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Elements of telecommunications economics

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**Elements of
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To my parents

Preface

The purpose of this book is to introduce the telecommunications manager, engineer, administrator and regulator to the whole range of work which may be described as telecommunications economics. Of course, if such a survey of the whole field is to be attempted, there is not space to treat any one topic in the depth it really deserves. For this reason, the book is entitled *Elements*. Rather than attempt to provide an exhaustive catalogue and evaluation of all work to date, I have sought to show how economists look at telecommunications, to indicate the kind of work that is being done and the reasons for it, and to exhibit the kind of results that are being obtained and some of their more important implications.

Telephone engineers all over the world will surely be familiar with *Telecommunications economics* by Mr. T.J. Morgan, now in its second edition. The present author cannot hope to rival Mr. Morgan's knowledge of telecommunications nor his experience in applying the methods of telecommunications he describes. What, then, is the case for the present book?

The justification is two-fold. In the first place, Morgan's book is entirely devoted to what is traditionally called 'engineering economics' — that is, to the appraisal of the economic merits of alternative engineering schemes. Other topics such as forecasting and accounting are, of course, covered, but only insofar as they are necessary for the development of his central theme. By contrast, engineering economics, broadly interpreted, takes up only the first seven chapters of our own book. The remainder of the book is concerned with the wide range of other topics, such as pricing and finance, cost and demand, regulation and nationalisation, efficiency and equity, with which the modern manager and administrator in telecommunications must be familiar, but which are not subsumed under the heading of engineering economics.

The second justification for the present book is that the discipline of economics itself is changing, and this is necessarily reflected in the approach to telecommunications economics. Engineering economics reflects the longstanding concern of economists with the profitable and efficient operation of the individual enterprise. However, during the last quarter century the development of 'welfare economics' stimulated economists to question whether the tariff and investment policies resulting from the application of engineering economics would lead to a use of resources which would be efficient and equitable from the point of view of society as a whole. An increasing number of economists have been concerned to trace the implications of welfare economics for telecommunications. The next five chapters of our book survey their work.

My own belief is that the character of economics will change yet again in the next quarter century. The policies implied by welfare economics have not been widely adopted, nor have they been particularly successful where they have been adopted. Economists have given too little attention to phenomena such as uncertainty and ignorance which abound in the real world, and they have failed to reconcile their prescriptions of what 'ought' to be done with explanations of what actually *is* done. In the last few years, however, there has been an increasing concern to remedy these defects. The penultimate chapter of this book discusses some of the current (and fast changing!) issues in regulation in the USA. The last chapter outlines some of the new ideas in economics and attempts to develop their implications for telecommunications.

Interest in telecommunications economics has expanded enormously during the last decade. In 1967, when I first started work on telephone pricing policy, I was not aware of more than half a dozen economists who shared this interest. Even in 1974, when I started work on this book, I still hoped to be able to reference all the published (and many unpublished) papers on telecommunications economics. Today, in 1979, it would be a full-time task merely to compile such a comprehensive bibliography, let alone to write a book. I have necessarily had to be selective in discussing material, but I have tried to reference all the published work of which I am aware. References are given in full at the end of the book, but at the end of each chapter there is a list of the works which are of particular relevance to that chapter.

My hope is that this book will be found useful in all countries of the world. If any subject is international, telecommunications is. The same problems are found universally, although different methods of solving them have been adopted. For this reason, the material in this

book has been grouped by topics, illustrating these from a variety of countries. Occasionally this makes for awkward reading, but it seemed preferable to the duplication which would result if each country's telecommunications system were to be analysed in turn.

The Editor of this series, Professor J.E. Flood, made extensive and detailed comments on four successive drafts of this book, and contributed the bulk of chapter 2. He has been an invaluable source of advice and moral support. Several friends, including H. Christie, G. Pyatt, W.F. Simpson, W.M. Turner, R. Turvey and L. Waverman, kindly commented on particular chapters. I have benefited from reading early drafts of a World Bank Telecommunications Handbook, by A. Newstead, R. Saunders and J.J. Warford. Over the years there have been helpful conversations with many other people, of whom the following spring particularly to mind: W.J. Baumol, A. Charnes, W.M. Gorman, C. Horn, L.L. Johnson, M.G. Marchand, B.M. Mitchell, R. Scholnick, J. Wiseman and E.E. Zajac. Chapter 11 is based in part on research carried out jointly with J.J. Rousseau. I am grateful to those organisations which have sponsored my research or hired me as a consultant on matters of telecommunications economics, including Bell Telephone Laboratories, Illinois Bell Telephone Co., American Telephone and Telegraph Co., the International Bank for Reconstruction and Development, HM Treasury and the Economist Intelligence Unit. To all the above I offer my thanks, and hereby absolve them of responsibility.

It is a pleasure to record my gratitude to Mrs J. Tonkin, Miss K.M. Major and especially Mrs M.A. Sheridan for their beautiful typing of successive drafts of this book; to Dr. I.H. Slicer, who prepared the index; to my wife, Kate, who has suffered far too often during the writing of the book, and to my parents, to whom this book is dedicated, who have encouraged me from the very beginning.

S.C. Littlechild

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Introduction

1.1 The importance of telecommunications

There are at least five reasons why it is becoming necessary for more and more people to obtain a thorough understanding of the economics of telecommunications.

The first reason is the sheer expense of telecommunications systems. The Bell Telephone System accounts for approximately one-quarter of all new capital raised each year in the USA. The British Post Office invests sufficient capital to build a third London airport every six months. The World Bank lends to telephone administrations in developing countries at the rate of about one thousand dollars per minute of each working day. With investment on this scale, it is clearly important that investment appraisals be carried out efficiently, that capacity be utilised fully and that costs be reduced wherever possible.

Second, telecommunications is a complex business. There are so many interdependencies: for example, the ability to make calls between two parties in the network requires a chain of various items of equipment, each of which is being competed for by callers along many different routes. The technology is a mixture of mechanical and electronic, and the product itself is invisible! It is not easy for the layman, whether consumer, taxpayer, administrator or regulator to know whether the right decisions are being made.

Third, telecommunications is not only expanding at a rapid rate – in fact, it is one of the fastest growing industries in any country – but it is doing so, in part, because the technology is changing so rapidly. The development of coaxial cables and radio relay stations in the 1950s led to such a drop in costs and prices that demand for inland long-distance calls boomed. The new features of the 1960s were submarine cables and satellites, leading to a rapid growth of international traffic.

In the 1970s the development of electronic switching devices promises to open up an incredible variety of new services. For the future, yet other inventions such as laser beams are already well into the experimental stage.

Fourth, telecommunications systems are not merely a cost-saving device for businesses and a convenience for households. They have enormous social and political implications. If a telephone conference becomes a substitute for a meeting, how much travel will still be necessary? If news reports can be dialled on television, will newspapers become obsolete? How will family ties and the distribution of population be affected by these developments? Will the world become a 'global village'? Few of these questions as yet have answers.

Finally, we must note that, in the great majority of countries, telephone systems are run by the government. Even where they are privately owned, they are heavily regulated. Rightly or wrongly, telecommunications has been thought too important to leave to the market. Decisions about tariffs and investment are not disseminated among thousands of relatively small producers, as with food or clothing or housing. Decision making in telecommunications systems is concentrated in the hands of relatively few men, so that each decision is important for the whole country.

1.2 The nature of economics

Economics has always been concerned with *financial wealth* and matters pertaining thereto. Adam Smith's pioneering volume in 1776 was entitled *An enquiry into the nature and causes of the wealth of nations*. At the beginning of this present century it was still fashionable to describe the subject matter of economics as 'that which can be brought within the measuring rod of money' (Pigou, 1920). Following this line of thought, one would deduce that telecommunications economics is concerned with those aspects of telecommunications systems where money is involved — that is, with tariffs, investment appraisals, operating employment policies and the raising of capital.

This definition causes certain problems. A wife performing housework is not part of economics, but a cleaning lady paid to do the same tasks is! Whether the performance of an orchestra should be classed as economic depends on whether the musicians are paid! It came to be argued instead that economics should be concerned with the *allocation of resources*, whether or not monetary payment was involved (Robbins, 1932). A housewife has to allocate her weekly income among the goods

in the supermarket, but she also has to allocate her time (another scarce resource) between her family, her job, her housework, her leisure etc. Different ways of spending time and money give different satisfactions. It is never possible to obtain at once all the satisfactions one would like. A choice has to be made. Economics is, therefore, often called 'the science of choice'. *Economising* is the efficient allocation of scarce resources among multiple competing ends.

This definition is obviously broader than the previous one. It means that social activities such as churchgoing and marriage have economic *aspects*, hence the study of economics may be able to throw some light on such phenomena. All those phenomena listed in the previous paragraph still belong within the scope of telecommunications economics, for they are all the subject of decisions. However, the new definition would include, for example, the allocation of frequencies in the radio spectrum between competing users, even if no price were charged.

Several economists are now moving one stage further, and asking such questions as — Who takes these decisions? With what aims in mind? How is the list of available alternatives determined? What influence does the structure of institutions in any country have upon the way in which these decisions are taken?

Attempting to answer these questions makes it abundantly clear that in any telecommunications system there is not one but many decision makers. They will generally have different knowledge, different aims and different incentives. For example, decisions about provisioning of plant may be taken by telephone engineers concerned not to overinstall expensive capacity, but at the same time concerned lest they are taken by surprise if demand suddenly rises. Capacity is expensive because other firms wish to use the necessary steel and labour for their own purposes. Demand is determined by firms and households deciding whether to conduct their business by telephone or letter. The government may be breathing down the necks of the telephone managers because it begrudges them capital, but at the same time fears the political implications of starving them.

Thus telecommunications economics is inevitably concerned not only with the decisions of telephone managers, but also with the decisions of customers, competitors and suppliers; employees, shareholders and taxpayers; regulators and administrators, politicians and governments. A comprehensive treatment of telecommunications economics will have to embrace not only the telephone administration itself, but also the social, legal and organisational environment within which it is located.

Some economists would argue that economics should be defined

more widely as 'the science of human action' (Mises, 1949). The notion of economising as defined above enables one to understand how a particular decision is made, given the set of ends and given the resources available. But it does not explain where those ends or resources come from, or how they change over time. What economics must also encompass, according to these writers, are the notions of *imagination* and *alertness to new possibilities* (Shackle, 1972, Kirzner, 1973). Without these elements of change, decisions could be made once and for all, and new situations would not be recognised, nor would any improvement in satisfaction be possible.

For the most part, economics generally, and telecommunications economics in particular, is based on the notions of economising and the efficient allocation of resources, but we shall see later that the notions of imagination and alertness have a key role to play at several points.

1.3 Economics and telecommunications

A study of economics can offer understanding — an understanding of what has been, what is and what will be. This branch of economics is generally referred to as *positive* economics; it stands in contrast to *normative* economics which deals with the prescription of what *ought* to be done.

The positive economics of telecommunications should be able to shed light on questions such as the following: Why has telephone penetration grown so fast this century? Why do some countries have thirty telephones per hundred population, and others only three? What will be the level of penetration in Britain in ten years' time? Why have US telephone companies previously favoured flat-rate service for local calling areas, but are now turning to 'usage-sensitive' pricing? Who will gain and who will lose by this? Why were telephone companies nationalised in so many countries? What explains the increasing competition to enter the telecommunications market in the United States?

The answers to such questions are obviously necessary as a basis for normative economics, i.e. if one is to recommend policies for the government or the telephone administration to follow. Should prices of peak-hour calls be raised? Should investment be cut back? How fast should electronic switching be introduced? Should the telecommunications sector of the British Post Office be split off from its postal sector? To answer such questions, one needs to specify the aims that are to be achieved, the alternatives available and the consequences of choosing each alternative. It is necessary to understand how the whole economic