is included whether it be for general merchandise, solid or liquid bulk. It's considered that maritime transport services are normal assets, so the relationship to its price would be inverse, which would generate a demand function with a negative slope and would change the same way as the National Income, so that the bigger the Gross Domestic Product, the bigger the amount of maritime transport in demand.

The estimation of this demand function confronts two main problems: the first one is a problem of identification, since demands as well as supply usually vary in the same way in response to very similar variables. The second one is due to the possible regulation of freight prices, which influences the determination of the balanced price, although nowadays most of the regulations have been eliminated (Coto Millán, 88 & 99).

The empirical model that we are going to develop is the following:

$$Q_{it} = a P_{it}^b e^{f(t)}$$

Where Q_{it} is the amount of tonnes of merchandise for each type of traffic i , for the period t , P_{it}^b are the different price indexes used for the period t for each type of traffic i , and where b is the parameter that determines the demand price elasticity. The selection of this exponential function is to avoid problems of heterokedasticity. With the time variable $e^{f(t)}$ we intend to come to a *ceteris paribus* clause that includes the demand function, as well as adapting a temporary model to a static model of demand. If we convert the previous function into a linear model through the change of variables in logs, we will get the following linear function that corresponds to the double log model (log-log):

$$L Q_{it} = L a + b L P_{it}^b + f(t)$$

$L Q_{it}$ = Natural logarithm of the quantity of maritime transport services in demand of the merchandise i and for the year t

$L P_{it}^b$ = Natural logarithm of the indexes of the prices used

$L a$ = Natural logarithm of the independent term of the lineal function

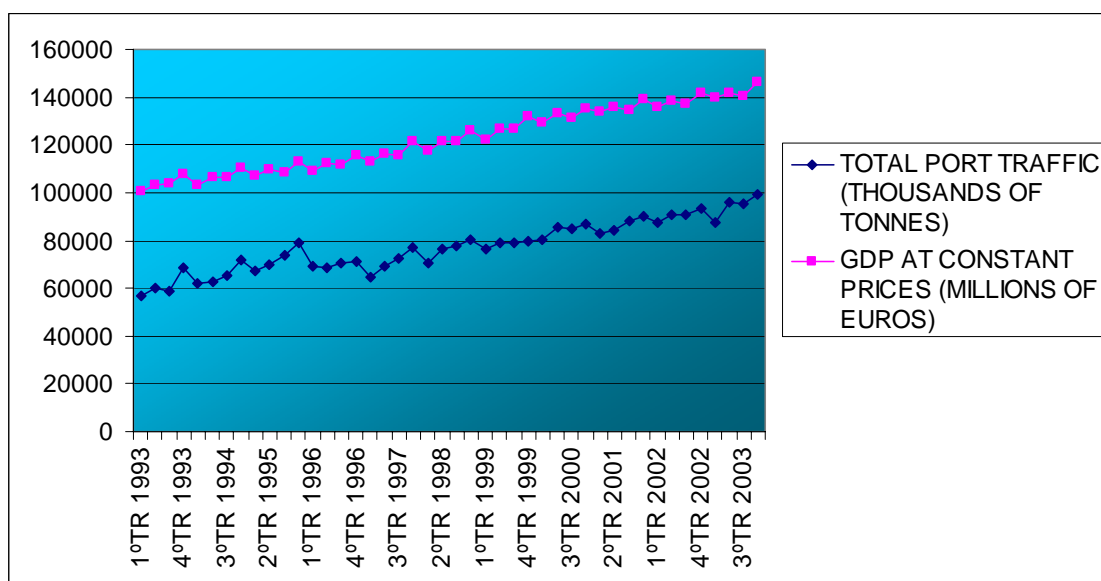
$f(t)$ = Time function

2.2. SPANISH PORT TRAFFIC DATA

The amount of sea transport services in demand is obtained from the total port traffic data from whole of the 27 port authorities considered to be of general interest¹ and which form the State Port system, managed as a holding by State Port Authority. As for the National Income, it is going to be measured from the GDP at constant prices (1995=100), valued in millions of Euros. The relationship between these variables, measured quarterly in the last ten years (Appendix I), is going to be analysed through the following chart (Chart 1):

Chart 1

Relationship between Total Port Traffic and GDP at constant prices in national terms



Source: From Statistical Yearbooks and monthly informational reports from State Port Authority from January 1993 to December 2003, and National Accounting of the National Institute of Statistic (INE).

It can be observed that both variables follow the same upward trend. The GDP keeps on growing progressively, and seasonal behaviour can be noticed each year. So,

¹ A Coruña, Alicante, Almería-Motril, Avilés, Bahía de Algeciras, Bahía de Cádiz, Baleares, Barcelona, Bilbao, Cartagena, Castellón, Ceuta, Ferrol-San Ciprian, Gijón, Huelva, Las Palmas, Málaga, Marín,

the growth starts in the first quarter and reaches its maximum in the fourth, remaining at similar levels in the second and the third; the first quarter of the following year begins with a decrease if we compare it to the fourth quarter. In regard to national port traffic, it can be observed that there is also an increasing tendency although it is a seasonal tendency as well. So, in the first quarter of each year it begins to grow until its maximum in the fourth quarter. Later, the first quarter of the following year decreases if we compare it to the fourth quarter, repeating the process over and over. The reason for this seasonal behaviour may be the rising of the energy consumption in the developed countries during the winter, as well as the rising of consumer goods sales at Christmas time.

The Relationship between the quantity of total port traffic in demand with the prices is not analysed, because price level indexes are not globally available for each type of merchandise, but specifically for each type of traffic. Later, we will see the demand function for the different forms of merchandise presentation.

On the other hand, if we examine the aggregate behaviour of all the Port Authorities of general interest, breaking them down under different traffic headings by solid bulk, liquid bulk and general merchandise, each group share and its evolution can be analysed through the decade we have chosen to study. The years 1980 and 1990 have been included to have a longer term reference as well (table I).

Table 1

Structure of the Maritime Spanish Aggregate Traffic (Thousands of tonnes)

YEAR	LÍQUID BULK	%	SÓLID BULK	%	GENERAL MERCHANDISE	%	TOTAL	%
1980	113427	53,89	58383	27,74	38685	18,38	210495	100
1990	118050	49,45	68586	28,73	52074	21,82	238710	100
1993	111333	46,99	69456	29,32	56130	23,69	236919	100
1994	116191	46,68	70010	28,12	62727	25,20	248928	100
1995	127938	45,99	79129	28,45	71115	25,56	278182	100
1996	124275	45,73	73598	27,08	73901	27,19	271775	100
1997	126350	45	71495	25,47	82900	29,53	280745	100

Pontevedra, Melilla, Pasajes, Santa Cruz de Tenerife, Santander, Sevilla, Tarragona, Valencia, Vigo y Vilagarcía.

1998	119248	40,86	79346	27,19	93256	31,95	291851	100
1999	118468	38,38	88860	28,78	101376	32,84	308704	100
2000	124923	38,31	92211	28,28	108959	33,41	326093	100
2001	126093	37,42	92977	27,58	117940	35	337010	100
2002	126181	35,79	100946	28,63	125412	35,58	352539	100
2003	130957	35,65	97637	26,58	138761	37,77	380091	100

Source: From Statistical Yearbooks and Informational Monthly Reports of State Port Authority from January 1993 to December 2003.

The share percentage for each kind of merchandise maintains the same tendency that we can observe in the international context. Liquid bulk has been losing its relative weight, from 53,89% in 1980 to 35,65% in 2003, due to two main factors: the international energy crises, as the higher the oil price the lower the oil in demand; and the rise in the use of pipes, oil pipelines and gas pipelines as well to transport this sort of merchandise, instead of using vessels to transport them. Solid bulk has virtually maintained its share percentage unchanged from 1980 to the present approximately 27-28%. At last, in regard to general merchandise, its share percentage in the total port traffic has ascended from 18,30% in 1980 to 37,77% in 2003. The explanations for this expansion are that there has been a huge international commerce level increase in raw materials as well as in manufactured goods; moreover, the containered cargo expansion, which improves the cargo handling due to the fact that it is homogenized, reducing costs and transport time considerable; finally, the technological innovation that permits the building of higher and safer vessels as well as increasing productivity in cargo handling.

3. FUNCTION OF DEMAND FOR GENERAL MERCHANDISE

If we analyse the maritime transport function demand for each group previously described, group one being general merchandise, group two being solid bulk and group three being liquid bulk, the function for general merchandise would be as follows:

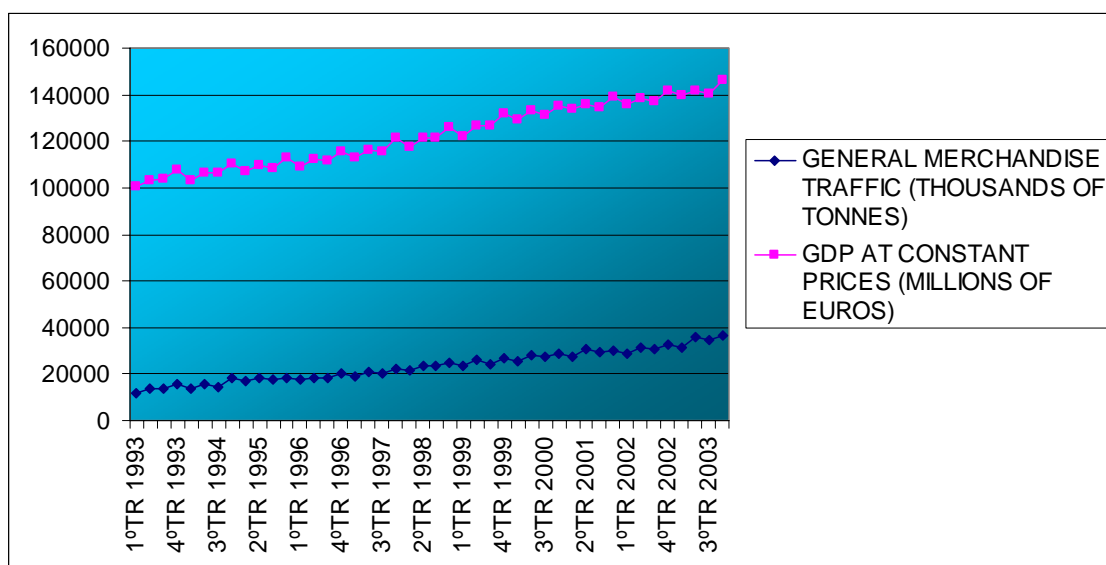
$$Q_{1t} = f (Y_t , P_{1t})$$

Where Q_{1t} is the amount of maritime transport service in demand for general merchandise for the year t ; Y_t is the country's income for the period t and P_{1t} is the price

for this type of merchandise. To analyse the evolution of these variables with specific data, we are going to pay attention to, on the one hand, the evolution of the quantity of general merchandise sea transport in demand, in regard to GDP at constant prices, base year 1995, in quarterly periods from 1993 to 2003 (Chart 2, appendix II). Data are not analysed monthly due to the fact that they are not presented like this by the National Statistic Institute. On the other hand, we are going to examine the relationship between the amount of maritime transport services in demand for general merchandise and the price index used for this kind of traffic, which would correspond to the demand function *ceteris paribus*. These last variables are calculated monthly from 1999 to around the middle of 2003, due to the fact that beginning from this date is when price indexes for this sort of merchandise are available.

Chart 2

Relationship between General Merchandise Traffic and GDP at constant prices



Source: From Statistical Yearbooks and Informational Monthly Reports of State Port Authority from January 1993 to December 2003, and National Accounting of INE (National Institute for Statistic).

It can be observed that the evolution of both variables has an upward trend, in the same way as we saw previously, when we showed the relationship between GDP and the total port traffic, but the escalation is more modest than before. On this occasion, seasonal behaviour can also be perceived each year, but different from the preceding case, as the year usually starts with an increase in the second quarter in respect to the first, but falls in the third only to rise in the fourth, with the exception of

the years 1996 and 1998. In the period studied, the first quarter of each year registers a lower increase than the fourth from the previous year, the same way as what happened before in the total port traffic analysis. We could find an explanation for this, in the commerce increase that takes place at Christmas time, due to the fact that this kind of goods usually arrives as general merchandise.

On the other hand, the evolution of the amount of the maritime transport services in demand has been analysed in respect to the second variable that influences it, which is the corresponding price index. In this case, the evolution of the regular liner freight index is going to be examined, due to the fact that the general merchandise is usually transported in this way, and its prices are competitively fixed at an international level at the Freight Conferences. The market of containered maritime transport in regular liner is mainly dominated by German shipbrokers, particularly by the members of the *Hamburg Shipbrokers Association*², that is why the price index of merchandise maritime transport in regular liner is constructed with the data obtained from the Ports chain Antwerp/Hamburg. The data are monthly price indexes which are going to be analysed in the period from January 1999 to May 2003, with 1995 as the base year, which coincides with the GDP base at constant prices previously examined (Chart 3 & Appendix III).

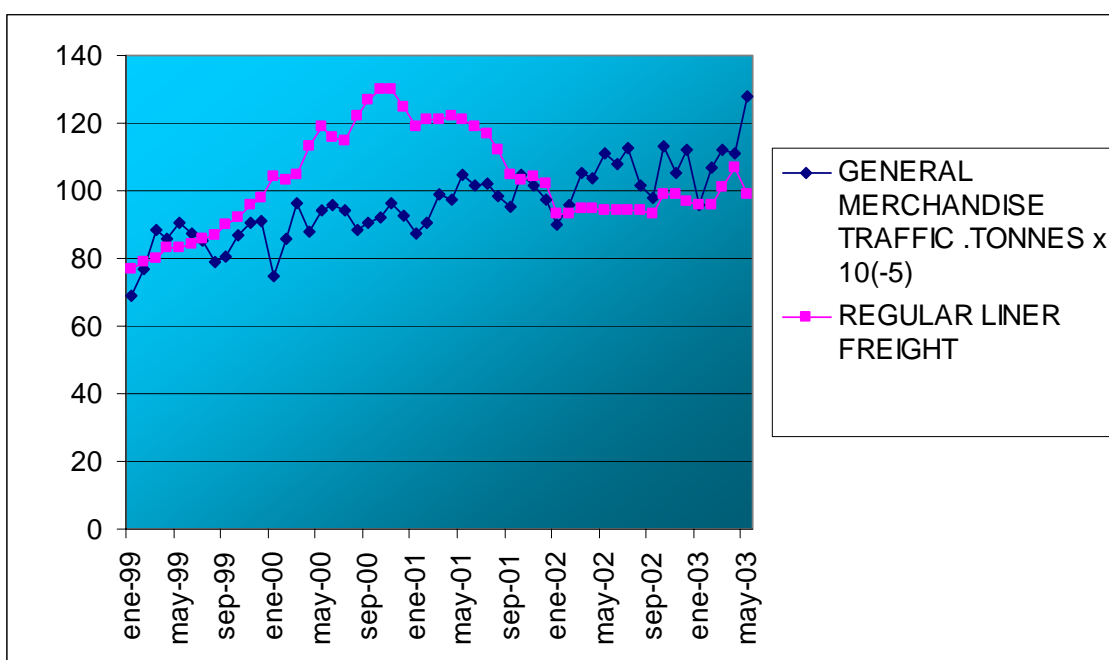
If we examine the series obtained in Chart 3, it can be observed that prices do not exactly follow the inverse tendency in relation to the quantity of sea transport services of general merchandise in demand, which makes clear that it is not the most influential variable in the endogenous variable, although it does condition it. So, it's made clear that the prices of services keep growing in a fairly moderate way through the period studied, but the global index for the year 2000 was 117 and for the year 1999 was 86, which means a 31 point increase. Instead, the global index in the year 2001 was 114, which indicates a 3 point reduction. The reason for this reduction in the year 2001 could be, on the one hand, the beginning of a global economic recession and, on the other hand, the terrorist attack on September 11th in USA, which affected the security of global transport and generated a reduction in traffic. Subsequently, the global index for

² *Hamburg Shipbrokers' Association* (VHSS) controls approximately 75% of the freighted available tonnage by container vessels in the free market.

the year 2002 fell 19 points from 2001, reaching 95 points later in the year, being especially low in the first half of the year; from this moment on, it began to increase, which could be motivated not only by the weak reactivation of the world economy, but also by rise in insurance premiums for vessels as well as transported goods, which means an increase of the end price of the service.

Chart 3

Relationship between the general merchandise traffic and the regular liner freight



Source: From Statistical Yearbooks and Monthly Informational Reports of State Port Authority from January 1999 to may 2003, and German Transport Ministry.

In regard to empirical analysis, the explained or endogenous variable: tonnes of general merchandise are going to be expressed in function with the price indexes of regular liner freight, considering that the rest of the variables that influence the amount in demand remain without change. The precise form of the function is the following:

$$L Q_{1t} = 5.87 - 1.43 (L P_{1t} / L P_{1-(t-1)}) + 0.001t$$

(0.518)
(0.5164)
(3.29*10⁻⁵)

$L Q_{1t}$: Natural logarithm of the quantity of general merchandise in tonnes.

$L P_{1t}$: Natural logarithm of the price indexes of regular liner freight.

$L P_{1(t-1)}$: Previous variable applying one lag.

$L P_{1-(t-1)}$: Explainer ratio of price variations between periods

>1 increase in real price

=1 no change

<1 diminution in real price

t: determinist tendency.

R^2 adjusted = 0.92

S.E. = 0.026; D.W. = 1.90

ADF ($L Q_{1t}$) = -7.79 ; D.W. = 1.97

ADF ($D L P_{1t}$) = -8.10 ; D.W = 2.15

Test Jarque-Bera = 1.37

Test White: Obs * R^2 = 2.71

Breusch_Godfrey, serial correctional test (-2) = 0.51

Breusch_Godfrey, serial correctional test (-3) = 0.70

Breusch_Godfrey, serial correctional test (-4) = 0.52

Breusch_Godfrey, serial correctional test (-5) = 0.42

The variables have been expressed in the log form with the purpose of working under a linear model. The explained variable, tonnes of general merchandise, maintains its level because it is stationary, as the Dickey Fuller test for this variable surpasses the critic value to reject the null hypothesis of unit roots, as well as a seasonal adjustment of multiplicand mobile mean kind is applied, which reduces the recursive variations for certain periods. The explanatory variable, price indexes of the regular liner freights, is integrated of order 1. The transformation used in the series is the ratio between the observed value and itself lagged in one period, which is stationary, and offers identical information to the initial differences. The last term of the regression t, is a determinist trend which approaches us to the *ceteris paribus* clause, eliminating the influence of other variables and adapting our model to the established demand law in statistical terms.

The Jarque-Bera test indicates the normality of the model residuals, with a probability value of 0.55 (p-value), accepting in this way the hypothesis of normality of the residuals.

The White test (homoskedasticity test) is used to evaluate the existence of homoskedasticity, as we obtain a value with a probability of 0.63, the null hypothesis of constant variance is accepted.

In regard to autocorrelation, Durbin Watson Test seems to indicate the non-autocorrelation of order 1. Breusch-Godfrey statistical tests have been done for successive lags being satisfactory the obtained results. The representation of the correlogram for 24 lags does not show any significant value either in the function of autocorrelation or in the function of partial correlation.

In respect to elasticity price of the demand, the sensitiveness or variation grade in the amount of general merchandise in demand takes a value of -1.43, before a variation in regular liner price indexes, which reflects an inverse and elastic or sensitive relationship between variables, so it surpasses value 1.

4. FUNCTION OF DEMAND OF SOLID BULK.

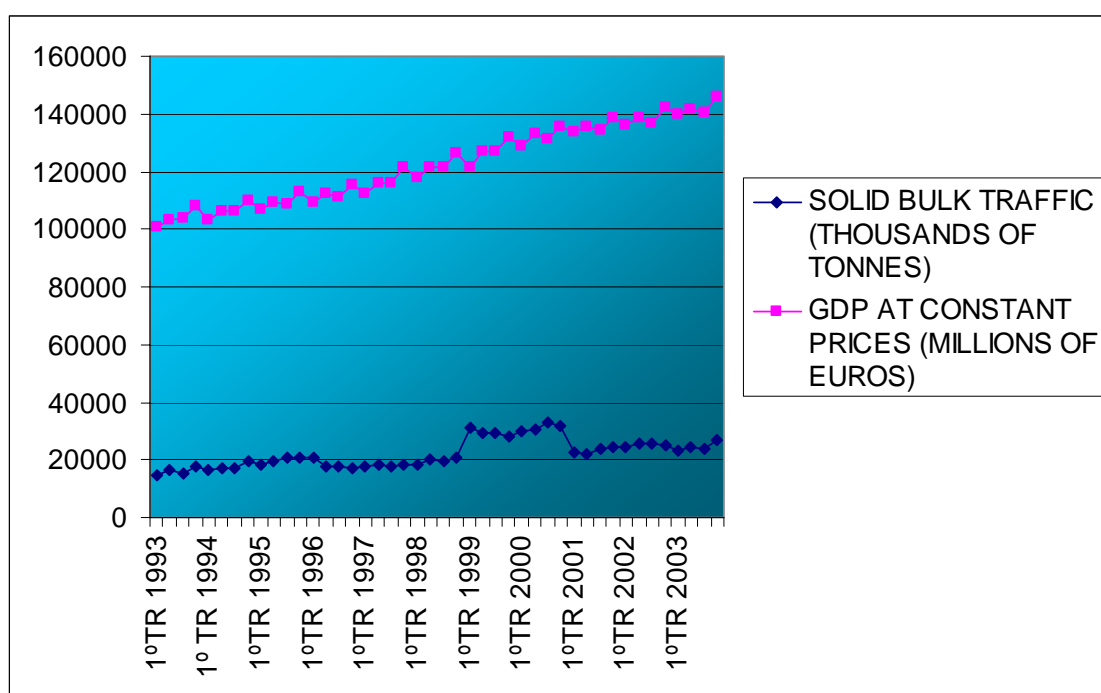
The function of demand of sea transport services of solid bulk would be as follows:

$$Q_{2t} = f (Y_t , P_{2t})$$

Where Q_{2t} is the amount of maritime transport services of solid bulk in demand for the year t , Y_t is the national income for the period t and P_{2t} is the price index that corresponds to this type of traffic. Just like the case of general merchandise, it will be analysed, on the one hand the relationship between the amount of solid bulk and the GDP at constant prices with quarterly data for the period from 1993 to 2003 and, on the other hand, the relationship between the endogenous variable and the other exogenous variable in this function, prices, with monthly data for the period from January 1999 to

August 2003. The analysis is elaborated in this way due to the fact that data are only available with this time period.

Chart 4
Relationship between solid bulk traffic and GDP at constant prices



Source: From Statistical Yearbooks and Monthly Informational Reports of State Port Authority from January 1993 to December 2003, and National Accounting of INE (National Institute for Statistic).

In chart 4 (appendix IV) the evolution of solid bulk in regard to GDP can be analysed, meanwhile GDP shows a stable growth, solid bulk changes around 14 million and 30 million during the decade studied, although there is a big expansion in 1999 and 2000. The reduced levels of solid bulk in 1997 and 1998 can be related to the Asian crisis and the currency devaluation, mainly in Korea, which caused a global decrease in this traffic (Coto Millán, 1999). The succeeding recovery of these economies in 1999 and 2000 can be related to the increase of this tonnage traffic. Subsequently, the international economic crisis that begins in 2001, aggravated by the terrorist attacks of September 11th, could be the origin of the decrease that takes place in 2001 and 2002. Through 2003 a slight upsurge begins to appear, although it does not achieve the levels of 1999 and 2000. In short, there is a higher relation between the national traffic of

solid bulk with the global economic activity, principally that of Asia, than with the national output.

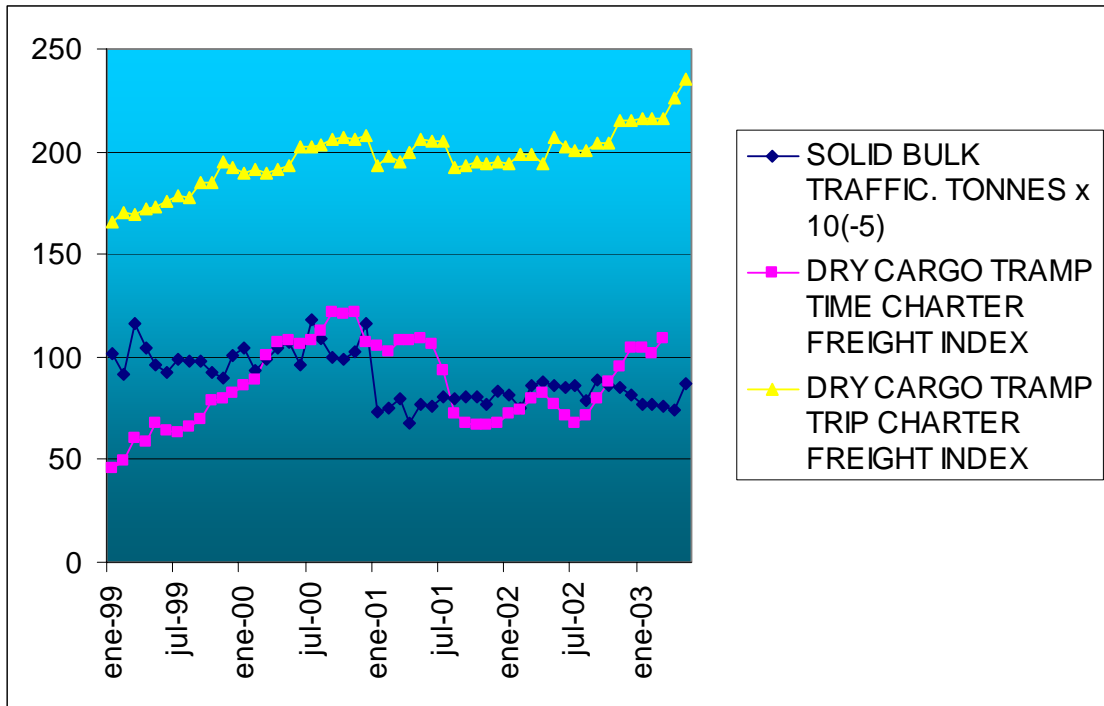
On the other hand, the relationship between the quantity of sea transport services of solid bulk in demand has been examined with the prices, precisely dry cargo³ freight, by freight trading agreements, as the UN does. The huge world traffic of solid and liquid bulk works competitively, *Tramp navigation*, as its price is fixed by freight transport agreements. These freight agreements can be either time freights, when a vessel is hired for a period of time, or by trip, when the hiring is for a concrete trip. Data are monthly price indexes and they are going to be studied for the period from January 1999 to may 2003, the base year for freight by time being 1995 and the base year for freight by journey being July 1965 to June 1966 (Chart 5 & appendix V). Dry cargo price indexes in time freight regimen have been obtained from German Transport Ministry, and trip freight from *Lloyd's Ship Manager*.

As we can see in chart 5, dry freight cargo price indexes in time charter have a similar evolution to trip charter in several periods, but these have lower volatile fluctuations. In the first case, time charter, indexes keep growing until November 2000, but from this moment on, in December 2000, a fairly important decrease takes place, going from 122 in November 2000 to 68 in July 2002, when a recovery process started. If we compare the global indexes, we go from 66 in 1999 to 108 in 2000, but in 2001 its decrease starts, taking a value of 90 and 80 in 2002. In regard to the quantity of solid bulk transported in this period, demonstrates that there is mostly an inverse relationship with this price index. So when around November 2000, prices of time charter service reach its maximum, the amount of tonnes transported begins to lower significantly, once it is adjusted in January 2001. On the other hand, when prices for this type of service begin to descend around July 2001, transported cargo commences a weak increase that does not reach the initial levels.

³ Dry cargo is opposite to *tanker cargo*, so it can be put on a par with solid bulk

Chart 5

Relationship between Solid Bulk Traffic and Dry Cargo Time Charter and Trip Charter Freight Indexes



Source: From Statistical Yearbooks and Monthly Informational Reports of State Port Authority from January 1999 to may 2003, German Transport Ministry and *Lloyd's Ship Manager*.

On the contrary, when trip freight price indexes are analysed, it can be observed that its evolution is, in general terms, rising and stable, and its global indexes being respectively 178, 199, 198 and 203, in 1999, 2000, 2001 and 2002.

If we intend to determine the functions of demand that relate the solid bulk tonnage with the price indexes of time freight through an econometric analysis and, later, with price indexes of trip freight, we would obtain the followings models based on the evolution of the explained series that shows in January 2001 a structural bankruptcy.

4.1. Function of the demand of solid bulk in relation to tramp time charter freight index:

$$L Q_{2t} = 4.91 - 0.079 L P_{21t} - 0.333 D_{01I} + 0.04 t$$

(0.175) (0.041) (0.039) (0.01)

L Q_{2t}: Natural logarithm of the quantity of solid bulk in tonnes

$L P_{21t}$: Natural logarithm of. tramp time charter freight index.

D 01I: Dummy variable that takes values from January 1st 2001.

t: linear tendency.

R^2 adjusted = 0.775

S.E. = 0.062; D.W. = 1.83

ADF ($L Q_{2t}$) = -4.011 ; D.W. = 2.08

ADF ($L P_{21t}$) = -2.395 ; D.W = 2.007

Test Jarque-Bera = 0.98

Test White : Obs * R^2 = 0.886

Breusch_Godfrey, serial correctional test (-2) = 0.69

Breusch_Godfrey, serial correctional test (-3) = 0.87

Breusch_Godfrey, serial correctional test (-4) = 1.02

Breusch_Godfrey, serial correctional test (-5) = 1.02

Variables have been expressed in log form with the purpose of working with a linear model, as the previous case. The endogenous variable is stationary with a significance level of 5%, measured by Dickey Fuller Test; in reference to the exogenous variable, prices, it is not a stationary variable under the results of the same test, although the option of working in difference has not been considered, owing to the fact that the model results do not correspond to a spurious regression.

In regard to variable D 01I, it is represented as a dummy variable to reflect the change in the y axis, in the origin of the function of demand from January 2001. Chow test rejects the null hypothesis of stability for this period, with which we would accept the alternative hypothesis of structural bankruptcy.

Form the point of view of the trend, it is a determinant and bring us to the *ceteris paribus* clause, and eliminates the influence of other non-desired variables in the function. The selected tendency is linear because it's the one that brings a better adjustment to the model. In the function of demand, their standard deviation appears below the parameters in brackets, reflecting that all the coefficients are significant, with the exception of the independent variable's coefficient, which surpasses slightly a 5% significance.

As far as price elasticity of the demand is concerned, which is 0.08, reflecting so an inverse or negative and inelastic relationship between both variables.

4.2. Function of the demand of solid bulk in relation to tramp trip freight index

$$L Q_{2t} = 7.47 - 0.56 L P_{22t} - 0.070 D 01I*L P_{22t} + 0.007 t$$

(1.337) (0.259) (-0.008) (0.002)

$L Q_{2t}$: Natural logarithm of the amount of solid bulk in tonnes

$L P_{22t}$: Natural logarithm of tramp trip freight index.

$D 01I*L P_{22t}$: Dummy variable that takes values from January 1st 2001

t : linear tendency.

R^2 adjusted = 0.79

S.E. = 0.063; D.W. = 1.84

ADF ($L Q_{2t}$) = -4.011 ; D.W. = 1.84

ADF ($L P_{22t}$) = -2.152 ; D.W = 1.90

Test Jarque-Bera = 0.62

Test White : Obs * R^2 = 1.03

Breusch_Godfrey, serial correctional test (-2) = 0.17

Breusch_Godfrey, serial correctional test (-3) = 0.12

Breusch_Godfrey, serial correctional test (-4) = 0.09

Breusch_Godfrey, serial correctional test (-5) = 0.07

The endogenous variable, as we denoted in the previous section, is stationary with a significance level of 5%, measured by Dickey Fuller test; in relation to the exogenous variable, tramp trip freight index, is also stationary under the results of the same test with the same significance level 5%.

As far as variable $D 01I*L P_{22t}$ is concerned, it is represented as a dummy variable to reflect the slope change of the function of demand from January 2001, being the best adjusted. Chow test (29.26) rejects the null hypothesis of stability for this period, with which the alternative hypothesis of structural bankruptcy would be accepted.

From the tendency point of view, the explanations are almost the same as those of the previous case. In reference to elasticity, there is elasticity before the period 2001 and elasticity afterwards, although with a reduced variation. The first part has an elasticity of -0.56, meanwhile the second has -0.63. It continues to demonstrate that an inverse tendency with a reduced sensibility in the quantity in demand related to the price variations exists.

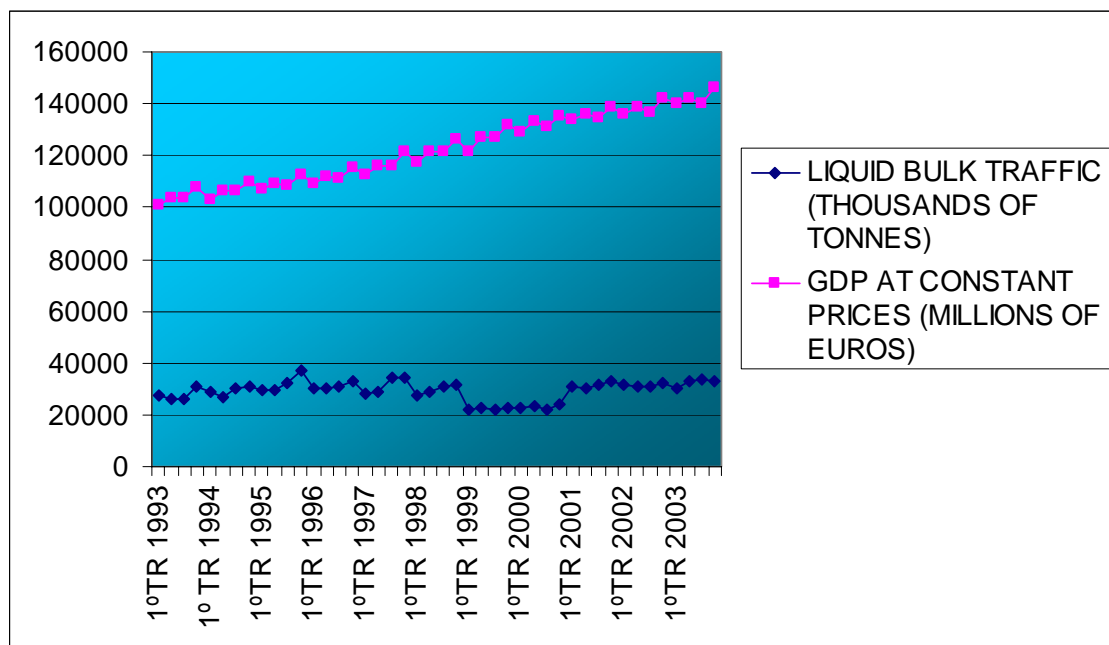
5. FUNCTION OF DEMAND OF LIQUID BULK.

Function could be expressed as follows:

$$Q_{3t} = f (Y_t , P_{3t})$$

The national amount of maritime transport services of liquid bulk in demand Q_{3t} , mainly oil and its derivatives, would be connected to the country's output Y_t , measured in GDP terms at constant prices (base 1995 = 100), as well as the corresponding prices of this kind of traffic P_{3t} , as the preceding cases. The relationship between transported tonnage of liquid bulk and GDP is going to be analysed in Chart 6 (Appendix VI).

Chart 6
Relationship between Liquid Bulk Traffic and GDP



Source: From Statistical Yearbooks and Monthly Informational Reports of State Port Authority from January 1993 to December 2003, and National Accounting of INE (National Institute for Statistic).

It can be observed that variations in liquid bulk traffic do not agree with national output variations. So, while the last one follows an increasing tendency, the explanatory or endogenous variable rises moderately until 1998, with a weak seasonal behaviour at the beginning of each quarter, followed by an increase throughout the year that reaches its maximum in the fourth quarter, mainly due to the increase of the power consumption in winter. But in 1999, a sudden descent of the volume of liquid bulk transported occurs, which is maintained during 2000 and improves beginning in 2001.

On the other hand, we are also going to analyse the influence of the second variable, prices, in the amount of maritime transport services of liquid bulk in demand. For this kind of merchandise, the variable used as a price is the tanker cargo price index, for *very large crude carriers*⁴ that hold crude oil and for small vessels⁵ that hold petroleum products and crude oil (Coto Millán, 1999).

If we look to the series obtained in Chart 7 (Appendix VII), it can be observed that there is a certain inverse relationship between these variables. Prices indexes for big- sized vessels in 1999 are low, which can be explained by the delivery of new vessels that were built in 1998, hence decreasing the service price as supply rises (Coto Millán, 1999). During 2000, prices begin to recover, above all in the second quarter, but from 2001 a strong decline occurs with its lowest point in May 2002. The reason for this important decrease seems to be the overproduction of oil by the OPEC countries. These countries agreed on a production decrease to curb the price fall, so in the last quarter of 2001 the overproduction was reduced, although at the end of this year there were reports from Iraq, about its non-observant behaviour in regard to the *oil for food* programme. Furthermore, Iraq was illegally introducing oil into the Mediterranean Sea either by oil pipelines, that were out of service, or by vessels (*Review of Maritime Transport*, 2002). Between May and September 2002, price reaches its lowest level, and from this moment on, a slight improvement begins. As for the amount of liquid bulk transported is concerned, it remains stable throughout 1999 and 2000, around 6-8 million tonnes. But, from January 2001, coinciding with price fall, a stage of increase

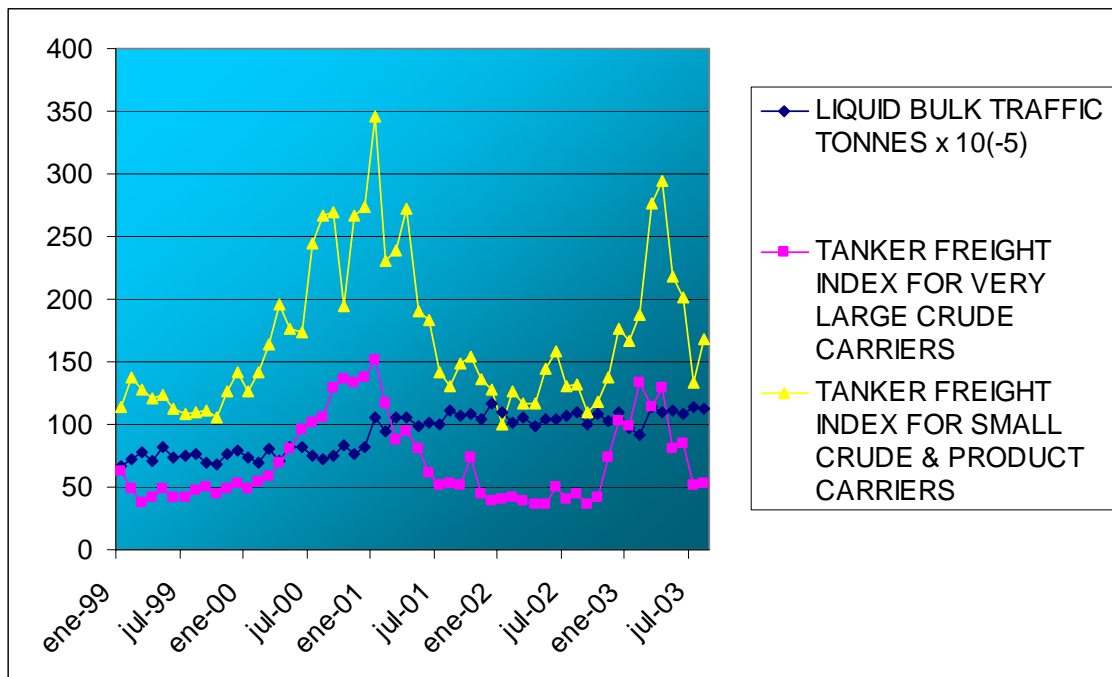
⁴ VLCC: *Very Large Crude Carrier*. In this includes vessels that have 150.000 tonnes or more of dead weight. The Dead weight is the total weight that vessel transports being at its maximum draught of arise including the cargo, fuel, water, crew, passengers, equipment, etc.

⁵ This refers to vessels between 30.000 and 70.000 tonnes of dead weight

begins, going to around 9-11 million tonnes during 2001 and in the first six months of 2002.

The evolution of prices of the services of small oil tankers is nearly the same as VLCC, although their fluctuations are more evident and their prices are higher.

Chart 7
Relationship between Liquid Bulk Traffic and Price Index of Very Large Crude Carriers and Small Oil Tankers



Source: From Statistical Yearbooks and Monthly Informational Reports of State Port Authority from January 1999 to august 2003 and UNCTAD.

The function of demand has been done empirically by relating the tonnage of liquid bulk with price indexes for big-sized vessels. In the case of the small vessels, the function has not been done due to the fact that the evolution is nearly the same, although with much more visible fluctuation.

$$L Q_{3t} = 4.53 - 0.063 L P_{3t} + 0.052 D_{01I} * L P_{3t} + 0.004 t$$

(0.085)
(0.020)
(0.007)
(0.001)

$L Q_{3t}$: Natural logarithm of the quantity of liquid bulk in tonnes.

$L P_{3t}$: Natural logarithm of Very large Crude Oils Carriers price index.

$D 01I * L P_{3t}$: Dummy variable that takes values from January 1st 2001.

t: linear tendency.

R^2 adjusted = 0.86

S.E. = 0.066; D.W. = 2.01

ADF ($L Q_{3t}$) = -3.897 ; D.W. = 2.24

ADF ($L P_{3t}$) = -3.87 ; D.W. = 1.91

Test Jarque-Bera = 1.57

Test White: Obs * R^2 = 1.82

Breusch_Godfrey, serial correctional test (-2) = 0.04

Breusch_Godfrey, serial correctional test (-3) = 0.13

Breusch_Godfrey, serial correctional test (-4) = 0.09

Breusch_Godfrey, serial correctional test (-5) = 0.44

The endogenous and the exogenous variables are stationeries with a level of significance of 5%, measured by Dickey Fuller Test. In respect to variable $D 01I * L P_{2t}$, it is represented as a dummy variable to reflect the slope change in the function of the demand from January 1st 2001, being the best adjustment confirmed. Chow Test (33.09) rejects the null hypothesis for this period, with which the alternative hypothesis of structural bankruptcy would be accepted

From the point of view of the tendency, the explanations are the same as the previous the case. In regard to price elasticity of the demand, there is elasticity before the period 2001 and afterwards. The first part has an elasticity of -0.063, while the second one has -0.011, which demonstrates an inverse trend with a reduced sensitivity in both cases.

6. CONCLUSIONS

The output and the goods and services consumption tends to divide itself spatially into units more and more specialised and dependent between each other, commerce and transport being the connection between these units. So, the most specialised and spatially dispersed the units are, the more the transport activity required.

In regard to the type transported, it is foreseeable that the general merchandise participation will continue growing in the total traffic, detrimental to liquid bulk, with solid bulk remaining stable.

The analysis of the demand over maritime traffic series that we have elaborated in respect to the several price indexes presents a clear difference:

1. The general merchandise traffic:

This type of traffic is the one which is most determined by the economic situation and the international policy. So, growth of international commerce, elimination of commercial barriers among countries, incorporation of new countries to the most relevant commercial flows, etc., determine the quantity of maritime transport of general merchandise in demand, so it is usually the most frequent merchandise presentation form for commercial flows, and concretely the containered one.

The effect of these factors in relation to international commerce is not reflected, in an explicit way, in the function that relates the amount of general merchandise in demand to the regular liner freight indexes. The problems of estimating are: how to sterilize this explicit relationship between quantities and prices in a dynamic context and, how to obtain homogenised and long term information sources.

Supposing that the regression obtained is valid in general terms, we have to take into account that any variation in price indexes has as a consequence, an inverse and sensitive response in the amount of sea transport services of general merchandise in demand. This elastic relationship between the amount in demand and the price may be due to the substitution possibility of this type of traffic for other types of merchandise

presentation, as can be the case of the raw materials that can be transported as solid bulk, or in other transport modes like train or road.

2. Bulk traffic:

In all the cases analysed (solid bulk in tramp time charter freight and tramp trip freight and liquid bulk) the functions of demand obtained reflect an inverse relationship between price and amount in demand, as well as the existence of inelasticity or reduced sensitiveness from one variable to another.

In the concrete case of solid bulk, is also shown a relationship between the quantity of solid bulk maritime transport services in demand with the global economic context, in such a way that the fluctuations coincide more with the international economic environment variations than with the evolution of national output.

In regard to solid bulk function of demand connected to tramp trip and time freight indexes, both of them follow a similar trend, although tramp trip freight index is less volatile than it is tramp time charter freight. In relation to elasticity-price of demand, the sensitiveness of the amount in demand of tramp trip freight indexes (-0.56 and -0.63) is quite superior to time freight (-0.08), although both are negative and inelastic.

On the other hand, liquid bulk evolution does not seem to be influenced by national output, but rather by the global evolution of oil prices, which at same time determines the evolution of freight prices for this kind of traffic.

In regard to the function of demand that relates the quantity of liquid bulk maritime transport services in demand to the very large crude carriers price indexes (small oil tankers have a similar evolution although much more accentuated) the elasticity obtained is an inverse but very low one (-0.063 y -0.011) which could be motivated by the high dependence that industrialised countries and undeveloped countries have on this kind of energy, as well as the low substitutability of any alternative energy.

Appendix I

Quarterly evolution of total port traffic and GDP at constant prices

(Thousands of tonnes and Millions of Euros)

QUARTER	TOTAL PORT TRAFFIC	GDP
1 st 1993	56819	100883
2 nd 1993	60223	103459
3 rd 1993	58617	103803
4 th 1993	68881	107980
1 st 1994	61877	103344
2 nd 1994	62889	106234
3 rd 1994	65293	106378
4 th 1994	72058	110084
1 st 1995	67383	107072
2 nd 1995	70108	109438
3 rd 1995	74094	108511
4 th 1995	78961	112764
1 st 1996	69378	109231
2 nd 1996	68332	112274
3 rd 1996	70401	111442
4 th 1996	71141	115507
1 st 1997	64633	112654
2 nd 1997	69140	116202
3 rd 1997	72673	115917
4 th 1997	77044	121736
1 st 1998	70440	117581
2 nd 1998	76273	121238
3 rd 1998	77416	121707
4 th 1998	80050	126257
1 st 1999	76710	121821
2 nd 1999	79152	126818
3 rd 1999	78961	126778
4 th 1999	79676	131803
1 st 2000	80464	128996

2 nd 2000	85227	133061
3 rd 2000	85134	131003
4 th 2000	86972	135379
1 st 2001	82911	133624
2 nd 2001	84502	135760
3 rd 2001	88302	134257
4 th 2001	90251	138928
1 st 2002	87296	136099
2 nd 2002	90681	138545
3 rd 2002	90592	136844
4 th 2002	93212	141989
1 st 2003	87498	140080
2 nd 2003	96285	141861
3 rd 2003	95296	140207
4 th 2003	99488	146163

Source: From Monthly Informational Reports of State Port Authority and Statistical Yearbooks from January 1993 to December 2003, and National Accounting of INE (National Institute for Statistic).

Appendix II

Quarterly Evolution of General Merchandise Traffic and GDP at constant prices

(Thousands of tonnes and Millions of Euros)

QUARTER	GENERAL MERCHADISE	GDP
1 st 1993	11923	100883
2 nd 1993	13967	103459
3 rd 1993	13583	103803
4 th 1993	15555	107980
1 st 1994	13921	103344
2 nd 1994	15708	106234
3 rd 1994	14582	106378
4 th 1994	18595	110084
1 st 1995	16922	107072
2 nd 1995	18268	109438
3 rd 1995	17846	108511
4 th 1995	18343	112764
1 st 1996	17505	109231
2 nd 1996	17977	112274
3 rd 1996	18334	111442
4 th 1996	20207	115507
1 st 1997	18670	112654
2 nd 1997	20868	116202
3 rd 1997	20563	115917
4 th 1997	22129	121736
1 st 1998	21732	117581
2 nd 1998	23638	121238
3 rd 1998	23821	121707
4 th 1998	24720	126257
1 st 1999	23466	121821
2 nd 1999	26359	126818
3 rd 1999	24452	126778
4 th 1999	26846	131803
1 st 2000	25701	128996

2 nd 2000	27800	133061
3 rd 2000	27295	131003
4 th 2000	28473	135379
1 st 2001	27702	133624
2 nd 2001	30369	135760
3 rd 2001	29519	134257
4 th 2001	30327	138928
1 st 2002	28808	136099
2 nd 2002	31654	138545
3 rd 2002	30862	136844
4 th 2002	32838	141989
1 st 2003	31499	140080
2 nd 2003	35729	141861
3 rd 2003	34481	140207
4 th 2003	36567	146163

Source: From Monthly Informational Reports of State Port Authority and Statistical Yearbooks from January 1993 to December 2003, and National Accounting of INE (National Institute for Statistic).

Appendix III

Monthly Evolution of General Merchandise Traffic and Price Index of Regular Liner Freight (Base 1995 = 100)

(Tonnes x 10⁵)

MONTH	GENERAL MERCHANDISE	P. I. REGULAR LINER FREIGHT
JANUARY 1999	69.07	77
FEBRUARY 1999	76.97	79
MARCH 1999	88.62	80
APRIL 1999	85.64	83
MAY 1999	90.41	83
JUNE 1999	87.54	84
JULY 1999	85.26	86
AUGUST 1999	78.81	87
SEPTEMBER 1999	80.45	90
OCTOBER 1999	86.79	92
NOVEMBER 1999	90.58	96
DECEMBER 1999	91.09	98
JANUARY 2000	74.92	104
FEBRUARY 2000	85.77	103
MARCH 2000	96.32	105
APRIL 2000	87.67	113
MAY 2000	94.31	119
JUNE 2000	96.02	116
JULY 2000	94.0	115
AUGUST 2000	88.49	122
SEPTEMBER 2000	90.46	127
OCTOBER 2000	92.17	130
NOVEMBER 2000	96.28	130
DECEMBER 2000	92.68	125
JANUARY 2001	87.56	119
FEBRUARY 2001	90.41	121
MARCH 2001	99.05	121
APRIL 2001	97.34	122

MAY 2001	104.87	121
JUNE 2001	101.48	119
JULY 2001	101.88	117
AUGUST 2001	98.18	112
SEPTEMBER 2001	95.13	105
OCTOBER 2001	105.47	103
NOVEMBER 2001	101.39	104
DECEMBER 2001	97.31	102
JANUARY 2002	89.92	93
FEBRUARY 2002	95.55	93
MARCH 2002	105.36	95
APRIL 2002	103.62	95
MAY 2002	111.15	94
JUNE 2002	107.85	94
JULY 2002	112.65	94
AUGUST 2002	101.55	94
SEPTEMBER 2002	97.64	93
OCTOBER 2002	112.95	99
NOVEMBER 2002	105.4	99
DECEMBER 2002	112.09	97
JANUARY 2003	95.89	96
FEBRUARY 2003	106.89	96
MARCH 2003	112.2	101
APRIL 2003	111.01	107
MAY 2003	127.97	99

Source: From Monthly Informational Reports of State Port Authority and Statistical Yearbooks from January 1993 to December 2003, and German Transport Ministry.

Appendix IV

Quarterly evolution of Solid Bulk Traffic and GDP at constant prices

(Thousands of tonnes and Millions of Euros)

QUARTER	SÓLID BULK	GDP
1 st 1993	14503	100883
2 nd 1993	16735	103459
3 rd 1993	15393	103803
4 th 1993	17876	107980
1 st 1994	16532	103344
2 nd 1994	17035	106234
3 rd 1994	17027	106378
4 th 1994	19439	110084
1 st 1995	18198	107072
2 nd 1995	19412	109438
3 rd 1995	20715	108511
4 th 1995	20803	112764
1 st 1996	20497	109231
2 nd 1996	17754	112274
3 rd 1996	17713	111442
4 th 1996	17388	115507
1 st 1997	17571	112654
2 nd 1997	18222	116202
3 rd 1997	17680	115917
4 th 1997	18220	121736
1 st 1998	18544	117581
2 nd 1998	20339	121238
3 rd 1998	19531	121707
4 th 1998	20731	126257
1 st 1999	30989	121821
2 nd 1999	29265	126818
3 rd 1999	29484	126778
4 th 1999	28334	131803
1 st 2000	29648	128996

2 nd 2000	30812	133061
3 rd 2000	32690	131003
4 th 2000	31758	135379
1 st 2001	22763	133624
2 nd 2001	21965	135760
3 rd 2001	24112	134257
4 th 001	24157	138928
1 st 2002	24286	136099
2 nd 2002	25516	138545
3 rd 2002	25360	136844
4 th 2002	25195	141989
1 st 2003	23011	140080
2 nd 2003	24483	141861
3 rd 2003	24032	140207
4 th 2003	26701	146163

Source: From Monthly Informational Reports of State Port Authority and Statistical Yearbooks from January 1993 to December 2003, and National Accounting of INE (National Institute for Statistic).

Appendix 5

**Monthly Evolution of Solid Bulk Traffic and Price Indexes of Time Freight agreements (Base 1995 = 100), and Trip Freights (Base June 1965 and July 1966)
(Tonnes x 10⁻⁵)**

MONTH	SOLID BULK	FREIGHT TIME PRICE INDEXES	TRIP FREIGHT PRICE INDEXES
JANUARY 1999	101.84	46	166
FEBRUARY 1999	91.96	49	170
MARCH 1999	116.09	60	169
APRIL 1999	104.15	59	172
MAY 1999	95.87	68	173
JUNE 1999	92.63	64	176
JULY 1999	98.90	63	179
AUGUST 1999	97.63	66	178
SEPTEMBER 1999	98.31	70	185
OCTOBER 1999	92.30	79	185
NOVEMBER 1999	90.14	80	195
DECEMBER 1999	100.9	82	192
JANUARY 2000	104.35	86	190
FEBRUARY 2000	93.03	89	191
MARCH 2000	99.10	101	190
APRIL 2000	104.52	107	191
MAY 2000	107.43	108	193
JUNE 2000	96.17	106	202
JULY 2000	118.19	108	202
AUGUST 2000	109.24	113	203
SEPTEMBER 2000	99.47	122	206
OCTOBER 2000	98.52	121	207
NOVEMBER 2000	102.42	122	206
DECEMBER 2000	116.64	107	208
JANUARY 2001	73.67	105	193
FEBRUARY 2001	74.74	103	198
MARCH 2001	79.22	108	195

APRIL 2001	67.47	108	200
MAY 2001	76.47	109	206
JUNE 2001	75.71	106	205
JULY 2001	80.19	93	205
AUGUST 2001	80.04	72	192
SEPTEMBER 2001	80.89	68	193
OCTOBER 2001	80.94	67	195
NOVEMBER 2001	77.18	67	194
DECEMBER 2001	83.45	68	195
JANUARY 2002	81.64	72	194
FEBRUARY 2002	75.50	74	199
MARCH 2002	86.52	80	199
APRIL 2002	87.82	82	194
MAY 2002	85.9	77	207
JUNE 2002	85.23	71	202
JULY 2002	86.13	68	201
AUGUST 2002	78.9	71	201
SEPTEMBER 2002	88.68	80	204
OCTOBER 2002	86.08	88	204
NOVEMBER 2002	84.97	95	215
DECEMBER 2002	81.42	104	215
JANUARY 2003	77.21	104	216
FEBRUARY 2003	77.15	102	216
MARCH 2003	75.75	109	216
APRIL 2003	74.45		226
MAY 2003	86.57		235

Source: From Monthly Informational Reports of State Port Authority and Statistical Yearbooks from January 1999 to May 2003, and from German Transport Ministry and from *Lloyd's Ship Manager*.

Appendix VI

Quarterly Evolution of Liquid Bulk Traffic and GDP at constant prices

(Miles of Tonnes and Millions of Euros)

QUARTER	LÍQUID BULK	GDP
1 st 1993	27668	100883
2 nd 1993	26188	103459
3 rd 1993	26248	103803
4 th 1993	31191	107980
1 st 1994	28503	103344
2 nd 1994	26658	106234
3 rd 1994	30514	106378
4 th 1994	30712	110084
1 st 1995	29334	107072
2 nd 1995	29330	109438
3 rd 1995	32426	108511
4 th 1995	36849	112764
1 st 1996	30182	109231
2 nd 1996	30428	112274
3 rd 1996	30994	111442
4 th 1996	32691	115507
1 st 1997	28383	112654
2 nd 1997	29181	116202
3 rd 1997	34053	115917
4 th 1997	34670	121736
1 st 1998	27504	117581
2 nd 1998	29109	121238
3 rd 1998	31097	121707
4 th 1998	31599	126257
1 st 1999	21712	121821
2 nd 1999	22637	126818
3 rd 1999	22009	126778
4 th 1999	22474	131803
1 st 2000	22391	128996

2 nd 2000	23521	133061
3 rd 2000	22239	131003
4 th 2000	24076	135379
1 st 2001	30701	133624
2 nd 2001	30555	135760
3 rd 2001	31822	134257
4 th 2001	33010	138928
1 st 2002	31770	136099
2 nd 2002	30564	138545
3 rd 2002	31201	136844
4 th 2002	31971	141989
1 st 2003	30232	140080
2 nd 2003	32769	141861
3 rd 2003	33611	140207
4 th 2003	33220	146163

Source: From Monthly Informational Reports of State Port Authority and Statistical Yearbooks from January 1993 to December 2003, and National Accounting of INE (National Institute for Statistic).

Appendix VII

**Monthly Evolution of Liquid Bulk of Very Large Crude Carriers (> 150.000 ton. of dead weight) and Small Tankers Carriers (30.000-70.000 ton. Dead weight) and Price Indexes
(Tonnes x 10⁻⁵)**

MONTH	LÍQUID BULK	VLCC PRICE INDEXES	STC PRICE INDEXES
JANUARY 1999	66.84	62	114
FEBRUARY 1999	72.83	49	137
MARCH 1999	77.45	38	128
APRIL 1999	71.14	41	121
MAY 1999	81.89	49	124
JUNE 1999	73.34	42	113
JULY 1999	74.51	41	108
AUGUST 1999	76.24	47	110
SEPTEMBER 1999	69.34	50	111
OCTOBER 1999	68.70	45	106
NOVEMBER 1999	76.39	48	126
DECEMBER 1999	79.65	53	141
JANUARY 2000	73.27	48	126
FEBRUARY 2000	69.71	54	141
MARCH 2000	80.93	58	164
APRIL 2000	70.24	70	196
MAY 2000	82.58	81	177
JUNE 2000	82.39	96	174
JULY 2000	74.48	101	245
AUGUST 2000	72.72	106	266
SEPTEMBER 2000	75.19	129	269
OCTOBER 2000	82.90	136	194
NOVEMBER 2000	76.08	134	267
DECEMBER 2000	81.78	138	273
JANUARY 2001	106.03	152	346
FEBRUARY 2001	94.87	117	230

MARCH 2001	106.11	87	239
APRIL 2001	105.18	95	272
MAY 2001	98.89	81	190
JUNE 2001	101.48	61	183
JULY 2001	99.85	52	141
AUGUST 2001	111.22	53	130
SEPTEMBER 2001	107.15	51	148
OCTOBER 2001	108.35	74	154
NOVEMBER 2001	104.60	44	136
DECEMBER 2001	117.15	39	128
JANUARY 2002	109.79	40	100
FEBRUARY 2002	100.84	41	126
MARCH 2002	105.99	39	116
APRIL 2002	98.04	36	117
MAY 2002	104.1	36	144
JUNE 2002	104.06	50	159
JULY 2002	107.18	40	130
AUGUST 2002	109.13	45	132
SEPTEMBER 2002	99.48	36	110
OCTOBER 2002	108.59	41	118
NOVEMBER 2002	102.9	73	138
DECEMBER 2002	109.66	103	176
JANUARY 2003	96.59	99	166
FEBRUARY 2003	92.26	133	187
MARCH 2003	113.47	114	276
APRIL 2003	110.14	129	294
MAY 2003	110.71	80	218
JUNE 2003	108.43	85	201
JULY 2003	113.28	51	133
AUGUST 2003	112.05	53	168

Source: From Monthly Informational Reports of State Port Authority and Statistical Yearbooks from January 1999 to August 2003, and from UNCTAD.

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