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Effects on Consumer Demand Patterns of Falling Prices in Telecommunication

by

Bjart Holtsmark and Jørgen Aasness*

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Abstract

The relentless technological change in telecommunication industry is forcing down many of the cost elements of a telephone call. Already, the marginal costs of the use of telecommunication networks are so low that these services could, in reality, be almost free of charge. The technological change, together with increased competition in the sector, will therefore represent a strong force towards decreasing marginal prices of telecommunication services.

This technological change will have consequences for the demand for other goods and services. Especially important are probably the effects on the demand for traditional transport services. This paper uses a consumer demand model of the Norwegian economy to analyse these consequences. The model simulations indicate that the falling prices in the telecommunication industry will multiply the demand for telecommunication while consumers expenditure on telecommunication will be approximately constant. The demand for traditional transport will be reduced, and in particular so for luxurious transport modes as air transport (with high Engel elasticity), and less so for transport by bus and rail (with low Engel elasticities). The reductions in the demand for use of private cars and for boat transportation are larger than the reductions in the demand for bus and rail, but less than the reductions in air transport.

1. Introduction

It seems likely that technological development in the telecommunication industry, which also inevitably leads to increased competition in the sector, will be followed by a substantial price fall, cf for example The Economist (1995). An interesting question is what will happen if the costs of telecommunication services move towards zero. Possible consequences for the households demand patterns of such a development is the topic of this paper. An empirically based consumer demand model is used as the tool of analysis.

Because it is reasonable to believe that telecommunication services to a large extent are near substitutes to traditional transport services, an important consequence might be reduced demand for traditional transport. Also, because energy use in relation to transport is causing air pollution of several kinds as well as emissions of greenhouse gases, the question is, in addition, highly relevant in an environmental context.

There are basically two reasons to believe in a scenario where the price of telecommunication services falls towards zero, and these two reasons are closely related to each other. First is the technological change which means increased capacity. In this paper we will not go into technical details, but one should mention that the most important element here is the fibre-optic cables which lead not only to an enormous increased capacity, but also to reduced maintenance costs. Another important element of the technological change is that the switches are computerised with direct consequences for the marginal costs of use. This again has an impact on the prices at least if there is competition in the sector. The second reason to believe in a substantial price fall in telecommunication industry is a trend towards increased competition in the sector, which again to a large extent is the consequence of this technological development. Old national monopolies are broken down by the new technological possibilities. Internet is perhaps the most important example of that kind. Internet not only means the introduction of new types of services which are in direct competition to traditional phone calls. In the future new networks such as for instance Internet will be able to supply households with services which so far only have been supplied by traditional telephone networks. The fact that at least one telecommunication company is already offering software to enable telephone calls to be made over Internet, is an example of the new competitive environment which follows from the technological change. The important thing in this connection is of course that most of the Internet-users pay a flat-rate subscription to cover unlimited use, the price for connection eventually being the same as the cost of a local phone call. The future pricing policies in the telecommunication sector might be much closer to the current price system of Internet (i.e. marginal costs equal zero) than the current pricing policy of telecommunication companies.

The technological development in the telecommunication industry not only means decreasing prices, but also both a wider range of services and increased quality of already existing services. Both the quality improvements and the development towards a wider variety of services may increase the households possibilities for substitution between telecommunication services and traditional transport services (i.e. increasing cross-Slutsky elasticities between these types of services).

It is of course important to have a realistic view on the possibilities for predicting the consequences of the ongoing technological change in the telecommunication industry. In this paper we use an empirically based consumer demand model to analyse some aspects of this development. We are, however, aware of the complexity of the issue, and our results should therefore be interpreted with care. Nevertheless, we find that the present consumer demand simulations shed light on some important aspects of the development.

In section 2 we give an overview of the empirical model. In section 3 we present and comment on the model simulations, and section 4 draws some conclusions.

2. The model

This section describes important features and empirical characteristics of the consumer demand model applied in this paper. Detailed information, in terms of a complete description of the recursive system of equations, values of all the structural parameters, and an extensive set of price elasticities are presented in the appendix. The model determines the demands for a complete system of 13 commodity groups, and is an aggregated version of the 18 commodity group model presented in Aasness and Holtsmark (1995a). The latter paper describes both the theory and the empirical approach behind the simulation model in much more detail. The model is calibrated based on detailed econometric studies using both micro and macro data.

Our starting point is the traditional static consumer demand theory. Every household in Norway is assumed to maximize a utility function given a linear budget constraint. The derived demand functions are exactly aggregated over all households in Norway. The household utility function depends in a systematic way on the number of children and adults in the household, and can also capture economies of scale in household production. The model take also account of random heterogeneity in preferences. The direct utility function is weakly separable in several groups of commodities in a hierarchical order, corresponding to the utility tree in four levels presented in figure 1. Every point (or branch) in the tree correspond to a subutility function. The functional form of each subutility is a generalization of both the Stone-Geary utility function and the CES utility function. We have called the functional form a "Origo displaced CES" (OCES) function because the corresponding preference map is identical to the preference map of an ordinary CES function with a displaced origo. This implies that OCES allows for different Engel elasticities within each separable group, in contrast to the homothetic CES function. The OCES utility function gives larger flexibility than both CES and Stone-Geary utility function with respect to substitution properties, in particular w.r.t to global properties, e.g. with how price elasticities vary between poor and rich households. Using several OCES subutilities within a consistent utility tree makes it possible to harmonize aims of realism and flexibility with parsimony and simplicity.

The utility tree is designed to be suitable for the analysis of environmental policy issues. Consumption activities with intensive use of energy are therefore especially carefully modelled and put into different separable groups. And the modelling of transportation demand are especially suitable for analysis of the issue of this paper. Consumption on petrol and car maintenance and the households car stock are placed in one separable group. On the same level in the utility tree the traditional public transport services like bus, air, rail and ferry are put in an other separable group. These two transport aggregates, private transportation and public transportation, are then as a next step put in a separable group at the next level in the utility tree. This form of the model gives the possibility to explore differences in substitutability between different types of transport services. In the numerical model presented here it is for example little substitution between expenditures on petrol and car maintenance and the car stock. On the other hand there is much substitution between the different traditional public transport aggregates. It is also considerable substitution between the two types of transportation one level further up in the utility tree, where traditional transportation and telecommunication services constitute another separable group (called communication). The advantage of this model structure is among other things that it allows for different assumptions about the substitutability between traditional transport and telecommunication, between private and public transportation and within these two last transportation groups. When simulating possible consequences of a prospected dramatic fall in the price of telecommunication services in the years to come this carefully modelling of the traditional transportation demand is essential.

A substantial part of the households energy consumption is related to heating and the use of electric appliances. The utility tree is therefore designed to reflect the substitution possibilities at that area in a realistic way. For the topic of this paper the communication part of the utility tree is however of greater importance, and we will therefore concentrate on that part of the utility tree.

We derive the macro demand functions by perfectly aggregating the demand functions over all households in Norway. The macro demand functions depend on the price vector, the macro total expenditure, the number of households, the number of children and the number of adults in Norway. Although they are very valuable elements of the model for other purposes, the demographic elements of the model don't play an important role in the analyses of this paper.

Table 1 presents basic empirical characteristics of the model. The budget shares and the elasticities can be interpreted to hold both for the average household and for the macro demands. The table can be read directly, but some comments are given in Aasness and Holtsmark (1995a).

Table 2 presents a complete set of Cournot elasticities from the model. We will focus on the effects of price changes in telecommunication, i.e. on the second column from the right in table 2. The direct price elasticity for telecommunications is -1.02, i.e. decreasing prices imply that the demand for telecommunications increases almost proportionally with the price decrease - in the neighborhood of the baseyear. All the cross-Cournot elasticities are positive for the other transport goods and negative for the other goods. Thus the positive substitution effect (cf table A.3) dominates the negative income effect (cf table 1) for the other transportation goods, and for the other goods the negative income effect dominates.

Furthermore, observe that the cross-price elasticities for Air transport is largest (0.08) This is basically a result of the Engel elasticities, which are estimated from the Norwegian household expenditure survey and used as input in the calibration procedure. The Engel elasticities not only affect the Cournot elasticities direct through the income effect, but also through the substitution effect. The connection between the Engel elasticities and the substitution between the goods and services in this type of a utility tree are further elaborated in Aasness (1990, essay 2) and in Aasness and Holtsmark (1995b). Proposition 5 in Aasness and Holtsmark

(1995b) says that the Hicks-Allen substitution elasticity[1] between good *i* and good *j* are proportional to the product of the Engel elasticities of the two goods as long as the two goods belong to different separable groups. One should also note that this factor of proportionality is unchanged if we instead switch to good *s* and *j* as long as good *s* is an element in the same group as good *i*. This is verified by the fact that the relative difference between the Hicks-Allen substitution elasticities of the all the seven transport services are exactly equal to the relationship between the Engel elasticities of these services, cf table 1 and table A.3.

Some further comments on the elasticities and on the empirical basis of the model will be given in the next version of the paper. Furthermore we will relate our results to other empirical studies, e.g. Chen and Watters (1992), Cracknell aand Knott (1995), Lang and Lundgren (1991), and Husum (1995).

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[1] The Hicks-Allen substitution elasticity between good *i* and *j* is defined as the Slutsky elasticity of good *i* with respect to an increased price of good *j* divided with the budget share of good *j*. This is, however, equal to the Slutsky elasticity of good *j* with respect to an increased price of good *i* divided with the budget share of good *i*. Cf. that the matrix in table A.3 is symmetric. Because a Hicks-Allen substitution elasticity is a Slutsky elasticity weighted with the budget share of the good object to a price change, the Hicks-Allen substitution elasticities gives us a picture of the goods *relative* substitutability.

Figure 1

The utility tree in the complete demand system

Commodity codes in parentheses

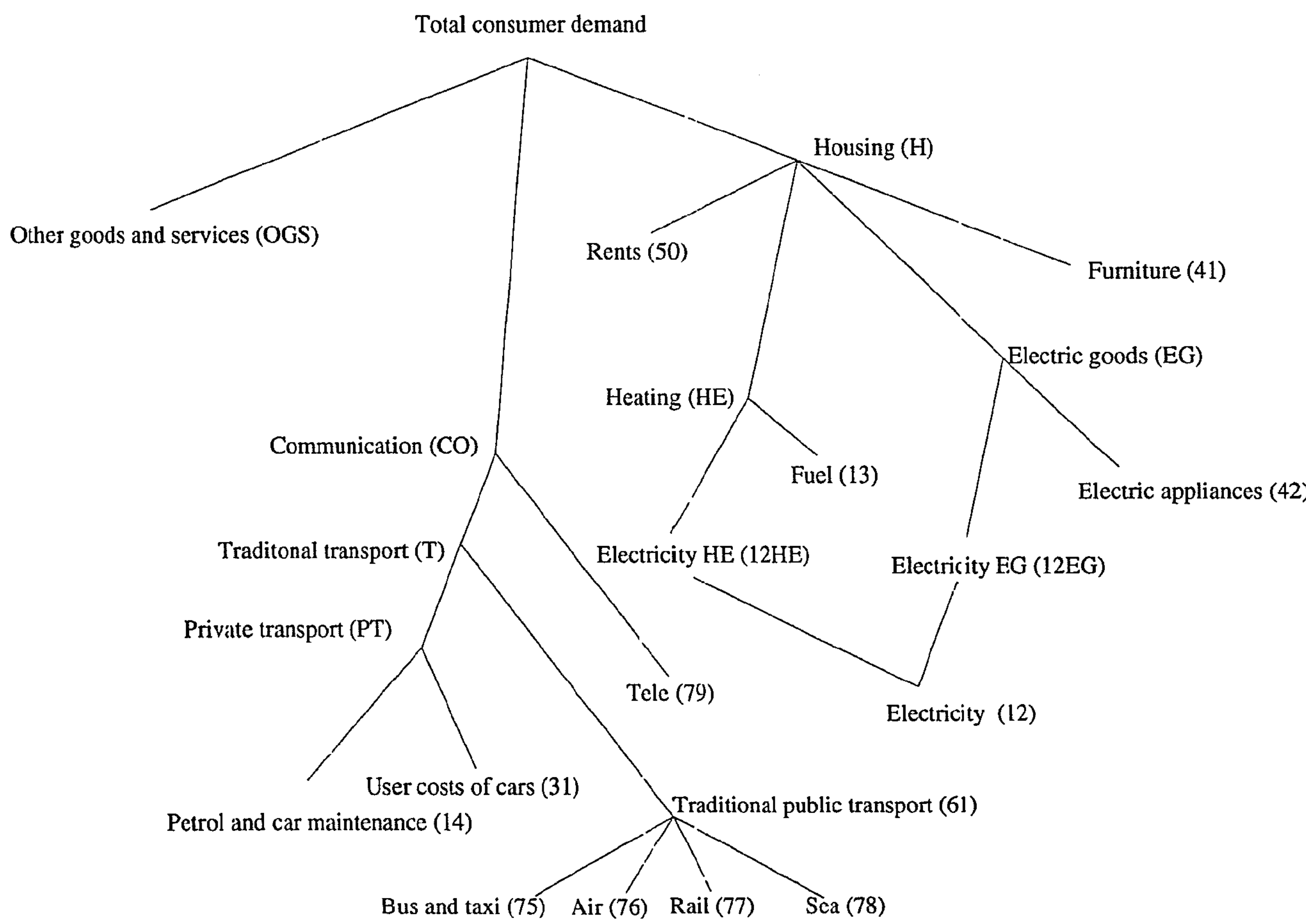


Table 1
Elasticities in the complete demand system[a)]

Commodity group Code	Name	Expenditure (million kroner)	Average household expenditure	Budget share	Engel elasticity	House-hold elast.	Child elast.	Adult elast.	Direct Slutsky elast.	Direct Cournot elasticity Average	Direct Cournot elasticity Poor[c)]	Direct Cournot elasticity Rich[d)]	Budget share Poor[c)]	Budget share Rich[d)]
50	Rents	74,576	42,412	0.186	1.350	0.105	0.128	-0.664	-0.529	-0.781	-0.631	-0.899	0.165	0.208
12	Electricity	14,712	8,367	0.037	0.487	0.232	0.240	0.296	-0.233	-0.251	-0.171	-0.365	0.043	0.030
13	Fuel	1,886	1,073	0.005	0.213	0.844	-0.416	0.070	-0.373	-0.374	-0.346	-0.421	0.006	0.003
42	Electric appliances	5,484	3,119	0.014	0.686	0.378	0.084	-0.117	-0.241	-0.251	-0.175	-0.344	0.015	0.012
41	Furniture and equipment	25,541	14,525	0.064	1.083	-0.176	0.147	0.074	-0.494	-0.563	-0.367	-0.749	0.062	0.066
14	Petrol and Car Maintenance	24,292	13,815	0.061	1.079	-0.462	-0.184	0.586	-0.462	-0.527	-0.459	-0.591	0.059	0.062
31	Car stock	17,147	9,752	0.043	1.281	-0.241	0.183	-0.119	-0.495	-0.550	-0.514	-0.581	0.039	0.047
75	Bus and taxi	4,237	2,409	0.011	0.681	0.228	-0.643	0.353	-0.809	-0.816	-0.593	-1.092	0.012	0.009
76	Air transport	8,239	4,685	0.021	2.434	0.035	-1.951	-1.296	-2.135	-2.185	-3.491	-1.723	0.011	0.030
77	Railway, subway, tramway	1,799	1,023	0.004	0.584	0.243	-0.551	0.432	-0.713	-0.715	-0.502	-0.997	0.005	0.004
78	Boat and ferry	1,553	883	0.004	0.973	0.294	-0.545	-0.168	-1.180	-1.184	-0.938	-1.434	0.004	0.004
79	Post and tele	5,679	3,230	0.014	0.876	0.017	-0.069	0.170	-1.009	-1.021	-0.895	-1.158	0.015	0.014
OGS	Other goods and services	214,987	122,264	0.537	0.846	0.012	0.027	0.183	-0.254	-0.708	-0.615	-0.811	0.565	0.510
	Sum (weighted)[b)]	400,129	227,556	1.000	1.000	0.000	0.000	0.000	-				1.000	1.000

a) If no other spesification, elasticities for the average household and macro demands in the base year (1992)
b) The budget shares and the elasticities are weighted with the budget shares
c) Household of average size and a total expenditure of 75 percent of average
d) Household of average size and a total expenditure of 150 percent of average

Table 2
Cournot elasticities in the complete demand system[a)]

Commodity group		e_{j50}	e_{j12}	e_{j13}	e_{j42}	e_{j41}	e_{j14}	e_{j31}	e_{j75}	e_{j76}	e_{j77}	e_{j78}	e_{j79}	e_{jOGS}
50	Rents	-0.781	-0.041	-0.006	-0.014	-0.053	-0.033	-0.017	-0.009	0.009	-0.004	-0.002	-0.010	-0.388
12	Electricity	-0.047	-0.251	0.033	-0.037	-0.019	-0.012	-0.006	-0.003	0.003	-0.001	-0.001	-0.004	-0.140
13	Fuel	-0.021	0.264	-0.374	-0.002	-0.008	-0.005	-0.003	-0.001	0.001	-0.001	0.000	-0.002	-0.061
42	Electric appl.	-0.067	-0.107	-0.003	-0.251	-0.027	-0.017	-0.009	-0.005	0.005	-0.002	-0.001	-0.005	-0.197
41	Furniture and eq.	-0.106	-0.033	-0.005	-0.011	-0.563	-0.027	-0.014	-0.007	0.008	-0.003	-0.002	-0.008	-0.311
14	Petrol and Car	-0.052	-0.029	-0.004	-0.009	-0.028	-0.527	-0.278	0.007	0.108	0.002	0.006	0.036	-0.310
31	Car stock	-0.061	-0.034	-0.005	-0.011	-0.033	-0.406	-0.550	0.009	0.128	0.002	0.007	0.043	-0.368
75	Bus and taxi	-0.033	-0.018	-0.003	-0.006	-0.018	0.066	0.061	-0.816	0.233	0.010	0.016	0.023	-0.196
76	Air transport	-0.117	-0.066	-0.010	-0.021	-0.063	0.236	0.217	0.101	-2.185	0.035	0.057	0.082	-0.699
77	Railway etc.	-0.028	-0.016	-0.002	-0.005	-0.015	0.057	0.052	0.024	0.200	-0.715	0.014	0.020	-0.168
78	Boat and ferry	-0.047	-0.026	-0.004	-0.008	-0.025	0.094	0.087	0.041	0.333	0.014	-1.184	0.033	-0.280
79	Post and tele	-0.042	-0.024	-0.004	-0.007	-0.023	0.168	0.148	0.015	0.151	0.005	0.009	-1.021	-0.252
OGS	Other goods and services	-0.041	-0.023	-0.004	-0.007	-0.022	-0.021	-0.011	-0.006	0.006	-0.003	-0.002	-0.006	-0.708
	Sum (weighted)[b)]	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

a) Elasticities for the average household and macro demands in the base year (1992).

b) We apply that $\Sigma_i w_i e_{ij} + w_j = 0$, i.e. adding up condition, for control.

3. Simulations

We have simulated the model when reducing the price of telecommunication services gradually from 1.0 in the base year (1992) to 0.03. The effects of this price evolution on various endogenous variables in the model are presented in figures 2-5. This assumed development of price reduction should not only be interpreted as a possible development of the tariffs applied by the telecommunication companies, but also as a reflection of ongoing and likely quality improvements in the industry.

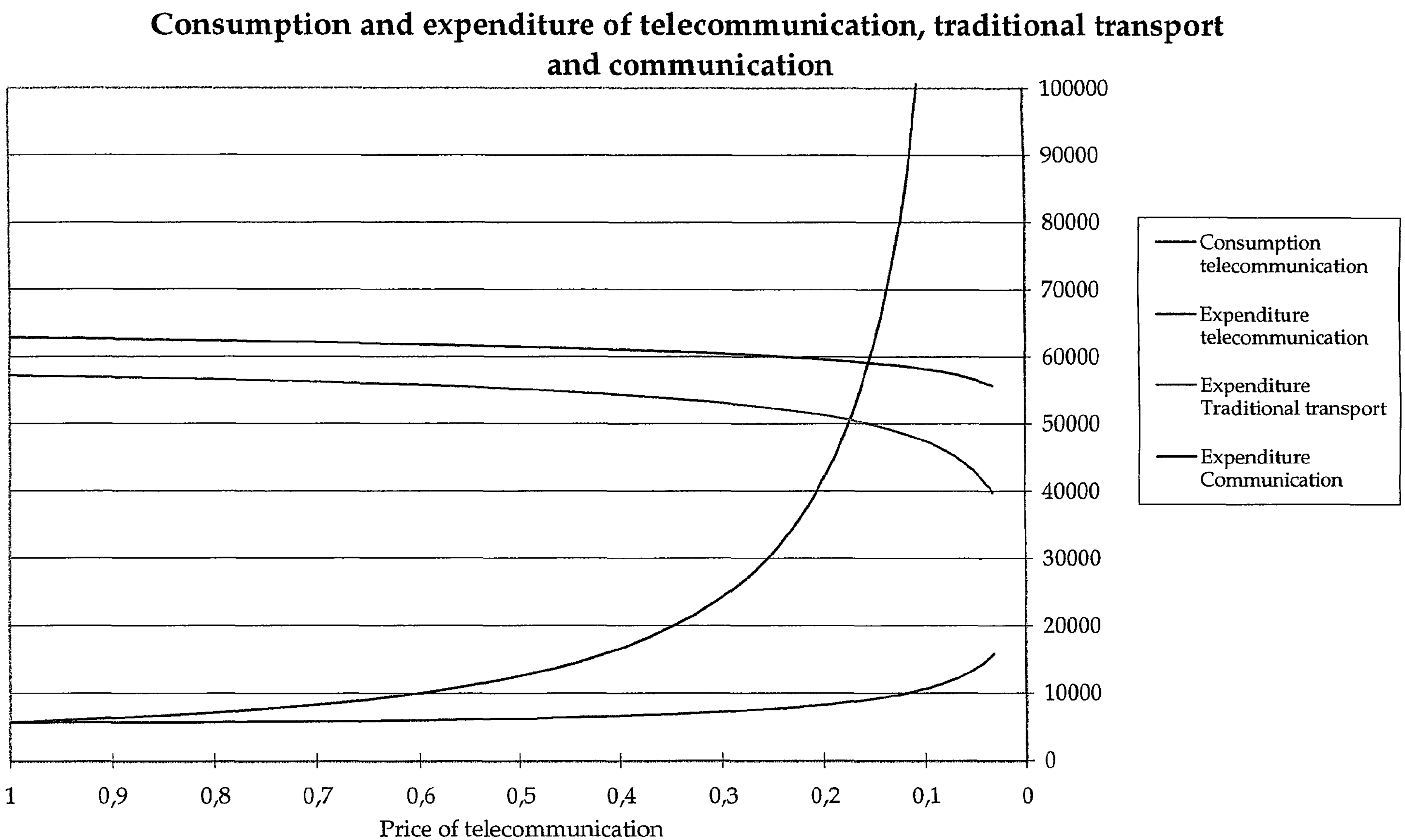
As we touched upon in the introduction to this paper, the technological evolution in the telecommunication industry also means a significant wider spectrum of services supplied[1]. This feature of the development is not explicitly taken into account in our consumer demand model nor in the presented model simulations. However, we can imagine to extend the utility tree in figure 1 with an elaborate branch under the Tele aggregate. An introduction of new tele services (i.e. with prices decreasing from infinity to something where demand is positive for some consumers) will imply a reduction in the price of the Tele aggregate. Thus we may interpret the price reductions to implicitly also reflect better quality and new services.

Figure 2 and 3 give a picture of the most important simulation results. Because the direct Cournot elasticity of telecommunications is near -1 in the baseyear, the households expenditure on telecommunication is only marginal affected. The total expenditure on communication is on the other hand falling due to reduced demand for all the traditional transport services. The speed of reduction is, however, different among the traditional transport services. Most affected is the demand for air transport. Next come the demand for cars and thereafter the expenditure on the use of the cars (petrol and car maintenance). The demand for the most traditional public transportation services, boat, rail and bus, are less affected. The demand for boat and ferry transportation are, however, almost as much influenced as is the demand for petrol.

Observe that the ranking of the different transport services according to how much they are affected by reduced price of telecommunication (figure 3) is equal to the ranking according to the Engel elasticities in the base year (table 1, figure 4). This is no coincidence, but is

[1] The trend towards increased variety of services supplied by the telecommunications industry in recent years is obvious. Internet and other electronic networks are perhaps the most obvious example. And for several reasons the usefulness of these types of networks are increasing over time.

Figure 2



Consumption and expenditure of telecommunication, traditional transport and communication
100000
90000
80000
70000
60000
50000
40000
30000
20000
10000
0
1
0,9
0,8
0,7
0,6
0,5
0,4
0,3
0,2
0,1
0
Price of telecommunication
Consumption telecommunication
Expenditure telecommunication
Expenditure Traditional transport
Expenditure Communication

Figure 3

Transport demands as functions of the price of telecommunication

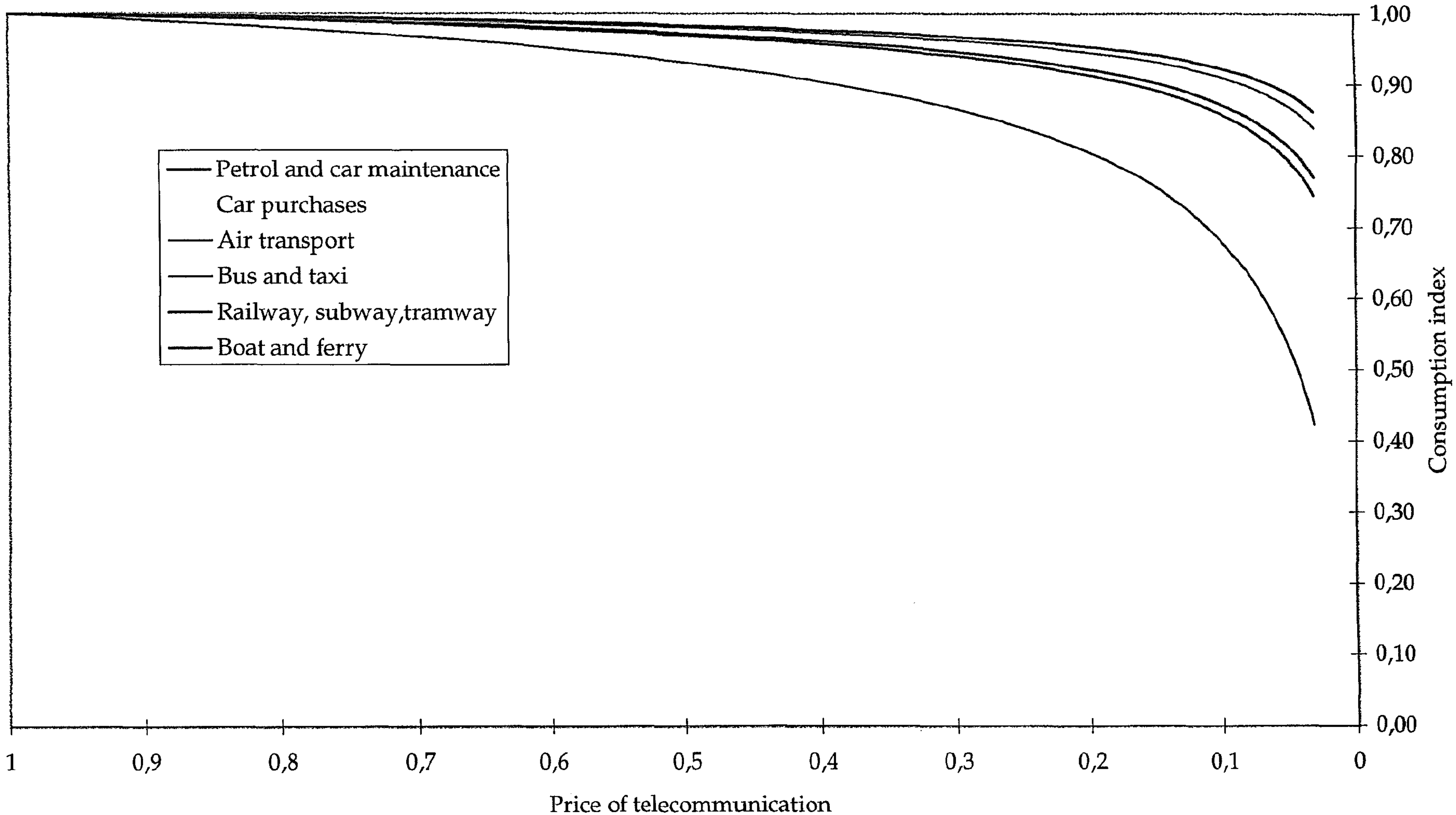


Figure 4

Engel elasticities as functions of the price of telecommunication

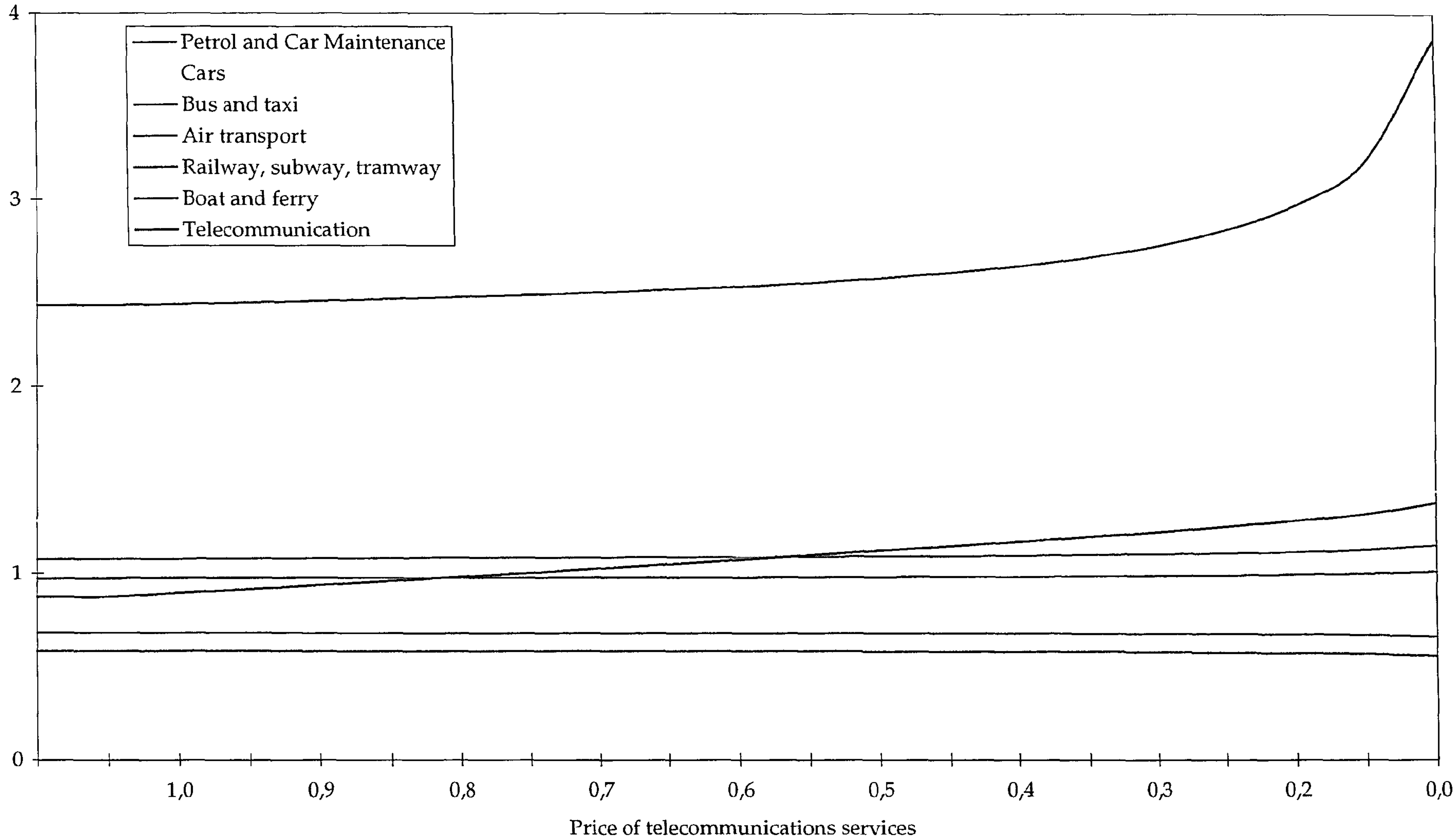
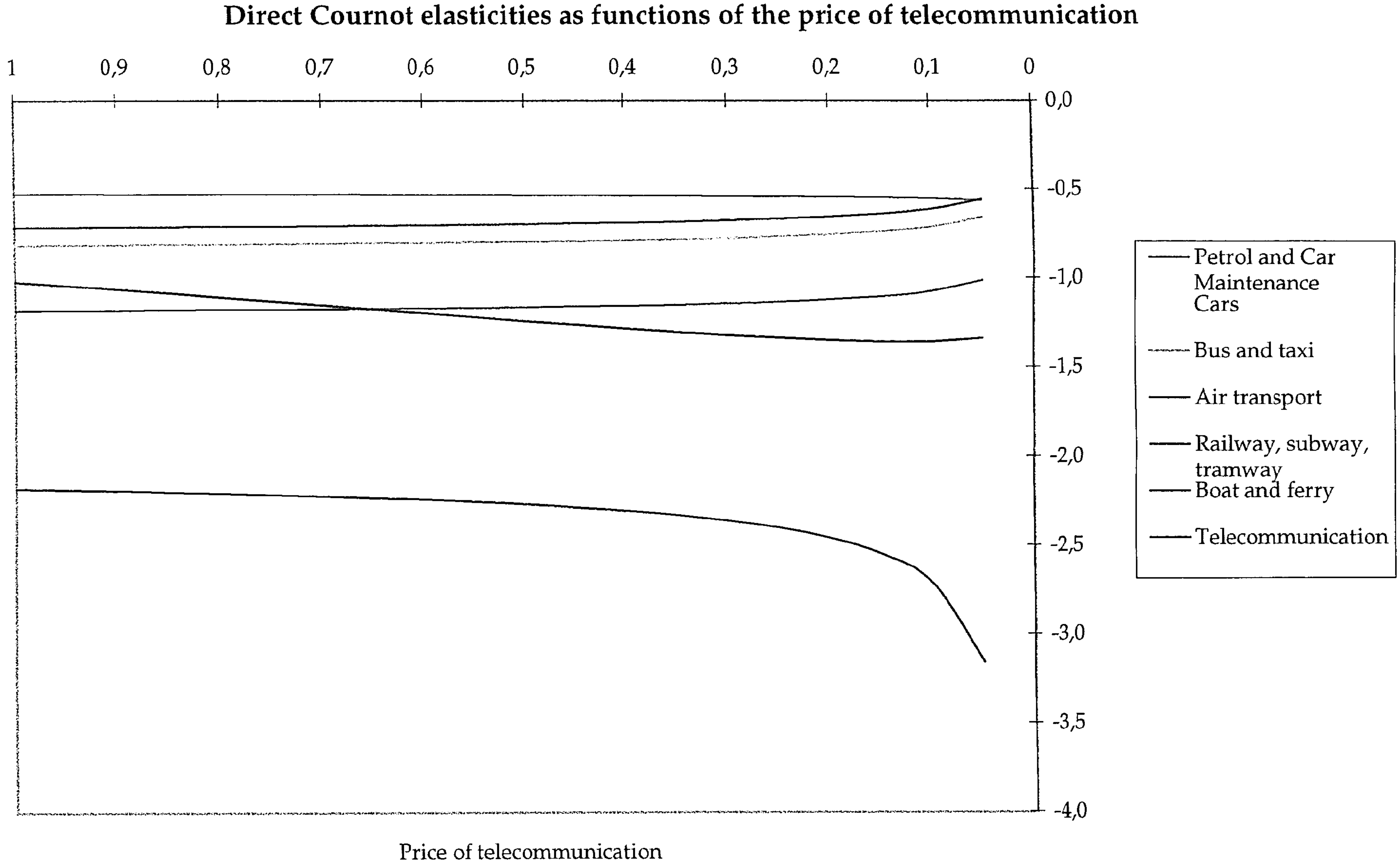


Figure 5



Direct Cournot elasticities as functions of the price of telecommunication
1
0,9
0,8
0,7
0,6
0,5
0,4
0,3
0,2
0,1
0
0,0
-0,5
-1,0
-1,5
-2,0
-2,5
-3,0
-3,5
-4,0
Petrol and Car Maintenance
Cars
Bus and taxi
Air transport
Railway, subway, tramway
Boat and ferry
Telecommunication
Price of telecommunication

connected to the assumed structure of the utility tree (figure 1). As explained in the previous section the fact that the traditional transport services are all in a group separable from the telecommunication services, levy important links between Engel elasticities of these services and their substitutability with the telecommunication services.

As pointed on in the previous section the Hicks-Allen substitution elasticity of two goods belonging to weakly separable groups is proportional to the product of their Engel elasticity. The proportionality factor will in general vary across the price-income space. The variation of this proportionality factor along the actual path defined by the present model simulation is nevertheless quite small. On the other hand, the Engel elasticities of air transport and telecommunication services increase substantially when the price of telecommunication services moves towards zero (cf figure 4), and correspondingly the direct price elasticities of these two goods decrease (cf figure 5).

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$$m_{COi} = \sum_{k \in T,79} \left(p_k \gamma_{ki} + m_{R_{Ti}}\right), \ \forall i \in \{0,1,2\}, \qquad (A.8)$$

$$M_{CO} = Nm_{CO0} + A_1 m_{CO1} + A_2 m_{CO2}, \quad \forall i \in \{0,1,2\} \qquad (A.9)$$

Price index and minimum expenditures at the top level:

$$p_u = \left(\sum_{k \in K^e} \omega_k p_k^{1-\sigma} \right)^{1/(1-\sigma)} \qquad (A.10)$$

$$m_{ui} = \sum_{k \in K^e} \left(p_k \gamma_{ki} + m_{R_k i}\right), \ \forall i \in \{0,1,2\}, \qquad (A.11)$$

$$M_u = Nm_{u0} + A_1 m_{u1} + A_2 m_{u2}, \quad \forall i \in \{0,1,2\} \qquad (A.12)$$

where K=$\{H, CO, OGS\}$. Top level demand and group expenditures:

$$Q_{OGS} = \gamma_{OGS0} N + \gamma_{OGS1} A_1 + \gamma_{OGS2} A_2 + \omega_{OGS} \left(\frac{p_u}{p_{OGS}} \right)^{\sigma} \frac{Y - M_u}{p_u}, \qquad (A.13)$$

$$Y_k = M_{J_k} + p_k \left(\gamma_{k0} N + \gamma_{k1} A_1 + \gamma_{k2} A_2\right) + \omega_k \left(\frac{p_k}{p_u} \right)^{1-\sigma} \left(Y - M_u\right), \qquad (A.14)$$

for $\forall$ $k \in \{H, CO\}$. Housing level demand and group expenditure:

$$Q_j = \gamma_{j0} N + \gamma_{j1} A_1 + \gamma_{j2} A_2 + \omega_j \left(\frac{p_H}{p_j} \right)^{\sigma_H} \frac{Y_H - M_{R_H}}{p_H}, \qquad (A.15)$$

for $\forall$ $j \in \{41, 50\}$.

$$Y_k = M_{J_k} + p_k \left(\gamma_{k0} N + \gamma_{k1} A_1 + \gamma_{k2} A_2\right) + \omega_k \left(\frac{p_k}{p_H} \right)^{1-\sigma_H} \left(Y_H - M_{R_H}\right), \qquad (A.16)$$

for $\forall$ $k \in \{HE, EG\}$. Heating level demand and expenditure:

$$Q_j = \gamma_{j0}N + \gamma_{j1}A_1 + \gamma_{j2}A_2 + \omega_j \left(\frac{p_{PT}}{p_j}\right)^{\sigma_{PT}} \frac{Y_{PT} - M_{J_{PT}}}{p_{PT}} - a_j \frac{Y_{70}}{p_{70}}, \tag{A.25}$$

for j=14,31.

Public transport level demands:

$$Q_j = \gamma_{j0}N + \gamma_{j1}A_1 + \gamma_{j2}A_2 + \omega_j \left(\frac{p_{61}}{p_j}\right)^{\sigma_{61}} \frac{Y_{61} - M_{J_{61}}}{p_{61}} - a_j \frac{Y_{70}}{p_{70}}, \tag{A.26}$$

for j=75,76,77,78.

Table A.1 Some definitions

Variable	Definition
A_1	number of children (0-20 years old)
A_2	number of adults
N	number of households
p_j	price of good j
Q_j	macro demand for good j
Y	households macro expenditure on consumption
Y_{70}	foreigners consumption expenditure in Norway
Y_j	macro expenditure on good j

Table A.3

Slutsky elasticities in the complete demand system[a)]

Commodity group		s_{j50}	s_{j12}	s_{j13}	s_{j42}	s_{j41}	s_{j14}	s_{j31}	s_{j75}	s_{j76}	s_{j77}	s_{j78}	s_{j79}	s_{jOGS}
50	Rents	-0.529	0.009	0.000	0.004	0.033	0.049	0.041	0.005	0.037	0.002	0.003	0.009	0.337
12	Electricity	0.043	-0.233	0.035	-0.031	0.012	0.018	0.015	0.002	0.013	0.001	0.001	0.003	0.122
13	Fuel	0.019	0.272	-0.373	0.001	0.005	0.008	0.006	0.001	0.006	0.000	0.000	0.001	0.053
42	Electric appl.	0.061	-0.082	0.000	-0.241	0.017	0.025	0.021	0.003	0.019	0.001	0.001	0.005	0.171
41	Furniture and eq.	0.096	0.007	0.000	0.004	-0.494	0.039	0.033	0.004	0.030	0.002	0.002	0.007	0.271
14	Petrol and Car	0.149	0.011	0.001	0.006	0.041	-0.462	-0.232	0.019	0.130	0.007	0.010	0.052	0.269
31	Car stock	0.177	0.013	0.001	0.007	0.049	-0.328	-0.495	0.022	0.154	0.008	0.012	0.061	0.32
75	Bus and taxi	0.094	0.007	0.000	0.004	0.026	0.107	0.090	-0.809	0.247	0.013	0.019	0.033	0.17
76	Air transport	0.337	0.024	0.001	0.013	0.092	0.383	0.321	0.127	-2.135	0.046	0.067	0.117	0.608
77	Railway etc.	0.081	0.006	0.000	0.003	0.022	0.092	0.077	0.031	0.212	-0.713	0.016	0.028	0.146
78	Boat and ferry	0.135	0.010	0.001	0.005	0.037	0.153	0.129	0.051	0.353	0.019	-1.180	0.047	0.243
79	Post and tele	0.121	0.009	0.000	0.005	0.033	0.221	0.186	0.024	0.169	0.009	0.013	-1.009	0.219
OGS	Other goods and services	0.117	0.008	0.000	0.004	0.032	0.030	0.026	0.003	0.023	0.001	0.002	0.006	-0.254
	Sum (weighted)[c)]	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

a) Elasticities for the average household and macro demands in the base year (1992)

b) We apply that $\Sigma_i w_i s_{ij}=0$, i.e. adding up condition, for control.

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