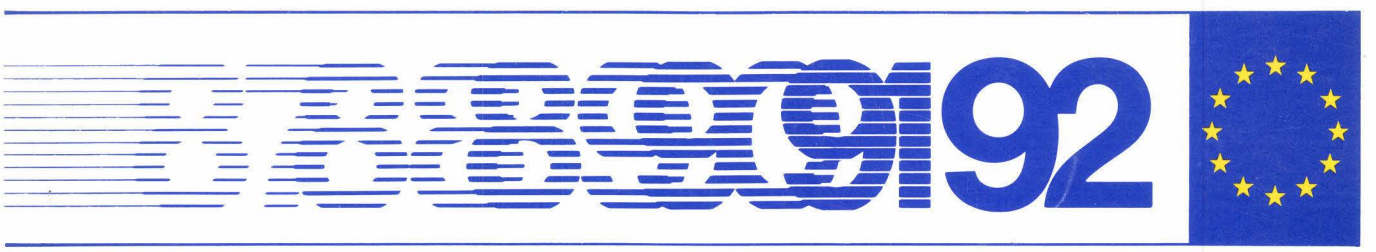
RESEARCH ON THE "COST OF NON-EUROPE"

BASIC FINDINGS

VOLUME 10



THE BENEFITS OF COMPLETING THE INTERNAL MARKET FOR TELECOMMUNICATION

— EQUIPMENT
— SERVICES

IN THE COMMUNITY

Document

COMMISSION OF THE EUROPEAN COMMUNITIES

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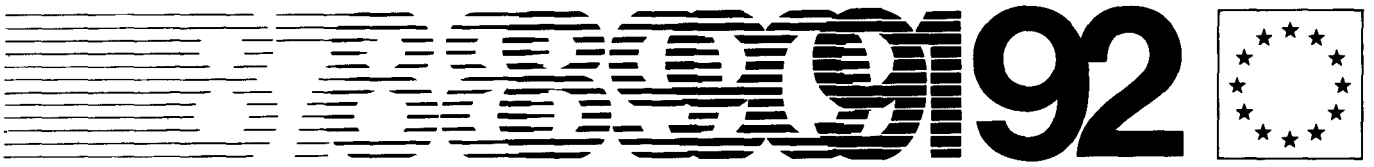

THE BENEFITS OF COMPLETING THE INTERNAL MARKET FOR TELECOMMUNICATION

— EQUIPMENT
— SERVICES

THE COMMUNITY

by

Jürgen Müller, INSEAD

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The Benefits of Completing the Internal Market for Telecommunication Equipment in the Community

INSEAD

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The Benefits of Completing the Internal Market for Telecommunication Equipment in the Community

FULL REPORT

Submitted to the European Commission

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Fontainebleau, April 1988

Jürgen Müller

Project Leader and Visiting Research
Professor of Industrial Organization

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1. Industry Background

1.1 Goals of Integration

One of the objectives of the European Community in completing the internal market by 1992 is to eliminate all current barriers to trade in telecommunications equipment. The 1985 White Paper by the Commission identifies the costs of physical and technical frontiers that need to be eliminated. The "Green Paper on the Development of the Common Market for Telecommunication Services and Equipment" spells these issues out in detail. Upon closer analysis, it is mainly "technical frontiers" due to different national equipment and network standards and certification requirements, and nationalist procurement policies, which account for the delay in achieving an effective internal European market. The aim of this study is therefore to concentrate on the effect of eliminating these barriers and to estimate in sectoral and macroeconomic terms the possible impact on individual countries and the Community as a whole.

1.2 The Products and their Markets

Telecommunication equipment is used to construct a telecommunications network infrastructure, for example with the aid of transmission and switching equipment and to have access to such networks with the aid of customer premises equipment (CPE). These three categories therefore make up the

most important market segments, in addition to a small set of miscellaneous products. Table 1.1 gives an overview over these four markets in Western Europe for the year 1986. This data, which is based on market surveys by the consultancy firm Frost & Sullivan, is one of several expert studies from market consultants which we have used. The reason is that in the official statistics no clear industry specific data sets exist, especially not on a comparable European basis. But expert studies often differ and the figures are often difficult to re-examine in terms of their original data and must therefore be taken at their face value, as a rough indication at best of the relevant magnitudes involved.

Table 1.1 indicates the dominance of central office (CO) equipment with almost half of the market volume. It is certainly the most complex piece of equipment in the market, determined largely by previous network investment (to ensure network compatibility), but also determining through its interface standard the major technology to be employed in the network and CPE market.

Table 1.1: **European Telecom Equipment Market (1986)**

	in Mill $	in Percent
Switching Equipment	7050	47
Terminal Equipment (CPE)	3600	24
Transmission Equipment	1950	13
Other Equipment	2250	15

Source: Frost & Sullivan, E 882, 1987, refers to W.Europe

The next significant market, according to the Frost & Sullivan definition, is terminal or CPE equipment with roughly 24 percent of total value, followed by transmission with 13 percent and a set of miscellaneous products with 15 percent. The overall market size was estimated to be 15b US $ in 1986, growing to 19b by 1990.

Different consultancy reports come to different agreements about the size of the market and the weight to be given to different product groups (Tables 1.2 and 1.3). The problem is apparent in Table 1.2, which represents the individual European markets on the basis of another consultancy study, in this case by Arthur D. Little (WTIP). Its market estimate for the EEC Market of the 12 with 17.5bn is already above the Frost & Sullivan Study's market estimate of $ 15bn for all W. European countries.

Table 1.2 puts the national and the EEC's market into an international perspective. It is estimated that the Communities share of the world market for telecommunication equipment is about 20 percent; each one of the member states has, when compared to the US (and even to Japan) only a small market share, with France, the UK and W. Germany as the largest national markets.

Table 1.2: **Telecommunications Equipment Market in the EEC, U.S. and Japan**

	1984		1986*	
	$bn	% of total	$bn	% of total
Belgium	0.7	1.0	0.8	0.9
Denmark	0.3	0.4	0.4	0.4
France	3.1	4.4	4.2	4.6
Ireland	0.1	0.1	0.1	0.1
Italy	1.4	2.0	1.7	1.9
Germany	2.9	4.1	3.6	3.9
Greece	0.2	0.3	0.2	0.2
Netherlands	0.6	0.8	0.6 2)	0.7
Portugal	0.2	0.3	0.2 2)	0.2
Spain	1.3	1.9	1.6	1.7
UK	3.3	4.7	4.1	4.5
(Sub total)	(14.0)	(20.0)	(17.5)	(19.1)
US	26.4 1)	37.7	34.5	37.8
Japan	6.8 1)	9.7	7.9	8.6
EC, US, Japan total	47.3	67.4	59.9	65.5
World total	70.0	100.0	91.3	100.0

Source: Arthur D. Little (WTIP)

1) 1985; 2) 1984; * 1986 estimate is in 1985 US dollars.

Table 1.3: **Telecommunications Equipment Markets in the Principal OECD Countries, 1984 (in Mill US $)**

	public switching	private switching	public transmission (incl. broadcast)	CPE
World Market	10000	9420	14590	6495
France	730	251	650	448
West Germany	457	492	690	400
U.K.	687	361	460	250
Italy	710	129	400	131
USA	2850	5400	5220	2830
Japan	627	808	1520	316
Canada	327	210	210	72

Source: Rausch (1987, p. 20)

Table 1.3 includes transmission equipment for broadcasting programs (TV and radio) which can increase the transmission market by roughly one third. Other studies include much of the office equipment market in CPE equipment, even if such equipment is only occasionally linked to a telephone network. While the exact size of the market is important for the actual scenario calculations, at the moment the estimates at hand suffice to indicate the broad magnitudes of these markets and their development potential.

The size of the telecommunications equipment markets is determined by the derived demand from telecommunications services. At the moment, most experts agree that in addition to the traditional voice segment of the telephony market, which makes up between 80 and 90 percent of telephony revenue, data transmission (including telex) will make up an increasing segment of the overall telephone market in the future.[1] While the voice market is growing at 5 to 6 percent

1 In 1986, 86 percent of Telefonica's revenue was from

per annum, data applications are growing at 15 to 20 percent per annum. It is not unlikely that revenues from data and image transmission may reach 30 percent of telephone revenue by the yar 2000. As a consequence, the weight of the CPE market pertaining to these applications will increase.

In this market, different procurement rules hold, as much of the CPE tends to be procured by private individuals (except for main telephones) so that restrictive certification rules and incompatible standards matter more than in the publicly procured switching and transmission market. For this latter market segment, restrictive procurement rules and specific national standards are more of a barrier to the completion of the internal market. It is important to note that the effects of completing the European internal market by 1992 will be different for equipment markets under public procurement from those under private procurement. It is therefore necessary to examine the determinants of industry structure in each of these markets first, before proceeding to analyze the effects of an effective internal market.

While the switching market may keep its current dominant position, as indicated in Table 1.3, the proportion of private to public markets is changing. Already, an increasing amount of switching activity is carried out at the customers' premise in so-called private branch exchanges (PABX). This

---

traditional telephony, 7.7 percent from telex and data, for BT the figures were 65.6 and 11.3, for the Bundespost 89 percent and 9 percent respectively, for Italy 88.7 percent and 7 percent.

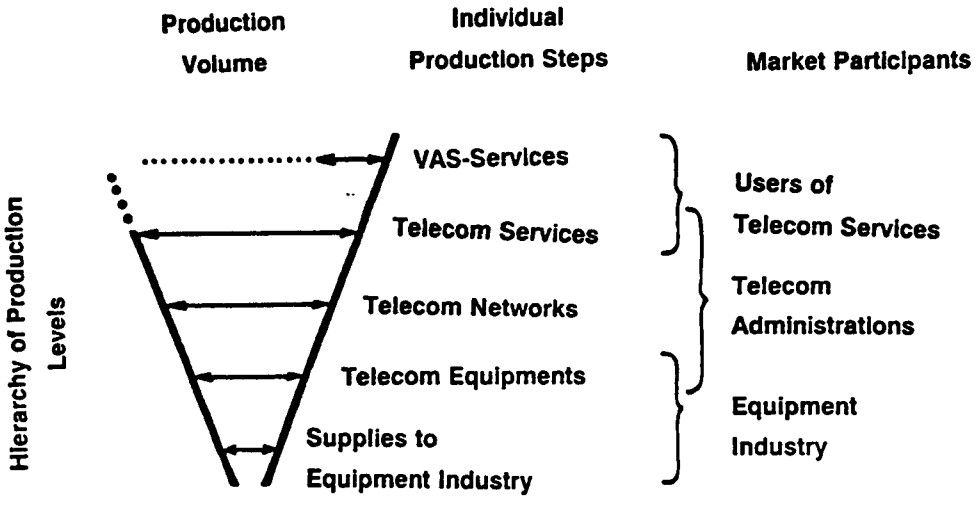
segment is being enlarged through the introduction of local area networks and other data services. As a consequence, 30 to 40 percent of the switching market may in the future lie outside the public procurement realm and be subject to different, more open procurement conditions.

To put the role of telecommunications equipment within a sector or within the economy into perspective, Figure 1.1 uses the concept of a value added cone (Davies, 1987). It describes the increasing amount of value added at each higher level of production. The cumulatively increasing production value at each higher production level is represented by an inverted cone. This value added chain in telecommunications services is intended to illustrate two things:

- The total amount of value added in the cone becomes larger with increasing telecommunication applications in the economy, encompassing more and more activities.
- The differences in industry structure at the different production levels.

If we move up the value added chain from component production (level one) to telecommunications equipment, we see that two activities at the bottom are characterized by a fairly competitive industry structure. The next two levels of activity, telecommunication networks and services, are under the realm of telecommunication administrations, which usually have a monopoly for setting up a telecommunications infrastructure and offering its services. It is their preferential purchasing policy, in addition to technical barriers related to different national standards, which account for most of the current costs of non-Europe.

Figure 1.1: HIERARCHICAL PRODUCTION CHAIN OF TELECOM MARKETS



Information services and value added network services (VANS) are one further production step, but they currently exist only for a small segment of telecommunication applications. They include services such as distributed data processing, access to data bases, electronic mail, electronic data interexchange (a support service for physical distribution systems or the linking of component producers, assemblers and distributors) as well as services such as telephone marketing etc. They are all based on simple network functions (such as transmission and switching) and can therefore be provided outside the traditional network monopoly. But here, like for CPE equipment, different national certification rules and restrictions on the use of the network services (usually leased lines and the inter-

connection to the public network) influence the evolution and integration of this market. It is therefore important to identify the market structure at each level, in order to assess the effect of a larger, integrated European market (Foreman-Peck and Müller, 1988).

The production level of interest in this study (level 2) concerns mainly the interaction between network operators (for equipment directly used in public networks), private network operators and customers who want to access such networks. In a second INSEAD study, the effects of a larger integrated market are analyzed for the next higher production level (level 3) that of telecommunication services (INSEAD, 1988).

1.3 Economies of Scale and Benefits from Specialization

The three main product categories to be analyzed, CO, transmission, and CPE equipment, all allow different degrees of international specialization, due to varying economies of scale in equipment production. Economies of scale are highest for CO equipment. Today's modern digital exchanges are nothing more than high performance computers that are specially designed for traffic switching and network control. Over 50 percent of value added consists of software cost that are independent of market size for given switches. To produce tools for software and hardware testing is also very much a fixed cost. Some components are custom-designed, adding another fixed cost element so that the economies of scale are in effect only limited by the size of the market. Western Electric produces 7m access lines p.a. at one plant in the USA, compared to figures well below 1m access lines p.a. in most large European countries. Even if a plant also produces large private branch exchanges (PBX), for which some component, software and testing tools might be simultaneously used, the European scales are still small, suffering from a cost disadvantage that is equivalent to 20 - 30 percent, when comparing a plant of 7m lines capacity p.a. to one of 1m lines p.a. in the larger national markets.

Table 1.4: **The Presence of Major Central Office Equipment Suppliers in Different European Countries (EEC and EFTA) 1986**

	EEC											EFTA		
	B	DK	E	F	UK	IRL	I	NL	P	D	A	CH	S	N
Ericsson		xx	xx	xx	xx	xx	xx	xx				xx	xx	
GTE							xx							
Alcatel	xx	xx	xx	xx		xx	xx	xx	xx	xx	xx			xx
ATT-Philips								xx						
GEC-Plessey					xx									
Siemens	xx								xx	xx	xx	xx		
Italtel							xx							
Northern/STC					xx						xx	xx		
Teli													xx	

1) refers to actual plant sites; excludes Greece

That even scales of this size are not possible is indicated in Table 1.4 which shows the distribution of CO manufacturers across Europe. Some of them have often more than one plant per country, with the smaller countries actually accounting for only a very small market demand.

The production of CPE products is also characterized by significant economies of scale, especially in PABX equipment. They are less important in the case of handsets and simple key telephones, as software costs do not inflate the fixed cost as much as in the switching products and variable costs are therefore much more significant. In addition, more components are standardized, off-the-shelf types, allowing

access to international specialist suppliers. This impression of lower barriers to entry and fewer cost penalties for smaller producers is reinforced by Table 1.5, which shows the current distribution of European CPE suppliers.

Table 1.5: **The Major Suppliers of CPE Equipment in Different European Countries**

	E E C										E F T A		
	B	DK	E	F	UK	I	NL	P	D	A	CH	S	N
Ericsson	xx	xx	xx	xx	xx	xx	xx	xx			xx	xx	xx
IBM	xx			xx	xx	xx			xx				
GTE						xx	xx						
Alcatel	xx	xx	xx	xx		xx	xx	xx	xx	xx	xx		xx
Philips	xx	xx	xx		xx		xx	xx	xx			xx	
Siemens/GTE	xx	xx	xx				xx	xx	xx	xx	xx	xx	
Northern/STC		xx			xx		xx			xx	xx	xx	
TIE				xx	xx								xx
Nixdorf									xx	xx	xx		

Other Suppliers

Sweden:	STA/Teli
Austria:	Kapsch, Schrack
Switzerland:	ASCOM
Denmark:	JTAS
Spain:	Amper, Elasa, Telefonica, Eletronica
France:	Matra-CGCT, AOIP, Barphone, SAT, Jeumont Schneide
Great Britain:	Plessey, GTC,
Italy:	Matra, Jeumont-Schneider, Dial, Telit, Olivetti, Safnot
Netherlands:	NEC, Nitsuko
Portugal:	CAEP
West Germany:	DeTeWe, Hagenuk, Krone, Bosse

Greece excluded

Economies of scale in transmission equipment (Table 1.6) are somewhere between these two products. For the production of cables, large plants (relative to the size of national markets) are required to fully utilize all the benefits of large scale production, but the scale penalties are not so large as in the case of CO equipment. While set up costs are high, fixed R&D costs are small by comparison, making the ratio of fixed to variable costs that much lower. Microwave transmission equipment is similar to CPE in its scale economies, especially for more standardized components, like repeaters and amplifiers.

In summing up, most equipment production is characerized by significant scale economies that would lend itself to extensive international specialization.

Table 1.6: **The Major Suppliers of Transmission Equipment in Different European Countries**

	EEC									EFTA			
	B	DK	E	F	UK	I	NL	P	D	A	CH	S	N
Ericsson		xx	xx	xx		xx		xx			xx	xx	xx
Alcatel	xx		xx	xx		xx	xx	xx	xx	xx		xx	xx
Marconi		xx			xx		xx						
Philips	xx	xx		xx	xx		xx	xx	xx				
Siemens	xx	xx				xx	xx	xx	xx	xx	xx		xx
Telettra		xx	xx			xx							xx

Other Suppliers

Sweden:	Relicana, STA/Teeli, Naika, NEC
Austria:	Kapsch
Belgium:	ACEC
Spain:	Indelec, AEG (Rail)
France:	Matra
Great Britain:	GEC, Plessy, STC
Portugal:	CAEP
West Germany:	ANT
Switzerland:	Northern Telecom

1.4 Limits to International Specialization

Taking the four major markets in level 2 together (CO, transmission, CPE and other products), we currently find highly protected national markets within each EEC member country. There is little intra-EEC trade, but a fair amount of exports to countries outside of the EEC (exports were roughly 23 percent of output, but only 30 percent of this goes to other EEC markets). Exports and imports are distributed fairly unevenly, with W. Germany being the greatest exporter to non-EEC countries, followed by France and the UK; the UK is the largest importer, followed by W. Germany, Italy and the Netherlands. Imports, at the moment, account for much less than 10 percent of final demand, a further confirmation of the national orientation of these markets. In addition to a small amount of intra-EEC trade, more than 50 percent of imports come from the USA and Japan. [1]

The reasons for this peculiarly "closed" market structure are threefold: selective procurement and certification policy, incompatible standards and "input specificity". "Buyer or input specificity" for individual products (the supplier delivers a good or a service which is specifically customized to the user's need, for example to allow compatibility with previous investment in a complex network system) is especially relevant for CO equipment. This input specificity, which is usually experienced in terms of specific national standards on quality specifications, makes it difficult to open up these national markets quickly, given the high

1 For details see European Research Associates (1985), Castello (1987) and EEC (1987).

adjustment costs of moving from one type of system or standard to another.[1] The degree of buyer specificity is less strong for transmission equipment, because the interfaces between different types of equipment have already been more or less standardized, allowing specialist suppliers to survive in different national markets. The same can be said for CPE equipment, except that here too nationally different certification standards play a role.

The other important determinant of the current market structure is the insistance of national governments on maintaining a "technology base" in such an advanced manufacturing sector as telecommunication equipment. As a consequence of the industrial policy outlook of national governments and their network operators, there are not only high barriers to entry, but also high barriers to exit. Even if economies of scale rise significantly in certain products, and there are strong signs for this especially in CO equipment, national or multinational manufacturers might not be allowed to rationalize and to close some national plants in order to reap all the available benefits of economies of scale and international specialization. Instead, they are often forced to maintain a production site and a technology base in each national market.

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1 There may also be slackness in buyers' inertia, which tends to reinforce input specificity, even when technical standards are converging.

2. Results of the Analysis on the Costs of Non-Europe

2.1 Status Quo Forecast

When analyzing the benefits of European integration, an "anti-monde" to the completion of the internal market by 1992 must be constructed as a reference point. These reference scenarios are based on what would happen if current industry trends were to continue without the extra stimulus of Community policy. In constructing such an "anti-monde" we notice that significant structural changes are already taking place in the face of stagnant national markets, but increasing international competition to better exploit the available economies of scale, even as much of each country's industry remains nationalistic in output. There is a fair amount of rationalization already taking place and more apparently to come. This would imply that some of the benefits of completing the internal markets are already being realized (see Appendix 2 for a list of the current cooperation agreements, mergers and joint ventures taking place in the industry). Furthermore, the market already has such an international dimension, that the large equipment suppliers tend to look more at market aggregates when deciding their new product policy and their overall, long term strategy, rather than just looking at individual national markets.

It is therefore necessary to specify in more detail those trends, which would happen independently of the completion of the internal market by 1992, even if they are difficult to distinguish in practice from the effects of the Green Paper. After discussions with industry experts our "anti-monde" consists of the following hypotheses:

- The movement towards joint interfaces and more common standards in CO equipment, combined with a more cost-conscious procurement policy would tend to reduce barriers to entry to national markets further. As a consequence, we would expecte the number of firms operating independently in the industry (Table 1.4) to be reduced in the next 3 to 5 years, i.e. from currently 8 to perhaps 5 major systems suppliers. Some of the subsequent specialization and rationalization would take place under the condition that national manufacturing sites continue to be maintained, while major systems are being adopted to meet local specifications.

- We make the same assumption for CPE equipment (see Table 1.5 above). However, since economies of scale are smaller in this segment of the market, the number of firms departing due to subsequent rationalization would only be 25 percent. However, import pressure would be increased with imports from outside the EEC.

- In transmission equipment, the industry structure would remain more or less the same as would the procurement policies of the network operators. This assumption is based on the already very developed level of

standardized interfaces that facilitate international trade, and the international outlook that characterizes already the present industry structure.

2.2 A Scenario in Accordance with the Recommendations of the Community's Green Paper

The next step is to assess the policy effects that would arise out of an implementation of the recent Green Paper's Recommendations and to differentiate them against status quo developments. It is therefore necessary to analyze these proposals in detail, as they affect the market for telecommunications equipment. The Commission has made a number of proposals (Proposals A - J) and accompanied them with a set of lines of action and an acceleration of existing action lines. Under the assumption that the Council of Ministers will act for these recommendations to take place before 1992 we would expect the current regulatory change to take place in a more consistent framework with a preference for a wider arena for competition and the availablility of more standardized European-wide services.

The major propositions that affect telecommunications equipment directly are Proposition A, D, E, F, G and H.

Proposition A allows the administrations to maintain their current monopoly role and the supply of infrastructure.

Proposition D not only recommends that a certain number of standardized services should become available European-wide, but that strict requirements regarding standards for the network infrastructure should be inforced in order to maintain or create Community-wide inter-operability.

Proposition E recommends non-discriminatory access to the network in terms of an open network provision. The mentioning of a consensus on standards, frequency and especially tariff principles is noteworthy.

Proposition F recommends that access to the network for CPE equipment should be free and unrestricted, subject only to minimal type approval regulation. This includes access to the satellite network via receive-only earth stations (ROES).

Proposition G recommends that regulatory and operational activities of telecommunications administrations should be separated to prevent conflicts of interest in the regulatory framework. This applies especially to areas such as CPE equipment, where the administration may be a regulator of access and certification rules while participating as a competitor in the same market.

Propositions H and I recommend the full application of the EEC's antitrust rules (Articles 85, 86 and 90) so that conflict of interest issues, predatory pricing and unfair cross-subsidization between competitive and non-competitive services can be avoided.

Finally, Proposition J recommends full application of the Community's common commercial policy to telecommunications. Since trade at the moment in this area is mainly on equipment is very crucial in bilateral trade negotiations, for example vis-a-vis the USA and Japan.

The likely effects of such a scenario have to be distinguished between those applying to the market for public procurement (mainly CO and transmission equipment) and that for customer premises equipment. The increasing move towards stricter European-wide standardization and Community-wide network inter-operability should lower change-over costs between different types of equipment, thereby allowing greater specialization and easing the potential for competitive procurement. Open network provision and more cost-oriented tariff recommendations will greatly facilitate the market for value added networks and the associated equipment necessary to support it. A more liberalized certification policy for CPE equipment should significantly lower barriers to entry. Together with proper rules against predatory behavior, major effects ought to be seen there.

2.3 A Scenario of Full Service Competition

The Commission accepts the right of the telecommunication administrations to maintain their monopoly provision of infrastructure services. Nevertheless, one very

large Community market, that of the UK, has already moved in the direction of network competition and there is a chance that France too, which represents almost a quarter of the EEC's telecommunication equipment market may move in this direction. In Italy too, factual network competition might emerge, perhaps not in a legislatively guided way, but as a matter of fact as has happened with broadcasting competition recently. These developments suggest that a scenario of full network competition[1] ought also to be considered. It represents a useful reference point against which to compare the status quo scenario and that based on the policies envisaged in the Green Paper.

The underlying features of such a scenario would be characterized by developments which we have already seen in the US, the UK and Japan. It would at least imply the possibility of other network providers to enter (mainly in the area of long-distance transmission) and for such services to be interconnected to the local loop and to international networks.

---

1 Full network competition refers to the kind of network competition that is taking place in the long distance market in the U.S.A., Canada (only for the data segment of traffic) and Japan. Competition in the local loop is only partly permitted, so that complicated "interconnect" agreements are necessary to allow customers access to alternative long distance carriers (Huber, 1987).

3. Methodology to Estimate the Costs of Non-Europe

3.1 Price Comparisons as Indicators of Selective Procurement Policy and Incompatible Standards

3.1.1 Observed Price Variations

From the consultancy study on public procurement (WS/Atkins,1987), plus our own interviews[1] and market surveys, we have obtained estimates of the prices for different equipment types currently being paid in Europe and compared them with "competitive world market prices".. The resulting differences in prices may - as a first approximation - be used as an indicator of the potential savings that could arise if the completion of the internal market would have similar competitive effects. In other words, one could assume in the extreme that the best prices that are currently obtained by a few national network operators could also be obtained by the other operators if fully competitive open procurement policies were used. However, as the resulting analysis shows, these differences must be analyzed more thoroughly before such interpretations are justified. On the one hand, there may be quality differences associated with current price disparities. On the other, the products being compared differ. For some equipment, such as CO equipment, installation and training costs may be included in the price paid by one administration, but not in that paid in another. Similarly, software unbundling (from hardware) might make hardware prices for CO equipment artificially low in one country, while their bundling in another country may overstate the price differences. Furthermore R&D costs are often paid out of a separate budget so that such prices

1 See Appendix 3 for firms and institutions contacted.

reflect only variable manufacturing cost. The same is true for many export contracts that form the basis for the observed "competitive world market prices". The price deviations in Table .1 must be seen with these caveats in mind.

Table 3.1: **Total Telecom Equipment Investment and Observed Price Deviations (Public Market, 1985)**

Country	PTO investment ECU million	percent price deviations CO	transm. (% more than)	CPE 1)
Belgium	500.00	120	60	40
Denmark	350.00	30	30	40
France	3,800.00	50	30	40
Germany	5,200.00	100	50	80
Greece	325.00	n.a.	n.a.	n.a.
Italy	3,100.00	100	30	40
Ireland	200.00	n.a.	n.a.	n.a.
Luxemburg	15.00	n.a.	n.a.	n.a.
Netherlands	550.00	50	n.a.	60
Portugal	235.00	n.a.	n.a.	n.a.
Spain	1,600.00	50	40	30
United Kingdom	3,400.00	40	30	40
Total	19,275.00			

Source: Price deviation: Country Interviews, investment: ITU

1) These price comparisons relate to prices obtain for international tenders and these observed in the US Market after the AT&T divestiture.

Table 3.1 also summarizes the 1985 construction budgets of the telephone companies in the EEC member countries on the basis of the ITU statistics. These figures often also include a fair amount of expenditure for buildings, cabling and vehicles as a comparison with the total market estimate of ADL indicates. In most countries, the ITU figures would seem to overestimate the actual public market by 20 to 30 percent. The figures for Italy and W. Germany are clearly out of line and must be adjusted downward, to be more in line with the ADL figures cited in Table 1.2 above.

The next three columns in Table 2.1 represent estimated price deviations from competitive world markets. They are highest in central office and CPE equipment (where they are sometimes more than twice the "competitive" price level) and significantly lower for transmission equipment. These figures are however only rough estimates on the basis of a Delphi[1] study. They, nevertheless, indicate significant price deviations, not only if compared to competitive prices received abroad (not only on export contracts, but also on prices paid in the U.S. and, for example in Norway, where more open procurement was practiced), but also significant deviations among the countries. Belgium, Germany and Italy head the list for central office equipment with Denmark and the UK being at the low end.

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1 A Delphi study relies on industry experts' opinion, who are interviewed in an interactive way.

Some of these price deviations are transitory, however, and have to be interpreted with great care. The UK has for a long time been among the high-price countries, but BT has now, with a more open internationally oriented procurement policy been able to bring down its equipment prices significantly when it decided to abolish its system of "Court suppliers". Belgium too tried in 1987 to abandon its relative high pricing policy, which it needs to sustain current R&D and export activities in the equipment industry (almost 50 percent of Belgian output is exported, one of the highest ratios in Europe). Their recent price agreements (1987) have come down significantly, especially for central office exchanges. This not only reflects the productivity advances of a move to more modern electronic equipment, but is also a result of paying for some of the R&D expenses and export subsidies out of a separate public budget. The relatively low deviations in France may also be explained by paying separately for R&D prototypes (Foreman-Peck and Müller, 1988, Chapt. 4).

As a consequence, these deviations are at best indicators of a structural imbalance. A complete move to competitive world market price levels in CO equipment may not sustain the amount of R&D necessary, even if, for the continous systems development, as we assumed for the "anti-monde", the number of firms in the industry was to be reduced by 40 percent.

Similar arguments apply with respect to transmission and CPE equipment. As mentioned before, transmission is, of course, much more standardized so price differences are bound to be

lower. Nevertheless, in a number of segments, where nationalist procurement policies are being pursued (for example in satellites and earth stations, fibre optics etc.) significant price differences may be observed.

For CPE equipment, quality, or what could be called perceived quality differences, may explain some variations in prices. The rest is undoubtedly related to fairly restrictive and protectionist procurement policies and cumbersome certification programmes. This might also apply to other products, for which we have not estimated actual price differences.

3.1.2 The EEC Green Paper fully Implemented

3.1.2.1 The Effects on the Public Market

Two effects are likely to be dominant. One of them arising out of increased Community-wide standardization, another arising out of the opening of public procurement contracts according to the EEC Directive 77/62[1] and its more recent recommendation 84-550.

Concerning standardization, the most important effects will be felt in central office equipment, where a number of different non-compatible systems currently exist. Their architectural conception is so different, however, that standardization will not bring about increased rationalization or more open markets. Instead, this process will have more to do with the industry restructuring and the

1 Originally, only 10 percent of public procurement contracts in telecommunications equipment had to be advertised Community-wide; that proportion is to be raised to 50 percent as an interim proposal before a full opening of the market by 1992.

Table 3.2: **Maximum Price Reductions for Major Product Groups (1985)**

	Total Market (m ECU)	Possible Price Reduction CO[1] (30 %)	in %	in m ECU	Possible Price Reduction Trans-mission (23 %)	in %	in m ECU
Belgium	800	240	50	120.0	184	25	46.0
Denmark	400	120	10	12.0	92	10	9.2
France	4200	1260	20	252.0	966	10	96.6
W.Germany	3600	1080	40	432.0	828	20	165.6
Greece	200	60	n.a.		46	n.a.	
Italy	1700	510	40	204.0	391	10	39.1
Ireland	100	30	n.a.		23	n.a.	
Netherl.	600	180	20	36.0	138	n.a.	
Portugal	200	60	n.a.		46	n.a.	
Spain	1600	480	20	96.0	368	15	55.2
UK	4100	1230	15	184.5	943	10	94.3
Total	17500	5250			4025		

	Total Market (m ECU)	Possible Price Reduction CPE[1] (23 %)	in %	in m ECU	Possible Price Reduction Others (23 %)	in %	in m ECU	Total Reduction in m ECU
Belgium	800	184	15	27.6	184	15	27.6	221.2
Denmark	400	92	15	13.8	92	15	13.8	48.8
France	4200	966	15	144.9	966	15	144.9	638.4
W.Germany	3600	828	30	248.4	828	25	207.0	1053.0
Greece	200	46	n.a.		46	n.a.		
Italy	1700	391	15	58.7	391	15	58.7	360.4
Ireland	100	23	n.a.		23	n.a.		
Netherl.	600	138	25	34.5	138	15	20.7	
Portugal	200	46	n.a.		46	n.a.		
Spain	1600	368	10	36.8	368	20	73.6	261.6
UK	4100	943	15	141.5	943	15	141.5	561.7
Total	17500	4025			4025			

1 For CO and CPE equipment WS/Atkins have conducted another study, using 1987 data. Their figures, which are based on observed price differences, indicate similar magnitudes.

closer collaboration between different manufacturers, developing new switching systems. Comparin the EEC's role in addition to that already carried out by the other international standard-setting bodies would lead us to suggest some price reductions in future switching costs if more of the interfaces can already now be standardized and greater interworkability is achieved. This suggests savings in the neighbourhoood of 5 to 10 percent out of a total CO switching market of about 5bn ECU are possible. Indirect effects out of increased competitive pressure because of greater compatibility might in the medium term lower central office costs by another 5 percent, so that the total effects of the Green Paper fully implemented, at least as far as the public market for CO equipment is concerned, could be as high as 0.4-0.7 bn ECU p.a. (Table 3.3).

For transmission equipment we expect much smaller effects of the Community's policy on standardization. Already now, international standardization and interoperatability of transmission components have achieved very high levels. It is only the indirect effects as a result of more competitive procurement that might help to reduce transmission costs by 5 percent. Similar arguments hold with respect to CPE equipment and other components.

The second effect concerns the opening of the public procurement sector in telecommunication equipment mainly regarding network equipment. The EEC recommendation 84-550 foresees that 10 percent of total tenders are advertised internationally. If this recommendation is interpreted selectively, in other words applied only for those products, for which the domestic industry

does not have to be protected, or where the size of the order is so small to not attract international offers, the effect could be quite minimal. On the other hand, if it was used to the strategic advantage of the telephone administration, for example in the area of central office equipment, the effect could be quite large. This was quite clearly seen by the recent struggle for the takeover of the French equipment manufacturer CGCT with a market share of only about 15 percent. In this case, there would also be an important signalling effect, as it would be difficult to justify a higher price for identical, but not competitively procured switching equipment.

For this reason we shall make two assumptions. The first assumes that the 10 percent rule is very restrictively applied. The second assumes that the envisaged opening up reaches 40 to 50 percent by 1992[1] and is used to the greatest advantage of the purchaser. In the former case, the effect would essentially be zero.

On the second assumption, the effect could be quite significant, as is evident from the figures obtained in Table 3.2 on the basis of the price deviations in Table 3.1. The possible price reductions are calculated on the assumption that the deviations from world market prices overstate the difference to a viable long term competitive price level by 20 percent.[2] Nevertheless, significant savings might still be possible. The savings would be largest in the high price

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1 This is perhaps an overly conservative assumption, since the Commission could easily attempt to reach 100 percent by 1992, but such a policy would face less opposition from the member states.

2 We assume that world market prices do not cover full average costs, but are closer linked to variable costs. A price deviation of 20 percent above world market prices may therefore be considered as a more realistic long term competitive solution.

countries Belgium, Germany, Italy, but also significant in France and the Netherlands. They would be relatively small in Denmark and the UK.

A comparison with the price estimates that were obtained by WS/Atkins (1987) seems to confirm these magnitudes. They expect higher savings in Germany and in the UK.

While the assumptions underlying Table 3.2 are somewhat crude and estimates have not been attained for all countries, the potential savings as a consequence of opening up 40 - 50 percent of the public market could be as high as 3bn ECU (out of a total of 17.5 bn ECU) (Table 3.3).

What is the likelihood of the full exploitation of a 50 percent open procurement rule in the near future? Given the magnitudes involved in the restructuring necessary to achieve such savings, considerable political opposition could be expected. This would make it very difficult for the telephone administrations to adapt an open procurement rule aggressively. If they were able to do so, recourse could nevertheless be taken to extra government funding from other public sources to maintain the current

level of activity and employment in the industry. As a consequence, the 3b ECU savings estimated in Table 2.2 represents only the maximum price reductions possible,[1] but these are difficult to achieve in practice. Instead, most administrations would try to apply open procurement rules in areas where structural adjustments costs are less high and easier supportable politically. This would suggest a minimum benefit of price reductions in the neighbourhood of 1b ECU. But this still would require a fair amount of continuous prodding by the Commission, a policy not necessarily conducive to the spirit of collaboration needed to reach agreement on other issues, such as standardization and joint certification.[2]

3.1.2.2 Private Markets

Table 2.2 already included estimates of potential price reductions in the market for CPE equipment and other telecommunications equipment. These effects are partly related to the public market, since the telecommunication administrations will act as a competitive distributor in these markets as well. Any savings attained there will be passed on to consumers requiring a likewise action by private distributors to stay in the market. To this extent the benefits of an open procurement policy as far as they extend to private markets have already been anticipated.

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1 Together with the 0.4 - 0.7 bn ECU from an effective European-wide standardization.

2 Nevertheless, the Commission seems to have become much more active recently, as the number of new directives issued indi-

There is, however, another significant effect to be considered, namely that of market enlargement and product diversification as a consequence of Community-wide certification according to minimal certification criteria.

The Green Paper envisages that the CPE market should be completely liberalized, in other words, the distribution of certain terminals on an exclusive basis by the administrations should stop. Furthermore, the Council Directive 86/361/EEC concerning the first phase of the establishment of mutual recognition of type approval for CPE (adopted June 1986) should lead to a much more common market in terminal equipment in which entry barriers are considerably lower. To achieve this end, a combination of standard-setting and reduced regulation (including the conflict of interest issue that can be solved through a separation of operation from certification) is necessary. Since the EEC's Directive also insists only on "essential requirements" for certification, the envisaged regulation of a common CPE market could come very close to the US model of certification under Part 68 by the FCC. [1]

This would have important dynamic implications as is indicated by the recent growth in the US CPE market. Since these growth rates were particularly large in the market for simple telephones which is actually a very unsophisticated market. Between 1978 and 1984 the number of telephone handsets owned privately increased from 1 percent to 60 percent. As a consequence of private purchasing, depreciation

rates dropped considerably, simple handsets were replaced much more frequently than before, leading to significantly larger turnovers (MAC, 1986, p. 4). Similar tendencies, though perhaps less dramatic, occurred in PABX and key systems. As a consequence of faster depreciation rates, sales also increased significantly. In addition, the increased competition reduced equipment prices faster. Between 1983 and 1985 the average price per PABX access line dropped by 20 percent to roughly 800 US $, the price for key systems dropped to 450 US $ per line[1] (NTIA, 1985, p. 14). These results are the effects of low entry barriers and a larger market, allowing firms to innovate faster while at the same time adapting a much more aggressive pricing strategy to gain a long term market share. To sum up, the potential dynamic efficiency gains in the CPE market arise mainly through influencing the innovation process and the associated market growth effects as a result of lower entry barriers. If that can be combined with a larger market, allowing firms to innovate faster while at the same time adapting a much more aggressive pricing strategy to gain a long term market share, the increased competitiveness will have further innovative and price reducing effects that may yet further stimulate total demand for both CPE equipment and network use.[2]

On the basis of these considerations, the dynamic effects could be equivalent to 50 percent of the static potential for price reductions identified in Tabel 3.2 (i.e. 50 percent of .7bn ECU). In addition, one could envisage an increase in the market volume

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1 in current dollars.

2 See also DIW (1984, Chapt. 3) for details on the CPE side, and INSEAD (1988) for details on the network usage effects of increased CPE liberalization.

of CPE equipment by 10 to 20 percent above the current growth trajectory. If a profit margin of 10 percent of this market growth is used as an indicator of the extra economic benefits, a further economic gain of up to .1bn ECU could be achieved.[1] (Table 3.3)

3.1.4 The Effects of Full Network Competition

We have argued above that the recommendations to open up the public procurement market might not be carried out because of political opposition from equipment suppliers, unions and regions affected by the subsequent rationalization of the industry. If network competition were introduced however, the telecommunication administrations would have to behave very differently as compared to the scenario envisaged in 3.1.3. Given the threat of market entry, they could no longer afford to purchase at preferential rates, but would have to purchase on commercial terms, as has been evidenced by the changing behaviour of BT and the American long-distance carriers after the introduction of network competition. In this case, the full effects of open procurement that we indicated in Table 3.2, could be realised easier.

The effects of network competition, even if at the moment politically unrealistic, provide at least another reference point against which to adjust the results of the recommendations of the Green Paper. They also indicate the full effect of open procurement policy, if the Commission can overcome political obstacles from national administrations.

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1 A 10 percent market increase is equivalent to .4bn extra sales, yielding 0.05bn ECU extra benefits, a 20 percent increase yields 0.1bn ECU.

3.2 An Integrated Approach

Our previous analysis rested on separate price comparisons which can be observed under conditions when the European market is segmented. In other words, prices in some markets are significantly higher than in others and firms use the different price-cost margins in each market to sustain their overall production operation. In a truly integrated market there would be a movement towards a one-price area in which prices should not differ significantly from outside markets. Sizeable savings would then only be possible if they were realized through higher productivity in production, increased specialization because of utilization of economies of scale and scope and a reduction in the number of products available overall (even though it is likely that there will be increased product variety in each national market. Only in such an environment will a price drop of the magnitude suggested be feasible without the firm's in the industry going out of business or being unable to maintain their R&D effort necessary to sustain current and future levels of research and development and product innovation.

To model such an evolution, we have analyzed the production structure of the major equipment firms (CO, CPE, transmission and VANS) and considered what happens under different

assumptions about scale and price elasticities if a number of countries are involved in an integration and rationalization process that may be characterized by the move to the internal market by 1992. [1]

The basic idea behind this model, which follows very much an earlier study on the specialization arising from international trade in the presence of significant economies of scale, is derived from Dixit and Norman (1980). Their basic assumption is that if significant economies of scale are present which are not explcited in national markets, any enlargement of the market (i.e. through a customs union) will allow further rationalization to take place. The surviving firms will be able to move along their declining long-run average cost curve, thereby passing significant productivity savings on to consumers, until a new equilibrium is reached.

The size of a market is described in conjunction with scale economies by the number of firms it can support. In order to keep the model simple we assume equal sized firms. We must therefore abstract from the actual size distribution of firms to an "equivalent number" of equal sized firms. Some assumptions about these equivalent numbers are necessary, of course, to identify the proper number in each sector. We have used the following numbers for the typically large EEC member country, partly based on the data in Tables 1.4 and 1.5:

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1 See Appendix 1

Central Office Equipment	2
PABX Equipment	3
Telephone Handsets	4

The price elasticity of demand is brought in by assuming that the size of the market depends not only on the number of supplying firms but also on their output per head of population.

In a first example we assume that if six equal sized European countries create a customs union, integration increases the market size available to a national firm by a factor of 5.[1] National producers now face a five times larger market, but five times as many competitors. With a relatively low price elasticity (-.53),[2] we can show that at the new equilibrium there will be 33 firms remaining (instead of the previous 60) and output per head[3] increases by 30 percent. The benefits of integration are then directly consumed in telecom's output and in other output as there is to be no excessive profits in the Dixit-Norman model.

Further simulations show that the gains in consumption (in other words, the benefits to the economy) as a consequence of greater specialization are greater, the smaller the number of firms in the closed national market and the greater the expansion of the market. This would imply that small countries, for example Belgium, the Netherlands or Portugal, will gain more from market integration

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1 This is only an approximation as a comparison with Table 1.2 shows. The market expansion effects for a French or W. German manufacturer would be smaller, but larger for an Italian or Spanish firm.

2 in absolute terms and 10 firms per market.

3 measuring the benefits of integration.

than large countries if they start out with the same number of firms. While this is not normally the case in other industries, it does seem to be true in telecommunication equipment, as Tables 1.5 - 1.7 show. On the other hand, they may have no national producer left at all, a consequence which they may not be willing to accept for industrial policy considerations.

As long as price elasticity is below $|-1|$ and the number of initial firms large, the larger the number of firms that will remain in the industry. If price elasticity is above $|-1|$ and the number of firms is small (an indication of significant economies of scale), the proportionate change in the number of firms increases. In other words, a high price elasticity[1] indicates that the trade off between specialized and uniform products favours the lower cost uniform products. As a consequence, the proportional change in the number of firms increases much more in those markets where economies of scale are especially important (for example CO equipment), while the effects are somewhat smaller for those products, where economies of scale are exploited earlier. The lesson is clear, however. The eventual industry structure that emerges depends very much on the interaction between economies of scale and demand preferences (as indicated by the relevant price elasticity):

- If a national market can support very few firms, because economies of scale are high, then the benefits of integration are very high, as in the case of CO equipment. But welfare gains drop very quickly as the initial number of firms increases and economies of scale effects lose their importance.

- If the price elasticity of demand is high, even monopolists will find it in their interest to bring prices closer to cost so that the proportionate change in the number of firms is smaller and the benefits (i.e. the change in telecom consumptions) declines.

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1) in absolute terms

In other words, the big consumption gains as a result of integration occur in those sectors where, because of the fewness of firms, the degree of monopoly is high and, because of "input specificity", price elasticity is low. This indicates not only the assumptions underlying the model, but also what we will have to look for in the real world. In other words, it is not sufficient to just look at price differences, economies of scale, and the benefits of integration, but also what pricing policies are currently pursued by those equipment suppliers who have a degree of market power and the tradeoff between economies of scale and specialization.

3.3 An Assessment

We attempted to identify the effect of the completion of the internal market by first analyzing the determinants of the current industry structure, secondly observing significant price differences within the EEC (compared to the rest of the world), and on this basis predicted the likely effects of the full implementations of the Green Paper on market prices and volume.

The figures were based on two main scenarios: firstly, a status quo scenario where current trends continue; and, secondly, based on the Green Paper, a comparative scenario allowing for the effects of standardisation and with two levels of procurement liberalisation, one at 40 percent, the other at 100 percent. The gains from standardisation (because of better exploitation of economies of scale) were estimated at 0.85bn ECU to 1.1bn ECU. The additional gains from competitive procurement are estimated at 2.2bn ECU under the 40 percent scenario and 3.7bn ECU under the 100 percent scenario.

So, totalling all effects, these can vary between 3.05bn ECU and 4.80bn ECU, depending on the degree of openness of the procurement market.

Table 3.3: **Possible Effects Under the Green Paper Scenario**
(in billion ECU)

Products	Effects of standardisation: Static	Dynamic	Effects from procurement liberalisation 40% liberalized Static	Dynamic	100% liberalized Static	Dynamic
Central office switching	0.25/ 0.5	0.2	0.8		1.3	
Transmission		0.2	0.4		0.5	
Customer Premises Equipment		0.1	0.4	0,2*	0.7	0.5*
Other		0.1	0.4		0.7	
Total	0.25/0.5	0.6	2.0	0.2*	3.2	0.5*

* Market expansion effects

These findings were supported in a theoretical model that analyzes the tradeoffs between market enlargement, economies of scale and price elasticity and the likely equilibrium that would result in terms of industry structure.

Nevertheless, the positive results so far should not hide further stumbling blocks to integration. It seems that national industry objectives and differentiated standards will continue to play a rolefor a time to come. The full fruits of integration can only

take place, if some common agreement between the governments concerned can accompany this restructuring, for example, about where centers of R&D and the relevant national technology base ought to be located (as in the case of the Airbus Consortium), etc.

4. Other Points

The major effects of completing the European market in telecommunications equipment ought not to be seen on the industry itself, but on the users of these products, that means telecommunication network operators and the users of their services:

- The more efficient and the more flexible and versatile such services can be provided, the greater will be the productive benefits at the higher levels of production.

- The more competitive and the more flexible the interlinkage between demand for old and new services and equipment suppliers can be made, the faster the process of innovation, the quicker the benefits of the technology potential inherent in modern telecommunication equipment can be passed on to the economy as a whole.

Obviously, the effects of more innovative network provision are significantly related to the benefits of more efficiently organized input markets. But telecoms equipment is only one of the inputs; labor, buildings and land is another. For these other inputs too, preferential criteria often play a role, leading to cost inflation. It is therefore also important to see to what extent savings in the other input markets are possible and how they can be realized and activated, not only to reduce the production cost of a key input into the economy, but also to free resources for other, more productive uses.

Opening up an effective internal EEC market to outside suppliers also implies something about the degree of international specialization to be realized. Those markets that have already opened their telecommunications equipment sector to outside competition (such as the U.S. and to some extent the UK) have found that in the less sophisticated product market, for example in simple telephone sets and key telephones, Far Eastern suppliers have a definite advantage

and have gained important market shares. Is this result also to be expected with the completion of the internal market? If there was no suitable transition period and the domestic suppliers were not adequately prepared, such a scenario is certainly likely. But our interview evidence also suggests that already now assembly costs for these types of product tend to be very low (below 10 percent of f.o.b. price). As a consequence, there is little reason to assume that even for those products a fully rationalized production system cannot be set up, which can compete effectively with low-cost suppliers form the Far East in order to maintain a significant EEC presence in these markets as well.

5. Conclusion

In summing up we find significant savings as a result of moving towards the completion of the European Community in telecoms equipment. The reasons are insufficient exploitation of scale and specialization economies as a result of limited national markets and the insufficient competitive pressure because of protective procurement policies. Trade is also hampered by insufficient standardization and excessive certification requirements in the CPE market. In all telecom applications, the geographical enlargement of the telecommunications equipment market would have important consequences. To move from a national regulatory framework to at least an EEC-wide regulation would help to exploit some of this potential as it creates right away a larger unified

market. As a result a number of marginal applications will come into the realm of profitability, allowing further experimentation with technology and demand.

For this reason the issue of the unified European market in telecommunications equipment must not be seen as a threat but rather as a potential. The potential lies not only in increasing the available market area and therefore making certain applications profitable, which otherwise, would have to be foregone, but it also stimulates the competitive pressure at each of the different levels of equipment production and utilization. Increased competition means painful restructuring for some, but it also means lower prices and an increased application potential for others with important demand expanding effects. Furthermore, since telecommunications equipment is to a large extent an intermediate input, these competitive effects will be felt throughout the Community by creating a larger and wider activity of application. "The relevant geographic markets" would be extended so that regionally or nationally concentrated markets may become more competitive within a more international framework. The benfits of this are obvious. It seems therefore worthwhile to take on some of the current restructuring costs which are necessary to get there not only for component and product suppliers but also for the network providers and their staff.

References

Atkins, W.S. (1987)
The Cost of Non-Europe in Public Sector Procurement, Epsom, Surrey, Volume 3 of EC (1988)

Castello, N. (1986)
Intra-EEC and Extra-EEC Trade Flows in Telecommunications Equipment , January - June 1986, Preliminary Report, Brussels, December.

Davies, J.D.M. (1987)
The Intelligent Universe, Northern Telecom, Toronto.

DIW (1984)
Economic Evaluation of the Impact of Telecommunications Investment in the Community, Berlin.

EC (1987)
The European Telecommunications: Market and Trade Fact Sheet, July Edition, Brussels.

EC (1988)
Research on the "Cost of Non-Europe", Basic Findings, 16 Volumes, Luxemburg.

European Research Associates (1985)
Intra-EEC and Extra-EEC Trade Flows in Telecommunications Equipment, Brussels.

Foreman-Peck, J., J. Müller (eds.) (1988)
European Telecommunications Organization, Nomos, Baden-Baden.

Huber, P.W. (1987)
The Geodesic Network, U.S. Government Printing Office, Washington, D.C.

INSEAD (1988)
The Benefits of Completing the Internal Market for Telecommunication Services, Fontainebleau, part II of this volume.

MAC (1986)
Der Einfluß der Ordnungspolitik, des Wettbewerbs und der Entflechtung auf das Fernmeldewesen der U.S.A., Washington, D.C.

NITA (1985)
Competition Report, Department of Commerce, Washington, D.C.

-A.1-

Annex 1 A Scenario for the Completion of the European Market, Using the Dixit and Norman Model

Here we examine the quantitative consequences of a series of assumptions, which are fair characteristics of European telecommunications markets, when the individual national markets are extended by the removal of barriers to trade between member countries. We restrict our analysis to telecommunications equipment and VAS. We exclude the PSTN, because there is typically only one supplier per nation in the PSTN market and we do not envisage a further reduction in suppliers would be politically feasible. Consequently any efficiency gains in the PSTN from completion of the European market may be of a different nature than that observed in the other two markets.

The production of customer premises, central office and transmission equipment and VAS may all be represented, as a first approximation, as taking place under conditions of constant marginal costs but where fixed costs must also be incurred. These fixed costs include factory overheads, research and development expenditures and certification outlays. The ratio of fixed to variable costs determines the extent of economies of scale in production. They are least in CPE and most in central office equipment, but for each product depend upon the technique of production employed. Each European

market has a number of telecommunications firms (n) each producing an output (x) which we choose to measure in units per head of population or household. Following Dixit and Norman (1980) (as we do in the whole model), we make this choice because completion of the European market means increasing the number of potential customers (population) which national telecom firms may be able to serve. (We ignore for the moment, that these customers may want the products as means rather than ends).

Entry into national telecom markets is assumed to be free enough for excess profits to be bid away. Each firm is supposed to choose output so as to maximise profits, taking the outputs of competitor firms as fixed. In order to keep the model as simple as possible, consumers are imagined to demand the products of the telecommunications industry so as to maximise a preference function into which the consumption of telecoms (c) and non-telecom products (c_o) enter separably (the marginal utility from telecoms is not affected by the level of consumption of non-telecoms).

The functional form of preferences is:-

$$U = g(c) + c_o$$

These preferences are maximised subject to a budget constraint in which units are defined so that non-telecom products have

a unit price and consumption of such goods are the negative of the cost of telecoms production. That is, we ignore income per head (y) from all other sources except profits from the telecom industry, on the grounds that only such profits are affected by the problem under analysis.

$$y = pc + c_o$$

where p is the price of telecoms. The cost of telecoms production per head of population is expenditure on telecoms (pc) minus profits on telecoms (y), that is $pc - y = -c_o$. Hence the lower are telecoms production costs, the greater is the well-being of consumers ($U = g(c) - (pc - y)$ so when $pc - y$ falls, U rises).

Market equilibrium yields the following relationship between increase in market size (measured by population) and expansion of number of firms in the market:

$$dn/n = (n - E + Z)/(2n - E + Z - 1) \cdot [dH/H]$$

where E is the inverse price elasticity of telecoms market demand,

Z is the elasticity of E with respect to consumption of telecoms, i.e. $Z = E' \cdot [c/E]$,

$\frac{dH}{H}$ is the proportionate expansion of population with market extension

$\frac{dn}{n}$ is the proportionate growth in the number of firms

The growth in consumption of telecoms per head depends not only upon the number of supplying firms in the market but also on their outputs per head:

$$c = nx$$

$$dc/c = dn/n + dx/x = [1/(n-E+Z)] \cdot [dn/n]$$

With these two equations we can ascertain the approximate gains from opening up the Western European telecommunications equipment market. We can employ the model to gain an idea of the impact on users, i.e. telecoms and end users of services of completion of the European market by assuming that the national markets of the UK, France, Italy, Germany and Spain are all of roughly equal sizes and constitute the whole of the European Community market.[1] Then from the viewpoint of the firms in any one of these countries, European integration increases the market size by a factor of five (dH/H = 5). As a first example we assume each country has ten telecom equipment

[1] For simplicity's sake, we have not added a 6th or 7th fictitious country to resemble the population of all EEC member countries.

suppliers (n = 10) and the price elasticity of demand (pe) is 0.5. Hence the inverse price elasticity E = 2. If we assume a constant elasticity E, then Z = 0. With these numbers, the number of firms in the new 'average' national market (dn/n) increase by 2.35, that is from 10 to 33.5. But previously there were a total of 50 firms in the aggregate of the five markets. The number of telecom suppliers in the European Community falls consequently by about one third. Each of these suppliers now produces a smaller output per head (of the total market) but the number of heads in the market has greatly increased, with the consequence that the total output of each firm has increased and economies of scale have been utilized to a greater extent. $\frac{dx}{x}$, the proportionate change in output per head of each telecom firms is (7/8) 2.35 and dc/c, the proportionate increase in telecom consumption, is (1/8) 2.35 ~ 0.3 or 30%.

-A.6-

Table A.1

Results of Simulation of enlarged market size on extra consumption and number of firms

	Changes in Consumption dc/c by factor:				Changes in number of firms dn/n by factor:		
E\n	3	5	10	n	3	5	10
2	1.67	.71	.3		1.67	2.15	2.35
1	1.25	.62	.28		2.5	2.5	2.5
1/2	1.11	.48	.27		2.78	2.65	2.57

The proportionate gain in consumption as a consequence of greater specialisation is greater the smaller the number of firms in the closed national markets, and (although it is not shown here) the greater the expansion of the market. Thus small countries, such as Belgium and the Netherlands, gain more from market integration if they start out with the same number of identical firms. The initial number of firms in the market may be taken as the channels by which scale economies impinge upon the industry. Sectors such as CPE with smaller scale economies will, for a given demand, be able to support more firms. In such sectors the consumption gains from integration will be less than for central office equipment, where economy of scale effects are thought to be large.

A more realistic and detailed assessment of the effects of completion of the European market involves choosing parameters

that take into consideration some of the simplifications of the model. In the current model all firms have similar cost functions and supply similar products, so that each produces a similar sized output. European telecom markets in fact are characterised by skewed size distribution of firms, which may be accounted for by product differentiation or buyers' interests in dual sourcing to ensure security of supply. In choosing the appropriate values of 'n' for our scenarios we therefore correct the actual firm size distribution to obtain something closer to the 'numbers equivalent' concentration measure. We compute the size of the main national markets and estimate the number of equal size firms that might survive, given the cost advantages of scale in those markets in Table 8.7.

The average numbers we propose are:-

n = 2 for central office equipment
= 3 for PABX
= 4 for telephone handsets
= 20 for VAS

Given that there are around 200 VAS suppliers in the UK market the VAS figure may seem the most inappropriate. However by far the majority of VAS firms are small, supplying niche products which we believe to be mainly location specific or software for the videotex market, which has different scale parameters than the rest of the VAS market. Our figure of 20

covers therefore only larger enterprises which are likely to export VAS to the rest of the Western European market, given a chance. We also assume that those countries which at the time of writing have not established a regulatory framework that allows a national VAS market to flourish, will have done so by the time the integration of the European market is completed.

The telephone handset figure raises the question of the extra-European trade regime assumed in the scenario. In a world free trade regime, telephone handsets are likely to be imported from outside Europe, probably largely by established telecoms suppliers, as has happened in the UK[2]. Under this regime certain telecom products may continue to find export markets or even increase their foreign sales. That possibility allows for a greater number of firms and lower costs through enhanced utilisation of scale economies. An alternative plausible foreign trade regime is one of 'Fortress Europe' where imports are restricted by controls, tariffs, certification rules, standards or voluntary export restraint. In effect the CPE regime in most EC countries is like this at present since foreign suppliers must in effect have a domestic subsidiary if they are to be permitted market entry. Such a regime would be consistent with our assumed n value for telephone handsets.

[2] See NITA 1985.

Moving to the PABX and central office equipment markets we have to acknowledge that the model, based upon differential calculus, is poorly adapted to the discontinuities that arise when n is small. The model may require fractions of a firm which obviously could not exist. The assumption that all profits are dissipated by competition then becomes impossible to fulfill, because even though there are supernormal profits there is no room for another firm to enter. With the magnitude of the market expansion envisaged in this scenario this problem is likely to be of little importance in the alternative world.

Another crucial point is the fulfillment of the stability condition

$$n - E + Z > 0$$

As n becomes smaller with unchanged E and Z, the chances of the above condition being violated apparently increases. However suppose that the demand curve for telecoms is linear. Then E varies directly with c and consequently

$$E'c/E = Z > 0$$

so that even if $n = E$, as when there are two firms and the price elasticity of demand (pe) is 1/2, the stability condition is fulfilled. Those markets with a small number of suppliers, in particular central office equipment, also seem likely to have price inelastic demands, on the derived demand principle.

-A.10-

Central offices are inputs into telecom services but account for a relatively small proportion of the costs. As an approximation, the price elasticity of demand for inputs is the product of the share in costs and the price elasticity of demand for the final output, telecom services. Since both terms are fairly small, so also will be the input demand price elasticity. The logic of the stability condition can be seen most clearly in a monopoly industry; n=1 where Z=0. Then if the price elasticity of demand (pe) is less than 1 (E > 1) a profit maximising monopolist will be unable to choose any output.

Innovation in the telecoms industry, linked with the convergence with computing technology, is likely to provide an offsetting influence to the low elasticity of demand that has been inferred from the historical record. New services, once they become accepted, will face price elastic consumer demands and therefore the equipment which is necessary to take advantage of these services, will face more price elastic demands than formerly.

-A.11-

Table A.2

Results of simulation of enlarged market size

	Proportionate change in number of firms with market expansion by 5. dn/n				Proportionate change in telecom consumption dc/c			
	CO	PABX	Telephones	VAS	CO	PABX	Telephones	VAS
pe\n	2	3	4	20	2	3	4	20
(pe = .53) E = 1.9	.45	1.77	2.06	2.44	4.5	1.609	.98	.134
(pe = 1) E = 1.0	2.5	2.5	2.5	2.5	2.5	1.25	.833	.131
(pe = 1.5) E = .666	2.86	2.69	2.63	2.52	2.143	1.152	.788	.130

Given these numbers, the big consumption gains occur in those sectors where the number of firms is small for there the degree of monopoly is high. By contrast in VAS assuming a low price elasticity of demand just above 1/2, the number of 'firms' falls from 100 to 68.9 but the increase in consumption is little more than 13%. When interpreting these results, the assumptions underlying these numbers must be kept in mind.

-A.12-

Dixit and Norman's Model of Scale Economies

and Imperfect Competition

c_o = consumption of all other goods per head

c = consumption of telecom products per head

Utility function: $U = g(c) + c_o$ (1)

p = price of telecoms, y = lump sum income of consumers

Consumer budget constraint: $c_o + pc = y$ (2)

From (1) and (2),

the inverse demand function: $p = g'(c)$ (3)

Xj = Production by firm j

f + bXj = cost of production for firm j (f and b are constants)

xj = production per head of firm j

H = number of heads in the market

f + bHxj = f + bXj

Total production per head in the industry: $c = \sum_k x_k$

Profits of firm j: $\pi_j = H[g'(\sum_k x_k)xj - bxj] - f$

First order condition for a profit maximum: $g' + xjg'' - b = 0$

The inverse elasticity of market demand from (3):

$E = -cg''(c)/g'(c)$

Hence the first order condition may be written:

$g'(c)(1-Exj/c)-b = 0$

-A.13-

The second order condition for a profit maximum:

$$2(c/xj) - E + Z - 1 > 0$$

where $Z = E'c/E$, the elasticity of E with respect to c

x= the value of production per head common to all firms

$$(xj/c) = (x/c) = (1/n)$$

where n is the number of active firms in the industry.

A Cournot-Nash equilibrium holds for all firms in the industry.

The first order condition can be written

$$g'(nx)\ [1 - E(nx)/n] - b = 0 \qquad (4)$$

The second order condition

$$2n - E + Z > 0$$

A necessary condition for stability of this equilibrium is

$n-E+Z > 0$

$\Pi(n)$ = profits per firm per head

Entry ceases when $\Pi(n) \geq 0$ and $\Pi(n+1) < 0$

The number of active firms in the industry is determined by the integer part of $\Pi(n) = g'(nx)x - bx - f/H = 0 \qquad (5)$

Output per firm is determined by the first order condition (4)

A larger market is equivalent to increasing H.

Rearrange (5) to

$$g'(nx) = b + (f/Hx)$$

and differentiate logarithmically

$$\frac{dn}{n} + E\frac{dx}{x} = \frac{f/Hx}{b+f/Hx} \cdot \frac{dx}{x} + \frac{dH}{H}$$

But $(b + f/Hx) = g'$ and $f/Hx = (g'-b)$, so using (4) and rearranging:

$$dn/n + [1 - 1/n]\, dx/x = 1/n \cdot dH/H \qquad (6)$$

Differenciating (4) logarithmically

$$-Edn/n - Edx/x - (E/n)/(1-E/n) \cdot [Zdn/n + Zdx/x - dn/n] = 0$$

Cancelling and rearranging

$$dx/x = (1-(n-E+Z))/(n-E+Z) \cdot dn/n \qquad (7)$$

Substituting from (7) for (dx/x) in (6) yields:

$$dn/n = (n-E+Z)/(2n-E+Z-1) \cdot dH/H > 0 \qquad (8)$$

$nx = c$ consumption per head. From (7)

$$dn/n + dx/x = [1+(1-(n-E+Z))/(n-E+Z)]\, dn/n =$$

$$= [1/(n-E+Z)]\, dn/n$$

References

DIXIT, A. and NORMAN, G.:
Theory of International Trade, Nisbet, Cambridge, 1980.

Appendix 2 Selected List of Mergers and Joint Ventures (1984-1987)

A) Telecommunications Equipment

1. Alcatel, the French equipment group, acquired the European activities of ITT

2. Ericsson, the Swedish producers, won the take over of the French equipment group CGCT, together with MATRA

3. In Italy the telecom manufacturers Italtel und Telettra attempted to form Telit, they collaborate together with GTE (now Siemens) in ITALCOM

4. An agreement between GEC and Plessey to merge their telecom business in a 50:50 joint venture

5. ITT's sale of its stake in STC to Northern Telecom of Canada

6. CGE, Siemens, Italtel and Plessey have cooperative links

7. Philips has a joint venture with ATT for C.O. (5 ESS) and transmission

8. Siemens has a joint venture (50:50) with GTE of the US (switching, transmission, R&D, manufacturing) that affects STE's European markets

9. BT acquired the majority interest in Mitel, the Canadian PABX manufacturer

10. Plessey acquired Stromberg-Carlson of the US

11. NTT, NEC, Fujitsu, Hitachi and Oki collaborate on project D60/70

B) Computers

12. IBM bought Rolm, a leading US manufacturer of office communications systems

13. In Britain STC purchased ICL, the computer maker

14. Ericsson formed links with Honeywell, the US computer firm

15. ATT and Olivetti link up.

Appendix 3 List of Firms and Institutions contacted during the Course of the Study

Bundespost

Philips

Northern Telecom

Federal Communication Commission

OFTEL

PTT Netherlands

OECD

Italtel

ITU

University of Lausanne

Bell Communications Research

Plessey Telecommunications & Office Systems LTD.

Olivetti & C. SPA,

AT&T Communications, U.S.A.

Bundeskammer der Gewerblichen Wirtschaft, Wien

Northwestern University

Massachusetts Institute of Technology

Universita Cattolica, Milano

The Brookings Institution

Dittberner

Siemens AG

Cable and Wireless PLC

IBM

GTE

British Telecom

RTT

Alcatel

DeTeWe

Bell Canada

France Telecom

The Benefits of Completing the Internal Market for Telecommunication Services in the Community

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The Benefits of Completing the Internal Market for Telecommunication Services in the Community

FULL REPORT

Submitted to the European Commission

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Fontainebleau, April 1988

Jürgen Müller

Project Leader and Visiting Research Professor of Industrial Organization

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Final Report

The Benefits of Completing the Internal Market for Telecommunication Services in the Community

1. Industry Background

1.1 Goals of European Integration in Telecommunication Services

One of the objectives of the European Community in completing the internal market by 1992 is to eliminate all current barriers to trade. This does not only apply to goods, but also to services (including telecommunication services), an issue specifically addressed in the EEC's Green Paper on the development of the Common Market for telecommunication services and equipment (COM (87) 290 Final). Its purpose is to initiate a wide-ranging discussion on those issues and to help in the establishment of a coherent Community-wide framework in the ongoing changes to the present system of telecommunications regulations. The aim of this study is to estimate the effects the Community policy will have on this development, both in sectoral and macroeconomic terms. This development will be compared against a status quo scenario,

as well as one of full network competition in long-distance services, as exempliefied by recent institutional changes in the U.S., Japan and the United Kingdom.

1.2 The Product Telecommunication Services

Telephone services are based on telephone networks, which link various parties through fixed (or mobile) networks electronically with each other, so that interactive exchange of information (voice, message, data, image) is possible. They are generally provided by public telecommunication organizations (PTOs), who exercise the monopoly for providing these services. Telephone services, which are derived from private telecommunication infrastructure (for example public utilities, such as rail, electricity etc.) cannot be sold to third parties. As a consequence, when we talk about telecommunication services we usually refer to those services provided by the national telephone administrations. Table 1.1 Summarizes the economic importance of these services in different Community countries. In 1986 the revenue from such services in the EEC was 62.5bn ECU (out of a "World" total of almost 300bn ECU). The four large member countries dominate the service market, followed by Spain, the Netherlands and Belgium. Most of the PTOs' revenue is from voice (85 - 95 percent). The rest is accounted for by telex and data services,[1] as well as TV programme transmission. With the

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1 Telex revenue ranges from 5 to 6 percent of revenue in Belgium, Italy, the Netherlands and Portugal, from 3 to 4 percent for Germany and the U.K. Revenues from Data services are probably equivalent to this sum. See ITU Yearbook 1987.

introduction of ISDN, data and image transmission are expected to increase significantly.

Table 1.1: **National Income from Telecoms Service Provision (1985)**

Country	Operating Income in mill. ECU	in % of GNP
Belgium	1,405.45	1.6
Denmark	1,075.90	1.7
France	13,428.15	2.1
Germany	15,123.62	2.0
Greece	720.58	2.2
Italy [3]	8,351.00	
Ireland	623.54	3.8
Luxemburg	82.07	
Netherlands	2,538.72	2.0
Portugal [1]	678.90	3.4
Spain	3,154.35	1.8
United Kingdom [2]	14,244.99	3.2
Total	61,714.31	

1) CCT and CLT 2) BT only 3) SIP only

Source: Telefonica/ITU
Exchange rates as of 1985

The telephone services, as we know them today (Figure 1.1), have not really changed that much over the first 90 - 100 years of their life, that is until about 1960. Most of the service applications to which the telephone network was put consisted of simple voice transmission. The efficiency of providing this service has, of course, greatly improved over

time, as the network grew larger, using economies of scale and fill. The equipment and its handling was modernized with important technical developments in transmission and switching (brought mainly about by the introduction of microprocessors, computers and modern transmission tools, such as satellites and fibre optics) and with an associated fall in cost for the provision of telecommunication services. The lowering of cost and the increased potential to connect data processing and office equipment as well as mobile terminals to the telephone network has meant that new kinds of terminal attachments can be connected to the telecommunication network for information transmission (Figure 1.2). With the change over from analogue transmission techniques to digital signal transmission (where information is converted into binary codes of 0's and 1's), a number of these services can now be integrated, in other words, use the same network. This allows voice, data and images to be transmitted via the same telephone lines.

Important applications can also be expected with respect to value added network services (VANS). These are mainly of the following types:

- message storage, processing and distribution, for example mailbox services, electronic mail and facs services (for third parties), telex forwarding, etc.;

Figure 1.1: Traditional Telephone Network

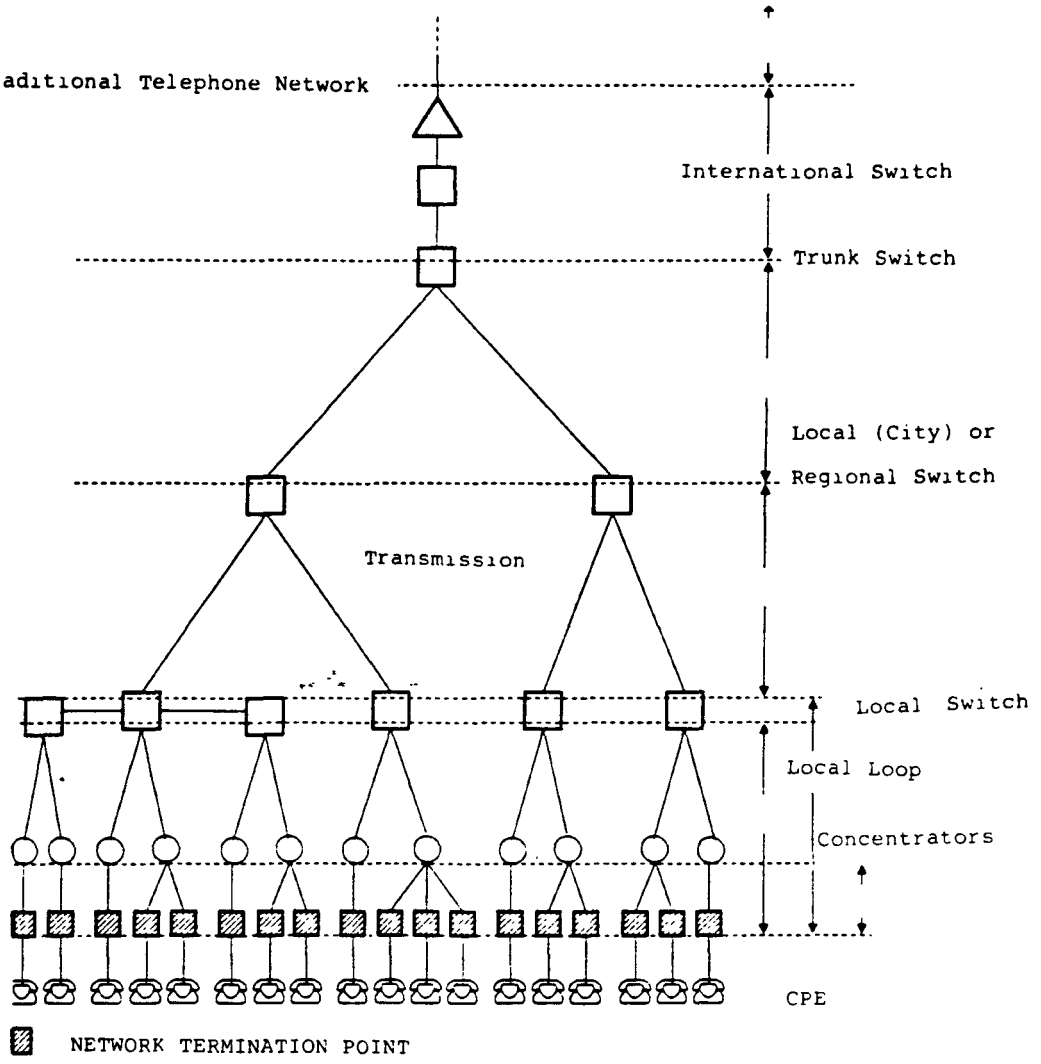
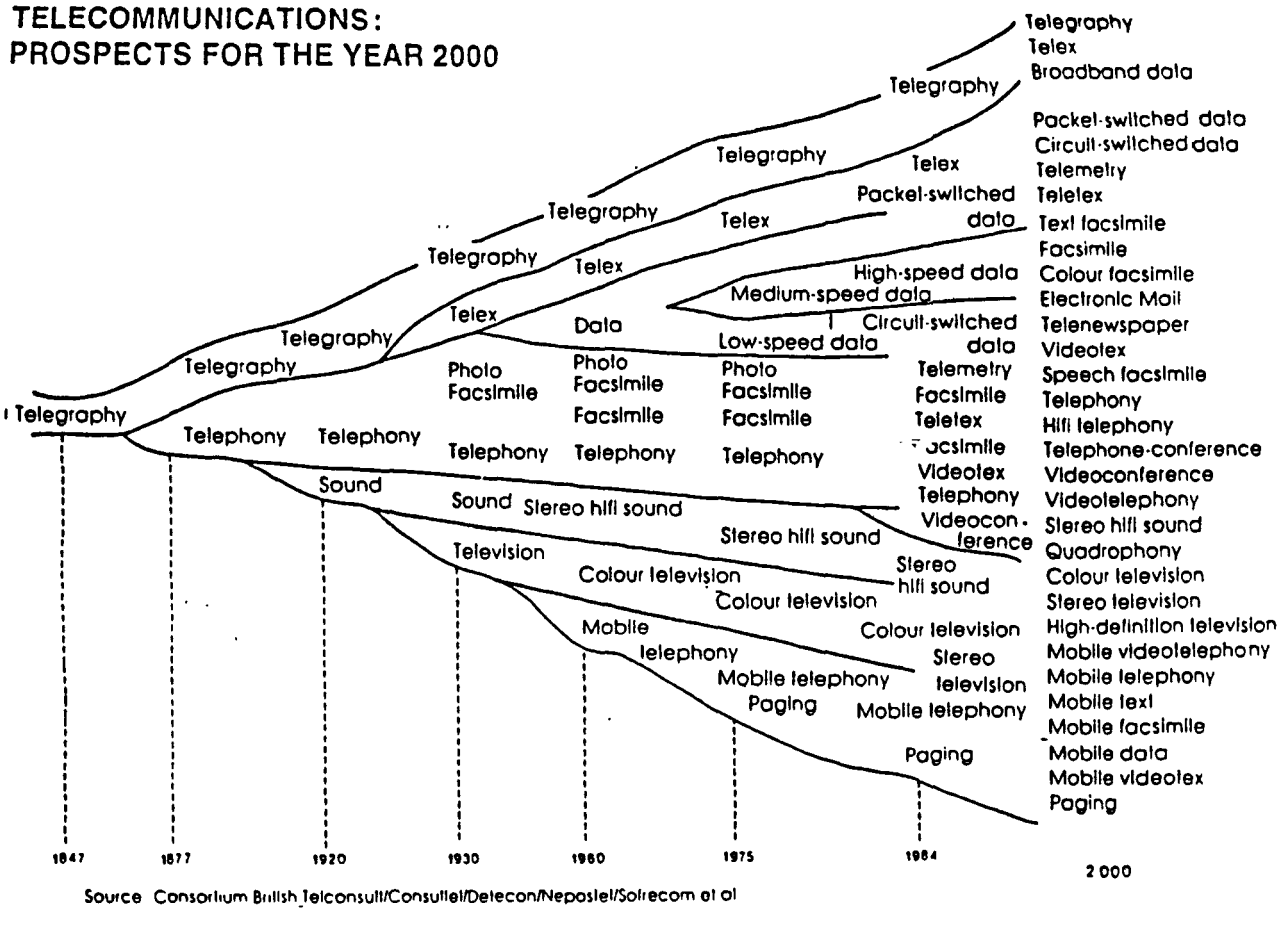


Figure 1.2:



- code and protocol conversion between different data processing systems;

- information retrieval services, for example from videotex data bases (both private and public), commercial data bases;

- information processing services, for example through electronic data interchange, e.g. for electornic ordering and billing (for example in financial and tourist markets, but also for real goods between firms, suppliers and distributors etc.);

- safety and alarm services etc.

The largest markets at the moment are information retrieval, electronic mail and electronic data interexchange, including distributed data processing.

With the broadening of telecommunication services its economic importance has grown despite the fall in real cost for each individual service activity. Telecommunication is therefore becoming a much more critical area for influencing the communication system within an economy, not only helping to link the various markets and activities better, but also to enlarge the geographic size, over which markets are now possible. As a consequence, its impact goes much beyond the national frontiers of an economy so that regulatory decisions

about by whom and how telecommunication services are being run must also be taken at higher international levels. The Community here has an important role to play.

1.3 Trade in Telecommunication Services

Trade in telecommunication services does not really take place in the way that international specialization normally occurs,[2] because the provision of telecommunications network infrastructures generally requires the physical presence of the network provider in the geographical area in question. The international telecommunications network infrastructure has traditionally been produced jointly by the national Telecommunications Administrations, or Recognised Private Operating Agencies, of the countries concerned. For connecting international traffic, neighboring carriers will forward (transit) traffic onward to its final destination and vice versa and are therefore reimbursed accordingly. The "trade balance" will be settled periodically, but since much of the traffic is in both directions, large imbalances that would give rise to a trade deficit or surplus are not the norm. In the case of bilateral telephone traffic the situation is similar to one of a bilateral monopoly with the relevant accounting and sharing rules negotiated accordingly. For traffic that may transit a number of countries or go via alternative routes, some elements of competition are introduced since the possibility to play off one transit country

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2 i.e. via comparative advantage and specialization.

against another may lead to rate reductions. Furthermore, some countries have consciously lowered their international rates in order to attract extra transit revenue. This is, for example, the case on the transatlantic route where several telecommunication administrations own parallel transatlantic cables. The access to competing satellite networks creates a similar incentive, even though their services are by nature produced internationally. At this stage international organisations, like INTELSAT, but also EUTELSAT, Arab Sat etc., provide the international space segment and produce services jointly with the Telecommunications Administrations on a bilateral basis. They can form part of network infrastructures but can also be part of the provision of services.

This tendency to attract transit traffic from other carriers or to improve the competitive position of their carrier and those segments of industry that are especially sensitive to telecommunications cost (such as banking) has introduced some elements of competition which may lead to increasing "international" specialization in the future. This phenomenon has been increased with the policy of the U.S. administration to spread its domestic deregulation policy abroad. With the appearance of several additional international carriers such competition could further increase, especially if they are linked to competing national networks, as in the case of the U.S., the U.K. and Japan. As a consequence, increased

competition could change the rules of the game significantly so that eventually, purely administered production structures may be replaced by more economically determined ones.

Trade does, of course take place on services transmitted via the telephone network or produced in direct conjunction with it, as in the case of VAS services. The attractiveness of telephone tariffs may, for example determine where the "host computers" for data banks are located, while "telebanking" may further those financial markets that have access to especially cost effective telecommunication services.

With the increasing internationalization of the economies, the growing importance of tourism and international financial services, demand for international telecommunication services is increasing so that the telecommunication administrations see this as an important source of revenue.[3] Increasingly, domestic carriers will set up international companies in another carrier's territory, not only to assist its customers, but also to explore the potential for economic activites in that country.[4]

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3 In 1986, the revenue share from international calls ranged between 14 and 16 percent for Telefonica, DBP and PTT Denmark; it reached 19 percent for BT.

4 Cable and Wireless, the parent company of the British carrier Mercury has bought a network in the U.S.; Ameritech, one of the seven large American regional carriers has bought the VAN carrier AirCall in the U.K.; Telefonica, the Spanish carrier is involved in acquisition of the Argentine PTO and failed, together with France Telecom, in a bid to acquire the Chilean PTO.

1.4 Barriers to Integration

In the 1985 White Paper by the Commission (COM (85) 310) the costs of physical and technical frontiers are identified as basic obstacles to completing the internal market by 1992. The main advantage of reducing these frontier costs would be a greater integration of markets, in other words making them more competitive, while at the same time allowing increasing specialization and utilization of economies of scale. In telecommunication service provision economies of scale are already realized at a national level since except for the U.K., we have only one operator[5] and one physical network (for the moment ignoring the sizeable networks of public utilities and the military). Increased integration could therefore bring about only limited scale effects, unless one envisaged rather unrealistically the merger of a number of national telephone networks, given the strategic nature of telephone networks and the need for political control over such infrastructure being felt by national governments. But a harmonization of the different regulatory procedures may be possible and have important economic effects, as European governments are attempting to adjust their national regulatory structure to the effects of the "telematics revolution". This harmonization can take a number of forms, for example concerning

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5 There are several operators in Italy, Denmark, France and Portugal, but their responsibilities are strictly delineated according to geographic and functional lines.

- the regulatory structure,
- procurement of supplies,
- type of operation,
- tariff policy,
- standardization,
- utilization of the network, and
- access and connection to the network.

Each of these variables effects a number of markets either on the input side (affecting the national base of telecoms equipment manufacturers) or on the output side (affecting the performance of individual sectors or the services available to individual customers). If the market for inputs is harmonized in such a way that a uniform European-wide market with competitive procurement practices results, sizeable savings as a consequence of product and production rationalization are possible[6]. The same applies to the market for customer premises equipment, where barriers to entry and restrictive certification practices sofar inhibit the full Community-wide market integration and the benefits that can be derived from such a policy.

On the output side, performance can also be increased through more cost effective service provision, fewer restrictions on network utilization and the availability of additional, Community-wide standardized services. These effects may be due to

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6 See the INSEAD report on "The Benefits of Completing the Internal Market for Telecommunications Equipment in the Community", Fontainebleau, 1988, reproduced in EC (1988) Chapter 10.

(a) lower cost per given output and

(b) better network utilization through more rational pricing.

Concerning the first effect, our study shows that differences in operating practice may significantly affect productivity and the cost at which services are provided. Some administrations have had to pursue a restrictive investment policy so that there exists excess demand; manning levels had to be kept high in spite of large productivity advances in network services, because rationalization was politically not feasible.

Concerning the second effect, we found that most PTOs have also kept long distance tariffs artificially high in order to cross-subsidize other services, and postal and parcel services. Such decisions not only raise tariff levels, but also influence tariff structures (i.e. the ratio of connection to call charges, the cost relation between local and long-distance calls, between switched and fixed network services, etc), thereby further distorting input decisions for teleocm users. The most important of these tariff structure effects is the cross-subsidization from long-distance and leased line services to local telephone calls or, as mentioned above, from telecommunication to postal services. As a consequence, restrictions must be placed on the utilization of the network (especially for the use of leased

lines), so that service provision on the basis of the available network infrastructure, for example value added services, may be hampered.

These points suggest that even so scale effcts for the provision of networks are fully realized, benefits from integration may still be large. The result would be larger service offerings, and an increased spectrum of network-based service offerings, thereby widening the arena of competition in VANS and CPE. VANS would benefit from a larger market in which to operate, thereby allowing a better spreading of the fixed costs associated with the setting up of these services; a larger market could also support many more specialized services. For CPE equipment, the same arguments apply, leading to cheaper "standardized" products but also a host of specialist products that could not be supported in isolated national markets.

The arena of competition could be larger still if the current attempt to change the telecommunications regulatory structure tried at the same time to reduce the extent of the monopoly area necessary for infrastructure provision. Public Telephone Operators (PTO) could allow entry in the provision of CATV-networks, in mobile services, in CPE equipment provision and maintenance, etc.

This debate must not necessarily be seen in the regulation versus liberalization context alone. A number of administrations have shown that by sticking to commercial

principles and allowing maximum market influence, similar service developments might take place as in the case of competitive network provisions. On the other hand, competitive network pressure might help to reduce the dispersion in service efficiency currently observed. The reason for these differences relates on the one hand to different levels of operational efficiency, and on the other to goals with which telecommunication administrations are burdened such as

- preferential procurement policies,
- preferential training and hiring practices,
- preferential regional policies,
- cross subsidies to loss-making postal services.

These policies all have the effect of raising production costs, thereby making "the nervous system" of modern economic societies more costly and less effective. Furthermore, these policies tend to have an important influence on telephone tariffs. By making especially long distance communication unnecessarily expensive, the incentive to broaden the arena of competition and to integrate neighbouring areas into one market is hampered, reducing the potential effects of integration.

1.5 Recommendations of the Green Paper

The recommendations of the Commission are set out in points A-J of the Green Paper (pp. 17-19) along with a set of lines of action and an acceleration of existing action lines such as the Community programs RACE and ESPIRIT (EC, 1987, p. 20ff). The aim of the Green Paper is to bring about a more coherent framework in the ongoing regulatory change, to encourage the development of new services in a more competitive framework and to establish (and utilize politically, for example in international trade negotiations) a wider European Market for telecommunication services. In this sense, the recommendations suggest a coordinated widening of the competitive arena, while the acceleration of existing action lines is intended to speed up and to support this process.

Within this overall framework telecommunications administrations are permitted to maintain their monopoly role in the supply of infrastructure except for those countries (i.e. the U.K.), which choose to opt for a competitive infrastructure provision (Proposition A of the Green Paper).

Established suppliers can maintain the monopoly for a narrowly defined set of services (mainly voice telephony as a "reserved service"); they may compete with suppliers of new "non-reserved" services such as videotex, VANs, etc.) (Propositions B and C).

To harmonize the service offerings across Europe, a certain number of standardized services should be made available by each administration (Proposition D).

Access to the network as far as new services is concerned should be on the basis of non-discriminatory terms in the form of open network provision (Proposition E).

Access to the network via CPE equipment should be free and unrestricted, subject only to minimal type approval regulation. Access to the satellite network via receive-only earth stations (ROES) should be of the same type (Proposition F).

Conflicts of interest in the regulatory framework should be eliminated by separating regulatory and operational activities of telecommunication administrations (Proposition G).

Conflict-of-interest issues that might lead to predatory pricing and cross-subsidization between competitive and non-competitive services should also be avoided by applying fully Articles 85, 86 and 90 of the EEC Treaty (Propositions H and I).

Inclusion of telecommunication activities under the Community's commercial policy should lead to a consistent Community position for international trade negotiations, for example as related to GATT, ITU, WATC etc. (Proposition J).

2. Scenarios to Analyze the Likely Effects of a Unified European Telecommunications Service Market

2.1 A Status Quo Scenario

In order to have a reference point against which to analyze the effects of the completion of the internal market, a status quo scenario as an "antimonde" is necessary. The basis of this is to assume that the recommendations of the Green Paper had not been made, but other developments would still take place, eventhough the two effects are difficult to separate in reality.

In the course of our study we have noted the high degree of service integration already achieved between the national telecommunication operators, for example through the Conference of European Post and Telecommunication Administrations (CEPT) and its Coordination Committee on Harmonization (CCH), and the activities of the ITU and its International Telephone and Telegraph Consultive Committee (CCITT). Standards for new services and interconnection continue to be harmonized as, for example, in the case of videotex, teletex and facsimile services. Joint interfaces developed in that context allow the creation of private telecommunication services on the basis of public networks (via leased lines). In addition, some competitive effects are already being felt on the international side, so that the high price/cost margins on international calls are likely to be reduced further.

On the input side production continues to be rationalized due to the current industrial restructuring. The trend of regulatory reform in the individual countries will also continue though in a much less harmonized manner than that evisaged by an acceptance of the recommendations of the EEC's Green Paper. It is against this status quo scenario, in essence the "anti-monde" that the effects of the Green Paper must be compared.

2.2 A Scenario in Accordance with the Community's Green Paper

In order to assess the policy effects that would arise out of an implementation of the recent Green Paper's recommendation it is necessary to analyze these proposals in detail and to assume that the Council of Ministers or the Commission will act on these to come into effect before 1992. When comparing the status quo scenario with the recommendations of the Green Paper we notice that the EC goes further in its recommendations concerning:

- the provision of competitive "non-reserved" services by private firms (Proposition C),

- open network provision on the basis of non-discriminatory terms (Proposition E), and
- a more liberalized market for CPE (including receive-only satellite earth stations (ROES) in combination with more Community-wide standard setting) (Proposition F).

Important are also the insistence on stronger anti-trust rules (Propositions H and I) and the recommended separation of regulation from operation (Proposition G) which should give important support to those competitive activities that are permitted to take place in competition with the PTOs.

2.3 A Scenario of Full Network Competition

The preceding discussion about the status quo scenario might make a scenario of network competition in long-distance services highly unlikely in the Community. However, it must be noted that the very large U.K. market is already characterized by limited network competition. The U.K. may have additional network operators by 1992 after the transition period for Mercury runs out. France, too, which represents almost a quarter of the EC's telecommunication administrations' revenue, may move in this direction. This together with increased international competition might be enough to suggest a third scenario of full network competition.[6a] Even if it is relatively unrealistic, it also represents a useful reference point against which to compare the scenario based on the current Green Paper.

The underlying features of this scenario are very similar to the one observed in the U.K. or Japan:

6a Full network competition actually refers only to the ype of intercity network competition currently observed in the USA, the UK., Canada and Japan, in which the local loop monopoly is usually maintained under some regulatory framework.

- limited entry of other network providers,

- "fair" interconnection of new entrants into the local loop and international networks. Where cream-skimming has to be avoided for political reasons, an adequate access charge is levied to ensure the sustainability of existing operators where they are technically more efficient;

- permission of resale and shared use of leased lines to prevent predatory behavior on leased lines by telecommunication administrations, when they compete with other network carriers;

- of course, Propositions E, F, G, H, I and J of the Green Paper apply without modification.

3. Estimating the Costs of Non-Europe

3.1 Identifying the Effects of the different Policies

We are mainly concerned about the economic effects of these alternative scenarios, and therefore attempt first to analyze those effects which directly reduce telecommunication costs, then investigate the effects on changes in service offerings and finally the consequences of more rational and less restrictive tariff policies on the economy as a whole.

Concerning the first effect mentioned above, there are several (direct) cost reducing effects that might be identified as a result of completing the internal market. The first effect refers to the benefits of joint, open procurement. They have been identified in two separate expertises for the Commission.[7] Depending on the divergence of current domestic market prices from competitive market prices, tariff levels could be reduced between 2 to 8 percent as a result of more competitive purchasing.

The second direct effect is related to differences in operational efficiency. We have attempted to estimate these effects by comparing productivity between different telecommunication administrations and with an analysis of total factor productivity for different administrations over time.

The third direct effect relates to the results of a more rational tariff policy, when the recommendations of the Green Paper to move tariffs closer to cost, take place. These effects will be larger with the introduction of network competition, as the current political opposition to tariff rebalancing is overtaken by more direct economic pressure. While this is difficult to analyze sytematically without a consistent econometric model, some insights were gained by looking at existing price cost margins and demand elasticities for different services in order to gauge the likely consequences of such a "rebalancing" of tariffs, i.e. when the charges for rentals at local calls are raised and those for long distance lowered.

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7 See the studies by WS/ATKINS and INSEAD in EC (1988) Chapters 3 and 10, part 1 respectively.

The fourth direct effect relates to CPE equipment, as a consequence of a more liberal certification policy in a larger, unified market.

The other effects are more indirect in nature, but may be equally important, since they concern the range of service offerings. This is not only the case with respect to CPE, where a large product variety is expected, but especially with respect to VANS. Both aspects are directly related to the "narrowness" of the remaining monopoly area and an effective interface between the regulated "reserved" and the "non-reserved" competitive area. We also investigate the effects of improved regulatory structure and increased standardization.

3.2 Productivity Comparisons

3.2.1 A Production Function Approach

We start by analyzing productivity differences between PTOs. The aim of such a productivity comparison is to see whether one telecommunication administration, say the Spanish one, could produce the same output in the U.K. as BT actually does but using fewer resources. Such a comparison relates to bundles of national outputs to their corresponding national input indices or alternatively compares pairs of output with input ratios. Scale effects must also be considered. If they are important, an administration with a small territory may be more efficient, but operate at a lower scale level.

Differences in what is called X-inefficiency may also affect productivity. X-inefficiency refers to those unexploited efficiency gains which an organization could make by moving to its production possibility frontier (Leibenstein, 1966).

We assume that a production function underlies the provision of telecommunication services and that the relation between inputs and outputs is determined by a given "production technology". A production function defines the quantities of output that an organisation or industry can produce with given management, organisation and t echnology, from given quantities of input. This relationship is often described, by economists at least, as an engineering one, a function which summarises the engineering data about how the available technology can be embodied in different techniques for producing a set of outputs from a set of inputs. Although this may be fair enough at a highly disaggregated level, where plants and firms are concerned, management and organisation must also be taken as given and these are clearly not matters of engineering; they concern interactions between poeple. These interactions give rise to transactions costs, usually subdivided into the costs of information and of opportunism, which may well increase with the size of an organisation, while production costs may fall.

To analyse the relation between input and output, variables must be specified in the appropriate form (in flow terms, multidimensional etc.).

The general form of the production function is:

$$f(Q_1, Q_2 \ldots, Q_n; I_1, I_2 \ldots, I_n; t) = 0,$$

where Q_i are the outputs, I_i inputs and t the "production technology" index. If one telecommunication administration produces the same outputs (local and national calls, private lines, data services etc.) from the same quantity of inputs as another telecom organization, but produced more value added services, then the first system is more efficient. It has a higher value for the "production technology" index.

A problem of interpretation highlighted by the production function approach stems from the difference between the short run, when some factor inputs are fixed, and the long run, when all inputs may be varied. Telecoms investment has to be undertaken ahead of demand; the capacity must be in place before a service is extended. Just before the service is taken up, productivity will appear low because the capacity has not been fully utilised. The organisation is on its short run production function from which it shifts as the service is taken up. The cyclical pattern observable in a productivity index may be a consequence of this movement along short run functions. International comparisons of total factor productivity may therefore be misleading insofar as they compare organisations at different points on their short run production functions. The spread of domestic service to the virtual saturation level is a case in point. As more

households are connected to the network the infrastructure comes to be more fully used and productivity appears to increase rapidly.

The effects of externally imposed constraints, for example concerning procurement or employment rules, must also be taken into account. They may prevent an organization from achieving the same degree of operational efficiency as an organization which does not operate under this constraint. The aim of the exercise is therefore not only to identify the best practice possible and the deviations currently existing from it, but also to see how the effect of an internal market would help to reach such a best-practice level. Such an approach requires decisions about what is to be considered as a constraint and what is not. It is for this reason that we also want to analyze the effects of full network liberalization to identify the sources of productivity differences and to what extent they may act as a major constraint of telecommunication policy.

3.2.2 Simple Productivity Comparisons

Productivity comparisons are difficult to carry out because the inputs, outputs and the production structures differ across administrations even for such a homogeneous product as

telecommunication services. Simple (partial) measures of productivity such as mainlines or revenue per employee (Tab. 3.1) are only a first step, since they ignore differences in the degree of vertical integration. A PTO may install and maintain telephones with its own staff, as most administrations do, or subcontract this service out to private companies, as in the case of SIP. A PTO may or may not operate CATV networks; it may produce value added services together with its other activities or have a separate subsidiary for this purpose (Fig. 3.4).

Keeping these caveats in mind, Table 3.1 indicates significant differences in productivity between those administrations for which such data were available. The Netherlands, Italy and Denmark come out on top, with the U.K., Norway and Belgium on the bottom. Some institutional knowledge can help to identify some of the sources of productivity (for example the high value for SIP/Italy and Telefonica/Spain may be explained by the fact that both administrations contract a fair share of their activities out to private companies), but a more detailed analysis is needed to make more meaningful comparisons possible.

Table 3.1: **Main line per Full-time Telecommunication Staff**

	1974	%	1981	%	1986	1974/86
Denmark	109	(32.0)	144	(3.5)	149	36.6%
France	52	(126.9)	118	(27.1)	150	188.5%
Germany (West)	64	(70.3)	109	(39.4)	152	137.5%
Italy	93	(43.0)	133	(70.7)	227	144.1%
Norway	56	(25.1)	70	(28.6)	90	60.1%
Spain	67	(61.1)	108	(43.5)	155	131.0%
United Kingdom	50	(50.0)	75	(23.3)	94	88.0%

( )= change Source: ITU, 1986

Figure 3.4: Range of Work Undertaken by PTOs

xx = only by administration; x = partly by administration;

Country	Installation		Maintenance		Exchange		External Plant		Manufacture	R&D
	Business	Residence	Business	Residence	Maintenance	Construction	Maintenance	Construction		
Belgium	x	x	x	x	xx		x			
Denmark	x	x	x	x	xx	x	xx	x		x
France	x	xx	x	x	xx	xx	x	x		x
FR Germany	x	x	x	x	xx	x	xx	x		x
Italy (SIP)	xx	xx	xx	xx	xx					
Netherlands	x	x	x	x	x	x				
Norway	x	xx	x	xx	xx	x	xx			
Spain	xx	xx	xx	xx	xx	x	x	x	x	xx
UK (British Telecom)	x	x	x	x	xx	x	xx	x	x	x

3.2.3 Total Factor Productivity Analysis

To account for these differences, the most important inputs and outputs variables must be combined into a total factor productivity index based on weighted input and output variables. In Appendix 1 the precise input and output definition used are discussed as are other measurement problems that arise in this connection. Here it is sufficient to indicate that we use weighted input and output measures, using a Törnqvist index that gives us a series of binary comparisons between countries.

This is based on a fairly general functional form for the production function in the form of the translog function.[8] Corresponding to this production function is the Törnqvist total factor productivity index which has the form:

$$TFPij = \left\{ \prod_{k=1}^{k=n} \frac{Qki}{Qkj} \right\}^{(Wki + Wkj)/2} \Bigg/ \left\{ \prod_{l=1}^{l=m} \frac{Xli}{Xlj} \right\}^{(Uli + Ulj)/2}$$

where Qk is an index of kth output

Xl is an index of the lth input

Wk is the weight assigned to kth Q

8 This results from a second order Taylor series approximation to the general form of production function.

Ul is the weight assigned to the lth X

n is number of outputs

m is number of inputs

i is the reference PTO to which another PTO is compared, in this case British Telecom

j is another PTO.

A telecom organization i with a higher total factor productivity index produces more output from given inputs and is more efficient than the organizations with which it is being compared. In this case, if the ratio derived is greater than one, BT is more efficient, if the ratio is less than one, the comparative PTO is more efficient.

The weights in the Tornqvist index are conventionally the share of each output's revenue in total revenue and the share of payments for each input as a proportion of total cost. The economic justification for these weights is not strong in the case of telecommunication services because certainly output markets and perhaps input markets are not particularly competitive. Moreover returns to scale are widely believed not to be constant (Fuss, 1983).

In this study attempts are only made to correct for these problems as they affect the output weights. Only if prices are equated to marginal costs are revenue weights appropriate for outputs. If they are not, then cost elasticity weights

should be used explicitly instead. When returns to scale are increasing, these weights sum to less than one, with the practical consequence that small telecom organizations will seem less productive than they really are relative to large organizations, when revenue weights are employed. Obviously the opposite is true when there are diminishing returns to scale. The problem is that reliable cost elasticities for each product group are not publicly available.

The comparisons in our TFP analysis are based on standardized input and output variables. Outputs are standardized in terms of local and long distance calls which means that all other outputs have to be converted to this measure;[9] inputs are standardized for an average worker, material and capital input are related as far as possible to a physical measure. The TFP approach helps to overcome the deficiencies which are normally involved in simple partial international productivity comparisons (for example on the basis of full-time telecommunication staff per mainline) that we have carried out above, or on those that use exchange rates or an index of purchasing power parity.

Table 3.2 shows the results of this more complex exercise. As a standard of comparison we have used British Telecom,

9 A major problem is the large differences in the size of the calling area, that make a comparison of local calls difficult.

setting its productivity level at 100. Norway was also included because of data considerations. This more comprehensive analysis changes the previous ranking obtained (Tab. 3.1) dramatically. At the same time, even when accounting for most inputs and outputs, significant productivity differences remain between the PTOs. They show that Norway and Denmark, which have much smaller networks than BT are definitely more productive. (Denmark, as we note, has four different telephone companies). Telefonica and SIP now seem to be less efficient than BT and the Bundespost, which are about at the same level.

The results vary with the output measures used as the comparison between BT and the Bundespost shows. The Bundespost, the telecommunication administration most comparable in size with British Telecom performs better if short-haul calls are used as output weights but worse with long distance calls. The ambiguity arises because the pricing structure of output differs significantly between the two countries, as Table 3.6 further on shows.[10] BT, in addition, has a larger number of international calls. There are also some problems with using only SIP for the Italian comparison, since SIP only supplies domestic calls. Italcable, the international carrier could not be included in the analysis.

One possible refinement is to consider the effect of econo-

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10 The ratio of local to trunk call tariffs is .21/.56 in the U.K., .11/1.66 (or 1.00) in West Germany.

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Table 3.2: **International Productivity Comparisons**

Inputs: The Percentage Ratios of Inputs of National Telecom Carriers to Those of British Telecom

Input Category:	U, (1986)	Germany (1985)	Denmark (1985)	Spain[3] (1986)	Italy[3] (1986)	Norway[3] (1986)
Manhours	100	94.3	7.8	26.1	35.4	7.3
Units of labour equivalent material	100	52.6	5.1	13.1	31.5	1.9
Square metres of land and buildings	100	135.1	21.1	90.0	113.6	14.8
Vehicles	100	81.3	n.a.	14.5	60.2	11.5
Local network: number of access lines	100	122	11.9	44.5	82.6	8.3
Trunk network: digital channel kms	100	137	6.6	4.7	10.5	2.8
All input aggregated	100	98	7.9	24.7	42.6	5.1
TFP Index[1]:						
a) Labor Productivity Only						
Output Measure[2]						
Short haul equivalents	100	111	122	88	96	130
Long haul equivalents	100	86	128	80	57	84
Number of calls	100	81	153	n.a.	101	n.a.
b) Total Factor Productivity						
Short haul equivalents	100	107	121	92	80	185
Long haul equivalents	100	83	127	84	47	119
Number of calls	100	78	152	n.a.	84	n.a.

1 The indices of the table are the results of the TFP formula presented earlier, so that the higher the index number the more productive the organisation.

2 Output measure consists of inland and international calls and other output. Inland calls are represented in each of the three different ways shown. The three measures (short haul, long haul, number of calls) are alternatives.

3 Work on capital account has been excluded from the inputs of both systems. For further details, see Appendix 1 and Foreman-Peck and Manning, 1988b.

mies of scale, i.e. productivity differences due to network size. When assuming the effect of increasing returns to scale (assuming cost elasticities of .8, i.e. a proportional increase in inputs by a factor 0.8 doubles output) the productivity advantage is even larger for the smaller networks of Spain and Norway, but also helps to bring Spain and Italy in line with BT.

The results of these cost elasticity weightings must, however, be taken with a pinch of salt. Our attempts to estimate economies of scale separately for Germany and the U.K. have not been conclusive. While we have not rejected the existence of economies of scale,there was no statistical significance to suggest constant returns to scale either. As a consequence, if one assumes moderate economies of scale with a cost elasticity of .8[11], the smaller networks with a lower productivity than BT seem now (like Spain and Italy) to be equally efficient when scale is adjusted for, while the star performers Denmark and Norway more than double their performance vis a vis BT and the Bundespost. Even if these results are only preliminary, they suggest that large PTOs seem to be much more subject to external constraints, such as industrial policy and employment considerations, leaving their overall performance record severely affected, as smaller ones. But

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11 an assumption consistent with the empirical literature

the results are also surprising enough, that they warrant further, more detailed analysis, also in line with expected benefits as a result of further market integration.

We have already mentioned the problems encountered in data collection. This suggests that he results of Table 3.2 should only be interpreted as approximate measures.[12] Nevertheless, the surprising result that the smaller telecommunication administrations seem to be the most efficient suggests that the fear of smallness of size for competitive carriers must not be taken all that seriously.

Summarizing our attempts so far, we noticed significant productivity differences between the PTOs, even if inputs, outputs and the degree of vertical integration are more adequately accounted for. The adjustment for economies of scale enlarges these differences. The results suggest either significant productivity differences, perhaps due to differences in production technology and the degree of X-inefficiency, as well as the presence of important outside constraints on the PTOs, that prevent a movement to the least cost frontier.

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12 Obviously, further refinement on these measures is necessary, especially to account for differences in service measurement (i.e. local calling area differences), standard of service, waiting time for connections, national topography or social obligations. All the data and measurement concepts employed in computing Table 3.2 show room for improvement and therefore these results are obviously provisional.

Table 3.3: **Rates of Growth of TFP for Selected Countries**

YEAR	Canada			France	UK	Germany		USA
	IC[1]	NTC[2]	All	DGT	BT	DBP TFP1[3]	DBP TFP2[4]	AT&T[5]
1965					4.7			2.9
1966					2.5			4.3
1967					2.5			3.3
1968					1.3			4.4
1969					1.5			3.8
1970					4.8			0.6
1971					-0.1	0.1	0.1	1.1
1972					1.4	0.4	1.1	4.0
1973	5.3				1.5	-1.6	0.5	4.3
1974	7.1				-2.0	1.7	2.9	3.7
1975	7.8	9.7	7.9		-1.5	2.7	3.6	2.8
1976	2.2	8.4	2.5	6.7	2.5	5.9	6.7	4.4
1977	0.7	9	1	6.3	5.3	7.7	8.4	3.6
1978	3.5	13	3.8	6	6.4	11.4	11.8	4.8
1979	4.8	19	5.2	4.8	1.2	5.1	5.9	4.2
1980	6.0	20	6.5	8.5	-5.4	1.9	2.8	
1981	3.9	9	4.1	8		1.5	2.2	
1982				4.2		0.0	0.7	
1983				6		0.5	1.2	
1984						2.0	2.6	
1985						-0.4	0.2	
	4.6	12.6	4.4	6.3	1.7	2.6	3.4	3.4

Notes: 1 Terrestrial Carriers; Alberta Government Tel.; Bell Canada; British Columbia Tel.
2 Non-terrestrial Carriers; Teleglobe; Telesat
3 Usual Method
4 Method DGT
5 Bell Systm

Source: Canada: Denny et al. (1980); France: Danielo et al. (1985); USA: Christiansen et al. (1985).

3.2.4 Productivity Development Over Time

The next question we raised was: Do productivity differences over time exhibit the same pattern? We measured total factor productivity growth for those countries, where data was available (U.K., West Germany) and collected and interpreted available studies for other countries (U.S.A., Canada, France).

The results in Table 3.3 show not only large differences in average productivity, but also very sharp year-to-year fluctuations. The variations between the years sometimes seem to coincide, but in most cases there are significant differences. The cause of these variations is due to different rates of movement of input and output indices within and among the countries.[13] The interesting point is that the German growth in total factor productivity (TFP) almost parallels the evolution in the U.K. from 1974 up to 1980. France seems to differ significantly from the other countries, with substantially higher productivity growth, at least since 1980.[13a]

North American TFP growth historically seems to have been high relative to what is known about European telecommunications experience.

Between 1947 and 1979 the US Bell system averaged TFP growth (Tornqvist index) of 3.2% p.a. and an output growth of 7.4% p.a.

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13 A caveat is that in regulated or nationalised industries the assumptions underlying conventional TFP calculations are not necessarily strictly correct and at least the short run variations in the indices should be taken with a pinch of salt.

13a On closer inspection we discovered that the French method of computing total factor productivity growth included an extra contribution to net operating capital, a factor that had not been included for the U.K. and West German calculations. When this measure was included in the analysis for West Germany, the average growth rate in TFP between 1971 and 1985 rises from 2.6 percent to 3.6 percent and is then more or less in line with the average French growth rate during the same period.

Between 1965 and 1979, TFP growth was 3.5% p.a. and output grew at 8.4%. Over a similar period, an arithmetic index of UK TFP growth averaged less than 2% p.a. and output growth averaged 9% p.a. German productivity growth was a little higher (using a Tornqvist index) and so was output growth. Canadian TFP and output growth was the highest of the four systems. As mentioned above, TFP growth depends not only upon the optimum absorption of technical developments but also, if there are scale economies, upon the rate of growth of the system. However since the UK and the US systems grew at approximately the same rates, as a first approximation neither scale economies nor diseconomies can account for the apparent discrepancy in TFP growths.

Econometric evidence suggests that scale economies diminish with system size, which should confer an advantage upon the smaller European systems as far as TFP growth is concerned. The Tornqvist (geometric) and the arithmetic indices used respectively for the American and the British, German and French TFP measures are not exactly comparable but differences are likely to emerge principally in their variabilities rather than in their trends. That the German TFP index was also below that of the US suggests the nature of nationalised industry regimes and/or the associated social obligations accounted for faster US TFP growth. As far as it is possible to tell, Bell inputs were not a major source of gain to the Bell system, for between 1958 and 1976 Western Electric's TFP growth averaged only 2% p.a.

The productivity differences observed and the erratic movement between the years indicates that a number of additional factors may be responsible for this development in addition to those mentioned above. This relates not only to changes in the composition of output and input but also to the degree of network utilization (in essence a fixed capacity), which tends to vary with level of economic activity. We were not able to adjust the measurements with a specific capacity variable to correct for this influence, however.

What do these measurements tell us about international productivity differences? They suggest that at least compared to the UK, the US and the Canadian environment seems to have supported a higher productivity growth rate. But network size and speed of expansion also play a role. To analyze these two factors, we must recognize that productivity growth can be divided into two components:

- shifts of the production function as a consequence of superior production techniques (technical change), and

- better use of inputs with increasing scale, which has a more than proportionate effect upon output growth (economies of scale) (see Figure 3.5).

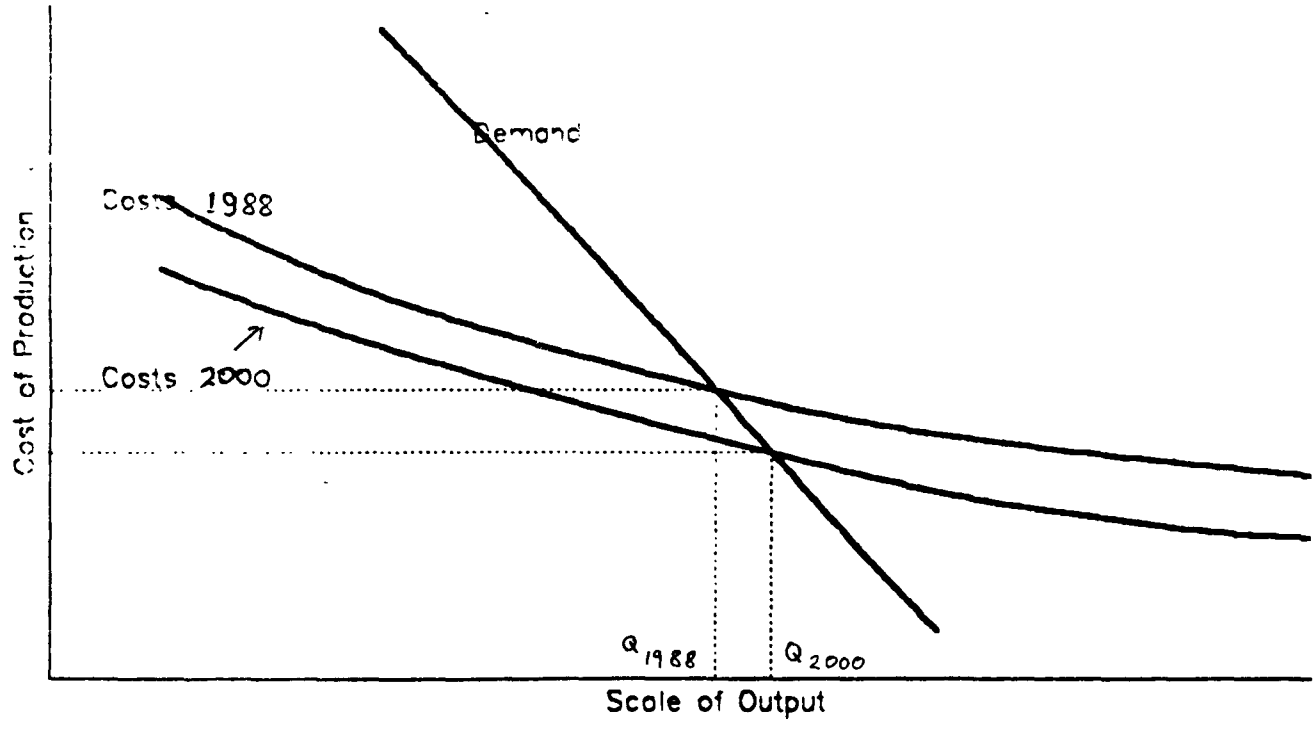
If we compare the case of a network which has been subject to capital rationing or inefficient management, increasing capital availability and/or exposure to competition (i.e. with one of allowing other network operators to enter) the latter may exhibit a more modern production structure, thereby shifting the production function to a more efficient regime. On the other hand, even if the pace with which the production function shifts for some administrations may not be affected, total factor productivity growth may still be influenced when economies of scale in the telecommunication network are significant (better utilization of the scale effect). This latter effect may be particularly important where tariff levels are significantly reduced and rebalancing favors the more price elastic segments of demand. In this case exploiting the demand for telecommunication services should lead to network growth and a stronger utilization of economies of scale.

Keeping this relationship in mind, we have analyzed the relation between total growth rates of the telecommunication network in the different countries and productivity growth (Table 3.4). Productivity growth in the German network seems to have been faster than in the British system (2.6 percent p.a. compared to 1.65 to 2.11 percent, depending on whether the last observation is included). But the German output also grew faster than the British over much the same period

Table 3.4: **International Telecom TFP Growth Comparisons**

	Input %growth p.a. (X.)	Telecom %output growth p.a. (Q.)	TFP growth (Q.-X.)
United Kingdom (1964-80)	6.64	8.75	2.11 (1.65)
Germany (1970-85)	10.59	13.19	2.6
Canada (1973-81)	5.3	8.74	3.44

Figure 3.5 : **Changes in Telecom Costs as a Function of Scale and Technical Change**



(13.19 percent p.a. for 1970 - 1985 compared to 8.74 percent p.a. for 1965 to 1980), suggesting that the Bundespost also benefitted more from scale effects.

For a comparison to be carried out along the lines suggested above, we need to know something more about the scale elasticity so we can analyze the two components of productivity growth in the form discussed above: If

Q. is the rate of growth of telecom output,
A. the rate of technical progress,
X. the rate of growth of inputs and
E the scale elasticity,

we assume the following relationship holds approximately

$$Q. = A. + EX..$$

If Germany and the UK had the same scale elasticities then the rate of technical progress or shift in the production function could be computed as:

$$Q._g - Q._{UK} = A._g - A._{UK} + E(X._g - X-_{UK}).$$

Assume $A._g - A._{UK} = 0$, where subscripts g and UK refer to Germany and UK respectively.

Then $E = (Q._g - Q._{UK})/(X._g - X._{UK}) = 4.44/3.95 = 1.124.$

Therefore $A._g = Q._g - (Q._g - Q._{UK})/(X._g - X._{UK})X._g = 1.287.$

The shift in the production function implied by different scale elasticities may be computed given historical values of both Q. and X.

Table 3.5 shows that the scale elasticity at which German

Table 3.5: **Relation between Scale and Technology Shifts**

Scale elasticity	Production function shift factor: $A._g$	$A._{UK}$
1.45	-2.16	-.87
1.30	.58	.12
1.125	2.287	1.287

and British technical progress would have been equal is 1.124, implying at the same time a yearly "technology shift" of 1.287 percent. This shifts the production function 50 percent faster than the historical Canadian rate of .83 percent p.a. (Kiss, 1983, p. 93). It is unlikely that German and British technical progress was so much higher than Canadian. Instead, and keeping in mind the higher scale elasticity estimates for the US and Canada seems to suggest that the true scale elasticities are higher than 1.124, to reduce the estimated German and British coefficient of technical progress. Because if Germany and Britain had scale elasticities similar to those estimated for the United States and Canada, i.e. 1.3 and 1.45, and also had the historical rate of technical progress of Bell Canada (.83 percent p.a.), productivity growth would have had to be roughly 25-50 percent higher than it actually was. We must look for reasons why the outside constraints put on the British and German system may have been more significant than in the situation of Canada.[13b] If one takes this interpretation literally, then the higher productivity growth in the privately owned regulated Canadian system that is characterized by relatively little short term policy interference suggests that a 25-50 percent higher productivity effect

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13b One interpretation is the more politically determined regulation in W.Europe, which tends to make the fine tuning of investment, tariff and service conditions more difficult compared to the more technocratic, rate of return regulation observed in the USA and Canada. Another is that the incentive structure to minimize cost, however imperfect under the American system, may have been stronger than in the European public enterprises.

may be taken as the effect of liberalizing the German or British networks from these constraints.

A major problem with drawing inferences from the above data is that the past cannot be an infallible guide to the future. Since 1976 there have been sufficiently radical changes in telecom equipment to warrant the description of a new technological trajectory. If anything the underlying rate of technical progress has increased in the last ten years. Coupled with the organisational slack which international comparisons of TFP levels suggest, the 25-50 percent growth penalty of the German and British network environment may not be too far off.

The importance of creating conditions under which the full effects of technical progress can be implemented in a telephone network should not be underestimated. This can be illustrated by analyzing the effects of a 1 percent higher productivity growth rate between 1988 and 2000 in Figure 3.5. With a 12.75 percent higher productivity rate in 2000, 11.3 percent less inputs would be needed to produce the same output. Taking the price elasticity of telephone demand also into account enhances this effect.

Assume for simplicity constant elasticity demand and unit cost functions and that network operators make normal profits so that economic costs are covered by revenues. Then it can

be shown that the elasticity of telecom output (Q) with respect to shifts in the cost function such as might be caused by a more consistent regulatory regime is illustrated by

$$(\ln C) - 1/(b+g)$$

where b is the elasticity of unit costs with respect to output and g is the reciprocal of the absolute value of the price elasticity of demand for telecoms.[14]

If the price elasticity of demand for telecom services in aggregate is -0.6 and the unit cost elasticity is -0.2, the ultimate effects on telecom output of an 11.3% fall in costs is 7.7%, i.e. an increase from Q_o to Q_1 in Figure 3.5 or the measure of $(-11.3 \times -1/(-0.2+(1/0.6))\% = 7.7\%$.

An alternative measure of the tariff rebalancing effect is based upon the quantity elasticity - the shift in the demand function of Figure 3.5 measured horizontally instead of vertically. In terms of the above notation we need

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14 i.e. $\ln C = \ln a + b \ln Q$ ... a unit cost function, with parameters a and b

$\ln p = \ln f - g \ln Q$ ... a demand function, with parameters f and g

$\ln P = \ln C$ are the equilibrium condition.

With economies of scale, $b<0$. Then

$\ln Q = \frac{\ln f - \ln a}{b+g}$, $\frac{\ln Q}{\ln a} = -\frac{1}{b+g}$ = the proportionate change in telecom output Q in response to a proportionate change in the intercept of the unit cost function, a.

$$\log Q / \frac{1}{g} F = g/b+g.$$

Thus if b = -0.2, g = 1.66 as above, the quantity elasticity is 1.137. A 20 percent expansion of traffic in a given system from tariff rebalancing could ultimately, with more investment to lower costs, increase traffic by 20 x 1.137 = 22.74 percent. Obviously with larger scale coefficients these effects will be larger. With a modest scale elasticity of 0.8 tariff rebalancing lowers unit costs by 22.74 x 0.2 = 4.54 percent.

Higher scale and price elasticities raise this number, lower ones reduce it.[15] Keeping the overall service revenue of 61bn ECU of 1985 in mind suggests that the resource savings due to higher productivity rates are substantial, as they are to the advantage of the traffic that would in any case have been generated, while the extra traffic generating effects would also result in resource savings (due to economies of network fill) and in extra service output.

3.3 Influence of the Tariff Structure

3.3.1 Tariffs and Cream-Skimming

The overall role of telecommunication tariffs is:

- to provide means for obtaining efficient use of existing

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15 A doubling of the unit cost elasticity to -0.4 with the same price elasticity yields price reductions of 8.92 percent.

capacity, for example through peak-load pricing,

- to give signals for new investment and

- to yield revenue on past investment and current operating expenses.

Greater network efficiency is therefore not only achieved through lower cost per given output, but also through better utilization as a consequence of a more rational pricing structure, since current telecommunication tariffs diverge significantly from costs. Rentals (to have access to the network) and local calls are usually charged below their true economic costs; long distance and international calls are charged significantly above costs. As a consequence the price signals to the users of the telecommunications network are distorted, causing the users to make allocatively inefficient decisions. Over longer distances, he may make less use of telecommunication services than the true economic costs would suggest. Instead, he may use other communication means or, as a business man, engage himself less in far away markets. This leads not only to an underutilization of the productive resource telecommunication, but also to a reduction of the potential geographic market size.[16] Over shorter distances, the telephone

16 These indirect effects - a lessening of the potential competition - may be an important side effect that has so far been overlooked in this discussion.

gets used more, requiring a further capacity build up than would be required if the customer was facing the proper opportunity costs.

To these allocative costs for the telephone user, and the dynamic cost of insufficient market expansion, one has to add the dynamic costs to potential service producers whose entry is prohibited, because of the danger of cream-skimming [17] through arbitrage. While arbitrage may hurt an administration financially, its prohibition also prevents the innovative offerings of certain services, or the spreading of others, because "shared use and resale" of such services, which could lead to arbitrage, is not permitted. Those enterprises which have developed certain telecom applications in-house or between their subsidiaries (or cooperating partners, for example in the case of airlines, banks, etc.) are allowed to sell these services to third parties only under certain restrictions and sometimes not at all. That implies not only a significant barrier to entry for VAN services based on the telephone network, but also discriminates against smaller users that cannot develop or utilize these services in-house because of their small scale.

17 This refers to the incentive that any potential suppliers of telecoms services (either on the basis of leased lines or competitive physical networks) has to enter mainly in the lucrative long distance market, thereby "skimming" the cream needed to subsidize the deficit services - rentals and local calls. The fact that the tariffs between the different long distance services (i.e. dialled services, leased lines, data services, broad band transmission rates) differ significantly may still lead to cream-skimming because of the potential to arbitrage.

Only a "harmonization" of tariffs can reduce the arbitrage incentive, so that the current restrictions which are based on the use of leased lines (i.e. "no connection to the switched network, no use for third parties") can be removed. Tariffs may be harmonized on the basis of cost (implying a "rebalancing" i.e. a lowering of long-distance (and in some countries leased line) tariffs and a raising of local calls to reduce the losses occurring there) or in relation to the tariffs of a major service - like dialled voice. While this second option, brought about a volume-related tariff on leased lines,[18] reduces the danger of arbitrage as well, it still leaves the allocative problem unresolved, because tariffs now diverge significantly more from costs than be ore.

It is our opinion, that the competitive network scenario would lead more quickly to a rebalancing of tariffs or the basis of costs. While there is some discussion about principles of tariff policy in the Green Paper's Proposition E, they are still sufficiently vague make a prediction of the related consequences of the Green Paper at the moment impossible. The competitive network scenario can therefore be taken as an indication of how far the Commission needs to go if simular effects are to be achieved by tariff principles.

3.3.2 Allocative Costs of Tariff Distortions

To identify the economic importance of tariff distortions it is necessary to obtain a rough estimate of the current cost of this policy, for example using the sum of the producers and consumers surplus as such an indicator.

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18 This is the option which the Bundespost has chosen.

The producer surplus is measured by the difference between the price received (which is the same as the price paid by the consumer) and the minimum the producers would have accepted - marginal cost. (The consumer surplus is how much buyers would have been willing to pay - i.e. the "demand price" - over and above the price actually paid. The difference between demand price and marginal costs is therefore a measure of the benefits foregone by a transaction which does not take place. In quantitative terms, the total net benefit from an exchange can be measured by the difference between the demand price, which is a point on the markets demand curve and the marginal cost curve.

This measure indicates that if tariffs are less than marginal cost the net benefits from the transaction would be negative (i.e. producer surplus losses swamp gains in consumer surplus), if the asking price is above marginal cost, some consumers may be excluded who would have bought at marginal cost. The welfare loss here occurs from losses in the consumer surplus that swamp any gains in producer surplus. As a corollary, of course, maximum economic efficiency is achieved with marginal cost pricing.

This does not mean that tariffs should in all circumstances equal marginal cost - there are a number of reasons why substantial departures from this principle will be required in pricing telecommunication services. But it does mean that

that the structure of marginal costs provides the basic information from which practical tariff structures will ultimately be derived and against which the allocative costs of distortions must be measured.

A simpler alternative is to compare tariffs with costs and to assume that the losses and gains are proportional across countries.

3.3.3 Current Tariff Structures in the Community

What makes the analysis of tariff rates so difficult, even if it is limited to the major market, switched voice services, is that there are usually four different tariffs for such service, providing for a rather complicated tariff structure. These are tariffs:

- for installation of a telephone (connection charges)
- for a monthly or bi-monthly rental,
- for local calls, and
- for trunk and international calls.

The first two tariffs pay for the access to a particular service, regardless of whether or not a subscriber in fact makes use of this service. Externality considerations may, especially in small networks, require pricing below cost, to encourage reaching a critical mass and may therefore vary with the growth of the service (Mitchell, 1978).

We are now equipped to analyze the current European tariff structure in Table 3.6. We observe indeed a wide variation in tariffs that seem inconsistent with what is probably a much more uniform cost structure across countries (even in the absence of telecom services being traded). Connection charges range from a low of 31 and 36 ECU in Germany and France, where the use of second telephones has been encouraged in an essentially saturated network, to the cash-poor administrations of Ireland, Italy and Greece, where the residents must pay most of the initial cost of a telephone connection in the connection fee. Actual connection costs are probably in the neighborhood of 250 to 400 ECU, showing that in all countries network externality effects (i.e. the benefits to existing subscribers if a new subscriber joins) are still taken into account. To make more people join the network, new subscribers recieve their connection often significantly below cost.

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Table 3.6: Major Tariff Variables in the EC (1987)
in ECU
(includes VA charges where applicable)

Country	Connections	Monthly Rentals Housholds	Business	Local Call (LC) Tariffs (3 min)	Call Area Size[1]
Great Britain	150	9.00	14.02	0.21	221
Italy	151	4.48	11.54	0.20	9
Belgium	116	10.50	10.50	0.14	78
Ireland	235	11.20	15.10	0.14	78
Luxemburg	58	5.78	5.78	0.12	na
France	36	5.67	13.82	0.11	120*
West Germany	31	10.80	10.80	0.11	135
Denmark	189	9.88	9.88	0.10	na
Netherlands	97	9.81	9.81	0.06	5
Portugal	66	7.98	7.98	0.05	1
Greece	199	2.23	2.23	0.03	5*
Spain	83	6.66	7.03	0.03	na

	Tariff for Trunk Calls (3-min.) up to 100 Km (TC1)	max. Dist. (TC2)	Intern. Call Index (3 min)[2]	Intern. Leased Lines[3]	TC1/LC	TC2/LC
Great Britain	0.56	0.56	0.57	1162	2.7	2.7
Italy	1.62	1.72	0.94	3500	8.1	8.6
Belgium	0.69	0.69	0.80	1625	4.9	4.9
Ireland	1.26	1.26	0.88	1878	9.0	9.0
Luxemburg	-.--	-.--	0.67	1702	-.-	-.-
France	0.85	1.59	0.65	1541	7.7	14.5
West Germany	1.00	1.66	0.48	2352	9.1	15.1
Denmark	0.36	0.36	0.41	1312	3.6	3.6
Netherlands	0.26	0.26	0.41	1743	4.3	4.3
Portugal	1.19	1.19	0.90	2889	23.8	23.8
Greece	0.97	1.15	0.89	2582	32.3	38.3
Spain	0.06	1.07	1.00	2481	20.0	35.6

1) measured in average number of exchange lines in 1 000 * estimates
2) refers to calls between Madrid and corresponding country, i.e. calls from Denmark are 41 % of the tariff in the reverse direction
3) rental and connection charge in $ for eight private circuits to adjacent country and two transatlantic. IBM 1987, reproduced in Financial Times Business Information

Source: Telefonica, Revista T, No 16, Oct. 1987; DIW, British Telecom

A tariff differentiation between business and households allows telephone authorities to take advantage of the higher demand elasticities of households for telephone rentals. This policy of price differentiation is only pursued seriously in four countries (U.K., Italy, Ireland and France). By charging the price inelastic and call intensive business sector with slightly higher rental charges provides the authority with an extra subsidy with which to increase telephone penetration in households or keep local calls lower. It also provides a way for keeping the deficit arising in connection with financing connection charges lower.

Comparing rental rates with the actual depreciation costs fo the local loop (independent of installation costs) suggests that they are also being subsidized from call charges. Our interview evidence suggests that the marginal costs for maintaining and depreciating old established lines may be 6 to 8 ECU per month per line, with 8 to 10 ECU in rural areas. The marginal costs for new lines is more in the neighborhood of 15 to 20 ECU, given todays very much higher wage costs.

The marginal costs of local (measured) calls are about .03 to .04 ECU per minute, with the initial minute being somewhat higher. This suggests a marginal cost for a 3-minute call in the neighborhood of .1 ECU or slightly above, depending on cost conditions and the size of the local calling area. Table 3.6 indicates important deviations below this figure for Spain, Greece, Portugal and the Netherlands, but also somewhat higher rates for the U.K. and Italy. Some of this difference may be explained by the wide variations in the size of the local calling area indicated in Table 3.6 with the average number of exchange lines. The U.K. data which has come under close scrutiny by OFTEL may actually be in line with U.K. cost, suggesting that our cost estimates may actually be on the low end.

Most important in terms of a typical telephone bill, are charges for trunk calls (50-500 km), since they make up 50 to 70 percent of the subscribers' telephone costs. Here our estimate suggests marginal costs per additional minute in the neighborhood of 0.1 ECU with the initial minute being about .03 - .05 ECU higher, suggesting a marginal cost for a 3-minute call of .3 to .4 ECU. Only the Netherlands and Denmark come close to this range (mainly because of the short trunk distance involved) with the U.K., Belgium and Spain somewhat above. The big distortions arise in Italy, Ireland, West Germany, Portugal and Greece , especially over the longer distances.

Table 3.7: **Elasticities of Demand for Telephone Calls**

Source	Country	Service	Price Elasticity
Waverman (1974)	GB	Inland trunk calls	-0.630
Cracknell (1982)	GB	Inland local calls	-0.095
		Inland trunk calls	
		- peak & standard	-0.123
		- cheap	-0.101
		International	
		- West Germany	-0.156
		- USA standard	-0.408
		cheap	-0.842
		- New Zealand	-0.484
Waverman (1974)	CDN	Residential and business calls	-1.200
Waverman (1974)	S	Trunk calls	-0.290
Davis et al. (1973)	USA	Local	-0.210
		Toll	-0.880
		Private line	-0.740
		WATS	-0.140
Littlechild & Rousseau (1975)	USA	Business - 100 miles	-0.100
		500 - 700 miles	-0.200
		Residential - 100 miles	-0.200
		500 - 700 miles	-0.300
Lago (1970)	All	International calls	-1.250
Naoe (1974)	J	International calls	-2.280

It is here where much of the negative allocative effects and the large welfare losses as a result of the current tariff policy take place, because the elasticity for long distance calls is significantly higher than for local calls (see Table 3.7). In the case of international calls, where the deviation of prices from costs is much greater and the price elasticities are still higher (-0.8 to -1.5) welfare losses are even larger.

3.3.4 Welfare Losses and Dynamic Effects of Current Tariff Structures

There have been a number of studies to estimate the welfare gains from a move towards marginal cost pricing. Neumann et al. (1982), who have carried out such a study for Germany, concluded that a move from the (1979) German pricing structure to a marginal cost pricing structure would have resulted in a welfare gain of almost 2bn DM, almost 10 percent of income from voice services. This figure is still valid today, as our more recent calculations (in the appendix) show.

A more rational tariff policy implies not only significant gains in consumer surplus, but also an upward shift in the aggregate demand curve. By changing the structure of prices, the total demand for telecom services - at given average prices - is increased. Furthermore an adjustment of tariffs nearer to cost, for example by more than 50 percent in the case of trunk calls in West Germany, could lead to a 20 percent

increase in call volume. To raise the charges for local calls on the other hand causes a much less proportional traffic loss. The positive allocative benefits of such a move are clear.

Furthermore, in the presence of system economies of scale (as shown in Figure 3.5) unit costs also decline with an expansion in demand, thereby confering benefit on existing traffic (at least in terms of resources saved) as well as stimulating overall demand further. Using similar demand and cost parameters as before, a 20 percent expansion of traffic as a consequence of rebalancing could ultimately - with more investment and lower cost, increase traffic by 22.7 percent, while at the same time lowering unit costs by 4.5 percent.[19]

None of the studies which we have surveyed cover the dynamic effects of the current tariff policies that we have mentioned above. Furthermore, these studies do not tend to show the impact of current tariff restrictions on user and producer freedom that are necessary to avoid the tendency towards arbitrage and cream-skimming as a consequence of a more liberal network use. These effects are bound to be considerable as

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19 The elasticity of telecom output with respect to a demand shift is 1/b+g, where the demand shift is measured by the proportionate reduction in the average telecom tariff that rebalancing would permit. If a similar demand shift as above of 11.3 percent occurs, then with similar parameters, i.e. b = -0.2, g = 1.66.

well and will have to be added to the static welfare losses calculated here.

3.4 Influence on Service Offerings

Two of the Green Paper's recommendations are bound to influence the variety and range of service offerings if they are fully accepted. The first concerns the proposal to allow competitive services in competition with the reserved services provided for by the telephone administrations (they too, of course, may provide competitive services but it is in reserved services where they have an exclusive right). The other one concerns open non-discriminatory network access which should help to enhance the value added network market, especially if it is combined with a tariff harmonization that allows the abolition of current restrictions on network use.

The competitive service offerings not only increase the spectrum of service offerings to the public, but also allow some elements of "network" competition to emerge, even if only in an indirect way. The substitution potential to such non-reserved services may thereby also serve as an additional check on X-inefficiency of the PTOs which goes beyond the normal regulatory pressure.

It is the second effect, however, that is of interest here. From a more harmonized, liberalized VANS market, additional service offerings are bound to arise. The precise effects

are difficult to quantify, depending on the actions of the PTOs themselves in this service area. The PTOs can be quite active, as for example the RTT or the DBP, or more passive, but with more infrastructure provision, as France Telecom, with the French Videotex example. What is essential for further service offerings is a good interface between infrastructure provision and VANS, independent of the activity level chosen by the PTO.

It suffices here to outline some of the likely effects:

- The VANS may help in eliminating space as a geographic barrier to the spreading of certain services, as in the case of computer services. In the past, these services were linked to the location of computers. The linking of computers via a telecommunications network extends these services over a geographic area, just as the locomotive spread the power of the steam engine in the last industrial revolution. The "down sizing" of computers and increasing availability of economic input-output devices enhances this effect;

- VANS aid the spreading of existing services from within organizations or large centres throughout the economy by making them available at economic costs to third parties.

- As a consequence, VANS create a larger geographic market

for already existing services and may lift some potential services beyond the "break-even market size". This implies the creation of new services that would not have been economic before (i.e. "experts on Tap", telecommuting, increased user-friendliness, etc.);

- VANS help in the creation of new services that are made possible by the "economic" linkage of computers through telecommunications.

- VANS lead to the further integration of office functions. The integration of design, manufacturing and component production will bring us closer to the "Office" and the "Factory of the Future" with computer-aided design (CAD), computer-aided manufacturing (CAM), flexible manufacturing services (FMS), etc. These developments bring with them a large potential for electronic data interexchange (EDI) that allows a further interlinkage of production and distribution steps.

- This linkage will be aided by the increasing cheapness of band-width (for example through a European-wide broad band network) that will alter significantly the cost of image transmission and the availability of services that depend on them (i.e. three-dimensional simulation for research in medicine, biology, chemistry; audiovisual education techniques, videobooks and conferences, etc.). Traditional VANS like access to data banks will become quicker and cheaper.

These effects are difficult to quantify across the territory of the different national European operators because some of them are already heavily engaged in diversifying product offerings and encouraging VAN markets, while others are still busy establishing the infrastructure for voice telephony. We have therefore only been able to identify possible effects in a qualitative way.

3.5 Influence of Harmonization

Products and services which are standardized may become more valuable if they are compatible with each other or if they can be made compatible (through interfaces) at realtively low cost. But the competitive process might not always lead to such compatibility (Besen and Saloner, 1987). Individual producers, especially those which enter the market first, have an interest in maintaining incompatibility as a barrier to competitive entry. Even if compatibility is achieved, for example thrugh industry standards, this standard might be achieved too early or too late, depending on industry structure. Due to the massive sunk costs of the first emerging standard, consumers may be locked in to different and perhaps inefficient standards, as in the case of typewriter keyboards and TV sets (David, 1987; Crane, 1978).

In order to correct for these market failure effects, governments must become involved in helping to set up standard-

setting institutions. An industry-run approach alone, which could achieve the same result, brings with it the danger of cartelization. However, care must be taken to ensure that the overall welfare effects of such decisions are kept in mind. The experience of the telecommunication industry shows, however, that the government too may be either biased and set the standards too early or too narrow, keeping only its domestic market and industry in mind. Standard-setting organizations with a larger georgraphic or even world market coverage, for example through the EEC or the International Telecommunications Union (like CCITT) may help to overcome this shortcoming. Such a policy would also reduce the barriers to entry that often arise with national standard-setting.

It is in this connection that the attempts of the Green Paper to increase harmonization has to be seen. The economic effects are likely to work similar to those observed in VANS in Section 3.3, namely

- a reduction in barriers to entry through increased market size will increase market growth and thereby also create learning and scale effects (for example in mobile radio);

- a lessening of monopoly power should reduce the price/cost margins and increase market size as well.

4. Results of the Scenarios

4.1 A Status Quo Scenario

The reference scenario, against which to compare the effects of the completion of the internal market will have to be a status quo scenario, in essence the "anti-monde". Table 4.1 gives an overview over the current institutional spectrum in European telecommunication markets, the constraints under which PTOs operate and the anticipated regulatory changes.

Except for perhaps in Denmark and Great Britain, industrial policy goals in procurement still play an important role. This means that PTOs are forced to support their domestic industries, sometimes at a considerable cost (INSEAD, 1988). Denmark has been able to do without it because its local telephone operating companies are almost too small to be "captured" by politicians or equipment producers. This has allowed its PTOs to be more interested in providing low cost service than pursuing an industrial policy goal. British Telecom has been forced to abandon its preferential and purchasing policy as a consequence of the emerging competition with Mercury. For customer premises equipment, however, the U.K. certification scheme still retains a preference for domestic products.

While complete state ownership of telecommunication administrations is still the norm, the potential for private shareholdings

Table 4.1: **The Institutional Spectrum in European Telecommunication Market (1987)**

	West Germany	Belgium	Denmark	Great Britain	France	Nether-lands	Italy	Spain
Industrial Policy Goals in Procurement	yes	yes	no	no	yes	yes	yes	yes
Complete State Ownership	yes	yes	yes[1)]	no	yes	yes[2)]	no/yes[3)]	no
Separate Post- and Giroservices	no	yes	yes	yes	no	no	yes	yes
Strong Network Monopoly	yes	no[4)]	no[4)1)]	no	no[4)]	no[4)]	no	no
No. of Network Operators	1	1	4	3[6)]	2[7)]	1	3	1
Separate Regulatory Institutions	no	no	no	yes	yes	no	no	yes
Change in Telecoms Monopoly envisaged	yes (1988/89)	yes (1988)	no	no	yes (1988)	yes (1988/89)	yes (1989/90)	yes (1987/88)
Separate Subsidiaries in Competitive Markets	no[8)]	no	no	no	yes	yes	yes	yes
Unrestricted Use of Leased Lines for VAS-Services	no[9) 10)]	no	no	no[11)]	no[9)]	no[9)]	no	no
Extensive CPE Monopoly	yes	yes[9)]	yes[1)]	no	no	yes[9)]	yes	yes

1) Regional. - 2) Some private Shareholdings envisaged. - 3) ASST owned by the state. - 4) Open for CATV networks. - 5) Private local networks possible. - 6) BT, Mercury and Hull Telephone. - 7) DGT and TDF. - 8) Beginning activities through DETECON. 9) Further liberalization envisaged. - 10) Shared use possible, also some interconnection to the public network. - 11) Unrestricted resale at least until 1989 prohibited.
Source: DIW.

is increasing. In addition to Spain and Italy, where private firms have a large degree of public shareholding, the reform envisaged in the Netherlands by 1989 may eventually lead to private shareholdings as well, once the PTT is transformed into a stockholding company. Such transformations tend to reduce government constraints on procurement and tariff policy as the interest of private shareholders must now also be considered.

The institutional link between telecommunication and postal services often creates extra financial burdens for the telecommunications side. The separation of the two services, which has now been instituted in a number of countries, tends not only to prevent this development, but allows each of the organizations to be more flexible and go their independent ways. It is interesting to note that Germany too has proposed to move in this direction and a change in France seems likely, so that the major markets could eventually be freed from heavy cross-subsidy obligations.

Network monopoly has only been abandoned in Great Britain. But the fact that private cable networks have been allowed to operate in a number of countries might increase the likelihood that private (ROES) antennaes for satellite reception will also be liberalized. This development anticipates the liberalization of receiving only earth stations as envisaged by the Green Paper.

Technology is playing a strong positive role here, especially as the convergence between telecommunication and data processing is making the old boundaries of the interface between the regulated and the non-regulated sector obsolete. But the legal boundaries associated with the current legal status of the telecommunication authorities are so all-embracing in some countries that most data processing and especially value added services could theoretically be included in their jurisdiction. While this does not take place in practice, it leaves a considerable amount of discretion with the network operator which in turn creates uncertainty for potential entrants in the field of competitive non-standard services.

Where more than one network operator already exists, for example in the form of the state-owned company Telediffusion de France (to distribute broadcasting programs), the possibility to allow such entities to eventually act as separate network carriers increases and with it the likelihood of network competition. This is expected to have important effects on efficiency and tariff structure, as our discussion above has shown.

Already now some countries have adopted the Green Paper recommendation of spearating the regulatory authority form operating companies as in Great Britain and France. West Germany, Belgium and the Netherlands plan to do so in the near future. Moreover, some telecommunication administrations have set up separate companies to participate in competitive markets

(for customer premises equipment, VANS, information services etc.), thereby creating fairer competitive conditions with private firms and anticipating the recommendations of the Green Paper. French and Spanish telecommunication administrations established such subsidiaries some time ago, while BT has only recently gone this route in order to better utilize the economies of scope that exist between network services and other activities.

Greater problems exist with respect to the liberalized use and the cost based pricing of leased lines (an important precondition for the development of value added and information services). All countries still maintain restrictions on the use of leased lines and may do so until 1992. It is in this area (along with a modification of the tariff structure) where large adjustments must still be made.

The same is true with respect to the CPE market in which liberalization is progressing only slowly. Especially concerning the first telephone apparatus where most PTOs still maintain a service monopoly, a significant, unrealized competitive potential still exists. This has been exemplified by the recent U.S. and Canadian development as well as the newer U.K. experience.

This overview of the status quo development shows already some moves towards implementing the recommendations of the Green Paper. But the most important issues remain in the area

of tariff policy, network access and a liberalization of the CPE market. Improved performance by the PTO, as a consequence of more liberalized procurement policies, increased operational efficiency and a move towards a more business like environment remains also a crucial issue.

4.2 Recommendations of the Green Paper Fully Realized

4.2.1 Keeping the Arena of "Reserved Services" Small

We have seen in section 4.1 that already now the current national arrangements concerning the regulatory framework of telecommunication operations are being revised. For workable competition to become more effective the regulatory framework must be changed further and effective boundaries and interfaces between "reserved services" and competitive services be drawn. Care must be taken on the one hand to ensure the full exploitation of economies of scope that exist between network operation and other activities. On the other hand, antitrust issues must be kept in mind so that

- restrictions for the activities of the national telecommunication administrations can be identified, which prevent unfair competition vis-a-vis private suppliers.

- Where the services the PTOs offer are available from third

parties as well this potentially fruitful competition can take place on an equal footing.

- This might even imply that some aspects of competitive activities might have to be regulated as well. But the question of regulating a competitive activity is clearly different from that of regulating a monopoly.

Our analysis suggests that the legal monopoly area for "reserved services" can be defined much more narrowly, in line with recommendation B of the Green Paper.

In this case, the qeustion of a proper interface between regulated monopoly areas and competitive activities becomes crucial, especially concerning the safeguards necessary to control the cross-subsidy potential that exists between regulated monopoly markets and the competitive markets in line with the available instruments under Articles 85/86 and 90. At issue here is the ease of entry, the avoidance of predatory behavior, fair access to bottleneck facilities, etc. so that the benefits of competition can be fully realized. Advantages that occur naturally to the telecommunication administration, for example due to favourable access to information about customers (when the network operator also competes in the CPE or VAN market), the network interfaces (concerning value added networks) and the access to bottleneck areas must be considered with this objective in mind.

If the area of reserved services is kept small, it might in the extreme only entail basic dialled telephone services while giving up the monopoly on all CPE. This is the policy currently envisaged by the Bundespost after the recommendations of the Witte report. The U.K. has already gone this road and France as well, so it represents a realistic form for a scenario in which the effects of recommendation B of the Green Paper are considered.

But even if with the emergence of ISDN and the increased importance of data and image transmission, the voice segment of the market declines to as much as 70 percent of total "public" or commercial telephony markets, it still leaves the majority of the service volume in the hands of the telephone administration. In purely quantitative terms, the likely effect of this recommendation may seem small, but the changed relationship with competitive service suppliers and the substitutability (even if only limited) between "reserved" and "non reserved" services is bound to have an influence on the performance of the network operator. We must therefore consider two effects:

- the potential market increase in the competitive area and

- the changed behaviour of the PTOs in the regulated area.

The quantitative implications of the second effect, i.e. because of the changed behaviour in the regulated area, are

difficult to assess. Much will depend on the amount of "non reserved" service offerings by private suppliers as a response to reserved offerings and the interface and interaction between them. Our discussion of VANS above suggests that a more liberal use of "reserved" network services will also tend to encourage VANS, while keeping other parameters (including interface provisions) constant. This would suggest a relatively small additional impact on the regulated, reserved services in addition to that discussed in relation to VANS.

4.2.2 Likely Effects from the CPE Market

In the competitive area we are mainly concerned with CPE, VANs and services that arise out of the ONA concept. In the CPE market, the initial difference from status quo is expected to be small as well. But we expect a larger reaction of suppliers to lower barriers to entry and a significant increase in market size, so that significant changes are to be expected. A uniform EEC-wide type approval policy according to minimal standards (based exclusively on the safety of the user (avoidance of first-party harm) and the network (avoidance of second-party harm)), should result in a sizeable enlargement of the CPE market, increased product variety and a considerable cheapening of products.

The effects of the completion of the internal market on the equipment industry have been dealt with above (INSEAD, 1988), but they do have important implications for the network as well. Cheaper and more versatile terminals will also generate

extra network traffic, as more terminal functions may become integrated, leading to a substitution effect from physical communication, but also to a market extension effect, because competition is possible over a wieder range. To the extent that liberalization of the CPE market lowers the price of telecommunications equipment it will reduce the cost of telecommunications. If these cost savings are used to rent more access lines than there might be an increase in traffic volumes because of increased number of lines. According to analyses undertaken by Bell Canada, regarding the relationship between access lines and toll usage, a 1% increase in access lines would result in about a 2% increase in long distance traffic volumes, all other things equal.

In Bell Canada's serving area of Ontario, Quebec and parts of the Northwest Territories, competition in the terminal equipment market was introduced in August 1980. Since this date, the business market has been characterized by more aggressive marketing efforts than in the pre-competitive environment, resulting in faster technological innovations and new product introductions as well as a general decline in Key and PBX terminal equipment prices. These factors, taken together, appear to have stimulated the demand for business access lines.

In a Bell Canada econometric model of business access demand , a proxy variable has been included to reflect the impact of such structural changes. The model results suggest that these

factors have indeed had a positive effect on the demand for business access lines. Since business access demand affects long distance traffic volumes, one may infer that these structural changes have also stimulated long distance calling.

Similar evidence is available for the U.S., where the CPE market was liberalized much earlier (Huber, 1987), however, just as in Canada, from a much more restrictive environment than that which characterizes the European CPE market, for example in France, Belgium, West Germany and Italy.

After a careful analysis of these developments and further interviews with industry experts, we assumed that an additional increase in telephone traffic of 5 per cent could be expected as a consequence of a European-wide liberal CPE certification and attachment policy. With unchanged telephone tariffs, this would mean 1.5bn ECU extra network revenue p.a.

Since much of this traffic will benefit from economies of fill, requiring little further network investment, some tariff reductions might be possible as well. This could lead to a further tariff stimulus, especially in those countries where the substitution effects initiated by a move towards a more competitive CPE market are largest. There will also be some additional investment in CPE devices that may help to reduce users' telephone costs further, for example, related to telephone answering machines, electronic mail, etc, though the

overall effects for the telephone administrations might not be as large. There will be indirect effects on the rest of the economy:

- reduced CPE equipment costs will free income for other purposes;

- substitution of physical information processes to telecommunications will reduce production costs and enlarge the competitive arena;

- tariff savings through more advanced CPE equipment will reduce the telephone budgets of firms and households.

The direct effects, 1.5bn ECU due to additional traffic will have to be considered in terms of opportunity costs. This can be interpreted in terms of .3bn ECU due to economies of fill, plus the extra profits obtained from this additional service revenue, perhaps .15bn ECU, resulting in economic gains of .45bn ECU. The indirect effects could be between 50 and 100 percent of this sum.(Tabelle 4.1)

4.2.3 Likely Effects from the VANS Market

Concerning VANS, exact figures about the European market size are rather vague; even for the U.S.A. only approximate figures are available. Revenues of the four prominent North American VAN carriers, Tymnet, Graphnet, ITT and Uninet, reached about $ 225m in 1984; services bureaus formed to provide remote

access to information earned about $ 52m in 1986, voice mail had reached $ 35m in 1983 and telephone conferencing $ 127m in 1983. For on-line data bases about $ 2bn was spent in 1986, a volume to be doubled by 1990 (IRD, 1983).

Data about the European market is more difficult to obtain. For data banks on financial information, about $ 300m was spent in 1982, compared to 1.5bn in the U.S. in 1983. A Frost & Sullivan (1984) forecast predicts the market for VANS in Western Europe of $ 5.7bn (in 1984 prices) by 1990. Of this, $ 2.5bn is for telecommunication services, text and message services are expected to earn $ 1.256bn and on-line data bases $ 1.3bn. The U.K. market is expected to continue to dominate this development, earning $ 1.375bn by 1990, to be followed by Germany with $ 1.34bn and France with $ 1.063bn. Italy and Scandinavia follow with slightly more than $ .5bn each and another billion to be achieved in the remaining 9 countries covered in this study.

If one takes this Frost and Sullivan revenue forecast for PTO revenues seriously, almost half of the revenue will be accruing to the PTOs. The behaviour of the PTO and the regulatory ease with which the development of the VAN market is permitted, will therefore be crucial to this scenario.

It is our opinion, that the full implementation of the EEC's recommendation in the Green Paper would be the minimum amount of institutional change necessary to achieve such growth rates.

Our interviews and literature research so far suggest that most value added networks currently spend at most 10 - 15 percent of their sales volume on PTOs' services, making them less vulnerable to high tariffs and restrictive use of the telephone network. The Frost & Sullivan estimates for revenues accruing to PTO (50%) is overly optimistic, however. But the degree to which liberal network use and cheap transmission facilities are available is crucial to the further development of this market. Predicting such high growth rates for services with relatively little value added (compared to costs of carrier services) means that much of the more price elastic apllication segment of VANS will dominate the market growth. The PTT revenue of 2.5bn ECU by 1990 might therefore be an estimate on the high end, at least as far as PTOs' revenues are concerned.

To achieve such figures would require not only a very cooperative approach by the PTOs, but also an increasing coordination of standard-setting at the European level as envisaged by the Green Paper. We would attribute at least half of this growth in transmission volume, namely 1.2bn ECU to be related to achieving the goals of the Green Paper. In terms of opportunity cost, we again consider 20 percent due to economies of fill, i.e. 0.25bn ECU, plus 10 percent due to the profit on extra network services, i.e. 0.12bn ECU, in total .3-.4bn ECU. (Table 4.1)

In addition to liberal network use and cheap transmission facilities, a further aspect crucial for the growth of VANS

is that of Open Network Architecture[20]. Through it, providers of VAN services can have easy access to the public network, employing all the tools of traffic economy in the process as well as the utilization of the increasing intelligence in the network (such as reversed charging, closed user groups, diagnostic and control options). If the ONA concept is successfully implemented, we envisage that a number of VAN services, and also information and add-on services that have only a marginal application at the moment (for example, because of high transaction costs), may increasingly become economical. This might also lead to private households becoming more interested in these services, especially on the higher income end, thereby greatly increasing the volume for such services and the amount of revenue generated within the network. As a consequence, the 2.5bn ECU figure mentioned by Frost & Sullivan could easily be increased by another 50 percent by 1992 to 3.75 bn ECU.[21] Employing the same calculations as above, this

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20 Here the aim of the Commission's proposal is to provide for the study of user requirements for non-discriminatory access to public telephone networks, for which an open network provision concept will have to be provided.

21 It is difficult to break this aggregate estimate down by countries, but it would also not be a very meaningful exercise. Many of these services will have relatively high fixed costs, once they have been set up, it is only their marketing and administrative cost, which will count as a variable cost. Having a larger unified EEC-wide market available in which to market these services will greatly increase their growth potential as well as attracting extra entry.

adds another benefit in the neighbourhood of .2bn ECU by 1990, and 0.05bn ECU in terms of the calculations for 1985.

4.2.4 Other Effects

The Green Paper also envisages an improved regulatory structure through the separation of the regulatory from the operational responsibility and a strengthening of the antitrust provisions. This should facilitate the interface of competitive services with "reserved" services, thereby encouraging entry and a widening of service options, whose quantification is, however, beyond the scope of this research report. Similar effects are expected as a result of increased standardization efforts in services. Increased compatibility would have a cost-reducing effect in terms of resources saved, as well as a market enlargement effect as a consequence of lower service costs. Again we have not attempted to quantify these effects here.

4.2.5 Weak Provisions for increased Performance and Tariff Rebalancing

However, in this "Green Paper" scenario there is little incentive to harmonize tariffs, implying that at the level of the member-states, many of the current allocative costs of tariff distortions are maintained or perhaps even increased, not to speak of the associated dynamic costs. This latter possibility is indeed a real one, as technical change is occurring much faster

than tariffs are being adjusted.
Furthermore, we see little effects from the current regulatory change on the existing differences in operating efficiency between different networks. This would imply that further welfare and efficiency gains in the neighbourhood of 10 percent of present PTO revenue are still possible, that could accrue in addition to the benefits mentioned in the area of CPE, VANS and ONA development. It is for this reason that we explore below also a scenario of full network competition, even so it is at the moment politically unfeasible.

4.3 Full Network Competition

4.3.1 Regulatory Parameters

The regulatory framework in which full network competition might take place has already been outlined. Before proceeding, a number of other parameters have to be established, however, since they too influence the competitive effect that is likely to result from introducing network competition.

The different parameters we have in mind refer to

- the current distribution of customers and the traffic pattern within and between countries;

- the cost structure of the existing telecommunication administrations and

- the degree of asymmetric regulation eventually pursued to encourage network competition.

The first parameter is important because any network competitor will first aim for the largest customers and the routes which carry the heaviest traffic.

The existing cost structure indicates the eventual competitive advantage of a new network, independent of any scale effects.

Asymmetric regulation refers to the extent to which the current telephone administrations are prevented from reacting to entry, even if they themselves have a cost advantage vis-a-vis new entrants.

Further obstacles must also be considered, such as the problems which are encountered in obtaining access to "right of way", to microwave sites and to the local loop, for example through interconnection agreements.

4.3.2 Tariff Rebalancing

Even if a reasonable regulatory framework concerning these

regulatory parameters is adopted, as for example in the U.K., in Japan or the U.S., new networks entry will require a two-year build up period before they can connect their first customers. They will not be in full operation for another year or two, giving established telephone administrations enough time to adjust tariffs and performance and to react to the expected competitive pressures of network entry. The evidence from those countries which have experienced network competition suggests however that incumbent operators reacht through increased performance and a realignment of tariffs in anticipation of the entry. Local rates and rentals are normally raised to eliminate loss-making activities, while long-distance and international rates came down. The size of the expected tariff adjustment as a consequence of network competition, depends on the current amount of cross-subsidization taking place. If access charges to the local loop are levied on entrants, a certain amount of cross-subsidies may continue without ... further entry.

Our considerations in section 3.2 have shown that connection and rentals barely cover their costs, as do local calls. Detailed calculations for France show that local calls cover only 50 perent of their cost, while long-distance rates are about 30 percent above costs. Similar or even larger tariff dispersions exist in the other member states, except perhaps in the U.K. If the cost estimates from section 3.2 are at all accurate, a sizeable tariff rebalancing would therefore be possible,

with associated welfare benefits particularly in those countries, where trunk calls are priced very high and local calls are considerably underpriced (see Table 3.6). In these countries, welfare losses might well be above the 10 percent figure on total call volume obtained for West Germany. Excluding the already partially rebalanced U.K. indicates welfare effects in the neighborhood of 4bn ECU for the EC as a whole. (Table 4.1)

These welfare effects are not directly comparable to opportunity costs saved, for example due to improvements in productivity because of an abolishing of internal market boundaries. On the other hand, they represent increases in consumer satisfaction and, because of a closer move to cost, important price signalling effects in those markets where telecoms services are used as an input.

4.3.3 Effects on Productivity

The amount of the productivity improvement as a consequence of network competition is difficult to estimate. Our comparisons of the Bundespost and BT with Bell Canada in Section 3.1 suggested that a 25 to 50 percent higher growth rate in productivity may be possible. With productivity growth currently ranging from 1 to 2 percent, an increase of at most 1 percentage point p.a. seems possible. Equal effects may

be possible for Belgium, Italy and Spain.[22] In terms of resources saved, this is equivalent to .6bn ECU p.a. (Table 4.1)

If one extrapolates this trend to the year 2000 and assumes that these productivity gains are fully passed on in further tariff reductions beyond the rebalancing effects already mentioned above, the additional demand effects could be sizeable. Assuming that the estimated price elasticity for trunk calls was -0.7 and taking account of the additional exploitation of economies of scale as a consequence of higher growth rates, a further 20 percent reduction in the real telephone cost between now and the year 2000 could easily gain extra traffic of 10 percent.

Such an acceleration of productivity could, if all the extra profits were passed on in terms of lower tariffs, maintain the current level of profitability of the major network operator. If entry leads to considerable excess capacity in networks and a subsequent shake-out, rates of return on investment might go down during the adjustment period. It is difficult to forecast if the long-term rate of return on investment would be different from today, since that depends to a large extent on the regulatory environment chosen and the riskiness of the investment.

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22 We have not been able to extend the analysis to the Netherlands, Portugal, Greece and Ireland.

4.3.4 Effects on the VANS Market

If the open network access solution of the Green Paper is successful, we would expect much more efficient network utilization, implying still higher rates of total factor productivity, at least during the transition to a new equilibrium. This does not necessarily result in higher profits, however, since competitive entry ought to ensure that at least in the long term competitive rates of return - adjusted by the relative investment risk - are observed. But together with the expected tariff rebalancing and the absence of user restrictions on leased lines, the effects in the VANS market ought to be significant. This can also be seen from a recent analysis of the German market (von Weizsäcker et al., 1987) where the losses from a continuation of the existing restrictive tariff policy are compared to a more liberal VANS policy.

The underlying model of von Weizsäcker is based upon the assumption that the demand for VANS expands as experience accumulates. Learning takes place through consumption instead of, as more usually, through production. A 'tax' (in the form of volume-related tariffs on leased lines as currently practiced by the Bundespost) reduces demand for VANS and thus, by reducing the amount of learning associated with the cut off consumption, raises production costs above what they would otherwise have been.

Von Weizsäcker considers two scenarios: the first a closed economy and the second, open. Assuming a price elasticity of demand of -0.25 and a learning parameter of 0.685 then, although the welfare loss in 1987 is only 1/8 percent of VANS revenues, by 2007 it has reached 1/3 percent of GNP while the demand for VANS is to be about 8 percent of GNP.

In a world economy a country can import or export VANS. When the domestic institutional environment is less than optimal these services will be imported because domestic supplies will not flourish. On the one hand the possibility of imports implies the "closed economy estimates" are upward biased, on the other, export possibilities give an opposite bias.

The production costs of VANS, excluding transmission, are once and for all software development, a fixed cost. Hence the larger the market served, the lower the cost per customer and the greater the variety of services. In the second,open market scenario, von Weizsäcker assumes

(i) German suppliers have a 75 percent market share in Germany and a 2.5 percent market share outside, and

(ii) the world market is ten times the German.

He then supposes

(a) market shares are unchanged and both markets grow at the same rate. He compares this position with scenario

(b) the German market grows more slowly so that even with market shares unchanged German suppliers' global market share falls.

The market share product quality feed-back now reinforces the previously discussed learning-effect. These effects together with the tax (through volume charges) on leased lines, cause a substantial deterioration in the German balance of trade.

Assuming an initial market share in the reference state of 9.09 percent, the German share falls to 5.6 percent by 2007, also assuming a growth parameter of 0.68 and that home market share never falls below 40 percent. The German domestic market share falls from 3/4 to 1/2, the trade deficit rises from 0 to 42.18 bn DM and the welfare losses in terms of GNP effects amount to more than 1 percent by 2007.

With these magnitudes it is clear that there would be a considerable divergence between EEC countries over the next twenty years if some choose not to liberalize their VANS network and others do. Moreover, since VANS are tradeable, the VANS competitiveness of Western Europe as a whole will be retarded by the reduced learning experiences, contributing to a lower income than necessary and a balance of trade deficit, as American and Japanese VANS suppliers enter.

4.3.5 Further Secondary Effects

There are a number of further secondary effects to be considered. First is the effect on investment. Allowing network competition will obviously bring more investment into the network, especially if it was cash-starved in the past. Even if it was not, the extra investment to take place can be sizeable. In the U.K., Mercury had investment £ 200m by the end of the 1985-86 financial year; calculations for France show that an investment volume for a separate network operator may be FFr 1.3bn, distributed over the period 1988 to 1992. Furthermore, if demand elasticities are at all as high as Table 2.7 indicates, additional "derived" demand for investment would take place, once tariffs have been lowered as a consequence of higher productivity.

The second kind of investment expansion will take place for the established network operator and is likely to be larger in magnitude. He will not only have to increase his own capacity (i.e. as a consequence of increased "derived" demand, where he had to lower his price as a consequence of rebalancing), but he will also have to replace his existing equipment in the network much faster because of quicker equipment depreciation. In other words, the entry of competitors with more modern equipment will necessitate for the established network operator a departure from traditional accounting rules to more economically based depreciation rates. This will only be a transitory phenomena, but should still bring about a sizeable investment boom.

We also expect a larger amount of labor shedding, as networks will be forced to rationalize under a competitive threat and equipment manufacturers face a harsher competitive climate in which preferential procurement prices will be more difficult to maintain. This will be especially significant in those countries, where rationalization in the network and the equipment industry has been prevented for political reasons.

Because of the effects of network competition, other political influences will be reduced as well, for example to continue the cross-subsidy of postal services, to continue excessive R&D and export support for the equipment industry, to pursue a more regional policy etc. This would have the obvious benefits of bringing about a more coherent telecommunications policy, but it would eliminate all the distributive policies currently pursued through tariffs, procurement or hiring. A uniform national tariff policy could only be pursued under strict regulatory rules of interconnection and access charges; otherwise route-specific de-averaging would mean that the denser routes are priced lower than the thin routes and traffic to outlying areas.

In sum, the benefits of integrating a European market under a liberalized network scenario are not so much felt as trade effects as few of these services are actually traded, but they occur more as indirect competitive effects. A larger European market would, of course, facilitate the establishment

of separate carriers, which would be much more difficult nationally. While some elements of this scenario might be politically unrealistic, it shows that the effects of a more coherent long-term telecommunication policy of the EEC are truly worth working for.

4.4 A Summary

Table 4.1 summarizes the main results of the two scenarios. The major difference between the two is the greater effect of a competitive procurement policy and of tariff reform under network competition. Without a network monopoly, entry, even if only on the fringes, forces PTOs towards a more cost conscious procurement and operating policy and, as we see under point 3.3.4, a policy of tariff rebalancing. The example of the Swedish PTO - Televerket - shows that such policies are also possible without network competition, but our interviews in the different countries suggest that industrial and regional policy considerations, labor market obligations and union pressure prevent the PTOs from carrying them far enough. The increased pressure the EC is putting on tariff harmonization is therefore a step in the right direction, as is the policy on VANS and ONP. But only if the regulatory framework can be strengthened to increase performance and if the PTOs are released of the other policy task by pursuing them through more direct policy tools (taxes, subsidies, retraining, etc.) will more rational tariff and operating policies result.

Table 4.1: **Effects of Regulatory Reform on European Telecommunication Services (1985)**

Measures/Effects	Green Paper Effects	Full Network Competition Effect
1) Lower equipment cost	2-4 bn ECU p.a. (not to be double counted)	4bn ECU p.a.
Implies lower tariffs and through network expansion, utilization of economies of fill and scale	0.75 bn ECU p.a.	slightly larger
2) Keeping Arena of "Reserved Services" small	not estimated	not estimated
Implies increased product spectrum and market enlargement effects		
3) More competitive "Non-reserved Services"		not estimated
3a) easier CPE certification, increased product variety, lower CPE prices, increased network use (by 0.6 - 0.9 bn ECU)	0.25 - 0.5 bn ECU direct plus 0.2 bn ECU indirect resource savings (p.a.)	
3b) liberalized VANS	0.3 - 0.4 bn ECU by 1990 i.e. 0.1 bn ECU p.a.	larger, because fewer network restrictions
3c) open network provision	0.2 bn ECU by 1990 i.e. 0.05 bn ECU p.a.	not estimated
4) Improved regulatory structure, facilities entry, competitive interface	not estimated	same
5) Standardization, competitive interface	not estimated	same
6) Tariff Reforms (closer to cost)	marginal effects (no EEC instruments as yet)	4 bn ECU p.a.
7) Improved operating efficiency	marginal effects (no EEC instruments as yet)	0.6bn ECU p.a.

The likely effects of the Green Paper towards the completion of the internal market by 1992 are of a sizeable magnitude, but the remaining policy problems are large enough to warrant further efforts, before the market for telecommunications services are truly integrated in such a way, that their full technology potential can be realized on an EEC-wide basis.

Bibliography

Atkins, W.S. (1987)
The Cost of Non-Europe in Public Sector Procurement, Epsom, Surrey, Volume 9 of EC (1988).

Besen, S.M., and G. Saloner (1987)
Compatibility Standards and the Market for Telecommunication Services, Rand Corporation, Santa Monica.

Cracknell, D.R. (1982)
Price Elasticity of Demand for UK Telephone Calls. Paper presented at the Public Utilities Forecasting Conference. Paris, June.

Crane, R.J. (1979)
The Politics of International Standards, Ablex, New Jersey.

Castello, N. (1986)
Intra-EEC and Extra-EEC Trade Flows in Telecommunications Equipment, January - June 1986, Preliminary Report, Brussels, December.

Christensen, L. et al. (1985)
Total Factor Productivity in The Bell System 1947-197, Defendant's Exhibit D-T-128.

David, Paul A. (1986)
Some New Standards for the Economics of Standardization in the Information Age, TIP Working Paper No. 11, Stanford University, August.

Davis, B.E.; Caccoppole, G.J.; Chaudry, M.A. (1973)
An econometric planning model for American Telephone and Telegraph Company. In: Bell Journal of Economics and Management Science. Spring.

Denny, M.; Fontenay, A. de; Werner, M. (1980)
Comparative Efficiency in Canadian Telecommunications: An Analysis of Methods and Uses, Phase II: Productivity Employment and Technical Change in Canadian Telecommunications, Report to the Canadian Department of Communications, May.

E.C. (1988)
Research on the "Cost of Non-Europe", Basic Findings, 16 volumes, Luxemburg.

- (1987)
Towards a Dynamic European Economy, Green Paper on the Development of the Common Market for Telecom Services and Equipment, COM (87) 29. final, Brussels.

Frost and Sullivan (1984)
Value Added Network in Europe, London.

Foreman-Peck, J.; Manning, D. (1988a)
Natural Monopoly and the British Telecommunications Network, Proceedings of the Communications Policy Research Conference, 1987, ed. N. Garnham.

- (1988b)
How well is BT performing? An International Comparison of Telecommunications Total Factor Productivity, Memo, The University of Newcastle upon Tyne.

- (1987)
Liberalization as an Industrial Policy: The Case of Telecommunications Manufacturing, National Westminster Bank Review.

Fuss, M.A. (1983)
A Survey of Recent Results in the Analysis of Production Conditions in Telecommunications, in: Courville, L., de Fontenay, A. and Dobell, R., Economic Analysis of Telecommunications: Theory and Applications, North Holland.

Haid, A. and J. Müller (1987)
Total Factor Productivity Measurements: An Important Management Tool, in: 5th World Telecom Forum, Vol. 3, Geneva.

Huber, P.W. (1987)
The Geodesic Network, U.S. Government Printing Office, Washington, D.C.

INSEAD (1988)
The Benefits of Completing the Internal Market for Telecommunication Equipment, Fontainebleau, part I of this volume.

Kiss, F. (1983)
Productivity Gains in Bell Canada, in: L. Courville, A. de Fontenay and R. Dobell (eds.), Economic Analysis of Telecommunications: Theory and Applications, Elesevier Science. Publishers B.V. (North-Holland), pp 85-113.

Lago, A.M. (1970)
Demand Forecasting Models of International Telecommunications and Their Policy Implications. In: Journal of Industrial Economics, November.

Leibenstein, H. (1966)
Allocative Efficiency v X Efficiency, American Economic Review, 56, pp 392-415.

Littlechild, S.C.; Rousseau, J.J. (1975)
Policy Pricing of a US Telephone Company, In: Journal of Public Economics 4.

Mitchell, B.M. (1979)
Pricing Policies in Selected European Telephone Systems. In: H. Dordick (ed.), Proceedings of the Sixth Annual Telecommunications Policy Research Conference, Cambridge, 437-475.

- (1978)
Optimal Pricing of Local Telephone Service. In: American Economic Review, Vol. 68.

Naoe, S. (1974)
An Analysis of the Interrelations Between International Telecommunications and Economy. Research Institute of Telecommunications and Economics (Tokyo 1972). Paper presented at the International Conference on Telecommunication Economics. University of Aston in Birmingham, May.

Neumann, K.H.; Schweizer, U.; Weizsäcker, C.C. von (1983)
Welfare Analysis of Telecommunication Tariffs in Germany. In: Finsinger, J. (ed.), Public Sector Economics.

Wavermann, L. (1974)
The demand for telephone services in Great Britain, Canada and Sweden. Paper presented at the International Conference on Telecommunications Economics, University of Aston. Birmingham.

Weizsäcker, C.C. von (1987)
The Economics of Value Added Network Services, Cologne.

APPENDIX I Input and Output Definitions Used.

A) Output Measurement

Ideally the output measure would include both the quality and the quantity of service in all dimensions, waiting time for connections, length of haul, duration and time of day for calls. The output measure actually computed, in general, consists of three categories, inland calls, international calls and 'other' output. Access was not included as an output on the grounds that it is an input derived from the demand to make and receive calls. There is the 'option demand' argument for including access as an output but the true output in this case is the exercise of options.

Call volume is reported as number of calls in some countries and number of meter pulses in others, with no standard length of time for a pulse (or billing unit). Even if the measurement was common it would still fail to include the characteristics of the call. In order to standardise inland call output the total revenue from inland calls for each country was divided through by the appropriate price, to determine how many short haul (5 kms) calls of three minute duration could have been made. An alternative output measure was computed in terms of long haul calls (500 kms) of a similar duration. This procedure indicates sensitivity of output measures to different national pricing policies with respect to distance. Where total number of calls is available this is used as an additional measure.

Output for international calls was standardised in a similar way. Total revenue from international calls for each country was divided through by the appropriate national cost per minute of a call to the USA. The USA was considered the most appropriate country to use for standardisation, being a more equal distance from all European countries than any one European country would be.

- A2 -

Constructing an index for the remaining category of output proved more difficult because of the diversity of outputs provided by carriers and the aggregative method of reporting them. A physical measure should ideally consist of numbers and types of leased lines, telex lines and calls, radiopagers, mobile telephones, VAS, etc. As a physical measure we used revenue deflated by the price index for an average business telephone bill. A business index is used as it is assumed business subscribers are more likely to use these 'other' outputs than residential subscribers.

These standardised measures of output were weighted, firstly, according to their own share of revenue in total revenue (without access revenue) and, secondly, by hypothetical cost elasticities. A lower and upper limit is used to test the sensitivity of results to plausible different elasticities. As a lower (higher) limit 0.4 (0.5) is used for inland calls, 0.05 (0.1) for international calls and 0.15 (0.3) for 'outer output'. The implied overall cost elasticities were 0.6 and 0.9, that is a one per cent increase in aggregate output raises costs by 0.6 and 0.9 per cent respectively.

The average wait before being connected to the network is one (negative) dimension of output in which BT scores well in international comparisons. Whereas Telefonica in Spain has an average seven month wait, BT claims to have eliminated its waiting list completely. In principle, a national carrier could reduce its costs by not maintaining sufficient spare capacity to connect new customers immediately. Therefore, some relative waiting time, weighted by the negative of the appropriate cost elasticity, should enter the output index. However because it is believed to be small it was not included in the output measure. Nor have international variations in the quality of service to existing customers been taken into account.

B) Input Measurements

Labour

In addition to the number of manhours worked, the structure of the workforce must be considered, for this influence the overall quality and productivity of labour.

We calculated:

$$\text{number of skill adjusted workers} = \frac{\text{total staff cost}}{\text{annual cost of a PTT basic skill worker}}$$

$$= \frac{WLt + NIt + PCt}{WLi + NIi + PCi}$$

where WL = wage bill
NI = national insurance payments
PC = pension contributions
t = total workers
i = basic skill worker

The justification for this adjustment is as follows. Suppose there are three types of labour L1, L2, L3 paid wages W1, W2, W3 and with marginal productivities $\partial Q/L1$, $\partial Q/L2$, $\partial Q/L3$. Category 1 is the basic skill level and $\partial Q/L2,3 > \partial Q/L1$. The total wage bill is W1L1 + W2L2 + W3L3. Our skill adjusted labour input in terms of the basic skill worker hour equivalent is therefore

$$L1 + (W2/W1)L2 + (W3/W1)L3$$

Since $\partial Q/2/\partial L2 > \partial Q1/\partial L1$ then W2 > W1 and L2 labour receives a weight in the labour aggregate which reflects its superior marginal productivity over the basic skill category. In this way we standardise for international differences in the skill composition of the labour force.

As a different average number of hours was worked different telecom organisations the physical measure was converted

into total skill adjusted manhours per year. This was calculated by multiplying the number of skill adjusted workers by the average hours worked per annum per worker. The average number of hours worked has been assumed to allow for part-time working. One possible drawback is that overtime working is not incorporated into our calculations. However, as far it has been possible to ascertain, overtime is only significant in Britain.

C) Capital Input Measurement

Where measures were available for inputs used for investment the physical input was reduced appropriately. Generally, inputs used for capital account work here confined to labour but in some cases the physical measure of materials input was also adjusted.

In order to compute a physical measure of land and buildings input, we divide the value of land buildings asset by the average rental price of a square metre of warehouse accommodation. We use an average rental price from European Marketing Data and Statistics, Table 122. This gives us a physical measure in total square metres.

For the trunk network we convert transmission kilometres into digital channel kilometres. The standard system size internationally is 1,920. Therefore, we multiplied microwave, coaxial and optical fibre kilometres by 1,920 to get a common measure of digital channel kilometres.

We then imputed rentals for each category of capital,

i.e. $r = (d + 1) Pk$

where Pk is the price of a unit of capital
d is the depreciation rate
i is the rate of interest.

The rate of interest is constant for each of the four categories but the depreciation rate varies for each, according to the lives assigned to the assets.

In practice physical measures for four aspects of capital were calculated:

(1) land and building in square metres,
(2) number of vehicles,
(3) local network in numbers of access lines,
(4) trunk network in digital channel kilometres.

The weights assigned were their own proportionate share of the total imputed cost, where the total imputed cost is the sum of the imputed rental values of all capital inputs, expenditure of materials and staff costs.

D) Material Input Measurement

The diversity of inputs in this category made standardisation in a physical index difficult. The method chosen was to divide the expenditure through by the national average wage rate per hour in each country to derive a common measure of 'labour equivalent units of input'.

E) Data Sources

The main source of data is the annual Reports and Accounts and supplementary publications by the PTTs. Where there are omissions in the data more detail has been obtained from the organisations concerned. One obvious problem with the data is that accounting procedures and reported categories differ between organisations making comparisons difficult. BTs financial year runs from April 1st to March 31st while other telecom organisations use a calendar year.

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