Pricing of Intermodal Transport. Lessons Learned from RECORDIT[1]

Andrea Ricci
ISIS – Institute of Studies for the Integration of Systems[2]
Rome
Italy
E-mail: aricci@isis-it.com

EJTIR, **3**, no. 4 (2003), pp. 351-370

Received: December 2002[3]
Accepted: December 2003

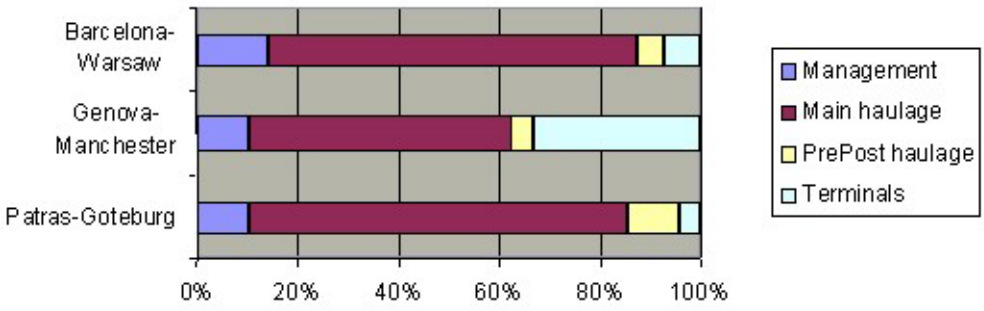
Intermodal transport is defined as a sequence of activities involving modal haulages, transhipments and terminals, and requiring the intervention of a variety of operators, whose roles partially overlap and compete. This entails an inherent complexity of the cost and price formation mechanisms, and an overall lack of transparency resulting both from the technical difficulty to establish a reliable and effective accounting framework, and from the high level of competition currently observed between operators.
Specific obstacles to cost valuation and pricing are also related to the choice of the units of measure, whereby intermodal traffic is usually assessed with reference to the Loading Unit concept, rather than in terms of vehicles moved.
The RECORDIT project (Real Cost Reduction of Door-to-door Intermodal Transport) is briefly presented, with particular reference to its pricing-relevant objectives: designing an original accounting framework for intermodal transport, and documenting the value of individual cost items (both internal and external) based on the detailed, bottom-up analysis of three intermodal trans-European corridors and their all-road competing alternatives.
Intermodal transport is found to be consistently cheaper than all-road solutions, and its external costs significantly lower, thereby confirming the high potential of intermodal transport in increasing the sustainability of the transport sector. Lead times are however substantially longer than for road, which contributes to explain the currently limited market share of intermodal transport services.
For price setting purposes, RECORDIT has carried out a comparison between social costs (internal + external) and taxes and charges currently paid. The evidence from the three

[1] http://www.recordit.org
[2] http://www.isis-it.com
[3] An earlier version of this paper was presented at the second seminar of the IMPRINT-EUROPE Thematic Network: "Implementing Reform on Transport Pricing: Identifying Mode-Specific Issues", Brussels, 14th/15th May 2002.

corridors analysed does not lead to uniform conclusions, owing to a high level of variability of results in relation to corridor-dependent parameters, and thereby confirming the need for a price-setting approach that allows to adequately reflect the specific characteristics of each route.
Further research and policy initiatives can be envisaged to facilitate the pricing reform process, particularly directed at reducing information gaps and increasing transparency, also through the establishment of more effective institutional and market mechanisms.

1. Introduction

On most European transport corridors where intermodal freight services exist, direct competition can be observed with other modal solutions, and in particular with all-road transport. Price is clearly a critical factor in the assessment of the comparative performances of competing transport options. In the perspective of generalised pricing reforms, intermodal transport should therefore be considered as "just another transport mode".
On the other hand, intermodal prices largely depend on the costs of transport services in each modal sector: as shown in figure 1 below, non-haulage costs (terminal costs + management costs) can indeed be as high as 40% of the total intermodal costs, but haulage costs proper (i.e. pre and post haulage plus main haulage) are normally found to be largely prevailing. In fact, while no standardised organisational model exists in the intermodal sector, current trends point at the ever increasing role of multimodal operators and freight integrators, who actually build up the intermodal chain, and assume *de facto* responsibility for "making the price" of the service. Implementing pricing reforms in the different individual modes will therefore bear immediate consequences on the costs (and therefore on the prices) of intermodal transport.



Source: RECORDIT

Figure 1. Internal costs components of intermodal transport

Devising pricing strategies in the intermodal freight sector raises in fact a number of difficult challenges:

- Estimating the real costs (i.e. both internal and external) of: (i) modal haulages, (ii) terminal operations and transhipments, and (iii) management and other logistic functions associated to the intermodal concept.

- Analysing the cost formation of intermodal transport services, based on the recognition that the various cost components above are not immediately additive: the cost borne by e.g. a freight integrator reflects the *price* of intermediate services (e.g. modal haulage), not their production *cost*
- Understanding – in light of the above-mentioned interdependencies - the implications of modal pricing reforms on the costs and prices of intermodal services.

Intermodal transport chains are complex, involving a wide range of operators. Detailed cost data for each of the steps of the intermodal chain are scarce, and, even when available, cannot be directly added up, owing to (i) different classifications of cost categories, and (ii) risks of double counting. RECORDIT has addressed this challenge by designing a highly disaggregated accounting framework, based on the application of a standardised classification of costs to all steps in the intermodal chain.
There is only limited transparency for what concerns the relationships between costs and prices in the intermodal sector. Moreover, pricing practices are extremely variable, across operators, corridors, and market segments. As a result, understanding the price formation mechanisms relies heavily on the availability of empirical, detailed evidence. RECORDIT has gathered such evidence in relation to the intermodal services currently offered over some 9000 km of European transport network. Consistency and comparability of data are ensured by cross checking bottom-up data made available by individual operators with top-down data derived from statistical sources and corporate accounts.
Pricing reforms in the intermodal transport sector can be devised as the combination of (i) pricing interventions in the individual modal markets and (ii) pricing interventions at terminals and nodes. The widely accepted view is that intermodal transport is more efficient (in terms of total social costs) than its main competitor, the all-road transport, mainly owing to its lower external costs (environment, accidents, congestion). However, the additional costs arising from the operations at terminals and nodes, and from the overall management of the intermodal chain, may well offset all or part of this competitive advantage. The intermodal pricing challenge, therefore, is not so much to devise an original strategy to pass on to the user the full social costs of the intermodal service production, but rather to understand the extent to which pricing interventions in the modal sectors (and at terminals) may affect the balance of competitiveness between intermodal and all-road transport. RECORDIT has developed an accounting model allowing to simulate the impact of transport policies and interventions on the costs of modal and intermodal transport, and on the changes that can subsequently be expected in market prices and relative competitiveness.

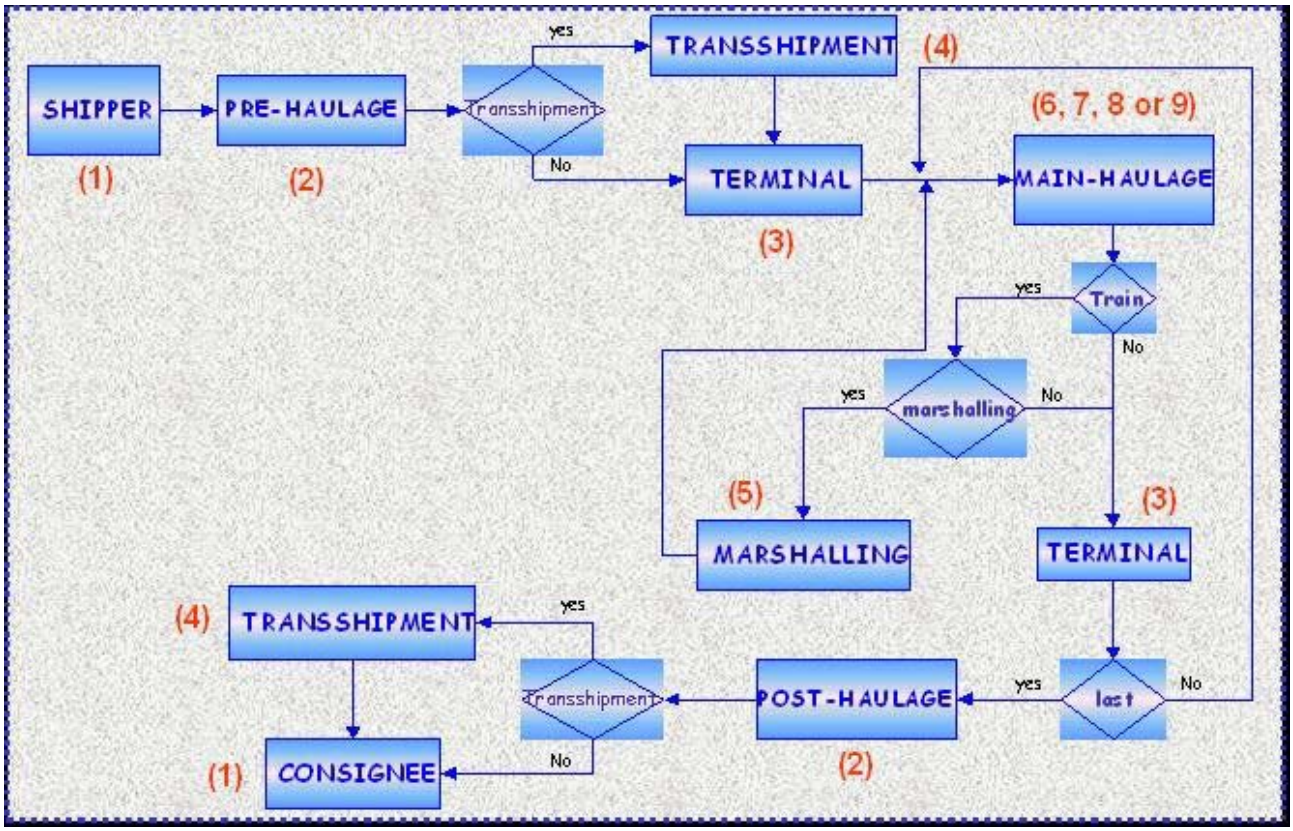
2. Costs and prices of intermodal transport

2.1 Intermodal transport chains: definitions and layout of cost formation mechanisms.

Intermodal transport is defined as “the movement of goods in one loading unit, which uses successively several modes of transport without handling of the goods themselves in transhipment between the modes”.
This entails that:

- two or more different transport modes are deployed, and therefore at least one transhipment takes place
- the main haulage is not carried out by road, but by rail or water, while trucks/lorries are used for the initial and final legs of the goods movement (pre and post haulage).

The general layout of an intermodal chain can be described as a sequence of activities, classified in nine main blocks, as shown in Figure 2.



Source: RECORDIT

Figure 2. General layout of intermodal transport chains

Loading/unloading - Shipper / consignee

The first and the last step of a transport process are the companies, which dispatch and receive the consignment. Their costs include those incurred in loading (unloading) and storing the units used for transport (containers, trailers). In addition a company may incur costs in leasing or owning units used for transporting the goods. External costs are geared to the use of machinery and equipment for the above operations.

Pre haulage / Post haulage

Pre and post haulage to and from terminals (e.g. rail) is typically provided by road transport companies. Road haulage companies incur costs involved in the ownership and operation of vehicles, which in most cases involves the payment of taxes. The total costs include the time

spent loading and unloading as well as movement. Costs may also be incurred for the payment of infrastructure in the form of tolls. External costs are generated by the truck movement

Transshipment
This can be defined as the location in which loading units are physically transshipped from one vehicle to another similar vehicle of the same mode (e.g. truck to truck). Internal costs involved are the capital cost of the equipment necessary for transshipment, its operation and the storage area required. External costs are geared to the use of machinery and equipment for the above operations.

Terminal transfer
A terminal is defined as a place containing the functions and technical assets whereby a loading unit may be transhipped between two *different* kinds of carrying units. Transfer may be between the various modes – rail, road, sea and inland waterway. External costs are geared to the use of machinery and equipment for the above operations.

Marshalling Yard transfer
The function of a marshalling yard is the transhipment of loading units from one *train* to *another*, or, more commonly, the rearrangement of wagons into a single train. External costs are generated by the movement of vehicles (locomotives, wagons) and by the use of other equipment and machinery for the transfer operations.

Main haulage: Road
Road haulage companies incur costs involved in the ownership and operation of vehicles, which in most cases involves the payment of taxes. Costs may also be incurred for the payment of infrastructure in the form of tolls and road pricing. This includes all national road tax stickers and motorway vignettes operative in Switzerland and Austria as well as tolls for Alpine and Channel crossing. External costs are generated by the movement of trucks.

Main haulage: Rail / Train
The costs refer to a *terminal*-to-*terminal* journey performed by rail transport. They include any charges for the use of the rail infrastructure. These charges may or may not cover the costs of the infrastructure. External costs are generated by the movement of trains.

Main haulage: Inland waterway
The cost structure of this transport block is similar to that experienced for main haulage by train. Charges may be incurred for the use of infrastructure. External costs are generated by the movement of barges.

Main haulage: Maritime
The cost structure of this transport block is similar to that experienced for main haulage by train. No charge is paid for infrastructure (the sea). Costs for piers and berths maintenance and repair are normally allocated to terminals. External costs are generated by the movement of ships.

2.2 One service, a multitude of market players.

The complexity of the layout illustrated above reflects directly on the organisation of the intermodal market, which is characterised by a multiplicity of players, including end-users (shippers and consignees), infrastructure managers, operators (modes, terminals) and service providers (forwarders, integrators), interacting at various levels and in non standardised forms. The cost and price formation mechanisms associated to the production of the intermodal transport service are therefore extremely difficult to assess.
A typical example is the handling of profits and mark-ups throughout the cost formation sequence: owing to the high number of operators involved in customer/client relationships, it is extremely difficult to establish a satisfactory (i.e. faithful, transparent and standardised) rule to avoid double counting while ensuring the required completeness of information.
The emerging role of the so-called integrators, while simplifying the picture by consolidating the process of service production, may on the other hand induce an increased lack of transparency for the market users (whereby a significant part of transaction costs would become agency costs).

2.3 A highly competitive environment

Intermodal transport involves a large number of operators from the private sector. The market environment in which they operate is highly competitive. As opposed to the general situation observed for many other transport services, direct competition can often be found among players operating on the same network segment. This situation largely influences the pricing strategies of operators and their overall market attitude:

- published prices, when they exist, are often found to be substantially different from real prices offered to customers. Discounts for high volumes, for frequent and/or regular shipments, and, more generally, for strategically preferred customers are common practice, and hardly documented
- similarly, cross subsidisation between routes is frequently adopted by operators seeking to gain dominant positions on specific itineraries and services.

The current market set-up does not in fact provide for the necessary transparency, resulting in market distortions and efficiency limitations; the highly competitive environment characterising the intermodal transport sector, which should in principle guarantee - if only in the medium/long term - the attainment of efficient market equilibriums, paradoxically implies, in the short term, a real difficulty in achieving the appropriate level of visibility and information exchange, such as needed for a transparent interplay of the market forces.
The difficulty in accessing pricing relevant information is clearly also a major obstacle to the estimation of real costs: devising an effective pricing policy in such an opaque context is indeed a very ambitious challenge.

2.4 Loading Units Vs Vehicles

Deriving *unit costs and prices* that are relevant to both policy makers and market players is a complex affair:

- the market of intermodal transport is organised with reference to the movement of Loading Units (LUs), rather than vehicles: in fact, the LU can be considered as the

equivalent of the vehicle in other forms of transport, whereby it is the LU - and not the various vehicles on which it is successively loaded - that physically moves all the way from origin to destination. But Loading Units can be of different types, with three main options: containers, swap bodies and trailers, each with its characteristics that relate to different organisational, technical and market needs. Despite the current trend towards standardisation, several solutions remain therefore available, even within each LU category, e.g. swap bodies that can be 20-foot or 40-foot long. For pricing purposes, analysts and operators alike therefore tend to express values in Euro/LU.km rather than in Euro/veh.km, as the former are more market-relevant and of direct interest to end-users (shippers and consignees).

- on the other hand, transport charging and taxation policies commonly refer to values in Euro/veh.km, therefore prompting the need for a "translation" of values expressed in LUs to values expressed in vehicle terms. Such conversion is far from straightforward, if one considers that a given vehicle (e.g. a 40 tonnes articulated truck) can accommodate various combinations of different LUs, with varying load factors.

3. Driving forces behind intermodal transport prices

As previously outlined, intermodal transport prices are largely the result of pricing rules and practice in a wide range of "upstream" activities (modal transport, terminal and transhipment operations, logistic organisation). Pricing reforms within these sectors will therefore bear direct, largely automatic consequences on the price levels of intermodal services.
On the other hand, all recent transport policy developments, whether at the EU level or within individual countries, decidedly feature the promotion of intermodal freight transport as a strategic priority. The White Paper of the EC on the revision of the Common Transport Policy devotes a special attention to intermodal freight transport services. In its section: "*Linking up the modes of transpor*t", it advocates a number of technical, economic and organisational innovations that directly aim at increasing the attractiveness of intermodal solutions. Also, and no less importantly, many other measures and actions proposed by the White Paper, although they do not target intermodal freight transport as such, are immediately relevant to the general objective of promoting intermodality. Specifically one should mention: the revitalisation of European railways (through radical increases in efficiency and the eventual establishment of a dedicated freight network), the generalised improvement of the quality of transport services and, last but not least, the introduction of an adequate system of transport infrastructure charging.
In crude terms, promoting intermodal transport entails massive shifting of freight movement from road to more environmentally friendly modes (rail, waterways, short sea shipping). The main challenge is therefore to understand:

- whether pricing reforms at the modal level will ultimately contribute to the promotion of intermodality (notably by increasing its price competitiveness with respect to all-road)
- what additional interventions, specific to the intermodal sector, may supplement and enhance the modal pricing reforms.

While capacity expansion is likely to be crucial to the future growth of intermodal transport, it will by no means be sufficient to guarantee the desired modal shift. Policies and actions must therefore be designed and implemented to:

- increase the productivity and efficiency of the intermodal sector (notably through technological and organisational enhancements)
- reduce the imbalances currently observed between intermodal and road (notably through institutional, fiscal and pricing interventions).

RECORDIT has developed original insights to support the formulation of credible policies in these two areas, by:

- Identifying the most promising areas (technological, organisational) where efficiency gains can be achieved in the production of intermodal transport services
- Assessing and interpreting the current market distortions - with particular regard to the insufficient internalisation of external costs – and their impact on the relative competitiveness of intermodal and all-road transport

4. RECORDIT: assessing the real costs of intermodal transport

4.1 Objectives and overall approach

RECORDIT directly addresses the above mentioned policy needs. It is based on the recognition that, in Europe, the current intermodal market is characterised and constrained by an insufficient knowledge of the mechanisms of cost and price formation. Increasing the transparency of those mechanisms will stimulate fair competition, and, as a result, raise efficiency levels and improve the quality of service, while contributing to increase the sustainability of the transport sector, social welfare and quality of life.
The RECORDIT purpose is twofold: on one hand, to identify priority areas where intermodal costs could be reduced through a better organisation of services and a more effective and systematic use of efficient technologies; on the other, to support the pricing reform currently in preparation, whereby users are expected to pay for the full costs arising from the production of the transport services, through the incorporation in prices of the so-called negative externalities generated by those services (environmental damages, congestion costs, accident risks, etc.).

4.2 The accounting framework

Accordingly, RECORDIT has devised and tested an original accounting framework for intermodal freight transport, where both internal costs (those faced by the various operators for the production of the service), and external costs (those currently borne by society at large) are described. The approach is based on a highly detailed representation of the sequence of activities that are carried out for the production of the door-to-door transport services (as per the layout illustrated above). RECORDIT has reviewed this entire process at the maximum possible disaggregation level, and mapped all cost factors associated to each step, resulting in over 800 individual cost items, all of which are described in the RECORDIT

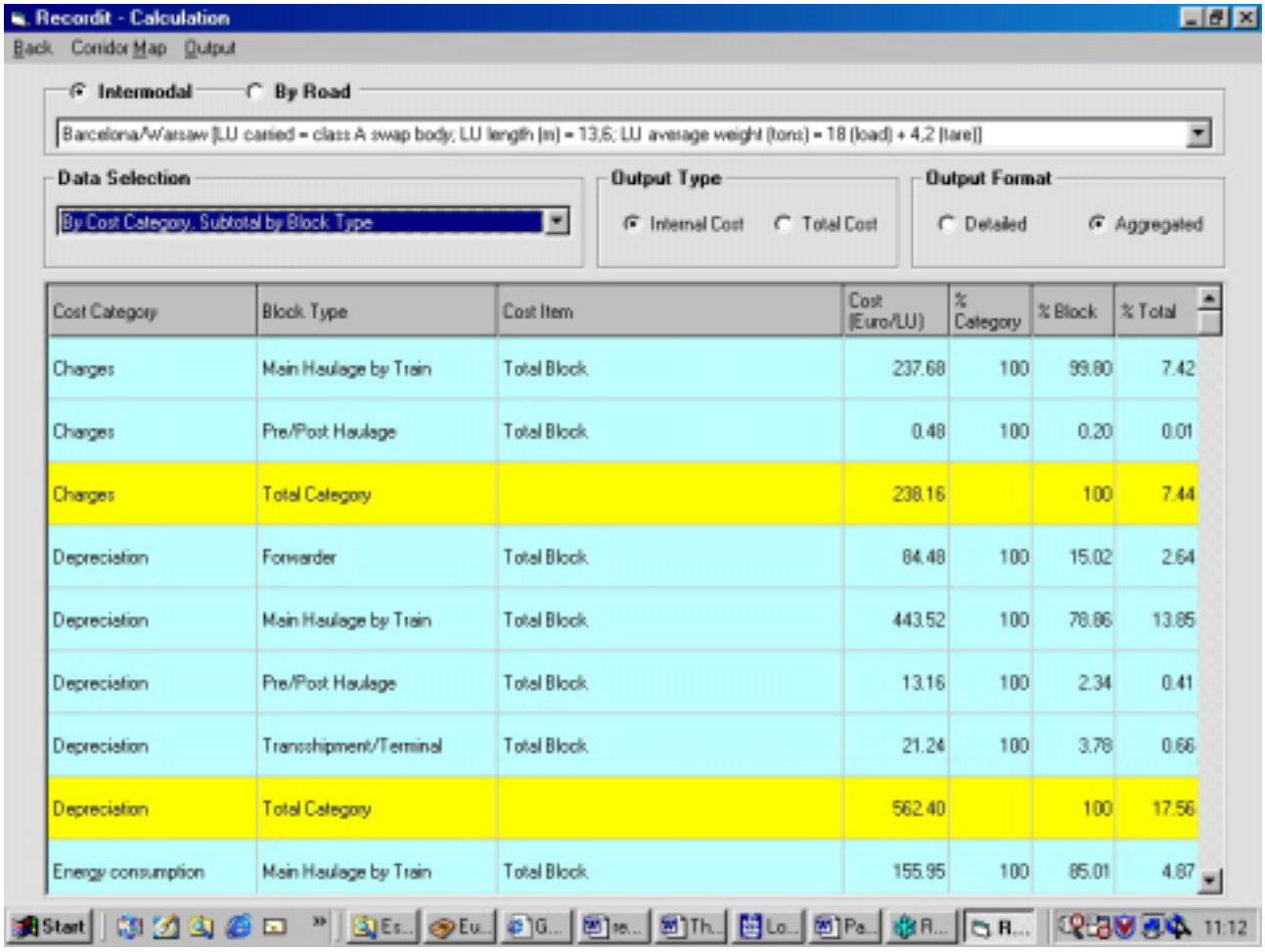
accounting framework, together with their units of measure and the methods to appraise the corresponding values. For what concerns externalities, RECORDIT has adopted the damage cost approach, based on the Impact Pathway methodology, which starts from the technical characteristics of the activity (technology and type of vehicle, load factor, corridor length), then calculates the so-called "burdens" associated to the activity (i.e. emissions of pollutants, emissions of noise, frequency of accidents), then models the physical impact of these burdens on human health, crops, materials, etc., and finally estimates the monetary value of these damages (through market values when available, as for e.g. crops and materials, or through Willingness-To-Pay values otherwise)

Corridors are described through their physical and organisational characteristics, including the length of route segments, the country of origin-destination, the indication of urban or extra-urban context, relevant for pre and post haulage, the type of loading unit to be carried, the number and nature of operators on the route and of the operational activities (or "blocks") involved (haulage, transhipment, etc.) Blocks are classified into the nine main activities where costs are incurred; loading a consignment, pre-haulage to a terminal (in which a transhipment point in the form of storage can be inserted), the terminal handling near to the shipper, the main haulage (with train, truck, ship or inland waterway), the terminal handling near to the consignee, the post haulage and finally the consignee receiving the consignment.

Internal costs are classified in eight main categories

1. Depreciation costs
2. Personnel costs
3. Consumption costs
4. Maintenance costs
5. Insurance costs
6. Tolls and charges
7. Third party services
8. Other costs

Each cost category can further be broken down in a series of detailed cost items, as illustrated in the example below.



Cost Category	Block Type	Cost Item	Cost (Euro/LU)	% Category	% Block	% Total
Charges	Main Haulage by Train	Total Block	237.68	100	99.80	7.42
Charges	Pre/Post Haulage	Total Block	0.48	100	0.20	0.01
Charges	Total Category		238.16		100	7.44
Depreciation	Forwarder	Total Block	84.48	100	15.02	2.64
Depreciation	Main Haulage by Train	Total Block	443.52	100	78.86	13.85
Depreciation	Pre/Post Haulage	Total Block	13.16	100	2.34	0.41
Depreciation	Transshipment/Terminal	Total Block	21.24	100	3.78	0.66
Depreciation	Total Category		562.40		100	17.56
Energy consumption	Main Haulage by Train	Total Block	155.95	100	85.01	4.87

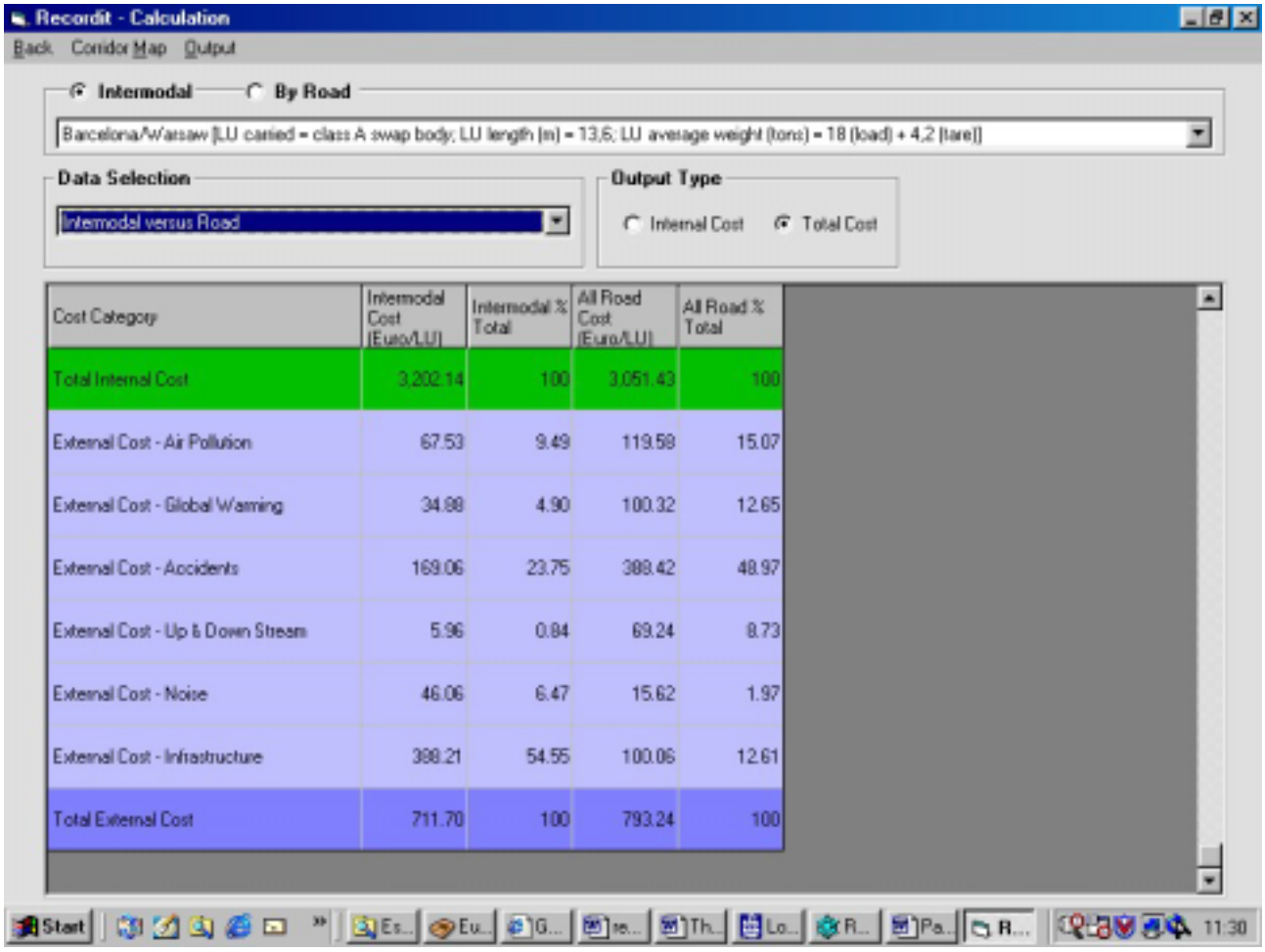
Source: RECORDIT

Figure 3. Breakdown of internal costs

In addition to the internal (operating) costs structure, the RECORDIT accounting framework allows an estimation of the environmental external costs arising from the intermodal and/or all road transport along the freight corridors under examination. The externalities considered are:

- Air pollution
- Global Warming
- Accidents
- Up and Down Stream
- Noise
- Infrastructure Damages

Costs can be analysed and presented at all possible levels of aggregation, as shown in the example below.



Source: RECORDIT

Figure 4. Breakdown of external costs

Based on the above framework, RECORDIT has:

- calculated the entire range of costs for three trans-European, door-to-door corridors (corresponding to a cumulated length of over 9000 km, across 16 European countries, including both Member and Accession States). The result is a database of costs, internal and external, which, although limited to the three RECORDIT routes, provides basic, fundamental insights at the European level as a whole, especially considering that both the intermodal solutions and their all-road, competing alternatives are systematically documented
- identified those cost items (cost drivers) that play a major role in determining the performance of intermodal services, thereby leading to recommendations on priority actions to reduce those costs. In parallel, the pricing relevance of results has been analysed, through the appraisal of the potential impacts of internalisation.

4.3 Pricing-relevant results

All quantitative findings from RECORDIT are based on the calculations carried out for three trans-European corridors:

- the freight freeway between Patras - Brindisi - Milano - Munich - Hamburg and Gothenburg;
- the tri-modal transport chain between Genova - Basel - Rotterdam and Manchester;
- the door-to-door intermodal chain along the corridor Barcelona - Lyon - Torino - Verona - Budapest and Warsaw.

The current market situation is such that, on any of the RECORDIT corridors, the door-to-door transport demand (i.e. loading units being moved all the way from Patras to Gothenburg, etc.) is in fact very limited. While the selected routes are theoretically sound - as they allow for a wide coverage of modes and contexts - the results (in terms e.g. of unit door-to-door costs) are not immediately market-relevant. However, intermodal services are offered and active on most sub-segments within the corridors, allowing to assess shorter, market-relevant routes.
In fact, while the primary objective of the project was to document the cost and price formation mechanisms, and therefore to estimate total real costs, the most interesting results for pricing purposes are those yielded by the comparison of intermodal costs with those of all-road transport on the corresponding routes.
More specifically:

- comparing total costs (internal + external) across the two options (intermodal Vs all-road) sheds light on their relative attractiveness, and should therefore contribute to explain their current market position
- comparing external cost with taxes and charges currently paid allows to identify market inefficiencies, both within modes and across them.

Summary results from RECORDIT are provided below to this effect.
Total internal costs for the movement of container[4] (i.e. costs directly borne by the end-user, including taxes and charges) are summarised in Table 1.

Table 1. Internal costs of intermodal Vs all-road transport

Corridor	Intermodal			All-road		
	€/movement	Length (km)	€/km	€/movement	Length (km)	€/km
Genova-Manchester	2315	2134	1.08	2836	1912	1.48
Patras-Gothenburg	3970	4128	0.96	4894	3599	1.36
Barcelona-Warsaw	3350	3270	1.02	3448	2735	1.26

Source: RECORDIT

The intermodal option turns out to be consistently cheaper than the all-road alternative, despite being longer. Its competitiveness is however severely undermined by the poor performance of intermodal transport in terms of trip duration, which is between 70% (Patras-Gothenburg) and 400% (Genova-Manchester) longer than for all-road, as shown in Table 2.

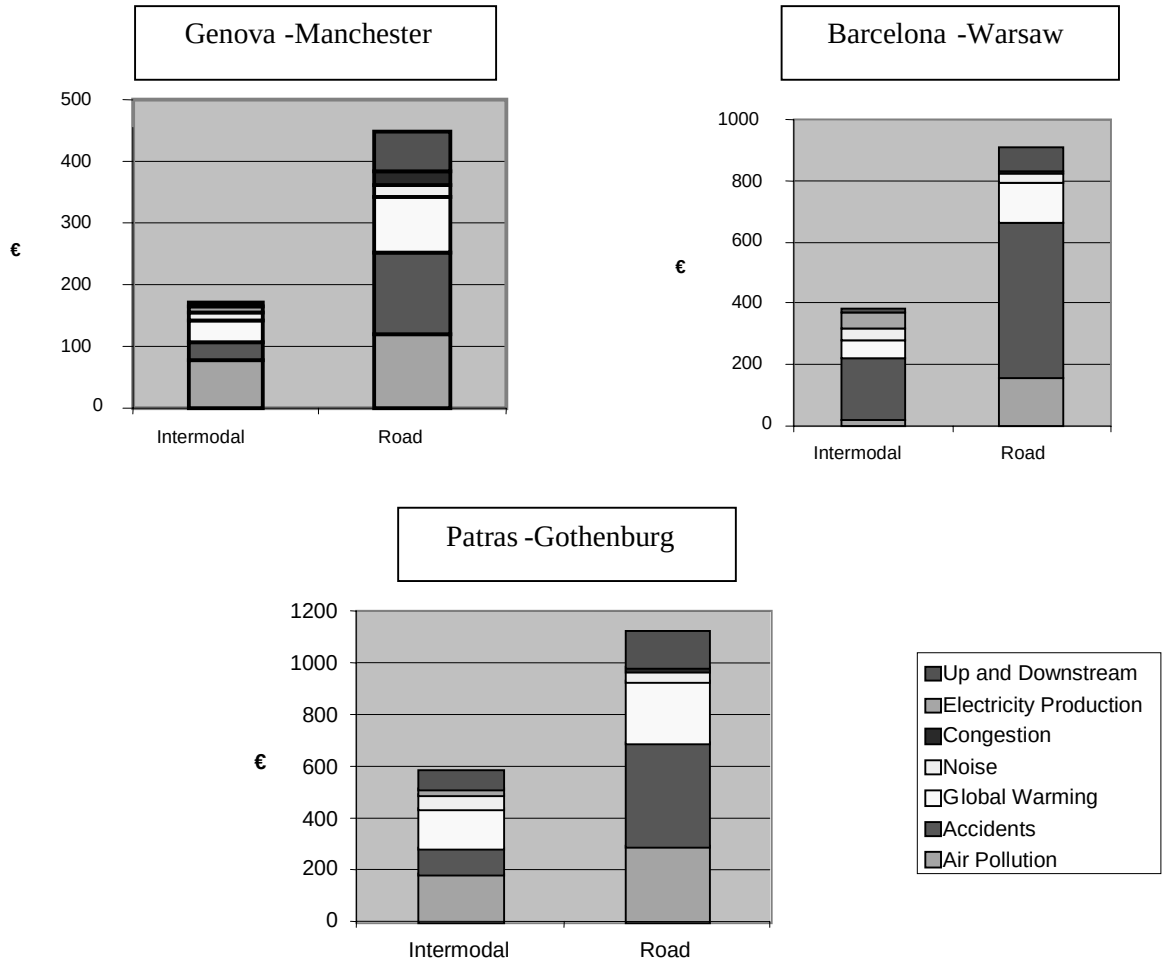
[4] all costs are shown for a so-called “class A” container

Table 2. Cost Vs Time performance

Per movement	Cost savings with intermodal option		Time savings with all-road option		Cost of hour saved (€)
	€	%	hours	%	
Genova-Manchester	98	3	71	80	1.4
Patras-Gothenburg	521	18	59	70	8.8
Barcelona-Warsaw	924	19	171	430	5.4

Source: RECORDIT

A similar comparison for marginal external costs confirms the better performance of intermodal transport, as illustrated below:



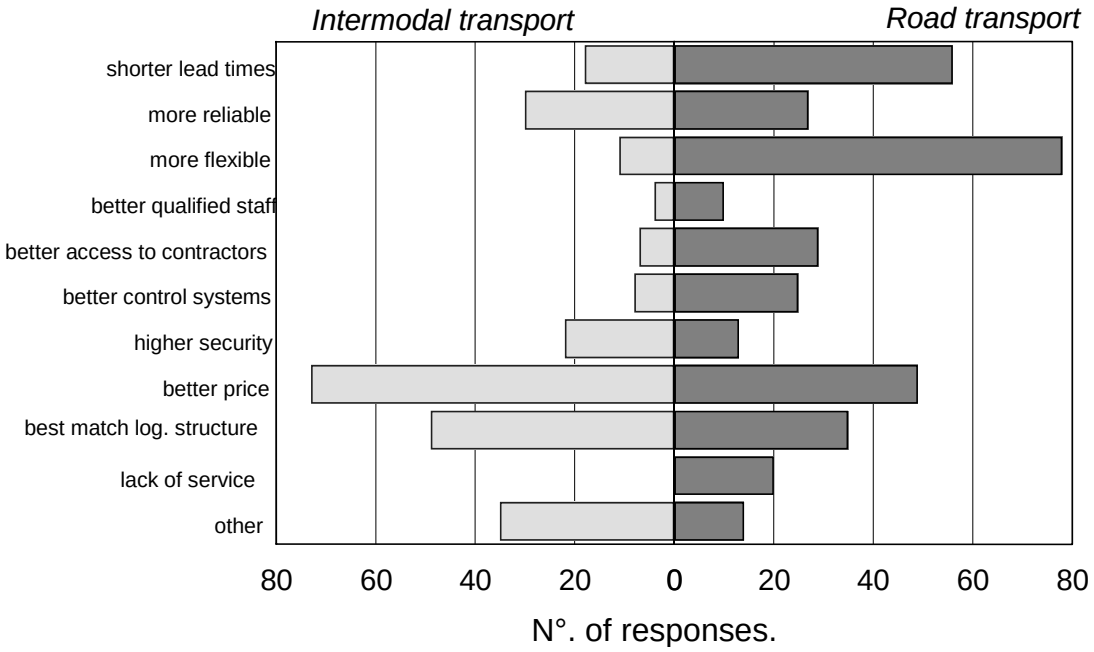
Source: RECORDIT

Figures 5, 6 and 7. External costs of intermodal and all-road transport

Promoting a massive shift of freight traffic from road to intermodal services would yield significant benefits for the environment and for the community at large. However, they also

show that the main obstacle to such a shift lies in the inefficiency of intermodal solutions, at least as perceived by the end-users.
In fact, findings from other research in this area provide additional pricing-relevant input, which may help interpret the relationship between prices and market behaviour:

- the study offering the greatest insight into the intermodal market in Europe was carried out by STRATEC (Lobé, P, 2001) in 1999-2000. Examining 12 routes in Europe the study found that although there are many factors influencing demand, price is still critical. Elasticities are however complex and highly route-dependent
- on the other hand, a survey carried out within the IQ project also concludes that whenever intermodal transport is perceived as superior to its all-road alternative, the factor playing the most important role in the modal choice is price; if the price is right, users may be prepared to accept that intermodal transport is much slower than road.



Source: IQ

Figure 8. Quality perception of intermodal Vs all-road transport

When it comes to the comparison between total external costs (including wear and tear of infrastructure), and taxes and charges currently paid (including those levied on the use of infrastructure, e.g. tolls, etc.), the evidence from three corridors proves however insufficient to derive generalised conclusions. The main reason behind such difficulty is the high level of variability of results, and their sensitivity to a large number of specific, corridor-related parameters.
Both for intermodal and all-road transport, the RECORDIT corridors show that a variety of different situations can in fact occur: with the exception of the Barcelona-Warsaw route, for which a clear undercharging situation is observed for both road and intermodal, other corridors and segments show contradictory patterns, whereby, in some cases, road transport appears to be already covering its external costs; as for the relative position of road and

intermodal (in terms of current level of coverage of external costs), it also strongly varies between routes and countries, owing to substantial differences in national charging policies, but also in the value of external costs (e.g. accident costs, which vary considerably across countries, and air pollution costs, which are extremely sensitive to the presence of urban or peri-urban stretches in the corridors analysed).

Research on the pricing of the different modes of transport, and the economic theory behind it, clearly point at the need for an integrated, coherent approach in pricing reform, that would avoid introducing further cross-modal distortions. The study of the intermodal transport case stresses such need even further, as it highlights the direct and manifold interactions between the behaviour of individual modes on one hand, and, on the other, the performance of intermodal transport that combines them along a variety of complex patterns.

A case in point is the role of pre- and post-haulage activities embedded in the intermodal chain. These road-based components of the trip are in fact often considered as the weak link of freight intermodality, not only owing to the intrinsic lower performances (e.g. in environmental terms) of road Vs e.g. rail, but furthermore because pre/post haulage is usually carried out with vehicles (trucks) that are consistently less efficient (EURO class) than those used for long road haulages, and with higher percentages of empty trips. Pricing of road externalities can therefore be expected to induce changes in external cost values (e.g. per km of road trip) that will be higher for intermodal than for all-road. On the other hand, the ultimate impact of these changes on the performance of the door-to-door movements clearly depends on the relative length of individual modal sections within the trip. Similar interactions can be also found between intermodal transport and other individual modes, and their impacts in the framework of the pricing reform will vary considerably depending on the pricing instrument adopted.

In any instance, and whatever the instrument adopted, the pricing reform will modify the relative attractiveness of intermodal transport Vs its modal alternatives (mainly all-road). This inevitably calls for analyses incorporating both direct elasticities (i.e. internal to the intermodal sector), and cross-elasticities (e.g. to estimate net modal shifts from road to intermodal solutions), which, as outlined above, are strongly dependent on the specific, and at times very local characteristics of individual routes. In fact, any assumption about an average elasticity for intermodal transport in Europe is disguising a wide variation on different routes.

5. Conclusions

5.1 Reducing uncertainties and understanding variability

Pricing reforms are only effective when based on a solid and robust assessment of real costs and the associated formation mechanisms. These in turn are strongly affected by the uncertainties characterising most of the valuation methodologies currently available.

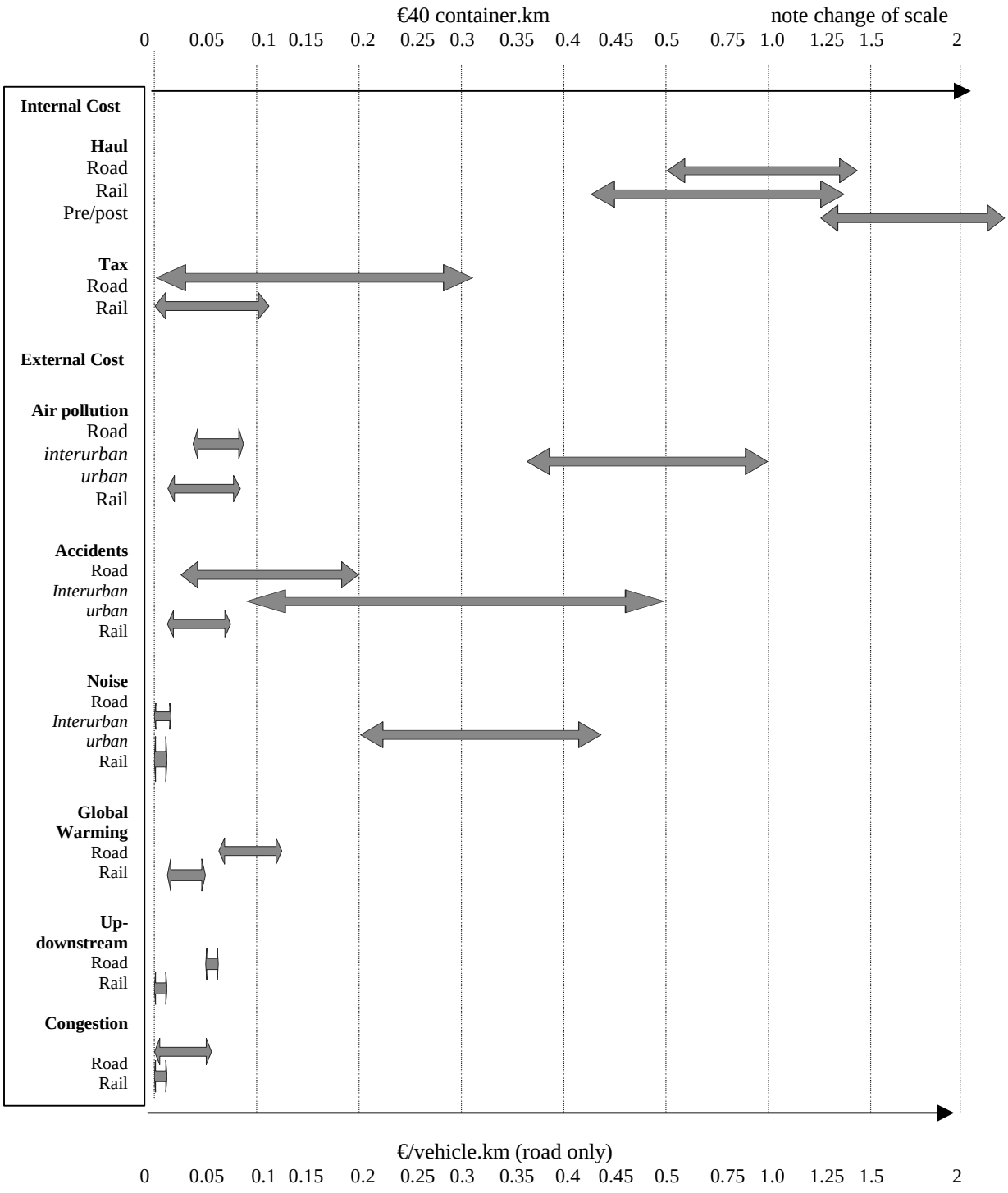


Figure 9. Cost variability

RECORDIT has established a reference data set of internal and external costs, based on the information collected on three trans-European corridors. This represents a valuable starting point for a detailed assessment of intermodal costs at the European level, but it is by no means sufficient in the perspective a full-fledged generalisation such as envisaged in the framework of European policy setting. The variability analyses carried out by RECORDIT

(see Figure 9 for summary results) show that individual cost items can vary considerably from one corridor to another (at times by orders of magnitude). While this might partially reflect the methodological uncertainties highlighted above, it is widely agreed that these variations are mainly mirroring the actual difference in real costs, due e.g. to varying technological inputs, management and regulatory practices, etc., as well as (for external costs) to varying geographical, meteorological, land-use contexts, varying patterns of electricity production mixes, etc.

This calls for a wider data collection campaign, in the form of additional bottom-up corridor studies, to enhance the current database and increase the meaningfulness of the variability analyses, as basic prerequisites for more reliable transferability and generalisation exercises.

A particular case in point refers to subsidy data. The RECORDIT case studies have shown how difficult it is to identify and document the wide and ill-defined range of subsidies currently characterising the freight market. While the overall value of subsidies awarded to large sections of the transport market are at times available, it is very seldom that such values can be allocated to the movement of goods on specific corridors in a reliable manner. Also, it appears that a variety of "hidden", or indirect subsidies are currently in place, which it is extremely difficult to pinpoint and evaluate. A dedicated effort in this area would certainly contribute to fill this important knowledge gap, and lend increased reliability to specific conclusions such as e.g. on the extent to which the current system of taxes and charges covers external costs.

5.2 Integrating intermodal transport in the design of pricing reforms

RECORDIT has developed a dedicated tool (the RECORDIT DSS), which allows to simulate, at corridor level, the potential impacts of policies/measures, and to compare the effects on costs, internal as well as external, for both intermodal and all road solutions. Policies and actions are described in terms of the cost drivers they are expected to act upon (e.g. reduction of turnaround time, increase in capacity utilisation, reduction of energy consumption, reduction of lead times, etc.), which are then reflected as changes in the value of the corresponding cost items of the RECORDIT accounting framework.

This allows for a full comparison between the *ex-ante* situation, i.e. before the implementation of the policy/measure, and the *ex-post* situation, after the implementation of the policy/measure, in terms of the potential gains achieved (costs, time, environmental impacts, etc.)

Results can be presented in various formats and disaggregation levels (e.g. by mode, by operator, by cost category etc.). Figure 10 illustrates the output of a comparison between intermodal and all-road:

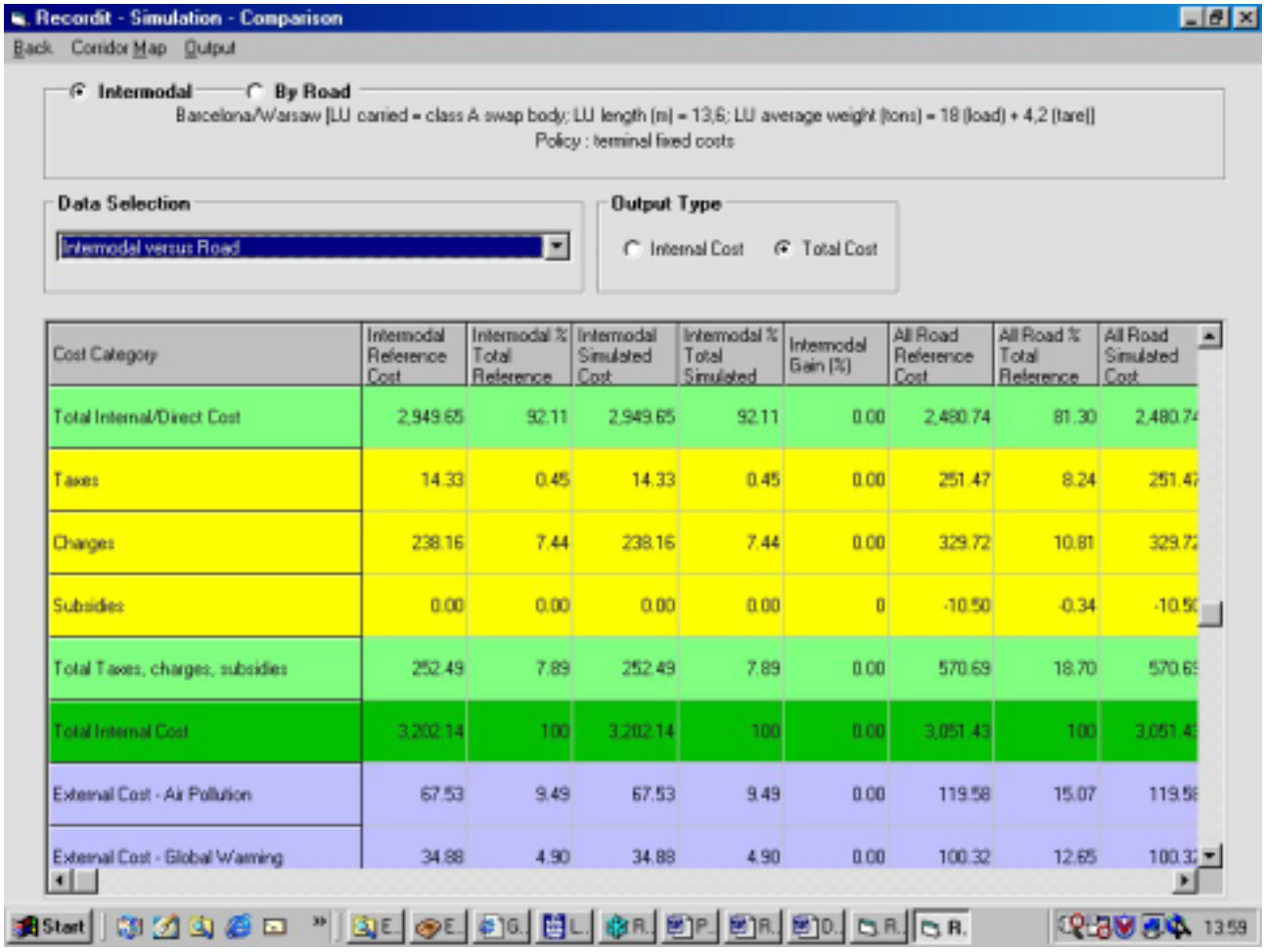


Figure 10. Sample DSS output

5.3 Reducing costs.

RECORDIT has carried out simulations in order to assess the main impacts of selected, possible measures and policy packages.

A first scenario concentrates on the reduction of internal costs associated to terminal and transhipment operations. It features the elimination of rail-rail transhipment (interoperability), a 15% improvement of manpower productivity in terminals, and a 33% cut in capital costs. The aggregated result is a 6% reduction in total resource costs (average value for the three RECORDIT corridors).

A second scenario focuses on Pre- and Post-haulage. An optimisation of the load factor (from 60% to 90%) is the main component of this package, and yields expected savings, in terms of resource costs, evaluated in the range of 2-4% (as expected, shorter routes perform better under this scenario).

A third policy package concentrates on rail haul improvements, also with reference to the 50% reduction in rail electricity consumption advocated by the White Paper. Such an ambitious objective may be approached through a combination of measures including an increase of the number of wagons per train, a reduction in the number of stops, an increase in

the load factor (up to 95%) and the generalized use of energy efficient locomotives. Altogether, this package achieves a 16% reduction in resource costs (average value between two corridors).
An attempt to extrapolate these results to the Europe-wide level shows that total resource costs can be saved in the order of 82 M€, 173 M€, and 59 M€ respectively for the three scenarios, while the increase in intermodal demand induced by lower prices is estimated in 3.3, 8.5 Gt.km, and 2.4 Gt.km respectively.

5.4 Internalising externalities

The case for marginal cost pricing has been forcibly stated in the 2001 White Paper. Users should pay fully for the external costs and (marginal) infrastructure costs that they impose. The taxes and infrastructure payments that they currently make pay only some extent. Examination of the balance between these two sides of the equation on the three corridors revealed a mixed situation. On two routes there was approximate balance between the costs imposed and the taxes paid (which merited a significant increase in taxes on both road and intermodal). Only on the third corridor (Barcelona-Warsaw) was there a large shortfall increase, equivalent to 0.16€/40'containerkm. A shortfall was also found for intermodal transport.
Using the figures derived from the corridors it is possible to project these to a country and hence European level. These figures, at 2001 year, show that the average level of External costs in the 16 countries studied was 0.32€vkm for a 40t articulated vehicle (0.31€ for a 18t rigid vehicle) for road. Taxes paid amounted to about half of this, and there was also a shortfall in payments to cover marginal infrastructure costs of about 0.05€ veh.km for a 40t articulated vehicle (0.03€ veh.km for a 18t rigid vehicle). If taxation was increased to ensure a modal transfer from road to rail intermodal, this would require an increase by 0.12€ veh.km for a 40t articulated vehicle, which ensures that the relative costs of road and rail are in balance. The impact of this would be increased use of intermodal (estimated 10 Gt.km) and savings in social costs of €44M per year in 2001.

5.5 Improving collaboration and information exchange among market players

Pricing reforms can only produce the expected results if information is available to all market players with a reasonable level of completeness and symmetry. The current institutional and market organisation fails to guarantee the necessary level of data availability and transparency, in the intermodal sector even more than for other modes of transport. As previously outlined, this is largely inherent to the multiplicity of operators, the partial overlapping of the services they supply, and the strong level of competition resulting thereof. Several actions could however be envisaged to overcome what turns out to be a major obstacle to the implementation of an effective pricing reform:

- owing to the complexity of the intermodal chain, it is more than often impossible to estimate the sheer volume of goods transported between any two locations in Europe. The prevailing transnational nature of intermodal traffic, which used to facilitate the tracking of freight flows as they crossed national borders, now only materialises in a further difficulty, geared to the length of the movement and, as a consequence, to the increased complexity of tracking consignments along corridors that are several

thousands kilometres long. Innovative technologies are now available to help fill such basic information gaps: solutions based on EDI and variants thereof, and the future development of GALILEO, should considerably facilitate the establishment and shared use of a comprehensive body of quantitative information. Implementation and transaction costs remain however high at this time, as analysed by e.g. the INFREDAT project, where a cost/benefit evaluation of alternative hi/medium and low tech solutions for the tracking and tracing of goods was carried out

- several market players are currently seeking new roles and exploring new market opportunities associated to the growth of freight transport, as well as the most efficient ways and means to gain profitable market positions there from. In the wake of liberalisation of e.g. the rail market, this translates into highly aggressive market behaviours that, in the short term, induce highly protective information handling approaches. RECORDIT has experienced considerable difficulties in bringing some of the major operators to share their insights on the intermodal market. Establishing a public-driven platform for information gathering, and subsequent sharing, could contribute to ease such difficulties, with obvious advantages to all participants in the medium/long term

References

Beuthe, M (2001): Freight Transport Demand Elasticities for Forecasting Modal Shifts, THINK-UP Seminar, Berlin

European Commission (2001): “European Transport Policy for 2010: time to decide”, COM 2001 (370), Brussels

INFREDAT, Final Report, 2000

IQ (1996): “Intermodal Quality” - Final Report

Lobé, P, (2001): “Computation of a Perception Index in Intermodal Transport”, PTRC 2001

RECORDIT (2001 a): Deliverable D4: “External Cost Calculation for Selected Corridors”

RECORDIT (2001 b): Deliverable D6: “Imbalances and inefficiencies of current pricing system”

RECORDIT (2001 c): Deliverable D9 (draft): “Final Report”

SOFTICE, Final Report, 1999.