

# **“Non-regular shippers”: an alternative service to diminish the empty container traffic, a first and comparative approach to the “Rotterdam” and “Le Havre” port cases**

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## **Abstract**

Nowadays, empty container traffic is an explosive phenomenon in ports, which provoke high transport capacities. In this paper, some countries which regular have container sea links with “Rotterdam” and “Le Havre” were compared in function of both their empty container traffic evolution and their economic environment. A new service called “non-regular shippers” is proposed as a possible alternative, to profit empty container traffic. Comparison might allow us to understand the connection between the world’s empty container traffic, containers port’s rank and the general economic environment in the countries linked with both ports. The criterion to measure the port’s empty traffic evolution is a basic and concrete rate called ECTER which allows us to establish an appropriate comparison between ports and to define the empty container tendencies to each one. A systematic analysis is introduced in this study to identifying 48 countries linked to each port, based on the technique of standardised principal components analysis. Principal components allow us to clarify the mutual influences and to compare it between partner countries of both ports, and to identify some partner’s countries with the potential to develop the proposed “non-regular shippers” service.

*Keywords: empty containers, maritime transport service, Rotterdam and Le Havre, traffic tendencies.*

## **1 Introduction**

This paper is in two parts. In the first part, we propose the new service to profit the container traffic capacities which are actually squandered. In the second part,



some partner countries of Rotterdam and Le Havre ports with regular container sea links were compared in function of both, empty traffic variables and economic variables. Comparison might be the first approach to identify some potential local markets to the service proposed in a basic way. To ports authorities and container handling companies, the empty container traffic is relatively indifferent because in general, handling rates in ports are the same for full or empty containers. Otherwise, the existence of empty container traffic results from the difference between imports and export volumes of goods between countries or ports hinterlands, then we could consider that this imbalance is inevitable, and then that the empty container traffic is a necessary waste. Certainly, container reception and expedition imbalance causes are not simple to define. Nevertheless, empty container traffic might be a useful transport capacity and a new market niche if logistics organisation achieves to associate the potential “non-regulars” demands of transport service with the empty container’s availability. Note that basic traffic containers data employed in both cases (1999–2002) do not appear on account of limited space for paper reduction.

## 2 “Non-regular shippers”

Proposition of a new service is based on the existence of non useful transport capacities and a potential demand which needs to be encouraged. We consider to offer all container transport capacities of empty container traffic in actual maritime flows. Then, offer transport capacities, origin and destination of new service depends on residual capacities in the containers flux and regular maritime links. In other words, the new service does not search to open new maritime links but search to open new market niches to profit wasteful container capacities in the existing links.

### 2.1 Market niche to the new service

“Non-regular shippers” service was thought up as a service to allow changes between particulars, small firms and emergent enterprises in different countries. Normally, small firms, emergent or small-scale production enterprises and craft-enterprises have equipment needs and expansion markets ambitions to their products, even if their equipment needs or their productions represent only reduced goods volumes. In this case, size and incomes of enterprises could not justify the buying of equipment in foreign countries, or the export costs. The principal cause is not the price of equipment or the foreign markets to their products, but the high price of transport negotiated by classical forwarding agents and this kind of enterprise could not negotiate rates with the ship owners directly because their transport needs are not regular or only few in volume. Thus, foreign business development is obstructed to this kind of enterprise. These companies and particulars constitute the “non-regular shippers” service market targeted.

## 2.2 “Non-regular shippers service” functional description

“Non-regular shippers” service concept is based on residual transport capacities as offered and on non-regular and detail shippers like demand. Our hypothesis is that offer and demand exists, so then we have to find a way to make them compatible. The service idea is that on the offer side, to promote a regular transport service between some selected ports in function of their identified empty traffic will allows us to know the real possible offer to each link. On the demand side, potential “non-regular shippers” have no specific needs to import or to export, but they might develop international exchanges. Reduced transport prices might encourage these changes, and might absorb the existent exchanges needs to this kind of clients. In this way, the new service will take an existent non-exploited market and develop it. Thus, if the new service is capable of offering attractive transport prices, at least cheaper than forwarding agents, and to guarantee regular transport links with the proper care of shipped goods, the service implantation is feasible. It is obvious to think that these kind of shippers are not capable of maintaining a demand to justify the new service, but the new service aims at this kind of possible shipper, not as individual shippers but as the huge number of possible shippers in the urban mass. These potential shippers will be renewed by others possible shippers thanks to urban activities progress. The key to a new service is to propose to ship owners to ship a number of containers per month submitted to empty containers availability, without ship owners or “new service” commitment on the number of containers on a precise date but throughout a month for example. In this way, the new service pretends to profit the waste transport capacities without provoking trouble in the current container flows, and aims in consequence to obtain reductions in the container rates. Containers will be filled in special grouping warehouses out of port zones but as near as possible to them. The new service near port “A” has to take the container from handling port yards when an empty container to destination “B” will be available and packages to this destination will be enough to full the container. In this moment a vehicle tractor-platform goes to pick-up the container and carries it into the warehouse. In the warehouse, goods and packages to the same destination e.g. “B” are waiting for, protected and conditioned, to fill the container. When the vehicle arrives at the warehouse, packages and goods are arranged into container. After filling the container and registering all the packages, the vehicle comes back to handling port yards to embark the container. Once the container is embarked, the vehicle returns to the warehouse. The function of new service will be continued in destination port “B” when the ship arrives there. At that moment a vehicle of “non-regular shippers” service will go to handling port yards to search and pick-up the container. In the same way, the container will be carried to the warehouse to take out the packages. Packages will be arranged in the warehouse after registration and customs checking. Finally they will be stocked in the warehouse to wait the owner who has to come to the warehouse to search for their packages. The “non-regular shippers” service concludes when owners receive their packages, signs formalities, and take the packages out of the warehouse themselves.



### 2.3 “Non –regular shippers” service particularities & conditions

“Non-regular shippers” service is based on the transport service promotion of fixed links between some ports. Responsibility of “Non-regular shippers” service about transport and formalities exist only between warehouses. The new service will not engage contracts to deliver shipments on a precise date. Packages delivery period will be in function of time to grouping enough shipments or packages to fill a container to each destination. “Non-regular shippers” service might guarantee time periods to deliver packages, e.g. 15 days. Added value of this service is the co-ordination of all transport partners between warehouses, packing, stocking and land transport between warehouses and ports. The new service might be very cheap in comparison to a classical service in some links. Moreover, the proposed service is not competing with other existing maritime transport services, because it aims at a different market and does not require special engagements from ship owners.

### 2.4 Obstacles to overstep and limitations of new service

Certainly, the implementation of a new service is not enough to solve the problem of empty container traffic and squandered capacities. Nevertheless, we esteem this new service as a possible and feasible way to actually diminish container transport capacities waste. There exist impediments to implant this kind of service on account of differences between national transport legislation about security measures, taxes, and custom policies. Another possible barrier to this new service might to be on account of ship owners, the client’s preferences and respect of previously negotiated transport rates with their principal shippers. In any case, Government or Private Company’s protectionism might to be the principal obstacle to this grouping and new transport service.

## 3 “Non-regular shippers” service attractive links

This second part is dedicated to esteem the possibilities to implant “Non-regular shippers” service. Estimation is based on empty container traffic availability as offer capacity and on local economic index to esteem in each case a market weight. We consider that the best successful possibilities to the new service implantation exist on countries where offer capacity and a potential market weight coincide. We intend to find representative structures, traffic’s behaviours, or general characteristics which allow us to have an empty container flow approach, to appreciate their particular comportment and to try to distinguish geographical patterns. Therefore, this approach will give us the possibility to do a country’s links classification and discrimination in function of their new service implantation feasibility.

### 3.1 Methodology

Factor analysis such as Principal Components Analysis is used to discover hidden structures, and to achieve an objectivity which is difficult to attain with



classical techniques. This technique permeated to consider variables of different nature and to compare individuals (partner's countries) between them in even conditions. Thanks to this technique the effect of port's size are eliminated to compare the empty traffic behaviour in a fair way between both ports.

### 3.2 Identification of criteria

- (a) Gross Domestic Product \* (billions USD): Is an aggregate measure of production equal to the sum of the gross values added of all resident institutional units engaged in production. Data 2002 in currently US dollars;
- (b) Gross Domestic Product per capita at current changes \* (US Dollar): We take it to include in analysis a measure of potential consumption through an index of individual income in each partner (\* Source: OCDE & CEI);
- (c) Total container traffic (TEU): This variable was considered as an indicator of container traffic size. Data for Rotterdam & Le Havre ports in 2002;
- (d) Empty container traffic unloaded (TEU): Empty container traffic is the exact measure of these non profit capacities. This variable shows the empty container traffic in the specific case of Le Havre & Rotterdam receptions;
- (e) Empty container traffic loaded (TEU): In the same way this variable shows the empty container traffic in the specific port's expeditions. We presume (d) & (e) variables as potential transport offer;
- (f) Empty containers traffic percentage (%): This measure is a simple quotient of empty container traffic between total container traffic for a specific year (ECT/TCT) of 2002;
- (g) Empty container traffic percentage average  $\mu$  (%): Container traffic is the principal index to measure the relative importance and progress of any port in relation of others on the time;

$$\mu = \Sigma [(ECTA / TCTA) * 100] / n$$

ECTA  $\equiv$  Empty container traffic per annum

TCTA  $\equiv$  Total container traffic per annum

n  $\equiv$  annual data number

- (h) Empty container traffic evolution rate (ECTER): Is an index which might estimate the future increases or decreases tendencies of empty container traffic (ECT) in function of total container traffic (TCT) evolution. ECT & TCT evolution rates are estimate to each year in function of last annual ECT's & TCT's. In this way we could consider ECT transformations on the time and to have an evolution rate index ;



Table 1: Rotterdam partner's countries data collection to analysis.

Country	GDP	GDP/c	Total traffic	Empty unloads	Empty loaded	Empty %	Empty %	ECTER
Argentina	103	2844	33068	1186	4016	16	18	0,99
Australia	407	20700	48910	1628	2870	9	8	1,42
Belgium	243	23700	24779	4605	599	21	25	1,13
Brazil	454	2569	124184	3196	15686	15	16	0,98
Cameroon	9	576	2233	571	9	26	28	0,91
Canada	726	23100	110558	16392	2459	17	12	1,58
Chile	63	4185	18789	4575	695	28	32	1,04
China	1219	963	520934	16129	38902	11	12	0,90
Colombia	77	1739	14132	4691	389	36	27	1,24
Denmark	171	32100	20809	2051	3048	25	22	1,07
Ecuador	22	1822	5455	1736	70	33	27	1,26
Egypt	99	1426	21924	649	2368	14	13	0,94
Finland	132	25300	73387	9605	3488	18	20	0,99
France	1392	23400	26715	1275	2294	13	17	0,90
Germany	1987	24100	62057	3803	12941	27	20	1,15
Greece	129	12100	27656	2381	1307	13	11	1,15
Hong Kong	163	24253	342109	8024	32331	12	12	0,97
India	491	478	54582	1966	2323	8	10	1,07
Indonesia	166	803	52908	2240	5797	15	20	0,81
Ireland	121	31100	437607	71989	8704	18	17	1,08
Israel	103	15468	6935	392	607	14	12	1,42
Italy	1172	20400	50344	1833	4309	12	10	1,16
Ivory Coast	11	657	2961	477	59	18	29	0,91
Jamaica	7	2750	21097	5582	561	29	30	1,09
Japan	3976	31200	374514	5090	33741	10	8	1,13
Malaysia	90	3880	188231	7751	13008	11	12	0,92
Mexico	639	6300	10555	2237	301	24	18	3,97
Morocco	39	1128	26232	3799	2976	26	32	0,96
Nigeria	42	362	2437	378	26	17	30	0,85
Norway	191	42000	78389	11292	14442	33	32	1,02
Pakistan	61	457	2035	28	41	3	5	1,06
Panama	12	3900	10146	1912	145	20	13	1,52
Peru	49	1959	8809	2567	153	31	26	1,42
Portugal	122	11800	115152	7601	3105	9	8	1,09
Russia	355	2400	67913	12441	3914	24	21	1,13
Senegal	5	478	1998	336	37	19	19	8,59
Singapore	87	21654	479079	12875	37250	10	11	0,97
South Korea	464	9748	161024	2818	10213	8	9	0,89
South-Africa	113	2587	89426	10538	14485	28	18	1,35
Spain	908	22400	167221	16737	6343	14	12	1,06
Sweden	241	27000	68794	5033	10846	23	25	0,92
Taiwan	278	12452	195300	4347	32378	19	14	1,20
Tunisia	20	2099	3322	37	129	5	9	1,05
Turkey	185	2655	51631	4712	1315	12	14	0,96
UK	1558	26400	936421	200833	19674	24	21	1,09
Uruguay	10	2950	7223	243	1270	21	17	1,20
USA	10418	36100	837314	110984	15787	15	13	1,15
Venezuela	87	3787	16865	2825	760	21	22	0,97

Table 2: Le Havre partner's countries data collection to analysis.

Country	GDP	GDP/c	Total traffic	Empty unloaded	Empty loaded	Empty %	Empty %	ECTER
Argentina	103	2844	9473	141	1324	15	10	1,37
Australia	407	20700	2078	71	47	6	9	2,48
Belgium	243	23700	25691	6173	2237	33	31	1,08
Brazil	454	2569	40563	3347	2696	15	16	1,03
Cameroon	9	576	9840	2208	1	22	18	1,11
Canada	726	23100	73249	12022	73	17	17	1,05
Chile	63	4185	4383	95	356	10	9	1,38
China	1219	963	71502	1615	5688	10	10	1,06
Colombia	77	1739	8673	315	34	4	7	1,32
Denmark	171	32100	1	0	0	0	25	1
Ecuador	22	1822	939	106	93	21	21	1,03
Egypt	99	1426	7359	843	60	12	18	0,90
Finland	132	25300	0	0	0	0	0	1
France	1392	23400	38582	3515	6197	25	32	0,84
Germany	1987	24100	21454	1513	4224	27	43	0,79
Greece	129	12100	20426	1872	118	10	16	0,77
Holland	417	25900	51703	29833	2085	62	44	1,25
Hong Kong	163	24253	129994	2521	11942	11	9	1,14
India	491	478	2666	30	0	1	6	39,29
Indonesia	166	803	1217	6	0	0	1	1,20
Ireland	121	31100	24879	6081	192	25	22	1,16
Israel	103	15468	2050	69	1	3	33	1,28
Italy	1172	20400	33910	668	126	2	5	1,39
Ivory Coast	11	657	20393	7209	678	39	37	0,98
Jamaica	7	2750	4149	808	38	20	31	1,04
Japan	3976	31200	70032	696	2951	5	8	0,86
Malaysia	90	3880	30447	213	4421	15	13	1,19
Morocco	39	1128	7261	1888	18	26	21	1,08
Mexico	639	6300	40662	1626	77	4	7	0,78
Nigeria	42	362	8178	3245	6	40	33	1,43
Norway	191	42000	0	0	0	0	0	1
Pakistan	61	457	1207	0	0	0	1	1
Panama	12	3900	7078	39	54	1	7	1,98
Portugal	122	11800	12157	1017	284	11	18	0,95
Russia	355	2400	1658	660	2	40	40	1,20
Senegal	5	478	10185	3092	8	30	36	0,89
Singapore	87	21654	159328	3048	31551	22	20	1,06
South-Africa	113	2587	14192	1064	890	14	16	0,87
South Korea	464	9748	33494	234	2275	7	12	0,82
Spain	908	22400	64168	3143	2396	9	15	0,78
Sweden	241	27000	0	0	0	0	25	1
Taiwan	278	12452	30696	179	4421	15	25	0,78
Tunisia	20	2099	3048	1070	0	35	9	1
Turkey	185	2655	37729	5979	71	16	19	1,01
UK	1558	26400	84471	29019	924	35	31	1,09
Uruguay	10	2950	1154	0	205	18	10	1,20
USA	10418	36100	288461	28377	728	10	9	1,15
Venezuela	87	3787	1898	3	0	0	12	3,33

$$\text{ECTER} = [\text{ECT evolution} / \text{TCT evolution}]$$

ECTER	Meaning
> 1	Empty containers progress
< 1	Empty containers regression
= 1	Similar container traffics evolution

Evolution of empty containers traffic ECT evolution & TCT evolution are estimate as a linear regression on base of empty containers traffic data per annum. Variable data to analysis appear in tables 1 & 2.

Table 3: Basic statistics.

Criterion	Variable	Mean	Std deviation	Minimum	Maximum
GDP	X <sub>1</sub>	612,854	1585,750	5,000	10418,000
GDP/capita	X <sub>2</sub>	11921,400	11953,000	362,000	42000,000
Total traffic	X <sub>3</sub>	125087,000	204003,000	1998,000	936421,000
Empty unloaded	X <sub>4</sub>	12383,100	33042,300	28,000	200833,000
Empty loaded	X <sub>5</sub>	7670,230	10651,700	9,000	38902,000
Empty %	X <sub>6</sub>	18,229	7,781	3,000	36,000
μ Empty %	X <sub>7</sub>	17,854	7,458	5,000	32,000
ECTER	X <sub>8</sub>	1,305	1,153	0,810	8,590

Rotterdam's partners countries.

Criterion	Variable	Mean	Std deviation	Minimum	Maximum
GDP	X <sub>1</sub>	620,521	1583,900	5,000	10418,000
GDP/capita	X <sub>2</sub>	12420,200	12026,200	362,000	42000,000
Total traffic	X <sub>3</sub>	31514,100	50221,800	0,000	288461,00
Empty unloaded	X <sub>4</sub>	3451,100	7023,760	0,000	29833,000
Empty loaded	X <sub>5</sub>	1864,420	4873,190	0,000	31551,000
Empty %	X <sub>6</sub>	15,479	13,660	0,000	62,000
μ Empty %	X <sub>7</sub>	17,854	11,660	0,000	44,000
ECTER	X <sub>8</sub>	1,946	5,464	0,770	39,290

Le Havre's partners countries.

### 3.3 Analysis of statistical variables and principal components

#### **First & second principal components of active variables "Rotterdam"**

$$F1 = 0,72 X_1 + 0,64 X_2 + \boxed{0,94 X_3} + \boxed{0,72 X_4} + 0,69 X_5 - \boxed{0,34 X_6} - \boxed{0,44 X_7} - 0,19 X_8$$

$$F2 = -0,14 X_1 - 0,23 X_2 - 0,18 X_3 - 0,43 X_4 + \boxed{0,09 X_5} - \boxed{0,88 X_6} - \boxed{0,84 X_7}$$

#### **First & second principal components of active variables "Le Havre"**

$$F1 = 0,75 X_1 + 0,62 X_2 + \boxed{0,87 X_3} + \boxed{0,82 X_4} + 0,35 X_5 + 0,37 X_6 + 0,29 X_7 - \boxed{0,22 X_8}$$

$$F2 = \boxed{0,41 X_1} + 0,26 X_2 + \boxed{0,34 X_3} - 0,22 X_4 + 0,08 X_5 - \boxed{0,86 X_6} - \boxed{0,85 X_7} + 0,23 X_8$$

In the case of Rotterdam the most interesting countries to continue the research of feasibility implantation of the new service are: Spain, Italy, South Korea, Taiwan, Hong Kong, China, Singapore, Japan, Malaysia, Canada, USA, Ireland, and UK. In the case of Le Havre, the most interesting countries to



continue the research of feasibility implantation of new service are: Japan, Hong Kong, Singapore, Canada, USA, Ireland, France, Belgium, Germany, UK and Netherlands. This first approach might be to target some countries between the mass of partner's countries to each port, to continue more in-depth research around the new service implantation feasibility.

Table 4: Triangular correlation matrix.

Rotterdam

	GDP	GDP/c	Total traffic	Empty unloaded	Empty loaded	Empty %	$\mu$ Empty %	ECTER
<b>GDP</b>	1,00							
<b>GDP/capita</b>	0,44	1,00						
<b>Total traffic</b>	<b>0,62</b>	0,47	1,00					
<b>Empty unloaded</b>	0,48	0,40	<b>0,84</b>	1,00				
<b>Empty loaded</b>	0,29	0,36	0,68	0,26	1,00			
<b>Empty %</b>	-0,13	-0,01	-0,17	0,07	-0,21	1,00		
<b><math>\mu</math> Empty %</b>	-0,20	-0,12	-0,25	-0,01	-0,29	<b>0,83</b>	1,00	
<b>ECTER</b>	-0,04	-0,14	-0,12	-0,06	-0,16	0,09	0,00	1,00

Le Havre

	GDP	GDP/c	Total traffic	Empty unloaded	Empty loaded	Empty %	$\mu$ Empty %	ECTER
<b>GDP</b>	1,00							
<b>GDP/capita</b>	0,43	1,00						
<b>Total traffic</b>	<b>0,78</b>	0,44	1,00					
<b>Empty unloaded</b>	0,53	0,39	<b>0,61</b>	1,00				
<b>Empty loaded</b>	0,01	0,19	0,50	0,01	1,00			
<b>Empty %</b>	-0,06	-0,08	0,06	0,50	0,10	1,00		
<b><math>\mu</math> Empty %</b>	-0,08	0,05	-0,05	0,33	0,06	<b>0,74</b>	1,00	
<b>ECTER</b>	-0,02	-0,15	-0,09	-0,08	-0,06	-0,17	-0,16	1,00

## 4 Conclusions

About empty traffic evolution and economic environment in countries, we could affirm that explosive traffic is linked with high dynamic economies which have the bigger production and high consumption too. The imbalance between national exports and imports give rise to empty container traffic circulation and progression. Certainly, ship owners' strategies might influence the container traffic composition, or volumes of containers expeditions or receptions, but this influence is punctual, and is effectively only on transit container ports. Then the real cause of imbalanced traffic and the solutions to this imbalance are more linked with national production and economic develop than with the ship owners strategies. Empty containers share around 18 % of total container traffic and might be considered as a first indicator of the proportion of empty container traffic in maritime links of ports of Rotterdam & Le Havre. In fact, there is similitude of some empty traffic behaviour between both ports (see similar F1 to each port). Nevertheless, actual results are limited in the period time and many hinterland and foreland factors are not considered, then we could not do more geographical or economic deep interpretations of results, but we can say that Rotterdam & Le Havre are principally "Europe's export ports" in function of their empty container traffic imbalance (principal empty containers traffic share

is unloaded empty containers in both ports). ACP results prove the linear independence of proposed index ECTER of the basic empty containers variables, and we saw that this index shows clearly the container traffic behaviour and might help us to esteem the future empty traffic by country, by port or by groups of ports. Thus we consider ECTER as a proper index to future research in this matter. Finally, we can say that “Non-regular shippers” service implantation is possible in the partner’s countries targeted in reason of big transport capacities squandered in links and the existence of appropriate economic conditions in countries, but it is necessary to insist in the character of the first approach of our results. More deep studies by partner ports considering hinterland conditions will be made for partner’s ports in attractive identified countries.

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