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Policy instruments for reducing CO_2-emissions from the Swedish freight transport sector

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ABSTRACT

Swedish politicians have set the target of a fossil independent fleet of vehicles by 2030 in order to keep the 2-degree international agreement. In order to achieve this, policies and instruments are regarded to play an important role. We analyse instruments in practice and in theory for reducing CO_2-emissions from the Swedish logistics and freight transport sector and their potential in the short, middle and long run. Four categories of instruments are analysed: economic, legal, knowledge based and societal in a literature study. Literature is rich on environmental transport instruments in general, however, concerning freight transports there are fewer articles. Although many instruments are general and can be implemented in different sectors, their potential might be uncertain due to the lack of empiricism. We can conclude that economic instruments are important in the short run until new techniques are implemented. Legal instruments are important sharpening limits for emissions or releasing vehicle restrictions. Knowledge based instruments are important for changing behaviour and can influence logistical factors, such as design of production- and inventory policies. Societal instruments such as infrastructure investments are important in the long run adapting to the new techniques.

1. Introduction

The Swedish Government has set an ambitious target in their fossil independent vehicle fleet by the year 2030 and a reduction of carbon emissions by 40% (compared to the 1990-level) by 2020. In order to achieve this, the transport policy instruments are regarded to play a major role, hence they must be correspondingly tough.

The transport sector counts for about a quarter of the Swedish energy consumption. 93% is used by the road sector. Freight transports count for about 30% of the road sector energy consumption (Energimyndigheten, 2011). Regarding CO_2-emissions from inland transports, they measured 20 160 ktonnes in year 2009, of which 18 899 ktonnes stemmed from road transport. 6555 ktonnes CO_2 came from heavy vehicle, buses and light lorries (Swedish Environmental Protection Agency, 2011). Given this, it is not so surprising that most transport policy instruments concern road transport. A literature search showed that almost all literature in the area focus on cars or public transport. Fewer articles and reports specifically studies instruments for the freight transport sector. Yet freight transports count for about 32% of the CO_2-emissions from inland transports.

The Swedish Government has the vision that Sweden should have no net emission of climate gases by 2050. This implies that emissions from the transport sector can be near zero due to the absorption of the ecosystem. Given the now adopted policy measures, the forecast of CO_2-emissions are far from the targets, hence new measures have to be implemented in order to close the gap, see Fig. 1.

As can be seen in Fig. 1 the Swedish targets are much more far reaching than the ones stipulated by the EU. What a fossil independent vehicle fleet means has not been defined by the Government but is interpreted as a reduction with 80% compared to year 2004 by the Swedish Transport Administration. Within EU the target is to reduce emissions by 20% between 2008 and 2030. For 2050 EU strives for a reduction of about 70% whereas the Swedish vision is to have no net emissions.

In this paper we analyse instruments in practice and in theory for reducing CO_2-emissions from the Swedish logistics and freight transport sector. Literature is rich on environmental transport instruments in general, however, concerning freight transports and logistics there are only a few articles, with the exemption of urban logistics. Although many instruments are general and can be implemented in different sectors, their potential might be uncertain due to the lack of empiricism. In the paper we analyse four categories of instruments: economic, legal, knowledge based and societal in a literature study. This study has been conducted within the LETS 2050 research programme at Lund

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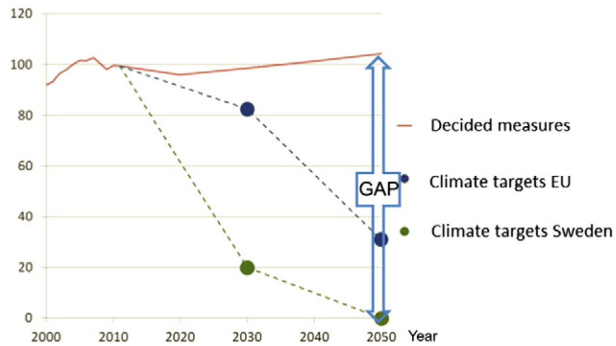

Fig. 1. Gap between political target and expected CO_2-emissions.
Source: Trafikverket, 2012.

University. The core mission of the LETS research programme is to identify, explore and suggest ways that Sweden can implement *low-carbon energy and transport systems for 2050*, in order to reach the ambitious climate policy objectives suggested by the 2 °C target.

2. Transport policy instrument

Transport policy instruments are the society's tools for influencing people, undertakings and other organisations and their behaviour in the transport sector. This means that the Government, acting for the society, can restrict or promote behaviour and consumption by e.g. legal instruments forbidding certain emissions, economic instruments imposing higher costs for driving cars or subsidising public transport. In respect of environmental policy, instruments are adopted in order to influence lifestyle and behaviour as well as for speeding up the developmental process. Generally policy instruments are required to be cost efficient (the aim is reached at lowest possible cost) and viable (it is easy to administrate and supervise), to have a high acceptability, to raise incentives for technical development and changed consume patterns, and in the case of environmental instruments, to assure that the target is reached as quickly as possible (OECD, 1989).

There are different ways of categorising policy instruments. In this paper we have chosen to use four categories:

- Economic
- Legal
- Knowledge based
- Societal.

Below we will discuss different instruments within these four categories and their potential for reducing CO_2-emissions from the freight transport sector.

2.1. Economic instruments

Economic instrument is all about internalising external costs. By internalising the "polluter pays principal" is achieved. If every transport mode had full internalisation, e.g. by means of taxes. the modal split would be completely different and the overall demand of freight transports would probably be lower (McKinnon, 2008). We will not dig into the economic theory behind the instruments here, but those who are interested can find a description in e.g. Santos, Behrendt, Maconi, Shirvani, and Teytelboym (2010). Economic instruments within the environmental area are characterised by (OECD, 1989):

- There is an economic stimuli
- There is a possibility of voluntarism
- Authorities are involved
- The aim is to maintain or improve the environment by the instrument.

Sweden has today a number of instruments for reducing CO_2-emissions from freight transports. A short description follows below together with descriptions of instruments yet not being used.

2.1.1. Carbon tax on fuels

Carbon taxes on fuels are common in many countries. It is an effective instrument for generating incomes to the state at a low cost. In Sweden a tax on energy, carbon and sulphur is charged on fuels and electric power, with the only exception of fuel for air. The effectiveness of the fuel taxes is dependent on price and driving distance elasticities. It is in general considered to have a significant effect, especially on cars. The price elasticity of diesel is lower than for petrol, indicating that freight transports are less sensitive for price increases (SIKA, 2004).

The potential for future carbon reductions from freight transports due to carbon taxes are not easily to forecast, then no estimates for the freight transport sector has been found. It is likely that price increases to a large extent can be passed on to transport buyers. If the taxes should correspond to full internalisation, the increase would have to be substantial, for the case of UK road freight transport in 2006 it would require a 50% increase in taxation (McKinnon, 2008). Also more recent estimates from the Swedish Transport Administration (Trafikverket, 2012) indicate an increase of the driving cost with 50% in order to reach the target. This increase includes diesel as well as petrol, and comprises passenger and freight transports. The increase in driving cost can be imposed as carbon tax or infrastructure fees (Trafikverket, 2012).

2.1.2. Congestion taxes/charges

Congestion taxes or charges are used to reduce traffic in areas with high density, in order to improve accessibility and reduce carbon emissions. Under 2006 the "Stockholm trial" was launched as a test. In 2007 the charge was made permanent and was also introduced in Goteborg in 2013. Charged are Swedish vehicles on weekdays between 6.30 and 18.30. The charges are differentiated according to rush hours. In a special issue of *Transportation Research Part A: Policy and Practice* (Volume 43, Issue 3, pp. 237–310, March 2009, Stockholm Congestion Charging Trial) different aspects, such as acceptability, congestion mitigation and traffic impacts of the congestion charge are discussed. An assessment of the "Stockholm trial" showed a reduction in traffic volume over cordon by 21% for 2006 (Eliasson, Hultkrantz, Nerhagen, & Rosqvist, 2009). For freight transports this resulted in a decrease in vehicle mileage. For the heavy lorries there was a decrease with 7.8% within the charge zone and a decrease of 1.58% within the county (Miljöavgiftskansliet, 2006). The environmental effects showed a decrease in CO_2-emissions from inner city traffic by 14% (Eliasson et al., 2009). In a 5-year assessment study it was shown that traffic volumes over cordon 2011 were reduced by 20% compared to reference 2005 (Börjesson et al., 2012).

2.1.3. Vehicle tax and road fee/infrastructure fee/HDV fee

Vehicle tax and road fees (Sweden belongs to Eurovignette) are instruments that influence the choice of vehicle and have long term impact due to the life span of the vehicles. The vehicle tax is differentiated according to environmental and safety standard. In Switzerland the HDV fee has shown to impact the composition of the vehicle fleet to be more environmentally friendly (Poulikakos, Heutschi, & Soltic, 2013). Today infrastructure fees are applied on rail, air and sea transports. The rail track fee is charged per train kilometre and weight. A component is also differentiated according to space and time, i.e. in the three largest cities a special fee in peak hour is charged. For sea transports there is a fairway and pilot fee. The fairway fee is differentiated according to weight and size of the ship but do not vary with fairway length. For air an en route fee is charged according to international statues. For sea and air there are port fees and take-off and landing fees respectively. A differentiated infrastructure fee based on societal marginal cost for each mode would better reflect the true costs and lead to another distribution of modal split (Nilsson, Mandell, & Vierth, 2012).