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Road Freight Market Distortion and the Viability of SSS

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Abstract

The transportation industry faces the challenge of developing an efficient and effective complement to the existing road system. An alternative strategy is to revitalise coastal shipping such as short sea shipping (SSS) to alleviate traffic congestion and enhance economic development by maintaining freight flow efficiency. The paper aims to examine the road freight market and how the distortion of this market impacts on the development of alternative transport services such as SSS. We examine the problem from a European perspective and in so doing we analyse the various strategies of the European Commission. We conclude that in spite of the efforts that the European Commission is making to promote SSS, this mode of transport is not considered to be especially attractive to freight handlers, in part because they are almost totally unaware of it. The market distortion in the road market needs to be corrected by the implementation of incentives mechanisms for freight handlers in order to shift from road to SSS.

Keywords:

Market distortion, short sea shipping, incentives.

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1. Introduction

The modal distribution of the transport demand over the past decades has given a dominant position to the road transport which has, however, created the environmental and road congestion problems of today. It is expected that the total freight transported by road in Europe could grow about 60% by 2013, implying an additional 20.5 billion tonne-kilometres per year across the EU 25 Member States (EU Commission, 2004). As a result other transport modes have lost their market share and their competitiveness particularly when we observe the maritime industry as a substitution for road freight. The European Commission regards such a prospect as unacceptable and has been supporting short sea shipping (SSS) and more recently, the 'Motorways of the Sea' as an alternative to long-distance road transport (Baird, 2007). In the search for solutions to traffic congestion and motor vehicle pollution, governments in Europe and other developed countries have begun to recognise that SSS is a viable transport mode. SSS also represents a new opportunity for many ship operators and medium size ports. Importantly, SSS has already become the most convenient modal choice in numerous corridors for operators who, through use of these services, have realised that they achieve lower generalised costs.[2]

There are many different definitions of SSS[3] but officially the European Commission defines short sea shipping as "… the movement of cargo and passengers by sea between ports situated in geographical Europe or between those ports situated in non-European countries having a coastline on the enclosed seas bordering Europe." SSS is also regarded by the EU Commission as the only freight mode that offers a realistic prospect of substantial modal shift from road, as well as being able to improve competitiveness and reduce environmental damage, which largely explains the strong emphasis by the EU in developing its new 'Motorways of the Sea' (MoS) policy.

In its goal to promote intermodal transport and SSS, the European Commission proposed in the Transport White Paper of September 2001 that MoS be developed as a competitive alternative to land transport. The MoS concept aimed to introduce new intermodal maritime-based logistics chains in Europe, to help tackle the growing congestion of road and rail infrastructure and to reduce air pollution.

The effect of SSS on other transport modes is a key factor when evaluating its success. The interaction between maritime transport and other modes may occur either as competition and/or following complementarity patterns. Complementarity in particular has attracted much attention thus far. Intermodal competition usually results in the substitution of operations between modes and is driven by their commercial viability, relative market strength, and different institutional and environmental constraints. To make full use of its potential, SSS needs to be integrated seamlessly into multimodal transport chains and be capable of offering door-to-door transport services.

The modal share for different mode of transport published by Eurostat (2009) confirms that, in spite of the efforts being made by the European Commission at the policy level, road freight movements accounted for an average of 45.6% of freight transport demand in 2007, compared with the 37.3% SSS average for that same year. These figures are

[2] See for example Ng (2009), Baird (2007) and Trujillo, Medda and Gonzalez (2009) for a comparison between road and SSS in different corridors.
[3] See Medda and Trujillo (2009) and Paixao and Marlow (2002) for a review of SSS definitions.

reinforced by the strong road growth (3.9%) in 2006-2007; it is noteworthy that SSS growth (1.7%) has also been surpassed by rail (2.7%) (Eurostat, 2009).

If the European Union objective is to promote SSS on the basis of its environmental advantages, it is worthwhile to ask why, despite the incentive provided by EU policy, this mode of transport is not yet a real alternative to road. We observe that it is still necessary to improve the links to inland networks to eliminate the main obstacles to SSS and establish 'sea motorways' between key ports in order to exploit its full potential. Moreover, agreement and implementation of correct incentives as, for example, the imposition of a government tax proportional with the amount of pollution associated with transport, is necessary in order to enforce the switch from road to SSS (Brooks and Trifts, 2008).

One objective of the present paper is to contribute to the SSS literature by highlighting the regulatory issues of SSS. Section 2 we summarise some of the most relevant European Union policy in relation to SSS. In Section 3 we define a model in order to show the importance of government intervention in order to reduce the dominance role of road freight. We inquire in Section 4 into the why roads were developed more than the SSS. We conclude that probably it is because of the market distortions and we argue some regulatory problems derivate of the European Commission policy. We draw conclusions in Section 5.

2. The European Union Policy[4]

Starting in 1992, the EU Commission Green and White papers dedicated discussion to the increasingly deleterious effects of transport on the environment. As a result, the EU Commission has actively promoted SSS as an important component in TEN-T. The first Communication on SSS was published in 1995, and stated that the development of SSS would be of European interest. Prior to 1995, intra-European freight transport had been dominated by unimodal road transport (Ng, 2009).

The predominance of road transport has also continued largely unabated because of administrative complexity and technical obstacles related to the transfer of cargo between modes – but especially port inefficiency, which raises the cost of using SSS – as well as the existence of complicated regulations, cabotage restrictions and protectionism, and the fact of the concentration of port activity at a few selected ports due to containerisation (Chlomoudis and Pallis, 2002).

To meet the goal set by the EU Commission to promote multimodal transport solutions, the EU Commission proposed an 18-measure action plan. Several subsequent communications (EU Commission 1997, 1999, and 2004a) discuss the present state of SSS relative to other transport modes, outline the achievements reached by this mode, and draw attention to the existing bottlenecks needing to be overcome (Paixao-Casaca and Marlow, 2007).

At the same time the White paper of 2001 (EU Commission, 2001),[5] has proposed the development of MoS to promote intermodal transport and therefore make greater use of

[4] See Ng (2009) and Paixao-Casaca and Marlow (2007) for a review about European Union Policy.

the sea. MoS will thus improve access to markets throughout Europe and bring relief to the over-stretched European road system. As a consequence, the EU Commission has recommended that MoS be developed as a competitive alternative to land transport and that MoS be integrated into the Trans-European Transport Network (TEN-T). According to the EU Commission (2001), this chain will be more sustainable and should be commercially more efficient than road-only transport.

As the objective of promoting MoS is to integrate shipping and European ports into TEN-T, the EU Commission (2002) has made clear that the SSS image must transform from its slow, worn-out, poor quality, low-value cargo transport role, into an efficient, environmentally-friendly and high profile part of an integrated and sustainable European transportation system (Ng, 2009). In order to strengthen its image, the EU Commission, (2002) has included SSS as a TEN-T project that reflects European interests, and in so doing prioritising SSS in terms of financial support.

Moreover, because it has been observed that MoS sea corridors carry fast, competitive and efficient SSS transport,[6] SSS will for this reason the be an intrinsic part of the MoS framework. These MoS will concentrate flows of freight on specific sea routes with the aim to establish new viable, regular and frequent maritime links between Member States, reduce road congestion, and improve access to peripheral EU countries (Psaraftis, 2005).

From this standpoint, the MoS could remove substantial volumes of goods traffic from congested European roads thereby easing major road bottlenecks (EU Commission, 2006c). The next logical steps entail the application of the MoS concept to SSS operations and the definition of maritime corridors; by so doing, the participating ports will comply with a set of requirements that can ensure efficient SSS practice[7]. By overcoming all service and administrative barriers, shippers will be assured that bottlenecks will no longer hamper the transport chain. In effect, the MoS are maritime corridors where the SSS meets a number of conditions such as frequency, regularity and quality of service.

Through the TEN-T, the EU is supporting the development of MoS in four key corridors around European coasts: the **Baltic Sea** (linking the Baltic Sea Member States with Member States in Central and Western Europe, including the route through the North Sea/Baltic Sea Canal), **Western Europe** (leading from Portugal and Spain via the Atlantic Arc to the North Sea and the Irish Sea), **South-Eastern Europe** (connecting the Adriatic Sea to the Ionian Sea and the Eastern Mediterranean, including Cyprus) and **South-Western Europe** (western Mediterranean, connecting Spain, France, Italy and including Malta and linking with the MoS of south-east Europe and including links to the Black Sea) (EU Commission, 2006a). By 2020, a fully fledged network of motorways of the sea should be established throughout Europe on the corridors just mentioned. According to the EU Commission (2006a), these corridors provide an essential part of the projects: the “floating infrastructures” of the European seas.

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[5] There is evidence from 1992 when a number of firms began to operate one of the first motorways of the sea. See Paixao-Casaca (2008) for a historical evolution of this transport mode.
[6] See the Short Sea Promotion Centres web page (Cyprus, Italy, Netherlands, Norway, Spain, Italy, etc.) for detailed information on Motorways of the Sea corridors (SSPC, 2008).
[7] See Trujillo and Medda (2009) for a review on port requirements.

As briefly discussed above, the EU Commission White Paper (2001) states that in order to help these lines develop, European funds should be made available. The EU Commission (2004b), the Council and the European Parliament therefore adopted a revision of the TEN-T, which provides a legal framework for funding of MoS projects and defines the three main objectives of projects: concentrate freight flows on sea-based logistical routes; increase cohesion; and reduce road congestion through modal shift.

To fund the MoS project the Marco Polo programmes were created.[8] The EU-sponsored Marco Polo programme funds projects that shift freight transport off the road and onto the sea, rail and inland waterways; this means fewer trucks on the road and, in its wake, less congestion, less pollution, and increasingly reliable and efficient transport of goods. The first Marco Polo programme (EU Commission, 2003) ran from 2004 to 2007. The Marco Polo and Marco Polo II programmes, with their average annual budget of 18.75 million Euros, aims to shift 12 billion tonne-kilometres a year of road freight to Short Sea Shipping, rail and inland waterways.

The current, second Marco Polo programme (EU Commission, 2006) runs from 2007 to 2013 and features:

- More money: The programme budget is €450 million Euros.
- More themes: This programme includes "motorways of the sea" and "traffic avoidance" projects.
- More countries: Countries bordering the EU are now also eligible for funding.

To guarantee the success of motorways of the sea, three conditions must be present for each project:

- First, in order to obtain the necessary concentration of freight flows, choices have to be made concerning ports and intermodal corridors and services.
- Second, all actors in the supply chain have to be committed to these projects.
- Third, MoS need to feature the best available quality throughout the chain in order to be attractive for users.

However, as we will see in the next section, the development of SSS has not yet achieved the level of expansion expected by the EU Commission.

3. The distortion of the road freight market: A theoretical approach

According to the empirical evidence, the intermodal effects of SSS depend, from the point of view of freight handlers, on the relative generalised cost for each mode, a term which not only includes the fares, but also travel time, congestion, environmental cost, and other elements related to overall quality of the service. In this section we depart from the literature on differentiated products to propose a model that describes the operator choice, the firms' price and cost decisions and the partial equilibrium in a market where intermodal competition plays a disciplinary role on rivals.

[9] Marco Polo is managed by the European Commission's Executive Agency for Competitiveness and Innovation.

We compare two freight operations by considering the SSS movement and the road/truck operation. The freight market can be characterised as an oligopolistic market, where road transport and short sea shipping transport suppliers are identified by a high level of product differentiation. In this case, the presence of product differentiation implies that the equilibrium price is above the competitive level and the Bertrand model on oligopoly markets has less stringent outcomes (Mas-Colell et al., 1995). Therefore, we can assume that both shipping and road transport providers act as monopolist suppliers of freight movement. We examine the movement from an origin A to a destination B.

The aggregate cost functions for the regulated shipping operator and the regulated truck operator are the following:

$$c_t = c(\eta_t, e_t, Q_t) = \eta_t + e_t Q_t \quad (1)$$

$$c_s = c(\eta_s, e_s, Q_s) = \eta_s + e_s Q_s \quad (2)$$

Where η is the technological parameter representing the determinants of the considered mode; for instance, in the case of the shipping operation, η_s is the efficiency of the ports, whereby loading and unloading tasks are carried out, and it encompasses the port regulation regime and custom setting. A high level of η indicates technological inefficiency. Following the definition given by Laffont and Tirole (1993), we assume that e is the shipper or road transshipper designated to move goods in the most cost-effective and efficient way. Q is the firm output.

Both operators aim to maximise their profit. We assume that transport via road is more efficient than the shipping operation, that is, $\eta_s > \eta_t$, which implies that $Q_t > Q_s$; therefore, movement via road is always preferred rather than the short sea shipping (SSS) transport.

We can now introduce the constraint capacity, K, into the road network model. The road/truck operator may be forced to pay a congestion cost when demand for freight movement increases and the road network reaches capacity. We assume the congestion costs to be linear in output:

$$c_c = \frac{Q_t}{K} \quad (3)$$

The road/truck operator is a monopolist and will therefore internalise the congestion costs and receive all revenue. The equilibrium including the congestion costs is obtained when:

$$\alpha_t - \beta_t Q_t = \eta_t + e_t Q_t + \frac{Q_t}{K} \quad (4)$$

$$Q_t^m = \frac{\alpha_t - \eta_t}{e_t + \beta_t + \frac{1}{K}} \quad (5)$$

Using the inverse demand function, the road/truck monopolist's problem can then be stated as:

$$\pi_t = (\alpha_t - \beta_t Q_t^m) * Q_t^m - \eta_t - e_t Q_t^m - \frac{Q_t^m}{K} \tag{6}$$

We assume that the variables are continuous and twice differentiable at K $\geq$ 0. The optimal capacity for the road freight operator is subsequently given by the first order condition

$$\frac{\partial \pi_t}{\partial K} = \alpha_t \frac{\partial Q_t^m}{\partial K} - 2\beta_t Q_t^m \frac{\partial Q_t^m}{\partial K} - e_t \frac{\partial Q_t^m}{\partial K} - \left(\frac{\frac{\partial Q_t^m}{\partial K} K - Q_t^m}{K^2} \right) = 0 \tag{7}$$

The marginal benefit of over-capacity under the road freight monopoly exceeds the marginal cost. The optimal capacity of the road freight transport operator is therefore below the socially competitive level. This distortion, which determines the deadweight loss of the road operator, can be measured using the variation we obtain in the Marshallian aggregate surplus.

In this model we have demonstrated that in the presence of market distortions, road freight movement has a comparative advantage in relation to SSS transport. The operator choice is thus biased towards road freight. In order to reduce this distortion in the operator decision, the government may intervene through the combination of incentive mechanisms as well as aggressive strategies. In other words, policy that provides the promotion of transport by short sea shipping, such as the Marco Polo Programme sponsored by the European Union, must be balanced with a concerned implementation of policies that target the road freight market, as for example, congestion charging, road pricing, and "ecobonos."[9] In terms of price, the elasticity of demand-price plays an important role. In a study by Baum (2002) of freight movements over 50 km in Europe, the demand elasticity of road freight was estimated at about -0.55, which means that a 10% increase in road price reduces its demand by 5%.

Furthermore, cross-price demand elasticities are usually higher than one. Looking at the interaction between SSS and road transport, we see that a 10% increase in the price of road transport services entails a more than 10% increase in the demand for SSS services, thus incentivising the possibility of shifting between road and SSS. For example, in the European context, Lobé (2001) estimates in a methodology founded on shippers' perceptions, that the cross-elasticity between road and SSS is about 1.2 for the route Antwerp-Bilbao for all goods, which means that a 10% increase in road price raises the demand for SSS by 20%.

Therefore, active intervention by governments can create leverage needed to stimulate an effective modal shift between road and sea and implement the intermodality in the

[9] The "ecobono" is a subsidy with state funds, but it is not granted to shipping companies, but rather to users of shipping (usually road haulage or logistics operators) who are free to choose their preferred carrier according to financial convenience, port time, transit tariffs, etc. This subsidy does not distort conditions of competition between shipowners and becomes a simple maritime incentive. Italy is applying this system, and Spain and France plan to apply this system in the future.

freight movements. Integrated packages are nevertheless needed to achieve substantial changes between modes.

4. Why have roads developed more than SSS?

In June 2006 the EU Commission adopted the review of its SSS promotion programme (EU Commission, 2006c). However, overall, the Commission does not seem to plan any changes to its policy in so far as SSS is concerned. Only some refinements have been made in its mid-term review. The Commission provides figures illustrating that SSS is the only mode of transport able to challenge the fast growth of road transport; nevertheless, a number of obstacles to the development of SSS still exist, namely:

1. It has not yet reached full integration in the multimodal door-to-door supply chain;
2. It involves complex administrative procedures;
3. It requires higher port efficiency and good hinterland accessibility.

In 2007 the Commission published, as part of the Logistics Package, a Staff Working document on the MoS (EU Commission, 2007). The document provides general information on MoS and the state of play, and has launched a consultation on how to widen the concept of MoS within the context of SSS quality services. There is extensive discussion on the MoS state of play which responds to questions asked by port authorities regarding the MoS concept and the document gives a useful overview on progress in the different regions of the European Union. The Staff Working document has also announced measures that will provide more clarity on funding possibilities and the coordination of different funding solutions (ESPO, 2005).

However, other reasons of an economic nature also seem to be responsible for the slow progress of SSS. As Baird (2007) highlights, ongoing subsidies combined with historic sunk investments applied to road and rail infrastructure heavily influence the attractiveness and competitiveness of SSS modes, and result in a distorted transport market.

To make a parallel between the funds dedicated to roads and that which should apply to SSS, or more concretely to MoS, we would ask, what is the MoS infrastructure equivalent to a roadway? According to Baird (2007), it is not a seaport, which he regards as simply a node. But we disagree; ports have the necessary infrastructure for the development of MoS. If MoS is to SSS as the motorway is to road transport, and the MoS has been defined as the corridor between two ports, it seems clear that one can conclude from this analysis that ports are the basic infrastructure for developing SSS. Without doubt the existence of efficient, fast and well-connected ports is a prerequisite for the development of the SSS.[10] Acknowledgement of this definition of SSS infrastructure, and the acceptance of the ongoing market distortions which favour land transport, demands a new policy approach towards the issue of modal shift, and in particular calls for greater economic and fiscal consideration to be given to the provision of sea transport infrastructure compared to that of land transport.

EU transport policy increasingly recognises and affirms the major role that sea transport can play in helping to develop new improved transport logistics solutions. Through the inclusion of MoS in the TEN-T programme, coupled with operational support for

[10] See Medda and Trujillo (2009) for a more detailed analysis of port characteristics in the SSS context.

innovative and modal shift actions via Marco Polo, the Commission has put in place the necessary mechanisms for an expansion of short sea shipping in Europe.

To this end, the Commission has recently updated its strategic goals and recommendations for the EU Maritime Transport Policy until 2018 (EU Commission, 2009). Action in the area of maritime transport now aims to ensure the long-term performance of the European maritime transport system as a whole to the benefit of all other economic sectors as well as the end consumer.

With regard to SSS the action plans propose the reinforcement of EU strategy for ensuring the full deployment of MoS projects, further facilitating the start-up of innovative integrated intermodal transport solutions, simplifying administrative requirements and supporting the Commission's proposed initiatives in the greening of transport. The Trans-European Network Transport projects, Marco Polo and the Regional Policy instruments should assist in those developments and address modal shift factors.

Furthermore, economic instruments such as taxes, charges and emission trading schemes are being examined in order to encourage users to use SSS alternatives that address road congestion problems and in general promote market solutions, and which contribute to the sustainability of the transport chain as a whole (EU Commission, 2008).

However, despite the EU Commission's positive advances in the realm of SSS, economic instruments by themselves are unlikely to result in any significant modal shift, given the current distorted transport market. Effective and sustainable modal shift will require an analysis of the market distortions. In order to develop a far more extensive SSS infrastructure (or MoS) throughout Europe as envisaged by the Commission, will inevitably demand that action is taken to address ongoing market distortions that favour road and rail infrastructure, with the aim being to provide a more level playing field between transport modes (Baird, 2007). Also Baird (2007) argues for the need to include some element of greater recovery of costs for freight transport vehicles using state-financed roadways and railways, or the direct subsidisation and/or incentivisation of MoS, or perhaps a combination of both.

Nevertheless, some new problems with regard to price regulation and monopolistic practices can emerge. The Marco Polo programme mainly funds shipping companies that operate some of the MoS, however, these companies may exploit their market power in the corridors of MoS where they operate and thus we require regulatory policy. Moreover, if we are in the presence of vertical integration between shipping and land transport companies, it may be necessary to regulate access prices so that other land transport companies can use the MoS with competitive pricing.

5. Conclusion

In recent years the European Commission has been promoting intermodal transport and SSS policy as a competitive alternative to land transport. The MoS concept is part of this transport policy because its aim is to introduce new intermodal maritime-based logistics chains in Europe. Nevertheless, this intermodal shift has not yet been achieved (Eurostat, 2009); in fact, in the past year the trend has reversed, that is, the growth of road transport has been faster than that of SSS.

The question here is why has the SSS market not been developed despite the efforts of the European Union and the various financing measures introduced? We have discussed in the paper two main reasons:

1. From the maritime transport perspective. The SSS alternative is not yet “attractive” to users for various reasons. For example, as some authors emphasise, there is still a poor perception of the benefits of SSS and of the reliability of the service when we look at ports as nodes that connect land and sea.
2. From the road transport perspective. Market distortions in favour of roads still remain in many European countries, hindering sea transport as a competitive alternative to road transport. This results in a stunted development of the SSS network.

In the first case one can say that since the objective of the European Commission is to promote the use of SSS, the EC should therefore lay the groundwork for making this market attractive to users. In fact, we observe in the various directives that the Commission is taking measures to improve the perception of SSS (unification of the cargo, improving port efficiency, unification of documentation, etc.) The Marco Polo Programmes are responding to the needs of funding for these measures in addition to financial incentives for shipping companies who introduce an MoS.

With regard to the second issue of distortions in the market in favour of roads, we can observe that this directly contradicts European Union efforts to promote SSS. To level the playing field, economic instruments such as charges for infrastructure, congestion pricing and emissions trading schemes should be examined and introduced in order to correct the market mechanism.

However, we have observed that new problems related to price regulation and monopolistic practices can appear in the maritime transport sector. The problem of cross subsidies and exploitation of monopoly power are possible anticipated effects due to the introduction of programmes such as Marco Polo. Also in this case government intervention is required in order to re-establish the competitive market in freight movement.

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