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MARKET STRUCTURE AND WELFARE EFFECTS IN THE FINNISH MARKET FOR LONG-DISTANCE TELECOMMUNICATIONS*

TOM BJÖRKROTH

Finnish Postgraduate Programme in Economics and Åbo Akademi University, Department of Economics and Statistics, Fänriksgatan 3B, FIN-20500 TURKU, E-mail: tobjorkr@abo.fi

This paper attempts to measure the welfare effects associated with the opening of the Finnish market for long-distance voice telephony in 1993. It also focuses on the remaining potential welfare losses associated with imperfect competition in this market. The results suggest that entry benefited consumers substantially in terms of consumer surplus, while the change in operators' net profits was negative. From 1993 onwards the potential relative welfare loss substantially decreased from about 40 per cent of sales revenues to about 11 per cent. However, the figures for the late 1990s strongly depend upon assumptions regarding market structure and price elasticity. Nevertheless, the results suggest that the potential relative welfare losses are not negligible. (JEL: L96, L13, D60)

1. *Introduction*

Studying welfare implications associated with changes in market structure may help us to judge whether alternative forms of market arrangements could be preferred. The study of welfare losses refers back to the contribution of Harberger (1954). Many subsequent contributions have shared his views, implying that the potential losses of imperfect competition are negligible. The studies regarding welfare losses often focus on inter-industry differences or on aggregate welfare losses in relation to GDP. As Geroski (1982) shows, the analysis can also be applied both to inter-industry and to intra-industry considerations. There are only a few applications to Finnish industries. Wahlroos (1982) applies Harberger's approach to Finnish data and reaches quite similar results: Welfare losses of 0.06 to 0.30 percent of GDP in 1977, which corresponds to 0.2 to 1% of the industrial value added. Willner and Ståhl (1992) present a procedure to measure welfare losses, based on demand elasticity and an indicator of market concentration. Their predictions of welfare losses over sales revenues for the Finnish four digit industries reach an average of 1 to 2%. However, depending on the assumptions regarding the market structure and the demand function, some estimated welfare losses were quite large.[1] These findings are in line

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[1] *For example in manufacturing of rubber products (industry 3559) their measure of welfare loss over sales extends from 1.53 to 52.98 per cent. In the manufacture of electrical appliances and housewares the corresponding measure lies between 2.29 and 16.35 per cent (See W&S, 1992, Table 3, p. 487).*

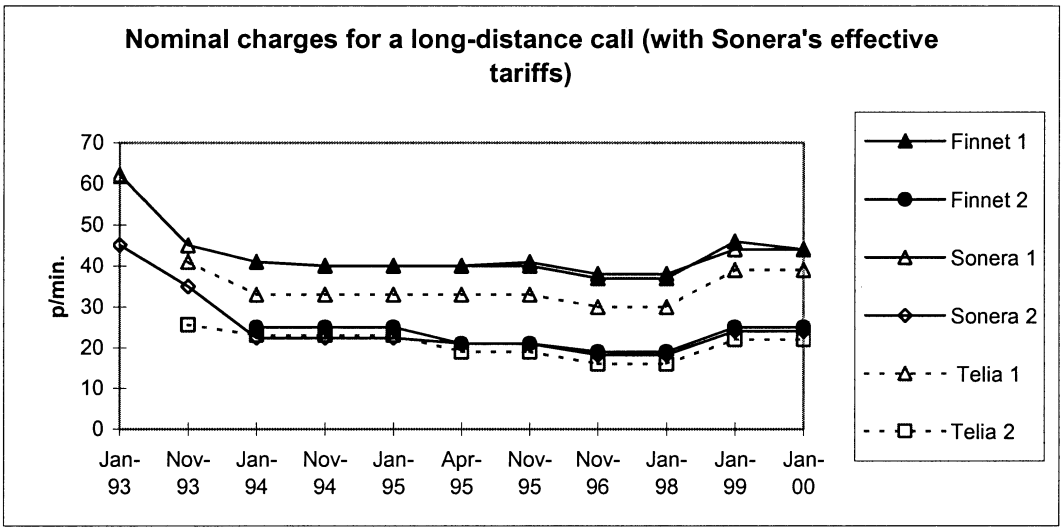

Figure 1. Nominal charges (pennies per minute) by operator and by type of call.

with the results of Cowling and Mueller (1978), for example, and thus motivate further research on this topic.

This paper will focus on welfare effects, both gains and potential losses within the Finnish market for long-distance voice telephony between 1993 and 1999. This market has recently experienced wide-reaching changes, not only regarding the technical solutions but also concerning the market structure. The onset of restricted competition occurred in 1993, when Telivo Ltd entered the market. Subsequently, other participants have entered the market and captured a large share of the market for domestic long-distance calls. Nevertheless, the market is still rather concentrated and mainly controlled by two operators.

This paper will proceed as follows. The next section provides some background information through a brief review on the development of charges and on the relative importance of the market in question. In Section 3 the original model of Harberger is amended for calculation of the welfare gain associated with the introduction of competition. In Section 4 we focus on the welfare losses associated with the remaining imperfect competition. We introduce a Cournot model, where the welfare loss is finally formulated as a function of market concentration and the price elasticity of demand. In Section 5 the models formulated in Sections 3 and 4 are used in the empirical analysis. We also calculate potential welfare losses for three alternative market structures involving price leadership. The results of different models are compared over time and if possible, we distinguish between plausible and implausible market structures. Section 6 discusses the importance of market dynamics in interpreting the results. Section 7 contains concluding remarks.

2. *Development of the market*

In Figure 1 we have plotted the price information of the three main operators in the Finnish market for long-distance voice telecommunications at some key dates. *Finnet* refers to the operator Kaukoverkko Ysi, owned by the Finnet group, which in turn was established by local telecom operators. *Sonera* refers to the formerly state-sponsored Tele, now the largely state-owned Sonera plc, and *Telia* refers to Telia Finland (former Telivo Ltd)[2]. The number 1 refers

[2] *Telivo was acquired by Swedish Telia and is known as Telia Finland Ltd.*

to charges during working hours and number 2 to charges during evenings and weekends.

Figure 1 shows a considerable lowering of especially daytime charges by Tele prior to the entry of Telivo in 1993. The reduction of nominal daytime charges with more than 27 per cent alone justifies an approximation of the welfare effects associated with this event. Figure 1 also reveals that the Finnet group and Tele/Sonera have had rather similar tariffs during the whole period. The daytime charges of Telivo/Telia were remarkably lower from November 1994. The reduced rate charges have also developed in a similar manner, with the year 1995 as an exception. At this point Tele introduced a new tariff structure with discounts related to the length of a call. Using nominal charges per minute caused the Sonera 1 and Sonera 2 series above to behave oddly. The use of effective tariffs[3] brings the charges of Sonera in line with the two other operators. To sum up, Figure 1 implies a rather large effect on the charges due to entry, but does not at a first sight support the hypothesis of fierce price competition with operators subsequently undercutting each others' charges. This could be viewed against Stigler's theory (1964, p. 46), which tells us that the inducements to price cutting are low when prices are set close to the competitive level. However, this should be a result of slow and (or) incomplete detection of price-cutting caused by weak enforcement of collusion. Whether these characteristize this market is doubtful. A more probable reason for the lack of price-cutting behaviour is the signal from the regulating authorities to interfere in case of a price war. A price war was thought to affect the ability of the operators to develop and maintain the network.[4]

We should not forget the interdependence between fixed telephony, or plain old telephone service (POTS), and mobile telephony. It is unclear whether these two forms of telephony should be considered complements or substitutes. Sung, Kim and Lee (2000) conclude that mobile telephony becomes a substitute to POTS once its penetration exceeds the density of fixed lines. In Finland the penetration of mobile phones exceeded the density of fixed connections in 1998, with 55.1 fixed connections and 57.1 mobile connections per 100 inhabitants. According to the results of Sung et al. (2000) this should have induced these two technologies to compete. However, from Figure 2 we can see that the number of minutes operated within fixed long-distance (Ld1) and mobile (Mob1) networks move into opposite directions between years 1996 and 1997. Barros and Cadima (2000) suggest that the introduction and growth of cellular technology decelerates fixed link diffusion, but stress that most mobile phone expansion has not been only at the cost of fixed telephony. Furthermore, they state that since these telephone services serve different needs, they should not be considered perfect substitutes. From our point of view mobile calls may serve as a substitute for other calls than domestic long-distance calls as well. Thus, for early 1990s, we do not consider this substitution too significant.

By relating them to the total turnover of the telecom operators, we can compare the relative importance of mobile and fixed long-distance calls. Figure 2 reveals that the ratio of revenues from mobile telephony to total turnover of the operators (Mob2) has increased steadily. The ratio of domestic long-distance revenues to this total turnover (Ld2) was halved between 1994 and 1999, and now accounts for about two per cent.

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[3] *The effective charge is obtained by assuming that a given set of calls of* various length *are made. The total cost is then divided by the total number of minutes. This enables us to take into account the discount scheme based on the length of a call.*

[4] *'Prior to the start of competition, the Ministry of Transport and Communications had also expressed its concern on the effects of a potential price war on the possibilities of operators to maintain and develop their telecommunications networks. These statements and the announcement by the Ministry of Transport and Communications that it would interfere with pricing, provided a price war accelerated, may have suppressed price competition.' Quoted from* Competition in Telecommunications, OCDE/GD(96)114, Competition Policy Roundtables No. 6.

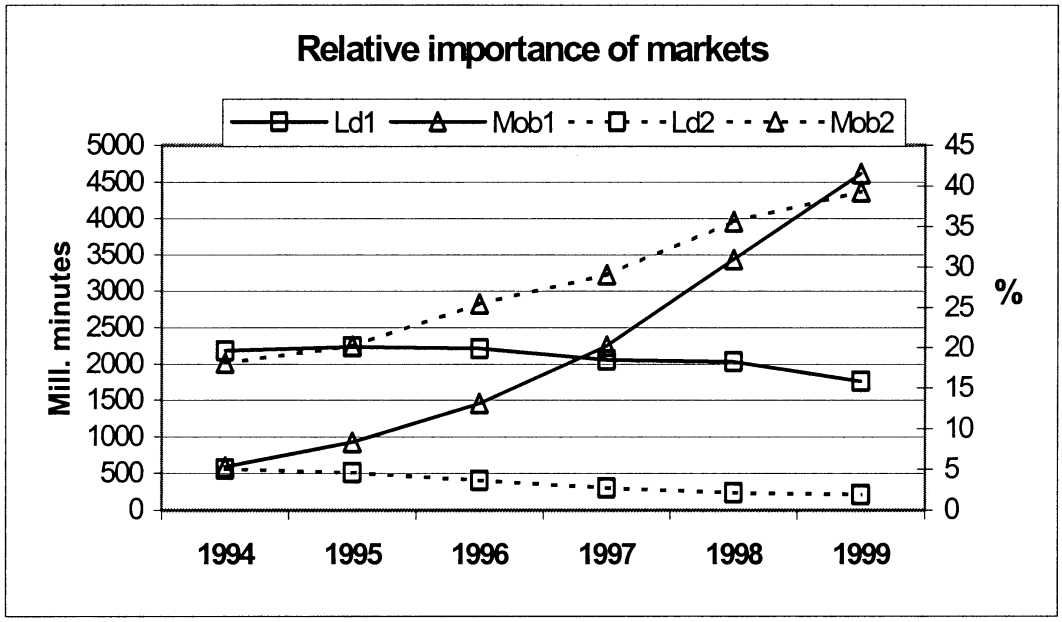

Figure 2. Minutes operated in each market (left axis) and share of total telecommunications turnover (right axis).

3. *An application of Harberger's approach*

In his classic contribution Harberger (1954) studies the misallocation of resources associated with monopoly and argued that places where resources are misallocated could be identified by comparing the rates of return on capital. He further assumes that the deadweight loss (*dwl*) or 'welfare loss' of a monopoly could be approximated using a triangle. The choice of the word 'approximate' has a clear meaning since:

'It should be clear from the outset that this is not the kind of job one can do with great precision. The best we can hope for is to get a feeling for the general orders of magnitude that are involved'. (Harberger, 1954, p. 77)

In our case, we consider a lowering of the price level. Thus we turn Harberger's welfare loss to a 'welfare gain' (wg_1), resulting from the lowering of the market price. We have reliable data on prices during monopoly (p_m) and competition (p_c). We also know the quantities associated with the monopoly status of Tele (q_m) and with the period of entry (q_c). That is, we do not have to approximate a marginal cost or any particular price that would yield a 'normal return' on capital. The prices p_m and q_m should *not* be associated with a price charged and quantity produced by a profit-maximising monopolist. Similarly, the prices and quantities connected with the entry and with the competitive threat should not be confused with magnitudes arising from a perfectly competitive outcome. The change in total welfare can be calculated as a sum of the changes in consumer and producer surplus. The change in consumer surplus (ΔCS) can be written as

$$(1) \quad \Delta CS = \frac{1}{2}(q_m + q_c)(p_m - p_c),$$

which is a sum of a fraction of a larger deadweight loss, $wg_1 = \frac{1}{2}(q_c - q_m)(p_m - p_c)$, which, due to a price reduction, has now become a part of the consumer surplus, and of the 'excess profits' (*EP*) which are transformed from producers' to consumers' surplus.

The change in producers' surplus from a price reduction can be written as

$$(2) \quad \Delta PS = (p_c - \bar{c})q_c - (p_m - \bar{c})q_m.$$

Here $\bar{c}$ denotes the constant marginal (average) cost of operating one minute of a call.

This expression includes the 'excess profits' (EP) lost due to price reduction and additional profits (wg_2) arising from increased sales.

The change in total welfare can then be written as the sum of (1) and (2)

$$(3) \quad \Delta W = (q_c - q_m)\left(\frac{1}{2}(p_m + p_c) - \bar{c}\right).$$

Our method of estimating the change in total welfare is not straightforward. Firstly, linearisation will automatically exaggerate the wg_1 if the demand curve is not linear. But we can still obtain a '*feeling for the general orders of magnitude that are involved*'. Secondly, there is a lag of one year between the observation regarding the movement from p_m to p_c and from q_m to q_c. We cannot rule out possible shifts in the demand curve. However, if we look at the disposable national income, only a modest change can be observed. Thirdly, the use of substitutes, e.g. of mobile telephony or e-mail, do not give rise to shifts in demand in the early 1990s. This point was addressed above, indicating that at an early stage of mobile diffusion these services are complements rather than substitutes.

Harberger (1954) calls the profits that diverge (positively) from the average return on capital as 'excess profits'. His interpretation of these excess profits is to some extent different from the one we will use. He argues that the amount of excess profits is a measure of the amount of services of labour and capital that must be bought by the industry in order to bring its profit rate into line with the rest of the industry (Harberger, 1954, p. 79). In the empirical section we will try to approximate the excess profits by letting the lower price (p_c) represent the price level that yields profits 'in line' with the industry. Thus, these profits, which constitute the transfer from producers to consumers, are calculated as

$$(4) \quad EP = (p_m - p_c)(q_m - 0).$$

4. A model with Cournot-Nash oligopolists

The welfare effects of a monopoly or imperfect competition can be approached from a game theoretic perspective as well. Cowling and Waterson (1976) (henceforth C&W) provide an initial theoretical model of the relationship between market structure and performance by making use of Herfindahl's concentration index. Their theory provides a prediction that the profit-revenue ratio is directly related to Herfindahl's concentration index and inversely related to the price elasticity of the industry (C&W, p. 269).[5] This approach has been developed further by the contribution of Willner and Ståhl (1992), who measure the welfare losses in relation to industry sales.

As Varian (1992) emphasizes the choice of an analytical framework should depend upon considerations of relevant strategies involved. Regarding the subject of our study, a Bertrand model would seem quite natural. However, as we may assume that the market for long-distance voice telephony is characterised by large capacities, constant marginal costs and homogeneous products, a Bertrand setting would according to Kreps and Scheinkman (1983), for example, lead to a Nash equilibrium with prices set equal to marginal cost.[6] The empirical results of McAvoy (1992) do not support this view. The Bertrand approach would also provide strong incentives for the firms to undercut each other's prices to capture market share, an assumption which is not consistent with empirical findings in Brunekreeft and Gross (1999). If we try to relax the assumption of constant returns to scale (CRS) or alternatively assume CRS and add even small fixed costs to the Bertrand model, this will (Shapiro, 1989, pp. 344–45) lead to the non-existence of equilibrium.

In short, the existence of Bertrand equilibrium involves marginal-cost pricing independent of the number of firms or, more importantly,

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[5] *C&W (p. 269) argue that their theory shares features with the theory of Stigler (1964), since he also stressed the importance of the Herfindahl measure of concentration in explaining the market outcome. Stigler (1964 p. 57) finds confirmation of his theory in the sense that competition increases with number of firms.*

[6] *Kreps and Scheinkman (1983) also provide an alternative setting involving intermediate capacities, but this has an unrealistic feature, since according to Varian (1992) it makes the sales of a firm a discontinuous function of its strategy (price).*

independent of the elasticity of aggregate demand. Shapiro (1989) finds this as being in contrasts with evidence regarding market structure and possible mark-ups and thus supports the use of the Cournot model as a workhorse in oligopoly theory. This view is shared by Kreps and Scheinkman (1983) who show that when in situations where most of the costs are incurred subsequent to the realisation of demand, situations that look 'Bertrand-like' will give a Cournot outcome. Thus, we have motivated the choice of model framework.

4.1 The basic model

We assume a linear inverse demand function $p = a–q$ and constant marginal costs $MC = c_i$. The profit function to be maximised with respect to output is then

$$(5) \quad \Pi = (a-q)q_i - c_i q_i \qquad i = 1,2,\ldots,n$$

Here q denotes the joint output in the industry and q_i represents the output of a single firm. The first order condition is

$$(6) \quad a - q - q_i - c_i = 0$$

We may manipulate (6) by multiplying it by q_i and by adding q^2 into the numerator and denominator of the third term. Then adding over all i ($i=1,2,..n$) yields

$$(7) \quad aq - q^2 - q^2 \sum_{i=1}^{n} \left(\frac{q_i}{q}\right)^2 - \sum_{i=1}^{n} c_i q_i = 0$$

Dividing Equation (7) by q then yields

$$(8) \quad a - q - qH - \bar{c} = 0 \ .$$

Here H denotes the Herfindahl index and $\bar{c}$ denotes the weighed average of marginal costs. Solving (8) for q gives the classical solution for oligopoly output (q_m) and price (p_m)

$$(9) \quad q_m = \frac{a-\bar{c}}{1+H}, \quad (10) \quad p_m = \frac{Ha+\bar{c}}{1+H} \ .$$

We can now use (9) and (10) to determine the ratio of welfare loss to sales (in per cent) of having imperfect competition by

$$(11) \quad \frac{W}{s} = \frac{100}{2} \cdot \frac{\left[\frac{a-\bar{c}}{1+H} - (a-\bar{c})\right] \cdot \left[\frac{Ha+\bar{c}}{1+H} - \bar{c}\right]}{\frac{a-\bar{c}}{1+H} \cdot \frac{Ha+\bar{c}}{1+H}},$$

which equals to

$$(12) \quad w = -\frac{100}{2} \cdot \frac{H^2(a-\bar{c})}{Ha+\bar{c}}.$$

The price elasticity of demand, e_p, can now be written as

$$(13) \quad e_p = \frac{Ha+\bar{c}}{a-\bar{c}}.$$

The above equation can be used to obtain

$$(14) \quad Ha + \bar{c} = e_p(a-\bar{c}).$$

When this is inserted in (12), we get the final expression for welfare loss over sales (w) in percent as

$$(15) \quad |w| = \frac{100}{2} \cdot \frac{H^2}{e_p}.$$

At this point we should consider the theoretical limits for welfare losses. From (15), it is obvious that w is decreases if e_p increases, assuming that H is given. Thus the welfare loss over sales is related to the demand structure by the intercept a, i.e. the maximum willingness to pay. Using a linear demand schedule it is obvious that the maximum potential relative welfare loss occurs under monopoly ($H=1$) at zero cost with $w=50$. A general rule can be obtained by using l'Hopital's rule on (13) that, as a tends to infinity e_p tends to H. This gives $w_{max} = 50H$. Thus, it may be useful to check the rationality of our results by inspecting what they imply for the maximum willingness to pay.

The outcome in (15) will be applied in the empirical section to estimate the size of $| w |$ in the market considered. C&W (1976, p. 269) admit there are serious problems in testing their predictions. One reason is that good measures of price elasticity of demand by industry are often available only at unsatisfactory levels of aggregation. As a solution to this we quote the authors' suggestion (p. 269):

"One approach to this dilemma is to change the focus of analysis away from explaining inter-industry differences and towards explaining intra-industry changes over time"

An approach like this is assumed to be highly relevant in studying markets where the concentration is changing (C&W, p. 269). This further motivates the use of the current and similar models in empirical estimations of welfare losses over time. One major problem arising from this approach is, however, that we are not perfectly informed how price elasticity has changed over time.

The CW approach also provides us with an alternative way to estimate the welfare gain over time. In contrast to the Harberger approach ΔW resulting from opening up the market could be calculated as ($\Delta W = w_t - w_{t+1}$), where w_t denotes the potential welfare loss at time t and w_{t+1} the potential welfare loss one year later.

4.2 Alternative market structures

The actual interactions in the market may well be something other than a simultaneous quantity setting. Therefore we have to consider alternatives, for instance niches for price or quantity leadership or perhaps both. Moreover, we cannot exclude the possibility that the leaders actually collude.

The results of the Cournot-Nash oligopoly above, here referred to as Case 1, are compared with potential welfare losses in other plausible market structures. In this section we use the approach of Willner and Ståhl (1992) when we consider three alternative market structures with linear demand functions as described above. Firstly, we consider price leadership, where the leaders are Cournot–Nash oligopolists. Secondly, we have a Stackelberg leader among a number of price leaders. Finally we deal with a case of price leadership where the leading firms collude. Results for all these cases are summarised in Table 6.

Case 2: Price leadership where leaders are Cournot-Nash oligopolists

Assume that the two largest operators, Sonera and Kaukoverkko Ysi are price leaders and act as Cournot-Nash oligopolists with respect to each other. Because of the large market share of these two operators the results will be in line with Case 1. We now make use of the n-firm concentration ratio (CR_n), where n refers to the number of market leaders ($n=2$). We also need to make assumptions regarding the price elasticity (e_p), since the welfare loss over sales (w) is now calculated as

$$w = \frac{100}{2}\frac{(CR_n)^2}{|e_p|n^2}. \quad (16)$$

Case 3: Price leadership with a Stackelberg leader

I this case we have two price leaders ($n=2$) among which we have a Stackelberg leader. The former state-sponsored monopolist could be seen as a Stackelberg leader if, for example, it rather voluntarily gave up a rather large market share, to use its facilities for other, more profitable, purposes in the future. Alternatively, we could assume that Kaukoverkko Ysi chose to capture 'only' half the market, even if it could have been achieved a larger market share. In this case w is calculated according to

$$w = \frac{100}{2}\cdot\frac{(CR_n)^2}{(2n-1)^2\cdot|e_p|}. \quad (17)$$

Case 4: Price leadership, where leaders collude

In this scenario the two largest operators have chosen not only to act as price leaders, but also to collude ($n=2$). We assume that one main operator (Telia Finland) and the group of 'others' are treated as followers. Under the assumption of linear demand, the welfare loss over sales (in per cent) is calculated as

$$w = \frac{100}{2}\cdot\frac{(CR_n)^2}{|e_p|}. \quad (18)$$

Table 1. Millions of minutes operated.

Year	Sonera	Finnet	Telia	Others	Total
1992*	2686.4	0	0	0	2686.4
1993*	3041.5	0	176.6	0	3218.1
1994*	1001	1129.6	46.9	0	2177.5
1995	901	1226	100.7	5.1	2232.8
1996	881.5	1217.2	102.6	7	2208.3
1997	828	1108.7	98.5	16	2051.2
1998	749	1118.4	142.2	16.6	2026.2
1999	667	986.5	95.5	11.7	1760.7

* Figures for years 1992–94 are estimated by multiplying the total number of calls with the average length of a domestic long-distance call. (Source: Telecommunications Statistics)

5. *Empirical findings on allocative welfare effects*

There are some difficulties in applying our amended Harberger's approach to the Finnish domestic long-distance-call market over time. This is because the definition of a long-distance-call changed almost at the same time competition was introduced. From 1994 a long-distance-call was defined as a call between telecommunication areas, in contrast to the earlier definition where calls between netgroups were defined as long-distance calls.[7] This has significantly altered the number of long-distance calls reported in statistics. Therefore we will focus on the years 1992 and 1993 in order to determine the welfare gain associated with the entry of Telivo. We omit the division of the entire market into markets for calls made during working hours and into a market for calls made at other times of the day. Using the division would have meant relying on very strong assumptions regarding the 24-hour profile of calls. It would also have meant assuming that the average length of a call is the same between operators and during all times of the day. We would also have the problem of ignoring the large number of calls made at discounted charges, implying much lower prices than the ones obtained from operators' price-lists.

5.1 Derivation of price levels

The discounts arising from contract between the operators and e.g. large companies, are likely to mislead us if we stick to the prices on operators' price-lists and consequently we will use the average revenues for the years 1992 and 1993. We create this average price by dividing the total revenues from the long-distance market by operator with the number of minutes operated each year. The average price will then be deflated to 1994 prices using the cost of living index as a deflator. In cases where we have more than one operator, the price level will be calculated as a weighted average of each operator's average revenue.

The numbers of operated minutes by year and operator are shown in Table 1 and revenues from the long-distance market by year and operator are found in Table 2.

The price for 1992

Because of Tele's monopoly status, the real price level for1992 (= p_m) can be calculated as

$$(19)\quad \bar{p}_m = \frac{\text{FIM792 million}}{\text{2686.4 million minutes}} \cdot \left(\frac{1}{0.969}\right) = \text{FIM}\ \frac{0.3043}{Minute}.$$

[7] *The reform meant that netgroups were merged into telecommunications areas. For an average user this meant that the number of subscriber that one could reach with a local-call increased about fivefold. This meant a dramatic decline of market for long-distance calls.*

Table 2. Revenues from the market for domestic long-distance *calls by operator (FIM million, current prices).*

Year	Sonera	Finnet	Telia	Others	Total
1991*	919	0	0	0	919
1992	792	0	0	0	792
1993	739	0	36	18	793
1994	218	240	12	5	475
1995	208	269	30	n.a.	507
1996	188	240	18.9	0.3	447
1997	180	240	11	n.a.	433
1998	157	226	20	n.a.	403
1999	163	243	17	0	423

* According to figures directly from Ministry of Communications. n.a.=not available. (Source: Telecommunication Statistics)

This is considerably lower than the price reported by Ilmonen (1994) which would have indicated the use of a price equal to 0.653 for calls during daytime and 0.355 for calls made outside working hours. Using this average price may bring our analysis to a more firm basis.

The price for 1993

The real price level associated with the onset of competition ($\bar{p}_c$), is calculated as a weighted average of the two operators' average revenues as

$$\bar{p}_c = \sum_{i=1}^{2}\left[w_i \frac{R_i}{Q_i}\right] \cdot \frac{1}{CL_{1993}} \quad . \tag{20}$$

The data on sales per operator (R_i), quantities (Q_i), and market shares (w_i) in Tables 1 and 2 and Table 2 below respectively allow us to calculate the nominal average price as FIM 0.2408 per minute. This corresponds to FIM 0.2435 when deflated with the cost of living index (1.0 for year1994) for the year 1993 (= .989).

5.2 Calculating the welfare effects

We can now calculate the change in total welfare gain (ΔW). Using Equation (3) the change in total welfare can be expressed as

(21)

$$\Delta W = \text{FIM}\,145.63\,\text{mill.} - \bar{c}\,\frac{\text{FIM}}{\text{minute}} \cdot 531.7\text{mill.min}$$

Thus we can calculate that the sign of total welfare gain is positive as long as $\bar{c}$ is less than FIM 0.27 per minute.[8]

We can approximate ΔW by letting the constant marginal cost equal FIM 0.1 per minute.[9] Thus the change in total welfare is equal to FIM 92.5 million.

5.2.1 What transfers have occurred?

If we assume that $\bar{p}_c$ allows for normal profits in the industry, we can calculate 'excess profits' á la Harberger during the last year of monopoly. By using Equation 4 we get the profits that have been transformed into consumer surplus. This figure is about FIM 163.3 million. The total change in consumer surplus, (ΔCS = wg_1 + EP) is thus about FIM 179.5 million.

Regarding the effects on operators' profits, it is clear that at any positive costs the profits from increased sales, i.e. wg_2, will not match the amount of 'excess profits' (EP) lost by a price

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[8] *Alternatively, we can calculate the part of the entire deadweight loss now gained by consumers into their consumer surplus:* $wg_1 = \frac{1}{2}(q_c - q_m)(p_m - p_c)$, *amounting to FIM16.2 Million, which is about 2% of the real sales in 1992. The profits from additional sales* (wg_2) *depends on the assumed level of marginal cost. Measured in FIM (1994)* wg_2 *sums up to:* $wg_2 = \text{FIM}\,129.5\,\text{mill.} - \bar{c}\,\frac{\text{FIM}}{\text{min}} \cdot 531.7\text{Mill.min.}$ *The change in total welfare is simply denoted* $\Delta W = wg_1 + wg_2$.

[9] *This is a rather realistic figure, since the terminating charge (i.e. the compensation a long-distance operator has to pay for terminating a call in a local operator's network) is slightly less than this or FIM 0.07 to 0.09 a minute.*

Table 3. Welfare effects and reallocation over total sales in 1992 (=FIM 817.55 mill.).

	Welfare gain (= wg_1+ wg_2)	Reallocation of *'Excess Profits' to CS*	Δ CS
Consumers	wg_1		
	2%	*20%*	*22%*
Operators	wg_2	**Reallocation of *'Excess Profits' to CS***	**Net change in operators' profits**
	9.34%		
		−20%	*−10.6%*

reduction. Assuming , the net reduction in the profits amounts to FIM 87 million.

Table 3 shows us the approximate magnitudes involved in relation to total market sales, which in 1992 equalled FIM 817.55 Million.

With reference to other aspects of welfare we should not neglect a possible rate re-balancing by the operators, which could have offset these welfare gains. A brief study of the charges for domestic long-distance and international calls does not provide any strong evidence to support this view.[10]

Summing up, our calculations suggest a relatively large re-allocation from operators' surplus to consumers over a period of one year. Despite some bias resulting from the simple methods used, the total change in consumer surplus is likely to total a considerable amount.

5.2.2 *Remaining welfare losses from imperfect competition*

Despite the welfare gain we have experienced, the remaining imperfect competition still induces a social loss of welfare compared with the abstraction of perfect competition. To begin with, we estimate this potential welfare loss by using the C&W (1976) approach described above. The period examined includes the years from 1993 to 1999. Telivo entered the market (from 1st of March) in 1993 and the Finnet group entered in 1994 capturing a market share of about 52%. From that year on there was also a change in the definition of a long-distance call, as mentioned above, but this has not seriously altered the market shares of the operators.

The Herfindahl index is based on each operator's market share of the total minutes operated. The estimates of price elasticity of Finnish domestic long-distance calls vary a lot from one study to another. We have used the price elasticity for 'Tietoliikenne' (='Telecommunications'), from Sullström (1995). It is calculated as an average of the compensated and uncompensated price elasticities in 1990 and is equal to –0.977. Granfelt and Torniainen (1993) report values of price elasticity of –0.26 for the Finnish market. Lurdes (1999) estimates a price elasticity of –0.94 for the demand for calls in Finland. This study, like that of Sullström, is based on Almost Ideal Demand System (AIDS) estimation.[11] These estimates are within the range provided by Hausman et al. (1993) for the U.S. market for long-distance telecommunications[12], as they report price elasticities between –0.25 and –1.2 depending on the particular service provided. The market shares together with the Herfindahl index (*H*) and the calculated welfare loss over sales (as percentage = $|\, w \,|$), assuming a Cournot-Nash oligopoly, for each year are reported in Table 4.

The results in Table 4 suggest that, if this market is characterised by Cournot conjectures, the welfare loss over sales continuously declined between the years 1993 and 1998. A welfare loss over sales of about 10 percent would

[10] *See Björkroth (2000).*

[11] *See Sullström (1995) pp. 40–42.*

[12] *If we use data in Tables 2 and 3 we get an approximation of the price elasticity as –.811. This value corresponds to the values reported by Granfelt and Torniainen (1993, Table 6, p. 34).*

Table 4. The characteristics of and welfare loss in the Finnish market for long-distance telecommunications.

	Market share (%)*				H	|w|
Year	*Finnet*	*Sonera*	*Telia*	*Others*		
1993		*94.51*	*5.49*		*0.896*	*41.11*
1994	*51.88*	*45.97*	*2.15*		*0.481*	*11.84*
1995	*54.91*	*40.35*	*4.51*	*0.23*	*0.466*	*11.13*
1996	*55.12*	*39.92*	*4.65*	*0.32*	*0.465*	*11.08*
1997	*54.05*	*40.37*	*4.80*	*0.78*	*0.457*	*10.71*
1998	*55.20*	*36.97*	*7.02*	*0.82*	*0.446*	*10.19*
1999	*56.03*	*37.88*	*5.42*	*0.67*	*0.460*	*10.85*

* The market shares are based on spoken minutes and are obtained from the annual Telecommunications Statistics: Televiestintätilasto 2000 from Table 2.16, p. 24.

have meant a social loss of roughly FIM 40 million (in current prices) in year 1997.[13] In 1993 the turnover in domestic long-distance telephony was reported to FIM 793 million and if *w* is estimated to 41.11 percent, this suggests a welfare loss of FIM 325 million in that particular year.[14] [15]

What do these results imply for the intercept *a*, (the maximum willingness to pay) and can we use this to discriminate between assumptions regarding elasticity and market structure conduct? From (13) we can, given the market concentration, derive *a* for plausible combinations of price elasticity and marginal cost. For year 1993 for example, assuming the price elasticity of -.977 and letting marginal cost vary from FIM 0.1 to 0.125 a minute implies that *a* reaches a value from FIM 2.45 to FIM 3.06. These figures seem rather low, but still reasonable figures. Checking for the elasticity of -.5 yields much higher figures for *a*. The result for the remaining 1990s gives additional support to the sensitivity analysis regarding the price elasticity.

Assuming this structure, we may also speculate about the extent to which the potential welfare losses would be reduced, if the three largest operators shared the market equally. It is clear that these theoretical minima ($w_{\min}$) are well below the values of *w* shown in Table 4. Under various assumptions of price elasticity, these values would be

$$w_{\min}\big|_{e_p=-0.977} = 5.66 \quad , \quad w_{\min}\big|_{e_p=-1.2} = 4.61 \text{ , and}$$

$$w_{\min}\big|_{e_p=-0.25} = 22.13$$

In this case a large absolute value of elasticity would bring the welfare loss over sales in line with the losses in many Finnish industries as reported in Willner & Ståhl (1992).

5.3 Results for other market structures

Because of the large market share of the two largest operators, the estimated welfare losses of two large price leaders making Cournot conjectures (Case 2) are similar to the figures in the basic case, where all three participants are Cournot oligopolists. However, the basic model indicates a 2.5 per cent larger loss for year

[13] *The total sales in long-distance telecommunications is reported as 433 Million FIM, but the data provided consists of approximations and the compensations paid to other operators were not included in the data (See Table 12.4 in Televiestintätilasto 1998, p.74).*

[14] *For details see Table 7.4 in Televiestintätilasto 1994, p. 67.*

[15] *These results are not particularly sensitive to assumptions regarding linear demand. Applying the results of Willner and Ståhl (1992, p. 485), the potential welfare losses remain the same even if we assume that the demand is isoelastic.*

Table 5. Welfare loss over sales for the basic case and for other market structures.

	A price leading fringe & Cournot competition		***A price leading fringe & Stackelberg leader***		***A price leading fringe & collusion***	***Cournot competition (Case 1)***	
Year	$\|e_p\|$=0.977 *w*	$\|e_p\|$=0.5 *w*	$\|e_p\|$=0.977 *w*	$\|e_p\|$=0.5 *w*	$\|e_p\|$=0.977 *w*	$\|e_p\|$=0.977 *w*	$\|e_p\|$=0.5 *w*
1994	*12.25*	*23.93*	*5.44*	*10.64*	*49.00*	*11.84*	*23.13*
1995	*11.61*	*22.69*	*5.16*	*10.08*	*46.44*	*11.13*	*21.75*
1996	*11.56*	*22.58*	*5.14*	*10.04*	*46.22*	*11.08*	*21.65*
1997	*11.41*	*22.29*	*5.07*	*9.91*	*45.62*	*10.71*	*20.93*
1998	*10.87*	*21.23*	*4.83*	*9.44*	*43.47*	*10.19*	*19.92*
1999	*11.28*	*22,05*	*5.01*	*9.80*	*45.13*	*10.85*	*21.20*

1994. The assumption of a price-leading niche with a Stackelberg leader (Case 3) results in far more modest welfare losses, which, compared with the results of Willner and Ståhl (1992), are in line with results for other Finnish industries. At low elasticities of demand, the case of collusive price leaders (Case 3) leads to implausible results.[16] Even with an elasticity of demand close to unity the welfare loss is too high to be credible. Assuming that our model with linear demand is correct, this clearly undermines the idea that this is the prevailing market structure. In trying to discriminate between these models, the model with a price-leading niche including a Stackelberg leader is appealing. The ability of the Finnet group to capture more than half the market during its first year of operations signals an impressive strength. But we may speculate whether the prevailing market share of about 50% is a result of inability or lack of interest to expand further during the late 1990s. It is tempting to assume that the main interest of the operators involved was in more profitable markets, such as mobile telephony. If the two main operators were really involved in quantity competition, this would mean twice as large a relative welfare loss compared with having a Stackelberg leader in the price-leading niche. Assuming that the elasticity of demand is close to unity, a relative welfare loss of 5 per cent of the sales in year 1999 of the price-leading niche (FIM 306 mill.) would sum up to only FIM 15 million in current prices. Under the same assumptions the relative welfare loss in Case 2 would total more than FIM 34 million. Even if these absolute values are rather small, the relative loss can still not be considered negligible.

5.4 On temporal aspects of welfare gain

It would be desirable to determine the changes in welfare over time in this market. However the practical implementation of Harberger's method for this is quite complicated, as it is obvious from Table 5 that we cannot stick to the assumption of no shifts in the demand curve for the late 1990s. Thus, the point of time where it seems most reasonable to apply this approach is from 1992 to 1993.

An alternative way of calculating the welfare gain is, in contrast to the approach in section 5.3 above, to approximate ΔW resulting from

[16] *Under the assumption of linear demand, the maximum welfare loss over sales can reach 50 per cent. Applying an elasticity of .5 to Case 4 makes* w *exceed 90 per cent, which cannot be true.*

Table 6. The welfare gain (w_{t-1}-w_t) for each market structure over time (e_p= -.977)

Year	Cournot-Nash	Price leading fringe (C-N)	Price leading fringe (Stackelberg)	Price leading fringe (Collusion)
1993	79.18	15.52	6.90	62.07
1994	*N.d.*	*N.d.*	*N.d.*	*N.d.*
1995	0.38	-0.34	-0.15	-1.35
1996	7.11	5.23	2.33	20.93
1997	3.65	0.92	0.41	3.68
1998	5.72	6.03	2.68	24.12
1999	-4.12	-2.59	-1.15	-10.37

* The definition of domestic long-distance call changed in 1994. N.d. = Not defined.

Table 7. Potential welfare losses in FIM (1994) million.*

Year	Case 1 (-0.977)	Case 2 (-0.977)	Case 2 (-0.5)	Case 3 (-0.977)	Case 3 (-0.5)	Case 4 (-0.977)
1992	408.77	104.60	204.39	46.49	90.84	418.40
1993	329.60	89.08	174.07	39.59	77.36	356.33
1994*	56.24	56.50	110.40	25.11	49.07	226.00
1995	55.86	56.84	111.06	25.26	49.36	227.36
1996	48.75	51.61	100.84	22.94	44.82	206.43
1997	45.10	50.69	99.04	22.53	44.02	202.74
1998	39.38	44.66	87.26	19.85	38.78	178.62
1999	43.49	47.25	92.32	21.00	41.03	188.99

* Price elasticities in parenthesis.

opening up the market with (w_t + w_{t+1}). Here w_t denotes the welfare loss under monopoly using the CW-approach and w_{t+1} the potential welfare loss during, Cournot competition in the following period.

We may apply the same principle to the results of Willner and Ståhl (1992). The welfare gains for each market structure over time are presented in Table 6.

If we now compare the results from the Harberger approach with the results for a structure where all operators are engaged in Cournot competition, the welfare gain from opening up the market is rather similar. The difference may arise to a large extent from our assumptions regarding the marginal cost. The result would be identical for both approaches if c =*FIM 0.125*, which supports the assumption of Cournot competition in 1993.

The other alternative that we should consider is Case 4 where a price leading niche is engaged in collusion both prior to and after opening up the market.

Comparing the outcomes in the light of the marginal cost assumption it seems that from 1992 to 1993 market conduct was based either on that both operators were engaged in a Cournot game or in collusion. The presented in Table 6 enable us to rule out the case of a price leading niche engaged in Cournot conjectures or in a Stackelberg game. The welfare gain of opening up the market is just too small in these cases. However, from 1994/95 onwards it is difficult to say anything definite about the prevailing market structure. At this point the possibility of calculating the Lerner-index and following the approach of MacAvoy (1998) would prove most helpful.

This uncertainty is, however, not crucial from the welfare point of view, except for the case that we have shifted away *from* a collusive behaviour *to* a case with a Stackelberg leader. The

research of market dynamics may shed some light on this issue.

6. *Effects of market dynamics*

As the market structure may change over time, we should consider the effects of market dynamics on our results. There is no clear-cut prediction of the exact dynamics in this market available, but the results of Fershtman and Pakes (2000) may shed some light on this issue.

Due to the suppression of fierce price competition by the regulatory authorities, it is tempting to assume that we are facing a semi-collusive market where firms act non-cooperatively, not in pricing but in investment or marketing activities.

What does such a collusive framework imply on the price level and number of firms? Fershtman and Pakes (2000, p. 232) report a result which contradicts the assumptions made in this study. They suggest that prices will be higher when collusion is not allowed. This is a result of the dynamic incentives regarding investment, entry and exit characterising a non-cooperative market. However, Fershtman and Pakes (2000, p. 227–229) demonstrate an appealing case where entry occurs in a situation where the incumbent (still) has a high return on its investment (ω). The entrant is likely to be far behind the former monopolist and immediately after entry there will be full price and investment competition. To quote:

"...indeed if the ω of the initial incumbent continues to fall we will see two successive entry periods among three competitors with low ω's. This...does not last long (on average less than two periods) as one of the three firms typically falls behind its two competitors and exits.' (p. 229)

Regarding the effects of market structure on consumer surplus Fershtman and Pakes (2000, p. 230) argue that collusion generates higher quality products (services), but whether this actually makes consumers better off depends on the price level. Allowing collusion thus depends on whether the benefits of having high-quality services at relatively high prices outweighs the losses of having a lower quality service available to a larger group of consumers. Thus, a social planner who puts more weight on consumer surplus than on producer surplus is likely to prefer a collusive setting to a non-cooperative setting.[17]

In short, the arguments of Fershtman and Pakes (2000) imply that we should focus on some non-cooperative (price leading niche with a Stackelberg leader) setting in the early periods i.e. 1993 to 1995, for example. During subsequent periods the results should be based on some more collusive outcome.[18] Hence, the development of potential welfare loss depends strongly on the characteristic of the post-non-cooperative market structure.

7. *Conclusions*

The recent changes in the market for domestic long-distance telecommunications provides us with a useful framework to study, the welfare effects of increasing competition and, the remaining welfare loss associated with imperfect competition. The first result is a crude measure of the welfare gains associated with the lower prices due to entry into this market in 1993. No really precise values can be estimated owing to the lack of data and precise information, but we can approximate a welfare gain of 70 to 95 million (measured in FIM(1994)). Among other things we show that a vast amount of producers' surplus, about FIM 160 million, was transferred to consumers' surplus.

Provided that the effect of competition on lowering the quality of the service is negligible, collusive conduct will result in a substantial potential loss of welfare and should therefore be strictly suppressed. With these data and results alone the state of present competition remains blurred until we have some evidence

[17] *However, Fershtman and Pakes point out that they have omitted the distributional consequences of allowing collusion, implying that use of a more realistic distribution of utility functions would have showed that low-income consumers may prefer the inferior product (service). Thus, the level of income should affect the allowing of collusion.*

[18] *This is under the assumption that a period corresponds to one year. However, a 'period' can in this context be reduced to denote anything from one or a few weeks to a number of months.*

about the Lerner index, for example, over time. Therefore we cannot argue for increasing the competition further. However, the market concentration has increased since 1995, and therefore the potential welfare losses require the attention of the regulatory authorities. This conclusion holds despite the fundamental assumptions regarding price elasticity and the inability to state anything definite about the market dynamics.

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