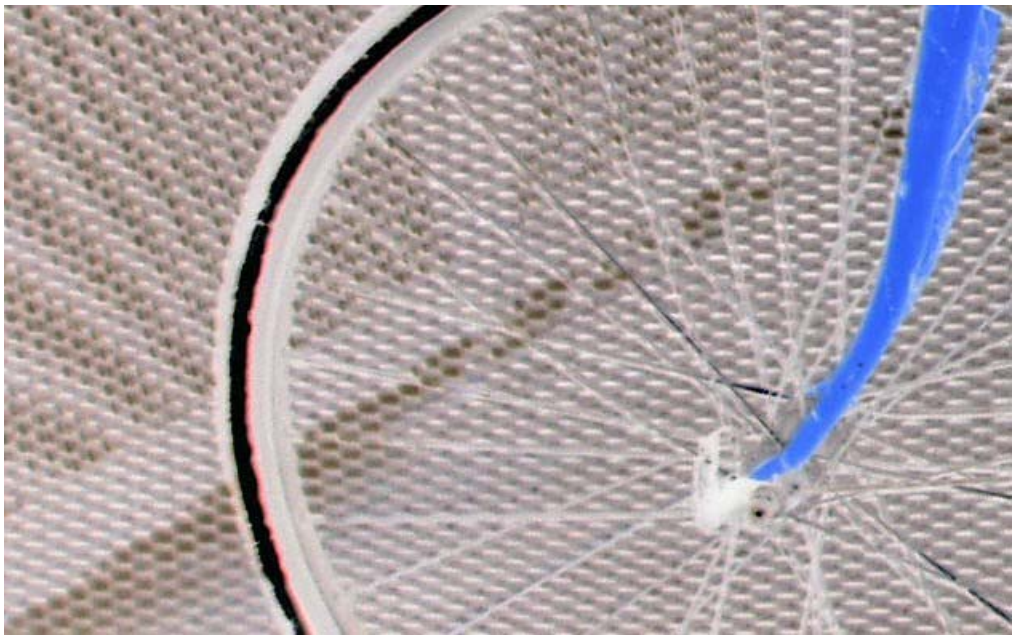
Petri Tapio

DECOUPLING HAS BEGUN IN FINLAND

Economic growth, traffic volume growth and the CO_2 policy of EU15 and Finland 1970-2001



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CONTENTS

ABSTRACT

Traditionally, transport literature reflects the view that traffic volumes and especially road traffic volumes are strongly connected to the gross domestic product (GDP). Recently published literature also states that the fuel efficiency of road transport, especially of passenger cars, has not shown any improvement for some years. This article presents new data from 1996-2001 of the recent developments of the relationships among GDP, road traffic volume and carbon dioxide emissions from road traffic in Finland. Decoupling of GDP and road traffic volume (immaterialisation) and decoupling of road traffic volume and CO_2 emissions from road traffic (dematerialisation) can be detected. The trends are expressed in reference to the development in 1970-1996. Some data from 1970-2000 of the other European Union (EU15) countries are also presented for comparison. Four hypothetical explanations of the phenomena are put forward: Policy towards sustainable mobility, Green urban lifestyle, Increasing income differences and Statistical misinterpretation.

TIIVISTELMÄ: TALOUDEN JA LIIKENTEEN KASVUN IRTIKYTKENTÄ ON ALKANUT SUOMESSA

Liikennealan kirjallisuus on pitkään edustanut näkemystä, jonka mukaan liikennemäärät korreloivat voimakkaasti bruttokansantuotteen kanssa (BKT). Viime vuosina on huomattu myös, että tieliikenteen polttoaineenkulutus on kasvanut samaa tahtia liikenteen määrän kanssa, erityisesti henkilöautojen osalta. Tämä julkaisu sisältää tilastotietoa vuosilta 1996-2001 BKT:n, tieliikennesuoritteen ja tieliikenteen hiilidioksipäästöjen (CO_2) yhteydestä Suomessa. Tieliikennesuorite on kasvanut selkeästi BKT:a hitaammin eli talouden immaterialisaatio on alkanut liikennealalla. Irtikytkentä voidaan havaita myös tieliikennesuoritteen ja tieliikenteen CO_2-päästöjen välillä, eli talouden dematerialisaatio on alkanut uudelleen liikennealalla oltuaan lähes pysähdyksissä vuosina 1978-1996. Julkaisun tilastotiedot kattavat kaikkiaan ajan 1970-2001 Suomen osalta. Vertailun vuoksi tarkastellaan EU15-maiden kehitystä vuosilta 1970-2000. Artikkelin lopuksi esitetään neljä hypoteettista selitystä irtikytkennälle: Kestävä liikennepolitiikka, Urbaanivihreä elämäntapa, Tuloerojen kasvu ja Tilastollinen väärintulkinta.

ACKNOWLEDGEMENTS

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1. INTRODUCTION

1.1. The Discourse of *No-Decoupling*

Traditionally, transport literature reflects the view that traffic volumes and especially road traffic volumes are strongly connected to the gross domestic product (GDP). Recently published literature has increasingly shown that there has not been any improvement in the fuel efficiency of road transport, especially in the passenger car sector. However, the period under examination differs among the studies. For example a study performed for the European Conference of Ministers of Transport (ECMT) stated that the seven biggest countries of Europe in terms of car manufacturing did not show any improvement in the fuel efficiency of passenger cars between 1985-1995 (ref. Lampinen 1998; IPCC 2001). The International Energy Agency (IEA 2000) detected a similar stagnation for Japan and the USA. Van den Brink and Van Wee (2001) reported a level-off of fuel efficiency in the Netherlands from 1990-1997. In Finland similar results are displayed from 1978 to 1996 (Tapio 2002a; 2002b).

Several reasons have been put forward in order to explain the phenomenon. So far nobody seems to have claimed that technical development has stopped altogether. Rather it has been stated that the weight and engine power of new cars increased rapidly during the period and nullified the positive technical development. The increase of air conditioning and electrical equipment in new cars have also been stated as reasons (van den Brink & Van Wee 2001). However, the technical explanation does not really shed light to the societal question: why?

The most popular social explanation seems to be a consumer demand for bigger and more powerful cars (Acutt & Dodgson 1998, 28-29; Van den Brink & Van Wee 2001; Tapio 2002b). As has been presented by numerous empirical research, for a significant segment of consumers travelling by the private car seems to hold status values which cannot be reduced to a derived demand from a rational need to move from point A to point B (Jensen 1999; Mokhtarian & Salomon 2001; Steg *et al* 2001; Hiscock *et al* 2002).

Less often the blaim is put on the supply side. However, a Delphi study on expert views in Finland resulted opinions that the car manufacturers and salesmen would in fact promote larger cars (Tapio 2002b; see also Tengström 1999). On the other hand, the European car industry organisation (ACEA) made a voluntary agreement with the ECMT that they will drop the average carbon dioxide (CO_2) emissions of new cars from 187 g/km in 1995 to 140 g/km by 2008 (CEGTE 2000). This reduction can also be expressed as a decline of average gasoline consumption from 7,2 to 5,8 l/100 km (Ministry of Transport…1999).

The hooray of positive development is overshadowed by increasing traffic volumes, following the increasing GDP. There was little success if any in the much discussed decoupling of the trends in 1985-1995 (Peake 1994; Lampinen 1998; Nijkamp *et al* 1998; Banister *et al* 2000; IPCC 2001; Stead 2001).

Also some fatalist aspects have been presented stating that there is little if anything to be done to the connection between GDP and traffic volume, which is supposedly a determined invariance (IPCC 1996; 2001; Dargay & Gately 1999; Schafer and Victor 2000). The approach has been criticised of being an example of 'Comtean positivism' (Tapio 1996; Tapio & Hietanen 2002), 'predict-and provide' approach (Banister 1999; Goodwin 1999) and 'determinism' (Höjer & Mattson 2000). The critique points to the need for change, and indeed, there are signs of governmental will for change at least in Great Britain and Finland (Banister 1999; Goodwin 1999; Tapio & Hietanen 2002).

The focus of this article is to present new data from 1996-2001 of the recent developments of relationships among GDP, road traffic volume and CO_2 emissions from road traffic in Finland. Some data of other European Union countries is also presented for comparison. The trends are expressed in the light of the development from 1970. The analysis will hopefully raise the level of optimism of transport professionals when they are working towards sustainable mobility. The exact definition of decoupling is presented in section 1.2, the results in section 2 and a discussion of the reasons behind the development is given in the last section of the paper.

1.2. The definition of decoupling

Decoupling of transport volume growth from economic growth can be expressed as elasticity values under 1, where the percentual change of GDP is divided by the percentual change of transport volume in a given time period:

$$\text{GDP elasticity of transport} = \%\Delta GDP / \%\Delta VOL \quad (1)$$

Here, transport volume can be measured as passenger transport (passenger km) or freight transport (tonne km). It may also be expressed by specific traffic modes. Regarding the major modes moving on the road, it may be expressed as vehicle km, a useful measure for transport planning. It is important to keep in mind, which aspect of transport is actually measured.

Respectively decoupling of transport CO_2 emissions from transport volume can be measured by:

$$\text{Transport elasticity of } CO_2 \text{ emissions} = \%\Delta VOL / \%\Delta CO_2 \quad (2)$$

To sum up (1) and (2):

$$\text{GDP elasticity of transport } CO_2 = \%\Delta GDP / \%\Delta CO_2 \quad (3)$$

A number of different concepts have been used to express the different aspects of decoupling (Vehmas et al 2003). For example decoupling measured by equation (1) is also refered to as immaterialisation, qualitative growth and structural change (Jänicke 1988; Tapio 2002a). Decoupling measured by equation (2) has been called also dematerialisation, eco-efficiency and simply technical development (Hinterberger & Schmidt-Bleek 1999; Tapio 2002a). Decoupling measured by equation (3) has been termed as decarbonisation, de-linking and different factor concepts (de Bruyn et al 1998; Hinterberger & Schmidt-Bleek 1999; Schmidt-Bleek 2000). Sometimes de-linking is used as a synonym for decoupling, however defined (see Vehmas et al 2003). De Bruyn (2000) uses the term “strong decoupling” when the environmental variable (eg CO_2 emissions) decreases in absolute terms, and “weak decoupling” when it is decoupled downwards from corresponding activity variable (eg transport volume) but still increasing in absolute terms (see further development of the concept in Vehmas et al 2003). In transport studies the concept of decoupling seems to be most used.

2. THE TIMES THEY ARE A-CHANGIN'

Figure 1 presents the development of the gross domestic product measured in market exchange rates in real terms (GDP_{mer}), the passenger traffic volume and freight transport volume in 1970-1999 and the CO_2 emissions from transport in 1985-1999 in the EU15 countries (Eurostat 1999; 2002). Regarding the whole period it is disturbing that the GDP has grown least among the variables and that passenger traffic has increased most. However, closer analysis of the elasticities reveals a change in the 1990's (Figure 2). The GDP elasticity of passenger transport dropped from *ca*. 1.4 to 0.9, whereas the GDP elasticity of freight transport increased from 0.85-1.0 to as high as 1.5. The GDP elasticity of traffic CO_2 emissions within the EU15 countries was 1,07 in 1985-1990, 1,01 in 1990-1995 and 0,99 in 1995-2000.

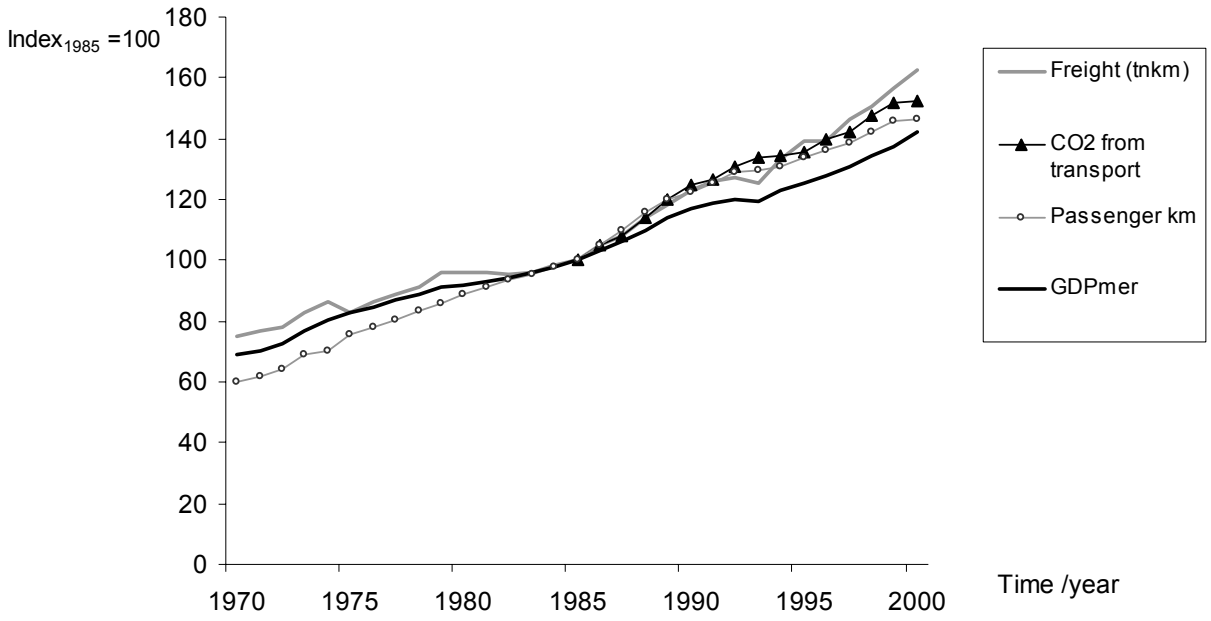

Figure 1. *The GDP_{mer} in real terms, passenger transport volume and freight transport volume from 1970-2000, and the CO_2 emissions of transport from 1985-2000 in the EU15 countries (Eurostat 1999; 2002)*

An important reference year of the analysis is 1990, because it is used as the base year of the Kyoto Protocol (1997). The EU has committed to the target of reducing the total greenhouse gas emissions by 8 % until 2008-2012. Finland, belonging to the EU 'bubble', has a more modest 0 % target. The same 0 % target has also been presented by the Finnish Working Group of Road Transport for road transport CO_2 emissions (Ministry of Transport… 1999). At the moment the EU15 countries seem to have severe problems in achieving the – 8 % target. This view is supported by the statistics of the International Energy Agency (IEA 2002); none of the countries have succeeded in achieving any reduction in the transport sector (Figure 3). The figures are presented as changes of total transport CO_2 emissions and related to real terms GDP_{mer} growth rates. Only Sweden, UK, Germany and Finland had transport CO_2 emissions growth rate of *ca.* 10 % or less in 1990-2000. The decoupling of GDP and transport CO_2 emissions can be established also in Denmark and the Netherlands. Italy, France, Belgium, Greece and Austria had traffic CO_2 emission growth rates between 15 and 25 % and negligible decoupling. The 'worst case' countries in this respect were Spain,

Luxembourg, Portugal and Ireland. The Luxembourg data may be distorted because consumers from the neighbouring countries fill their tanks in Luxembourg because of lower fuel price.

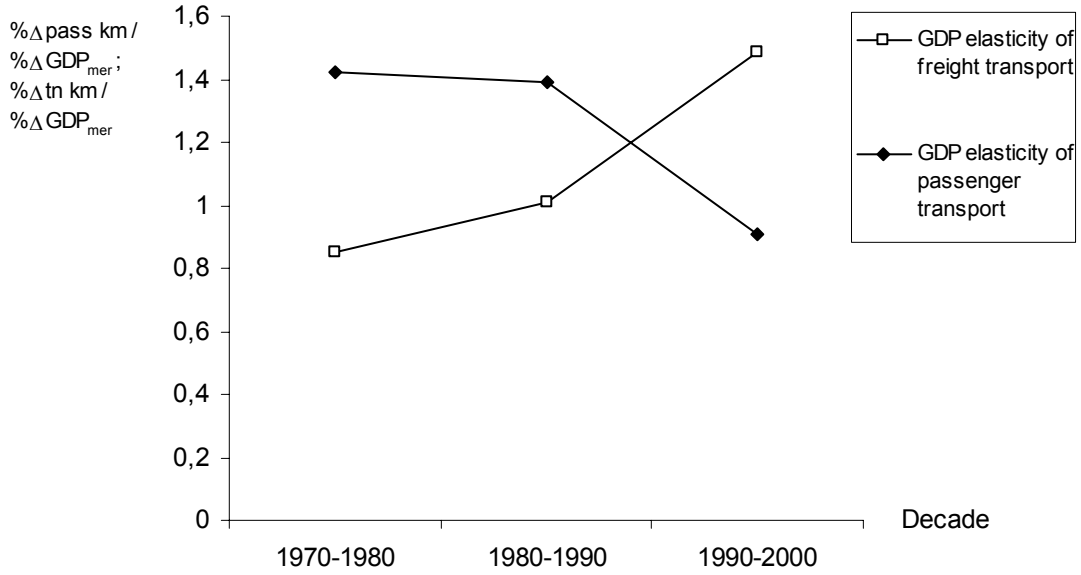

***Figure 2**. The GDP elasticity of passenger traffic volume (pkm) and freight transport volume (tn km) in the EU15 countries in 1970-1980, 1980-1990 and 1990-2000 (Eurostat 1999; 2002)*

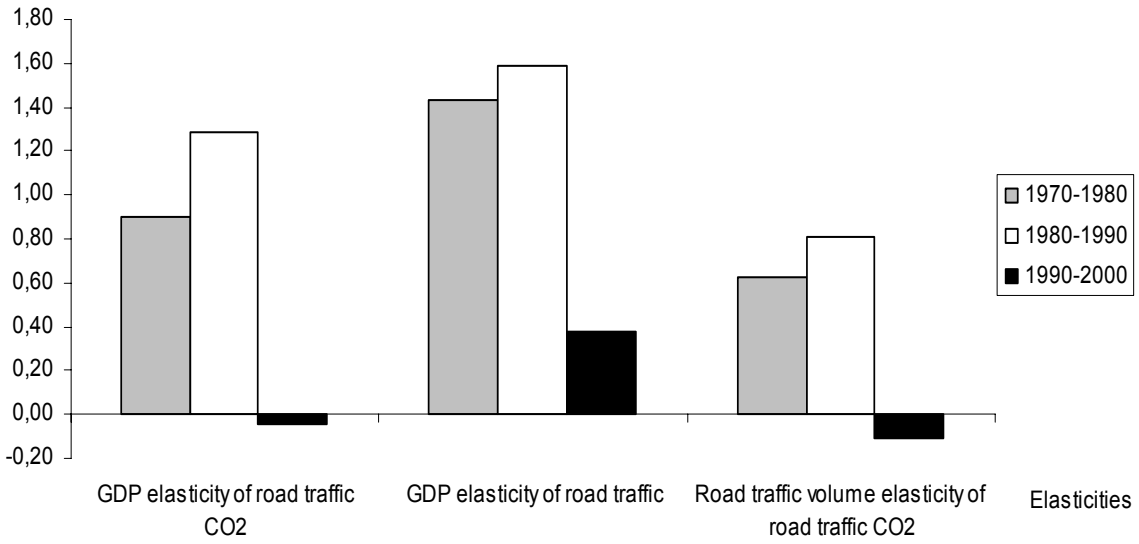

***Figure 3.** The change in GDP_{mer} in real terms and transport CO_2 emissions in the EU15 countries in 1990-2000 (IEA 2002)*

Figure 4 illustrates the main message of this article: in 1990-2000 the GDP_{mer} grew 24 %, the road traffic volume grew 8,6 % and the CO_2 emissions from road traffic decreased 0,9 % in Finland. The figures suggest that the decoupling of GDP and road traffic volume on the one hand, and the decoupling of road traffic volume and the CO_2 emissions from road traffic on the other hand, can be established. The GDP elasticities by decade for the period of 1970-2000 are expressed in Figure 5 and show a dramatic decline in the 1990's.

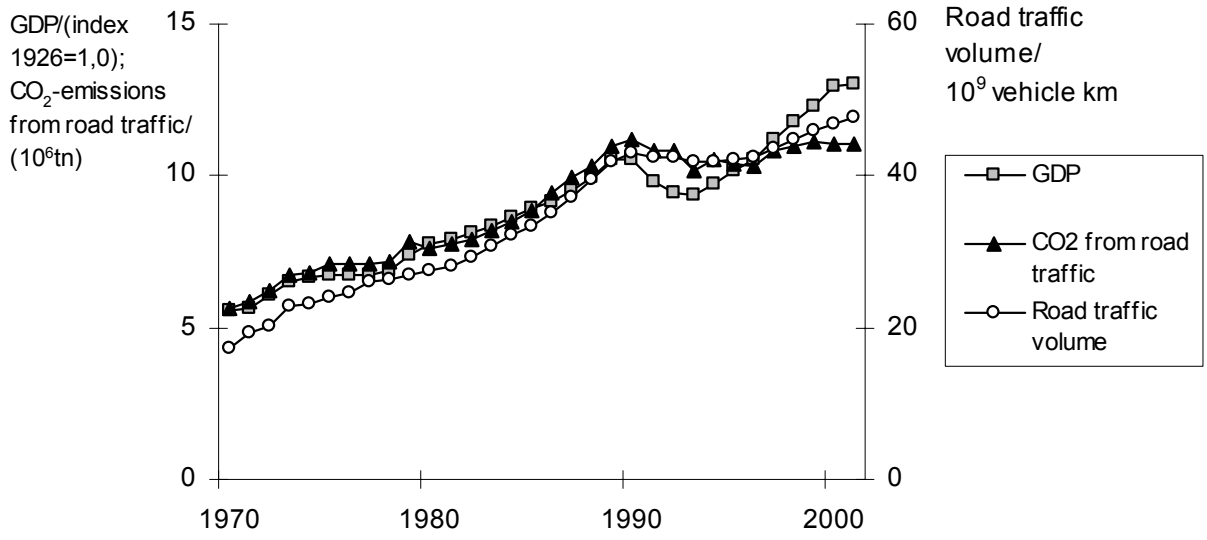

Figure 4. *GDP_{mer} in real terms, road traffic volume and the CO_2 emissions from road traffic in 1970-2001 in Finland (Statistics Finland 2002a; 2002b; FinnRA 2002; Mäkelä 2002)*

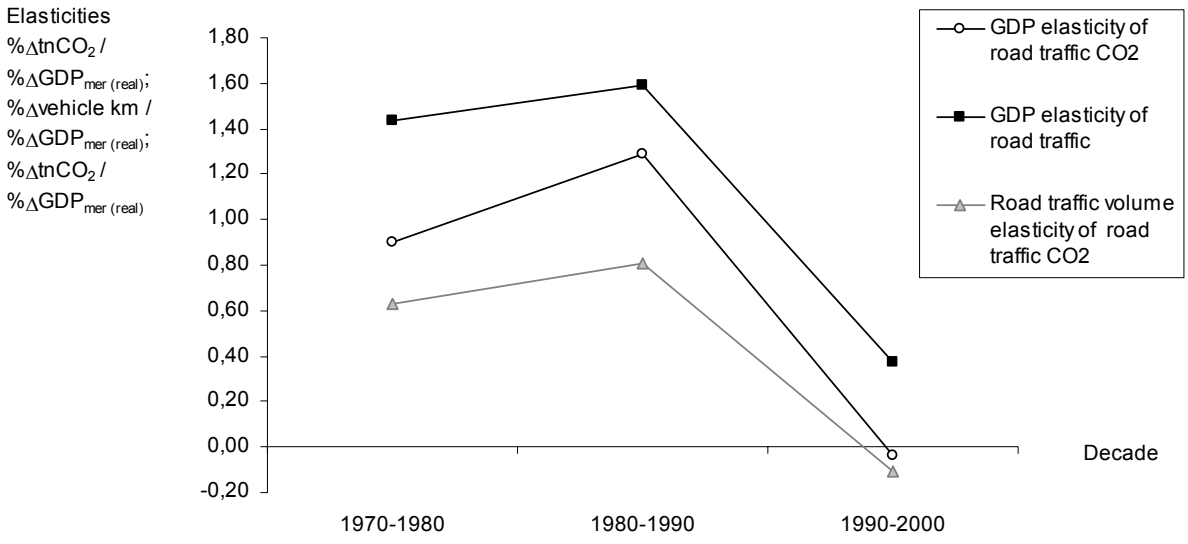

Figure 5. *GDP elasticities of road traffic volume and the CO_2 emissions from road traffic, and road traffic volume elasticity of road traffic CO_2 emissions from 1970-2000 in Finland (calculated from Figure 4)*

3. DISCUSSION

The statistics show the *weak decoupling* of GDP and road traffic volume as well as the *strong decoupling* of road traffic volume and the CO_2 emissions from road traffic during 1996-2001 in Finland. The EU statistics also show a decrease of GDP elasticity of passenger traffic volume in the 1990's, which can be considered a weak signal for a significant change in the future. On the other hand, GDP elasticity of freight transport has even increased. At least four hypothetical explanations to the phenomena can be put forward. The first two of the presented explanations could be considered optimistic, and the last two pessimistic regarding decoupling. Some empirical evidence is gathered to support each of the suggestions, but at the current stage they are only hypothetical in nature.

A. Policy for sustainable mobility

Maybe Finland is a *best practice* example of policies for sustainable mobility? With an 89 % acquisition tax, cars have been expensive, and the fuel price has increased markedly in the 1990's (Eurostat 2002). Although the fuel price elasticity of road transport has been quite modest in the past (Banister 1997, 439-440; Hirota et al 2003), it may be argued that in the end of the 1990's the fuel price entered a level where the elasticity starts to increase (see Fowkes *et al* 1998, 40-41; FinnRA 2000). As the acquisition and the use of a car is expensive, people might have stopped buying bigger cars - thus helping the agreement between ACEA and EU to be fulfilled in practice.

Governmental funding for new road infrastructure in the early 1990's was decreased clearly while the rail budget was almost maintained even during the recession of 1990-1994. There has been a steady increase in soft mode lane kilometres (Neuvonen 2002). the overall emphasis of high-tech in the Finnish economy, including governmental projects to construct an information society, has brought on the *Nokia effect*. The high-tech emphasis is essential for immaterialisation.

B. Green urban lifestyle

Maybe the urbanisation of Finns has familiarised them with public transport? Finland has become an urban country relatively recently, mostly in the 1960's and 1970's. As the policy of diminishing regional differences was abolished during the recession of 1990-1994, Finland experienced another fast pulse of urbanisation. Problematic social impacts resulted from uneven regional development, but the competitiveness of public transport was amended. Land use planning in the major cities as the Helsinki metropolitan area, Tampere, Turku, Jyväskylä and Oulu has supported urban infill, although there are still sprawl problems. Restricted parking policy in city centres together with the raising environmental awareness may also play a role.

Young people use a major proportion of their budget to information and communication technology (ICT) and mobile phone bills. There is some evidence of adolescents postponing the acquisition of driving licence, perhaps reflecting a decreased status value of the car (Kokkarinen 2000; 2001). Along with urbanisation the older generations were left in the countryside. Visiting relatives over long distances has created a lot of traffic, which will, according to some traffic professionals, eventually decrease as the senior relatives will be deceased (Tapio 2002b).

C. Increasing income differences

Is it just the lack of money? The third explanation would suggest that the Finnish economy and a group of households still have not recovered from the recession of 1990-1994. As the Finnish unemployment rate hit over 16 % in 1994 and declined slowly thereafter to no less than 9,1 % in 2001 (Statistics Finland 2002c), a consumer segment permanently under the threshold of affording a car was generated.

Whether this was due to economic necessity or right wing policy is less agreed. However, the income differences have increased rapidly as the income increase in 1990-2000 mainly concerned the richest two deciles, especially in capital gain (Finnish Environment… 2000; Kokkarinen 2001).

D. Statistical misinterpretation

Maybe international air traffic has substituted road traffic with the globalisation of the economy? The last explanation suggests that there would be little reason to be happy about the development of traffic from an environmental point of view, if people have started to use their scarce travel time budget to faster travel modes (see Schafer 1998; Schafer & Victor 2000). The increase in national air traffic is not sufficient to explain the saturation or road traffic CO_2 emissions, but the increase in international flights could be.

However, it is not air traffic, which accounted for most of the increase of traffic CO_2 emissions in 1990-2001 in Finland, but the slower waterborne modes. The total CO_2 emissions of transport increased by 8,4 %, or by 1,24 million tonnes in 1990-2001, of which waterborne modes accounted for 0,81 million tonnes (Mäkelä 2002). The high share of CO_2 emissions from waterborne modes can be explained by an increase in export of industrial products and an increase in tourist trips to the Baltic countries (mainly Estonia) after the collapse of the iron gate. Due to statistical problems the whole picture of international flights remains unclear. Unfortunately the major national travel surveys in 1992 and 1998/1999 were made by incomparable methods, prohibiting verification of the suggestion.

All of the explanations above might explain part of the phenomenon. However, a full-scale analysis is a topic for further research. At the current stage we can hope and work for the best and be ready for the worst.

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