## Illustration of multimodal import cost analysis with a practical example

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**Abstract**
This paper describes the import process of a wristwatch launched by a watch dealership by means of overseas container shipping. The paper focuses on three main areas. First, the environment of container shipping is surveyed in order to map the forwarding duties related to sea freight. The second main area focuses on the maximum utilization of containers, as their capacity is limited in terms of weight and size. The third examined area is cost calculations performed on the basis of price quotes provided by shipping companies. Altogether, it can be concluded that it is recommended to perform the comparison and competition of the price quotes provided by shipping companies as performing the necessary calculations can potentially save costs.

**Keywords:** overseas container shipping, shipping companies, container

### 1. Introduction

Shipping is one of the main factors of international trade between different continents; therefore, we consider researching the world trade significance of sea freight to be important as well. Sea freight can be rightly called one of the oldest transporting methods due to its centuries-old traditions. According to Pozsgai *(1994)*, the yearly value of world trade was between 2000–3000 billion USD in the 1990s. This value represented around 6–6.5 billion tons of freight traffic. Around half of this value, 3.3–3.7 billion tons of freight traffic was transported on sea.

It was our objective to examine the price quotes of five shipping companies (CMA-CGM, ZIM, Evergreen Line, Hapag-Lloyd AG and the United Arab Shipping Company) for four shipping routes (New York–Hamburg; Baltimore–Hamburg; Shanghai–Koper, Slovenia; and Hong Kong–Koper) and to demonstrate the expenses arising during sea transport. It was also our purpose to examine the volume and weight of wristwatches to be transported in containers of various dimensions (20 feet container, 40 feet container, high cube 40 feet container) in order to make sure that containers are utilized to the maximum extent.

| Hypotheses | Assumptions |
|---|---|
| Is it reasonable to examine the size and weight of wristwatches to be transported in containers? | Loading goods into the container raises two potential problems: what size and weight can be loaded into the container? |
| On which basis can a competitive selection be performed between shipping companies? | A competitive selection between shipping companies can be performed based on their freight charges and the related supplementary fees, the costs of on-carriage and transit times. |
| Is it possible to save costs if a competitive selection is performed between the obtained price quotes? | It is possible to save costs, since US and Chinese import has different expenses. |

Table 1. Research questions and assumptions Source: edited on own, 2016

## 2. Technical literature review

### 2.1. Overseas container shipping

Despite having no seaports, Hungary wishes to take part in sea transportation because this shipping method is capable of long distance and safe transportation of a significant amount of goods at relatively low costs *(Körmendi and Pucsek, 2008)*. Based on the aspects of transportation distance and the amount of transported goods, it can be concluded that sea transportation has 70% proportion of global freight traffic. Commercial ships have large carrying capacity and dead-weight capacity; therefore, they are capable of transporting even up to several ten thousand tons of goods *(Némon and Sebestyén, 2009)*. The specific cost level is much lower in this case, since the operational costs of ships are divided between the transported goods. The costs of sea transport are greatly increased by port services which are indispensable, as their nature and quality determine on-carriage. Further advantages of sea transportation include its insignificant environmental pollution and the flexibility of charges *(Zsombik, 2013)*. The risks arising from various climatic impacts affect this shipping method negatively, however, they can be eliminated if proper attention is paid to packaging fragile and easily damaged goods *(Szegedi and Prezenszki, 2012)*.

### 2.2. Sorting of transported goods

The selection of ships is greatly affected by the type, weight and packaging of transported goods, as well as prescription of the given commercial deal. Basically, two large groups can be distinguished: ships transporting dry goods and liquids *(Vakhelné Plaveczky, 2008)*. Container ships are vessels developed for transporting containers. Nowadays, container ships are the fastest and largest ships used for commercial purposes. They can be loaded quickly: 350 tons of package cargo or 10 thousand tons of containerized cargo in eight hours *(Nyakasné, 2002)*. According to Levinson *(2008)*, containers are important because they are in the center of a highly automatized system, the transportation of which from point A to point B has insignificant costs. Containers made sea transportation inexpensive.

### 2.3. Aspects of choosing ports in Europe

Two thirds of the overseas freight traffic of Hungary is performed by western and northern ports. Hungary could opt for the geographically closer ports of the Adriatic or the Black Sea, but their obsoleteness forces Hungary to choose a different route *(Fejér, 2009)*. Ports are logistics centers which are key players of sea transportation and not only because they constitute a point of delivery between sea and land, but also because they take part in the coordination of materials and information exchange *(Carbone and De Martino, 2003)*. Sea transportation is capable of providing services in various areas which make the organization of port activities easier *(Froese and Zuesongdham, 2008)*. Main activities include navigation, the observation of ship traffic, distribution of ships, servicing, maintenance of safety and protection, as well as logistics and cargo handling *(Ehlers et al., 2015)*. Ports are chosen based on logistics distance and not geographical distance. The traffic of Adriatic ports is stagnating, which makes it obvious to choose western and northern ports *(Erdősi, 2005)*. The following aspects have to be taken into consideration when choosing a port: possibility of loading ships of various size and type, frequency of line shipping service, storage capacity, charges in the port tariff, transit time, customs regulations and the costs of the connecting land-carriage. Regarding land transport, the most economical solution is to choose railway lines for on-carriage *(Andó, 2012)*.

## 3. Material and methods

Both primary and secondary research were carried out. The performed primary research mainly included interviews with external shipping experts and watch dealers. In order to be able to evaluate the obtained findings, we had to choose an approach which helps in performing a

competitive selection between different shipping companies. The selected method focuses on substituting multifunctionality and approaching with an objective function. Two method types were used: the weighting method and the method of bounds. In this research, a competitive selection was performed between the above mentioned five shipping companies on various routes.

## 4. Results

### 4.1. Examination of goods to be loaded in containers based on quantity and weight in the case of a specific product

As a first step, we calculated the amount of goods to be loaded into the container. During a personal in-depth interview conducted with a Hungarian watch dealer company, we learnt that the weight of watches with metal box packaging is 0.08 kg, while the dimensions of the packaging are 15x9x5 cm. The goods are loaded into the container in boxes with external dimensions of 300x200x250 cm and internal dimensions of 294x194x244 cm. Two potential problems arise from loading the goods into the container: the maximum size and weight of the unit that is placed in the container. In this case, these problems are considered to be limitations, since both factors have to be taken into consideration in order for the goods not to exceed the space of the given container. The most efficient use of space is only limited by the maximum storage capacity which is 32.7 $m^3$ in the case of a 20-feet container. Accordingly, our calculations revealed that 2180 boxes can be loaded into a 20-feet container, which equals to a total of 43600 wristwatches. If the maximum storage capacity of the 40-feet container (66.3 $m^3$) is taken as a basis, then 88400 wristwatches can be transported in 4420 boxes. Based on the results of our calculations, high cube 40-feet containers are capable of transporting 5066 boxes which equals to a total of 101320 Casio wristwatches.

In *Table 2*, the maximum storage capacity was used as a basis. This value is 24 000 kg for 20-feet containers, 30 480 kg for 40-feet containers and 32 500 kg for high cube 40-feet containers. Accordingly, the following data were obtained:

| Examining weight limit | 20' | 40' | 40' HC |
|---|---|---|---|
| Box (number) | 2180 | 4420 | 5066 |
| Weight (kg) | 3989.4 | 8088.6 | 9270.78 |

Table 2. Interpreting weight limitation for a given product. Source: edited on own, 2016.

*Table 2* shows that 2 180 boxes loaded with goods are placed in a 20-feet container, weighting 3 989 kg total. Consequently, the weight of the maximum amount of goods to be loaded into the container is 24 000 kg; therefore, size constrains prevail over weight constraints. The total weight of goods to be loaded into the 40-feet container is 8 088 kg, while the weight of goods to be loaded in the high-cube 40-feet container is 9 270 kg.

**4.2. Cost analysis for a given route and given container size, based on the price quotes provided by shipping companies**

Costs were analyzed through import from the United States and China. Calculations focusing on price and transit time were performed in relation to ISO containers (20', 40', 40'HC).

| Summary table | | | |
|---|---|---|---|
| New York–Debrecen (Hungary) | Container sizes | | |
| | 20' | 40' | 40'HC |
| Selected shipping company | CMA-CGM Shipping Company | Hapag-Lloyd Shipping company | Hapag-Lloyd Shipping company |
| Cost | 645 146 HUF | 858 582 HUF | 858 582 HUF |
| Transit time | 24 days | 19 days | 19 days |
| Shipping cost per wristwatch | 15 HUF | 10 HUF | 8 HUF |

Table 3. Summary of the costs and transit times of shipping companies selected for the New York—Debrecen (Hungary) route. Source: edited on own.

*Table 3* shows the selected shipping companies for the New York to Debrecen, Hungary route, considering the given price and transit times. CMA-CGM provided the lowest offer (645 146 HUF) for transporting a 20-feet container. This shipping company guarantees the delivery of the container to the specified address in Debrecen in 24 days. If a 40-feet container is selected, the best offer is provided by Hapag Lloyd both in terms of transit time and cost. They guarantee the delivery of the container to the selected port in 19 days for 858 582 HUF. The transportation of High Cube 40-feet containers has the same costs; therefore, one can calculate with the same cost and delivery time as in the case of the 40-feet container. In addition, shipping cost per wristwatch was also specified.

| Summary table | | | |
|---|---|---|---|
| Baltimore–Debrecen | Container sizes | | |
| | 20' | 40' | 40'HC |
| Selected shipping company | Hapag-Lloyd Shipping company | Hapag-Lloyd Shipping company | Hapag-Lloyd Shipping company |
| Cost | 612 001 HUF | 787 337 HUF | 801 586 HUF |
| Transit time | 21 days | 21 days | 21 days |
| Shipping cost per wristwatch | 14 HUF | 9 HUF | 8 HUF |

Table 4. Summary of the costs and transit times of shipping companies selected for the Baltimore–Debrecen route. Source: edited on own.

As it is seen in *Table 4*, the selected shipping company was Hapag-Lloyd in the case of all three container sizes, as they provided the best prices and delivery times.

| Summary table | | | |
|---|---|---|---|
| Shanghai–Debrecen | Container sizes | | |
| | 20' | 40' | 40'HC |
| Selected shipping company | UASC (United Arab Shipping Company) | UASC (United Arab Shipping Company) | UASC (United Arab Shipping Company) |
| Cost | 356 125 HUF | 451 538 HUF | 420 558 HUF |
| Transit time | 39 days | 39 days | 39 days |
| Shipping cost per wristwatch | 8 HUF | 5 HUF | 4 HUF |

Table 5. Summary of the costs and transit times of shipping companies selected for the Shanghai –Debrecen route. Source: edited on own.

According to *Table 5*, the best offer was provided by United Arab Shipping Company for all three container sizes.

| Summary table | | | |
|---|---|---|---|
| Hong Kong–Debrecen | Container sizes | | |
| | 20' | 40' | 40'HC |
| Selected shipping company | UASC (United Arab Shipping Company) | UASC (United Arab Shipping Company) | UASC (United Arab Shipping Company) |
| Cost | 356 125 HUF | 451 538 HUF | 420 558 HUF |
| Transit time | 35 days | 35 days | 35 days |
| Shipping cost per wristwatch | 8 HUF | 5 HUF | 4 HUF |

Table 6. Summary of the costs and transit times of shipping companies selected for the Hong Kong–Debrecen route. Source: edited on own.

According to *Table 6*, the most favorable price quote was provided by the United Arab Shipping Company, as they guaranteed the delivery of the container to the destination port (Koper) in 32 days and to Debrecen in 3 days. The offer of United Arab Shipping Company was 356 125 HUF for a 20-feet container, 451 538 HUF for a 40-feet container and 420 558 HUF for a High Cube 20-feet container.

| Relations | Container sizes | | |
|---|---|---|---|
| | 20' | 40' | 40'HC |
| **New York–Debrecen** | CMA-CGM Shipping Company | Hapag-Lloyd Shipping Company | Hapag-Lloyd Shipping Company |
| **Baltimore–Debrecen** | Hapag-Lloyd Shipping Company | Hapag-Lloyd Shipping Company | Hapag-Lloyd Shipping Company |
| **Shanghai–Debrecen** | UASC (United Arab Shipping Company) | UASC (United Arab Shipping Company) | UASC (United Arab Shipping Company) |
| **Hong Kong–Debrecen** | UASC (United Arab Shipping Company) | UASC (United Arab Shipping Company) | UASC (United Arab Shipping Company) |

Table 7. Shipping companies selected for four shipping routes. Source: edited on own.

It can be seen in *Table 7* that, in almost all cases, Hapag-Lloyd was selected as the best option for shipping from the ports of the Unites States through the ports of Europe to Debrecen as a final destination, i.e., New York–Debrecen and Baltimore–Debrecen. However, in one case, the most favorable offer for the New York–Debrecen relation was provided by CMA-CGM for a 20-feet container. Regarding containers from Asia to Europe, the best offer was provided by the United Arab Shipping Company for both the Shanghai–Debrecen and the Hong Kong–Debrecen routes. .

## 5. Conclusions and recommendations

Based on this research, it was concluded that the first hypothesis was entirely correct, i.e., it is important to examine the size and weight of wristwatches to be transported in containers. Based on the competitive selection of shipping companies, it was concluded that the offer of Hapag-Lloyd should be accepted in relation to the route between the United States and Hungary, while the best offer for the China–Hungary relation was provided by the United Arab Shipping Company. It was our third hypothesis that it is possible to save costs if a competitive selection is performed between the obtained price quotes. This hypothesis was correct, as the method used for ranking resulted in the most favorable offer. We recommend to perform examination of size and weight for the purpose of the most efficient use. Furthermore, we recommend dealers

to perform competitive selection between the obtained price quotes. If they are able to compare the provided price offers with the proper method and rank them, it is possible to save costs. If a Hungarian watch dealer wished to import wristwatches in bulk, we recommend to order them from China as imported products, instead of ordering containers from the United States.

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