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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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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 discreet 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):

$$Q_{it} = f\,(Yt, Pt)$$

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 Yt, and also a function of a price vector Pt, 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

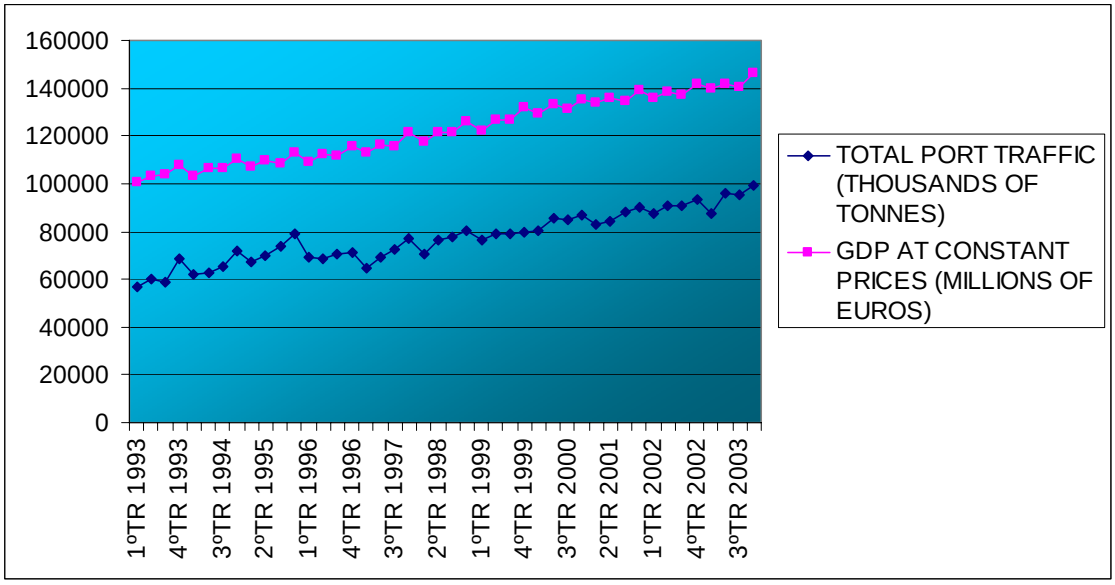
f(t) = Time function

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 interest[1] 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:

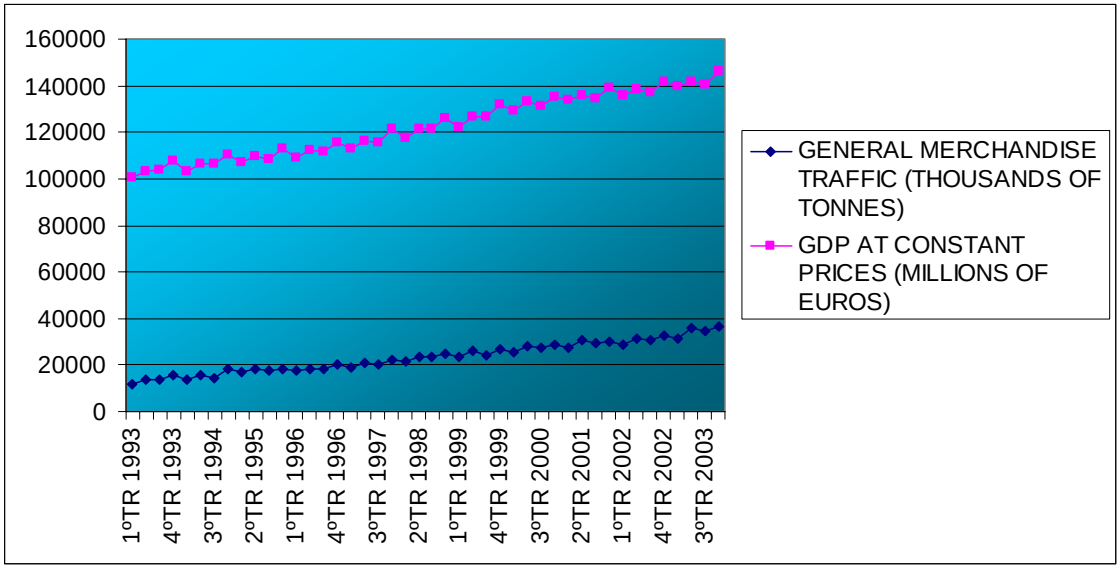
$$Q_{1t} = f\,(\,Y_t\ ,\ P_{1t}\,)$$

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).

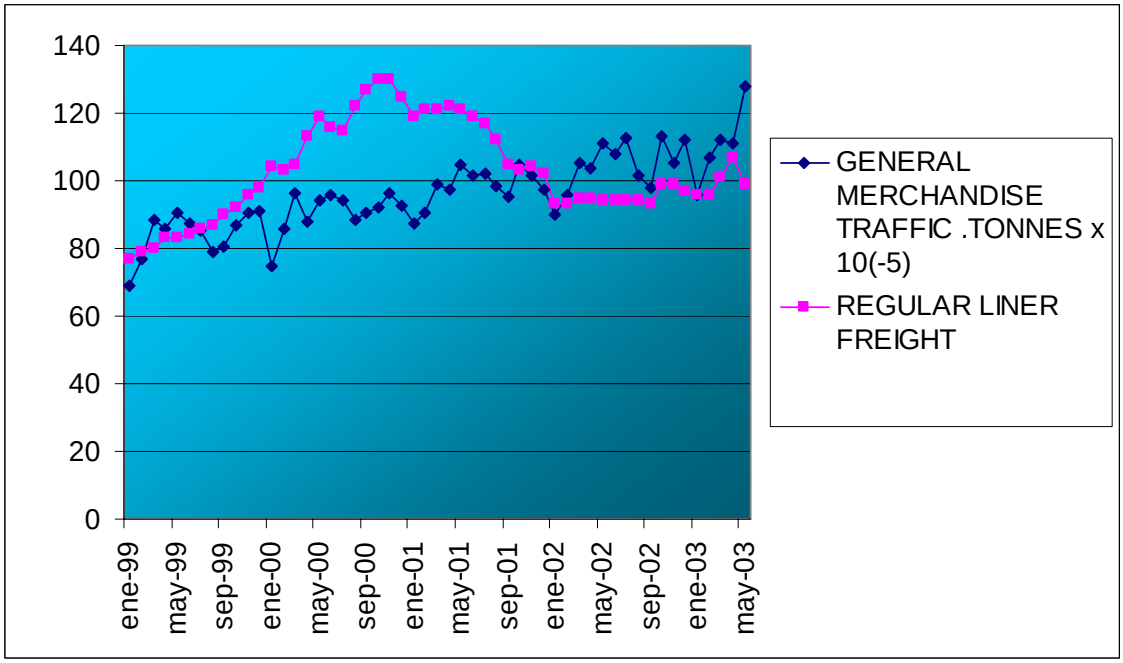
If we examine the series obtained in Chart 3, it can observed that prices do not exactly follow the inverse tendency in relation to the quantity of sea transport services of general merchandise in demand, which makes clear that it is not the most influential variable in the endogenous variable, although 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:

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

$$(0.518) \qquad (0.5164) \qquad (3.29*10^{-5})$$

$L\,Q_{1t}$: 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 resids, with a probability value of 0.55 (p-value), accepting in this way the hypothesis of normality of the resids.

The White test (homokedasticidity test) is used to evaluate the existence of homokedasticity, 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:

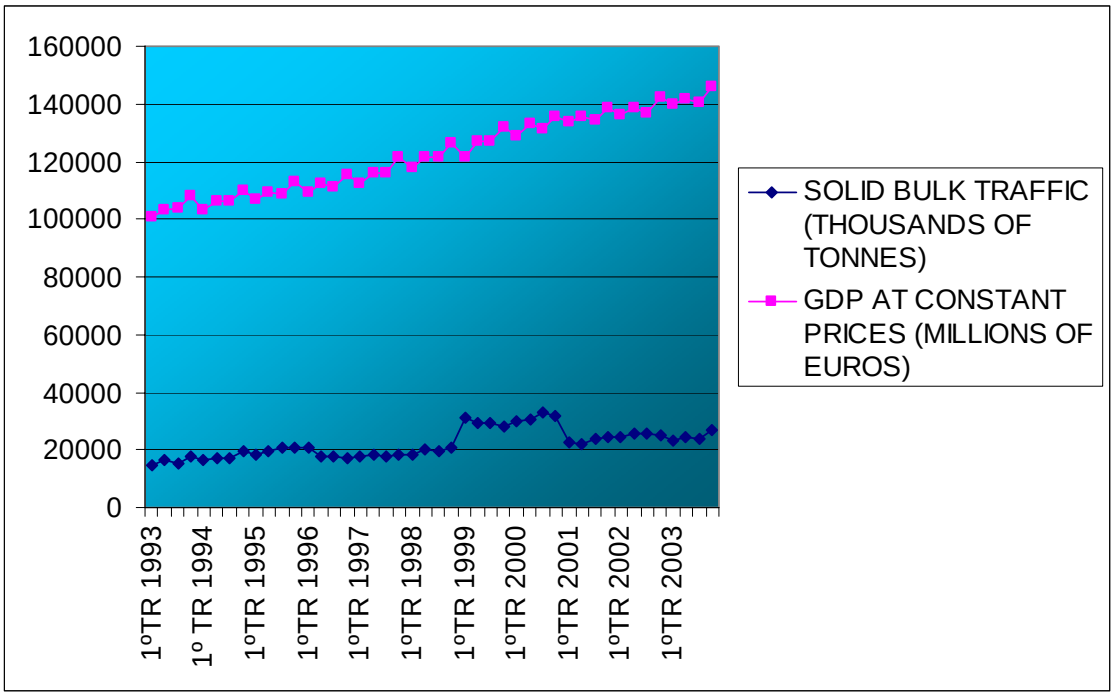
$$Q_{2t} = f (Y_t \ , \ P_{2t})$$

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.

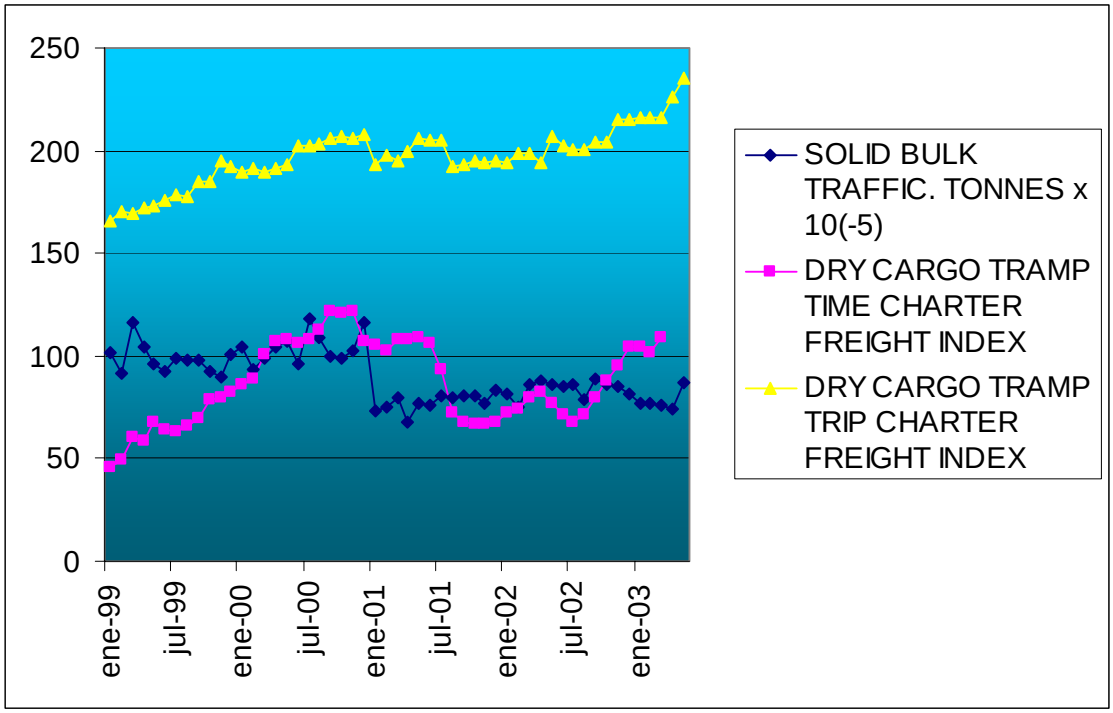
On the other hand, the relationship between the quantity of sea transport services of solid bulk in demand has been examined with the prices, precisely dry cargo[3] freight, by freight trading agreements, as the UN does. The huge world traffic of solid and liquid bulk works competitively, *Tramp navigation*, 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] D*ry 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.

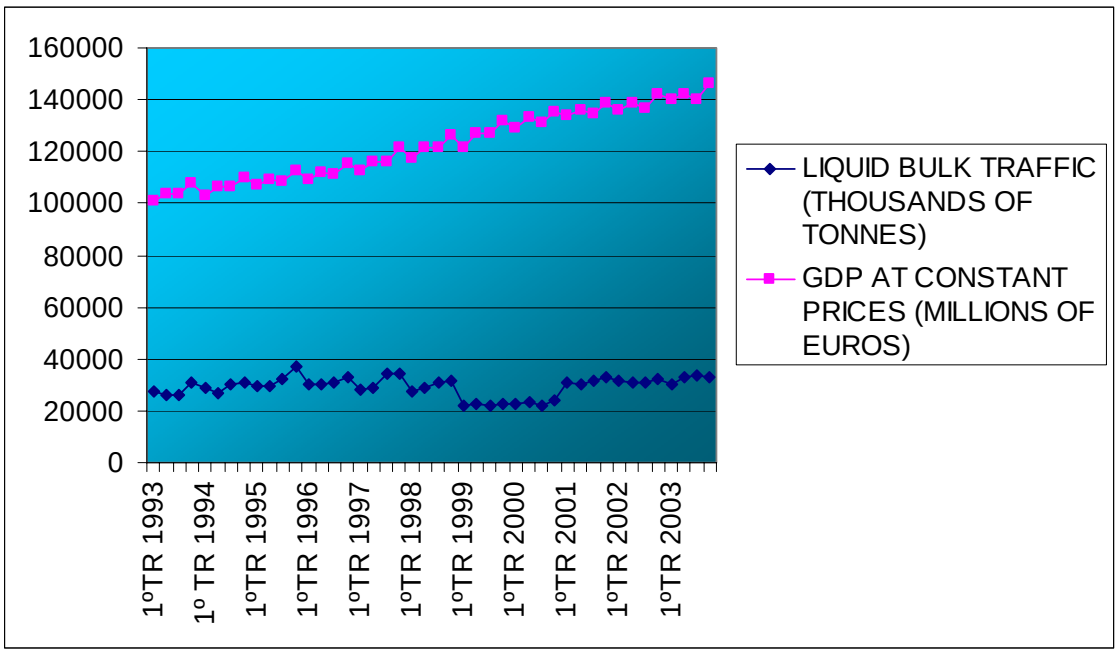
Function could be expressed as follows:

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

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 vessels[5] 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

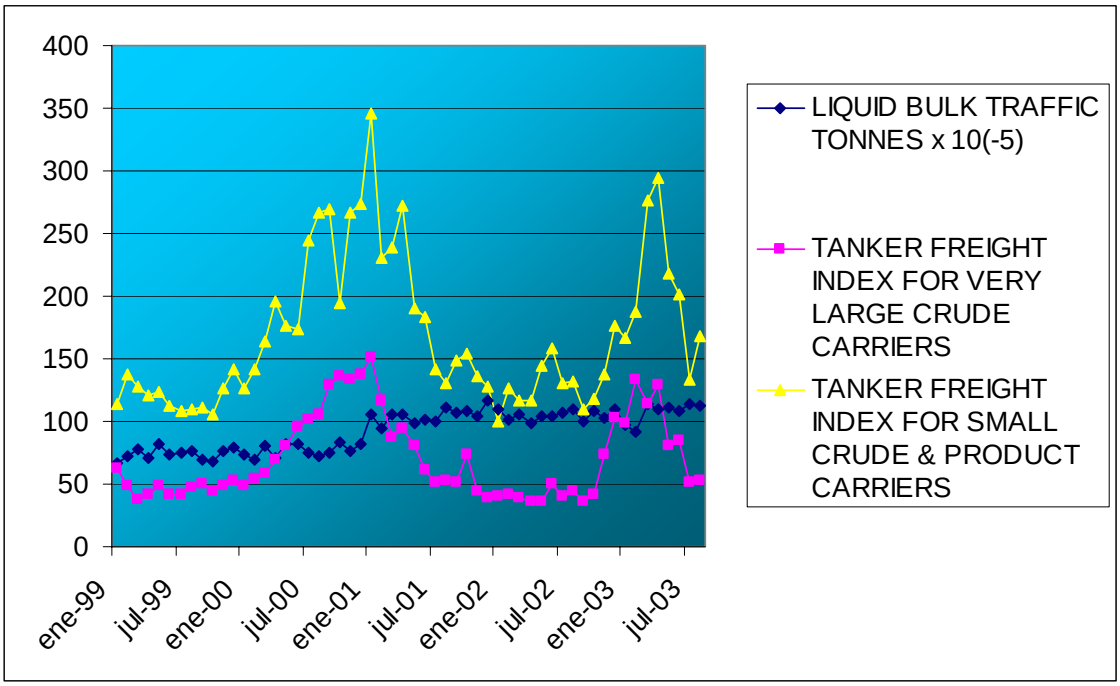
[4] VLCC: *Very Large Crude Carrier*. In this includes vessels that have 150.000 tonnes or more of dead weight. The Dead weight is the total weight that vessel transports being at its maximum draught of arise including the cargo, fuel, water, crew, passengers, equipment, etc.
[5] This refers to vessels 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 conteinered 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
1st 1993	**56819**	**100883**
2nd 1993	**60223**	**103459**
3rd 1993	**58617**	**103803**
4th 1993	**68881**	**107980**
1st 1994	**61877**	**103344**
2nd 1994	**62889**	**106234**
3rd 1994	**65293**	**106378**
4th 1994	**72058**	**110084**
1st 1995	**67383**	**107072**
2nd 1995	**70108**	**109438**
3rd 1995	**74094**	**108511**
4th 1995	**78961**	**112764**
1st 1996	**69378**	**109231**
2nd 1996	**68332**	**112274**
3rd 1996	**70401**	**111442**
4th 1996	**71141**	**115507**
1st 1997	**64633**	**112654**
2nd 1997	**69140**	**116202**
3rd 1997	**72673**	**115917**
4th 1997	**77044**	**121736**
1st 1998	**70440**	**117581**
2nd 1998	**76273**	**121238**
3rd 1998	**77416**	**121707**
4th 1998	**80050**	**126257**
1st 1999	**76710**	**121821**
2nd 1999	**79152**	**126818**
3rd 1999	**78961**	**126778**
4th 1999	**79676**	**131803**
1st 2000	**80464**	**128996**

2nd 2000	**85227**	**133061**
3rd 2000	**85134**	**131003**
4th 2000	**86972**	**135379**
1st 2001	**82911**	**133624**
2nd 2001	**84502**	**135760**
3rd 2001	**88302**	**134257**
4th 2001	**90251**	**138928**
1st 2002	**87296**	**136099**
2nd 2002	**90681**	**138545**
3rd 2002	**90592**	**136844**
4th 2002	**93212**	**141989**
1st 2003	**87498**	**140080**
2nd 2003	**96285**	**141861**
3rd 2003	**95296**	**140207**
4th 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
1st 1993	**11923**	**100883**
2nd 1993	**13967**	**103459**
3rd 1993	**13583**	**103803**
4th 1993	**15555**	**107980**
1st 1994	**13921**	**103344**
2nd 1994	**15708**	**106234**
3rd 1994	**14582**	**106378**
4th 1994	**18595**	**110084**
1st 1995	**16922**	**107072**
2nd 1995	**18268**	**109438**
3rd 1995	**17846**	**108511**
4th 1995	**18343**	**112764**
1st 1996	**17505**	**109231**
2nd 1996	**17977**	**112274**
3rd 1996	**18334**	**111442**
4th 1996	**20207**	**115507**
1st 1997	**18670**	**112654**
2nd 1997	**20868**	**116202**
3rd 1997	**20563**	**115917**
4th 1997	**22129**	**121736**
1st 1998	**21732**	**117581**
2nd 1998	**23638**	**121238**
3rd 1998	**23821**	**121707**
4th 1998	**24720**	**126257**
1st 1999	**23466**	**121821**
2nd 1999	**26359**	**126818**
3rd 1999	**24452**	**126778**
4th 1999	**26846**	**131803**
1st 2000	**25701**	**128996**

2nd 2000	**27800**	**133061**
3rd 2000	**27295**	**131003**
4th 2000	**28473**	**135379**
1st 2001	**27702**	**133624**
2nd 2001	**30369**	**135760**
3rd 2001	**29519**	**134257**
4th 001	**30327**	**138928**
1st 2002	**28808**	**136099**
2nd 2002	**31654**	**138545**
3rd 2002	**30862**	**136844**
4th 2002	**32838**	**141989**
1st 2003	**31499**	**140080**
2nd 2003	**35729**	**141861**
3rd 2003	**34481**	**140207**
4th 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 10^5)

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

2nd 2000	**30812**	**133061**
3rd 2000	**32690**	**131003**
4th 2000	**31758**	**135379**
1st 2001	**22763**	**133624**
2nd 2001	**21965**	**135760**
3rd 2001	**24112**	**134257**
4th 001	**24157**	**138928**
1st 2002	**24286**	**136099**
2nd 2002	**25516**	**138545**
3rd 2002	**25360**	**136844**
4th 2002	**25195**	**141989**
1st 2003	**23011**	**140080**
2nd 2003	**24483**	**141861**
3rd 2003	**24032**	**140207**
4th 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
1st 1993	**27668**	**100883**
2nd 1993	**26188**	**103459**
3rd 1993	**26248**	**103803**
4th 1993	**31191**	**107980**
1st 1994	**28503**	**103344**
2nd 1994	**26658**	**106234**
3rd 1994	**30514**	**106378**
4th 1994	**30712**	**110084**
1st 1995	**29334**	**107072**
2nd 1995	**29330**	**109438**
3rd 1995	**32426**	**108511**
4th 1995	**36849**	**112764**
1st 1996	**30182**	**109231**
2nd 1996	**30428**	**112274**
3rd 1996	**30994**	**111442**
4th 1996	**32691**	**115507**
1st 1997	**28383**	**112654**
2nd 1997	**29181**	**116202**
3rd 1997	**34053**	**115917**
4th 1997	**34670**	**121736**
1st 1998	**27504**	**117581**
2nd 1998	**29109**	**121238**
3rd 1998	**31097**	**121707**
4th 1998	**31599**	**126257**
1st 1999	**21712**	**121821**
2nd 1999	**22637**	**126818**
3rd 1999	**22009**	**126778**
4th 1999	**22474**	**131803**
1st 2000	**22391**	**128996**

2nd 2000	**23521**	**133061**
3rd 2000	**22239**	**131003**
4th 2000	**24076**	**135379**
1st 2001	**30701**	**133624**
2nd 2001	**30555**	**135760**
3rd 2001	**31822**	**134257**
4th 001	**33010**	**138928**
1st 2002	**31770**	**136099**
2nd 2002	**30564**	**138545**
3rd 2002	**31201**	**136844**
4th 2002	**31971**	**141989**
1st 2003	**30232**	**140080**
2nd 2003	**32769**	**141861**
3rd 2003	**33611**	**140207**
4th 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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