THE ECONOMIC IMPACT OF THE MARITIME SECTOR : THE USE OF ECONOMIC IMPACT STUDIES (EIS) AS A PUBLIC POLICY INSTRUMENT

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INTRODUCTION

In this contribution, we shall discuss the use of in which Economic Impact Studies (EIS) by public policy-makers. EIS are particularly useful in the preliminary stages of the policy-making process in order to properly evaluate the economic significance of specific industrial sectors and investment projects.

In the United States, the use of the results of Economic Impact Studies has been widely recognised by public policy-makers. In Belgium, the Flemish government first recognized the necessity of EIS as a tool to guide public investments in 1989. The economic section of the 1989 government programm focuses on the need to increase the value added of economic activities, whereas the section on infrastructure and transport expressly states that proposals for new projects will be subject to an evaluation of the value added created and of the backflow effects for the community. The new Flemish government, set up in 1992, also adopted these statements (cf. Vlaamse Executieve (1989), (1992)).

An EIS is used as a scientific tool to determine the economic significance of a given sector or economic activity linked to a particular investment project.

Through the use of recent and reliable input/output tables, both the direct and indirect effects of a project can be evaluated by means of the EIS methodology. Direct effects include those which are generated in the sector itself, whereas indirect effects can be observed in the supply industries.

The present paper provides some results of the first Economic Impact Study - based on recent reliable and annual I/O tables - conducted in Belgium with reference to the following sectors: shipbuilding, inland navigation and ocean shipping, sea ports and road haulage.

1. PREMISE

Economic Impact Studies constitute an excellent tool to determine the economic significance of both new and existing transport activities. There is a consensus about the transport sector being a vital catalyst for the generation of revenues and employment. Nevertheless, the actual extent of the impact of this contribution has so far never been the subject of detailed and accurate examination.

A transport economic impact study is a means to quantify the contributions of various transport activities. At a time when tax payers become increasingly concerned about large public expenditure or investments (cf. the anti-government infrastructure reflex since the late sixties), appropriate EIS allow to considerably improve the relationship between public agencies and the community at large.

2. THE IMPORTANCE OF EIS FOR GOVERNMENT POLICY

An EIS has a particular significance for public agencies, as it:

a. provides insights into the economic interrelationships between transport activities (e.g. road transport, inland shipping, port activity) and other sectors of the national economy;
b. can be used as a policy tool aimed at convincing both national and local communities of the importance of specific transport activities for a country or area;
c. provides vital data when carrying out investment analyses, especially for complex projects, as a complement to, for instance, social cost benefit analyses;
d. acts as a major marketing tool with regard to users of the public transport infrastructure, by situating its impact against a national or regional background.

Direct effects are related to earnings (value added) generated in a particular sector as a result of new or existing activities in the sector. **Indirect effects** comprise earnings generated in other sectors as a result of purchases of intermediate goods and services. In this paper we shall disregard the so-called **induced effects**, ensuing from household purchases, created as direct or indirect effects.

In order to estimate the actual significance of specific transport activities for the national or regional economy, it is vital to take into account both the direct and indirect impact of certain activities.

It clear that the public agency involved should be interested in the **direct** as well as the **indirect** effects of both **new** activities (resulting from planned investments) and **existing** activities. This field of interest is clearly shown by means of a contingency table, in which four quadrants (cf. figure 1) list every possible situation.

Figure 1

DETERMINATION OF THE ECONOMIC SIGNIFICANCE OF A TRANSPORT ACTIVITY.

		Nature of transport activity	
		NEW	EXISTING
Impact of transport activity	DIRECT	1	3
	INDIRECT	2	4

An EIS allows to evaluate the economic impact of both existing and new activities as opposed to the social cost benefit analysis which is confined to new projects.

3. EIS METHODOLOGY

When carrying out an EIS, two methods can be used.

Firstly, we can make rough estimates of the economic importance of the transport activity, by means of data which are publicly available or issued by "representative companies". These data can, after any necessary corrections have been made, be extrapolated to all activities that form part of the transport activity under consideration.

Secondly, we can work in a more exhaustive way; this entails two main elements. On the one hand, a detailed and well-prepared questionnaire is submitted to all companies which are part of the transport industry or an industry dependent on the transport sector. The questionnaire is necessary in order to accurately calculate the direct effects in terms of value added. On the other hand, the calculation of indirect effects requires the existence of recent and complete **national input/output tables**, which, in the case of Belgium, are available only from a private source, "Policy Research Corporation". The official input/output tables published by the National Institute for Statistics (NIS) are not only released with great delays (about eight years), but are, for some sectors, also riddled with inaccuracies.

The main advantage of calculating the value added generated within the framework of the transport sector, is that this value added can immediately be compared with the economic significance of, for instance, large individual companies, specific sectors of the economy, or even the GNP (which amounts to the total value added created in all sectors).

4. RESULTS OF THE FIRST EIS IN BELGIUM

In this contribution we shall discuss both the results of a study of the Department of Transport Economics at the University of Antwerp (cf. C. Peeters (1991)), revealing the economic impact of the shipbuilding and ocean shipping industry and a study of the consultant "Policy Research Corporation" (1991), with reference to the economic effects of the sea ports, the inland navigation and road haulage sectors. The latter study was made for the Flemish Ministry of Public Works and Transport - Department of the Environment and Infrastructure.

In both these studies the exhaustive bottom-up method is used, inserting new rows and columns into the annual input-output tables for the sectors mentioned above. The data for these sectors are based on accounting figures and questionnaires.

4.1. Development of annual multipliers

The technical coefficients of the intermediate inputs indicate the amount of supplies, expressed in Belgian francs from each industry, required to generate 100 Belgian francs of production in a particular sector, whereby only direct supplies are taken into account. However, in reality, indirect effects also play a major role; the production of the examined sector does not only generate production in the immediate supplying industry, but also in the industries that sell products to the primary supplier in order to attain the required production in the immediate supplying industry. We can calculate the direct and indirect effects by determining the inverse matrix (Leontief matrix). The sum of a column of inverse production coefficients equals a sectoral activity multiplier.

In Table 1, the development of the multipliers for inland shipping is listed for the period 1980-1988. Table 2 shows the average multipliers for the sectors studied.

Table 1

Inland Navigation Sector in Belgium :
National Multipliers in %, 1980-1988

Year	Multiplier
1980	196
1981	203
1982	194
1983	192
1984	191
1985	187
1986	184
1987	185
1988	187

Source : Policy Research Corporation N.V. - Antwerp

Table 2

Maritime and Road Haulage Sectors in Belgium :
Average National Multipliers, in %

	1980-1985	1986-1988
Inland Navigation	194	185
Ocean Shipping	135	133*
Sea Ports	186	181
Shipbuilding	138	141*
Road Haulage	174	181

Source : Policy Research Corporation N.V. and Department of Transport Economics, University of Antwerp-RUCA. Figures marked with * : only 1986 available

As shown in Table 2 the multipliers for inland navigation and seaports are higher than those for ocean shipping and shipbuilding. This implies that for every 100 Bfr.of production in ocean shipping and shipbuilding, the Belgian supply industry delivers for only 33 to 41 Bfr., while the deliveries exceed 85 and 81 Bfr. for the inland navigation and sea port sector.

The maritime multipliers have the tendency to decrease (period 1986-1988 versus 1980-1985), with an exception for shipbuilding. In general more products were bought from foreign suppliers. In the road haulage sector, the reverse happens; the multipliers increase from 174% to 181%.

The 'power of dispersion' (cf. P.N. Rasmussen (1956) compares the multiplier of a specific sector with the average for the entire economy[1], cf.Table3.

Table 3

Maritime and Road Haulage Sectors in Belgium :
Average 'power of dispersion' and 'sensitivity of dispersion'
Period 1986-1988

	Power of dispersion	Senitivity of dispersion
Inland Navigation	1,27	0,75
Ocean Shipping	0,98*	0,74*
Sea Ports	1,24	1,84
Shipbuilding	1,05*	0,89*
Road Haulage	1,24	1,71

Source : Policy Research Corporation N.V. and Department of Transport Economics, University of Antwerp-RUCA. Figures marked with * : only 1986 available

For inland navigation, sea ports and road haulage the power of dispersion exceeds considerably the value 1, which implies that the multiplier effect is greater (24 à 27%) than the average of the economy. The multiplier of ocean shipping and shipbuilding almost equal the average of the economy.

The sensitivity of dispersion [2], cf. also Table 3, compares the effect of an increase in the final demand for products of all industries on the output of one particular industry i, with the average effect (across all industries i) from a similar rise in the final demand.

The sensitivity of dispersion for the Belgian sea ports and the road haulage sector exceed the national average respectively with 84% and 71%. Consequently the effects of general economic growth are very noticeable in these sectors. A lack of investments in sea ports and road transport can generate a slowdown in general economic development. Nevertheless, for road transport environmental and budget constraints urge us to develop policy alternatives to solve the present congestion of the infrastructure.

Interesting alternatives, which ... further study, are inland navigation and shortsea-shipping . Although the multiplier of Belgian inland navigation is high, its sensitivity is very poor (25% below average). Today, the sector is not able to take advantage of general economic growth. As a result of a lack of investments in appropriate vessels, in spite of a very modern infrastructure. As a consequence, industrial firms in Belgian are not interested to this so called "old fashioned" mode of transport. Besides, foreign modern ships, especially from the Netherlands, already captured a considerable market share from the Belgian inland navigation fleet.

Similarly Belgian ocean shipping in not very sensitive to Belgian economic growth, which is a result that could be expected, taking into account the international market these ships serve and considering the fact that foreign ships are responsible for transporting almost 90% of Belgian import and export. Foreign investments are very important.

In order to calculate the contribution to the formation of GNP, national perspective needs to be taken into account. However, when attempting to solve congestion problems, the nationality of the carrier is of minor importance. Here, policy recommendations to shift traffic from road transport to inland navigation, short sea shipping and railway transport are urgently needed irrespective of the economic impact in market terms.

4.2. Direct and indirect value added

By applying the cumulated costs theory (cf. a.o. F. Bossier et al. (1984)) we can determine the amount of BFr. created in direct and indirect primary inputs (e.g. value added, wages and salaries etc.) for each BFr. 100 of domestically produced products, destined for final demand.
The sector examined not only generates value added in the sector itself, but also in the directly and indirectly supplying industries [3].

In Table 4 the direct and indirect value added of the maritime and road haulage sector are listed (figures in million ECU). The total value added amounts to 4 084 million ECU in 1986, within which road transport (48%) and sea ports (34%) are the most important.

Table 4

Maritime and Road Haulage Sectors in Belgium :
Direct and indirect Value Added in 1986 and 1990,
Million ECU

	1986			1990		
	direct	indirect	total	direct	indirect	total
Inland Navigation	69	45	114	83	50	133
Ocean Shipping	214	228	442	*	*	*
Sea Ports	1027	379	1406	1400	525	1925
Shipbuilding	131	45	176	*	*	*
Road Haulage	1414	532	1946	1750	875	2625
Total	2855	1229	4084	*	*	*

Source : Policy Research Corporation N.V. and Department of Transport Economics, University of Antwerp-RUCA. * : not yet available.

Table 5

Maritime and Road Haulage Sectors in Belgium :
Average Cumulated Cost Index Gross Value Added
(market prices). Period 1980-1985 and 1986-1988

	1980-1985	1986-1988
Inland Navigation	1,01	1,09
Ocean Shipping	0,55	0,51*
Sea Ports	1,37	1,36
Shipbuilding	1,16	1,11*
Road Haulage	1,08	1,12

Source : Policy Research Corporation N.V. and Department of Transport Economics, University of Antwerp-RUCA. Figures marked with * : only 1986 available

By analogy with the power of dispersion (cf. supra) we calculated a 'cumulated cost index' [4], for the average values see Table 5. It appears that for sea ports the creation of direct and indirect value added is situated 36% above the average of the total Belgian economy. Inland navigation, shipbuilding and road haulage perform 9 to 12% above average (1986-1988). The cumulated value added of ocean shipping, on the contrary is almost 50% less than the average of the economy. The reason is the low direct value added, which amounted in 1986 to only 16% of total output; for sea ports, for example this share amounts to 36%.

4.3. Backflow to the community

On the basis of the methodology used to evaluate the economic significance of a sector, we are also able to calculate the financial backflow to the community generated by the production of this sector and the accompanying production of the supplying industries.

The term "backflow components" refers to the various government revenues ensuing from activities in the examined sectors and supplying industries.

The following backflow components have been taken into account:

- employee social security contributions;
- employer income taxes;
- employer social security contributions;
- taxes levied on production;
- company taxes.

Within the set of sectors we considered road haulage and sea ports create the highest volume of backflow amounts to government; i.e. almost the same shares these sectors represented in total value added (compare Table 6 with Table 4). As a percentage of total output, inland navigation creates a larger backflow (27%) than road transport (18%) !

Table 6

Maritime and Road Haulage Sectors in Belgium :
Backflow to Government in 1986 and 1990,
Million ECU

	1986		1990
	Mio ECU	%	Mio ECU
Inland Navigation	60	4	62
Ocean Shipping	140	10	*
Sea Ports	460	33	601
Shipbuilding	66	5	*
Road Haulage	686	48	1043
Total	1412	100	*

Source : Policy Research Corporation N.V. and Department of Transport Economics, University of Antwerp-RUCA. * : not yet available.

5. CONCLUSIONS

The results of the first applications of Economic Impact Studies to Belgian case studies were described in this paper. For ocean shipping and shipbuilding, the figures have played a major role in the development of new policy measures by the Flemish government. Moreover one of the important conclusions is the demonstration of the considerable economic potential in terms of value added and backflow effects, of inland navigation, which can offer a viable solution for a part of the congestion problems in road transport. Today, the Belgian inland navigation sector is not yet able to take advantage of general economic growth. The development of policy alternatives on a national and European level are urgently needed. This study also shows the great economic importance of the sea port sector. In this sector, the Economic Impact Study is also used by the Flemish government as an instrument of project evaluation.

NOTES

1 Power of dispersion K_k

$$K_k = m \frac{\sum_{i=1}^{m} A_{ki}}{\sum_{k=1}^{m} \sum_{i=1}^{m} A_{ki}}, \; with \; k=1,...,m$$

With $K_k = 1$ the multiplier of industry k equals the average of the entire economy;
with $K_k < 1$ the multiplier effect is less than the average of the economy;
with $K_k > 1$ the multiplier effect is greater than the average of the economy

$$A_{ki} = \frac{\Delta X_i}{\Delta Y_k}$$

A_{ki} = sectoral capacity indicator, with X_i being the output of sector i and Y_k the final demand for sector k

$\sum_{i=1}^{m} A_{ki}$ = sector activity multiplier, a **column** of inverse production coefficients

m represents the number of sectors.

2 Sensitivity of dispersion G_i

$$G_i = m \frac{\sum_{k=1}^{m} A_{ki}}{\sum_{k=1}^{m} \sum_{i=1}^{m} A_{ki}}, \; with \; i=1,...,m$$

With G_k = 1 the sensitivity of dispersion equals the average of the entire economy;
With $G_k < 1$ the sensitivity is less than the average of the economy;
With $G_k > 1$ the sensitivity is greater than the average of the economy.

$\sum_{k=1}^{m} A_{ki}$ = the sum of a **line** of inverse production coefficients

[3] For each primary input component (Z), we can calculate the cumulated costs for an industry k as folloms :

$$Z_k = \sum_{i=1}^{m} b_i A_{ki}$$

where b_i = the technical coefficient of the component involved of the primary input of industry i;

A_{ki} = the inverse coefficient, national flow.

[4] By analogy with the power of dispersion, we can calculate a "cumulated costs index" (C_k) for each industry and for each component of the primary input :

$$C_k = m \frac{\sum_{i=1}^{m} b_i A_{ki}}{\sum_{k=1}^{m} \sum_{i=1}^{m} b_i A_{ki}}, \quad with\ k=1,...,m$$

With $C_k = 1$ the cumulated cost of industry k equals the average of the entire economy;

with $C_k < 1$ the cumulated cost is less than the average of the economy;

with $C_k > 1$ the cumulated cost is greater than the average of the economy.

BIBLIOGRAPHY

Peeters, Chris. Economische Analyse van Sektorieel Overheidsbeleid. Leuven-Apeldoorn : Wetenschappelijke Uitgeverij Garant, 1991. 1200pp.

Policy Research Corporation N.V. De economische betekenis van de Vlaamse vervoerssektor in de Belgische industriële structuur : ontwikkelingen van een analyse methodologie. Brussel : Departement Leefmilieu en Infrastructuur, 1991. 288 pp.

Rasmussen, P.N. Studies in inter-sectoral relations. København-Amsterdam : Einar Harcks Forlag-North Holland Publishing Company, 1956. 217 pp.

Bossier, F., de Biolley, T. and Vandamme, L. Cumulated Costs and Import Contents in the Belgian Input-Output Tables of 1965, 1970 and 1975, Cahiers économiques de Bruxelles, nr. 101, 1984, p. 125-167.

Vlaamse Executieve (1989), Regeerakkoord, Brussel, 107 pp.

Vlaamse Executieve (1992), Regeerakkoord, Brussel, 100 pp.