Management - a potential source of improved long-term demand forecasts in aviation and shipping

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INTRODUCTION

For the purposes of this paper long-term demand forecasts are distinguished from more immediate predictions, by their need to allow sufficient time for major investment projects to be evaluated, implemented, and in many instances generate sufficient net benefits to fully remunerate the capital devoted to them.

It is widely accepted that better long-term demand forecasts are likely result from the use of improved data and more sophisticated econometric techniques. The central theme of this paper is that an additional source of improvement is to be found in the better management of the working environment within which such forecasts are prepared. Though of potentially wider application, I have chosen to illustrate my theme by reference to some aviation and shipping problems which have arisen during my work as a Civil Servant. Consequently, I must stress that what follows is a personal view, which should not be imputed to the Department of Industry.

STATE OF THE ARTS

In common with other areas of forecasting, long-term demand predictions in aviation and shipping are tending to place less reliance on the crude projection of the previous decade or so's broad aggregate data and are increasingly based on disaggregated economic models with parameters derived via econometric techniques. However, useful surveys of the current state of forecasting methodologies applied to aviation and shipping problems are available elsewhere [1]. Consequently, I have confined my discussion of the 'state of the arts', to commenting on a few apparent differences between long-term demand forecasts in aviation and shipping, and to illustrating the need for substantial improvements in their quality.

Subject to obvious exceptions long-term demand forecasts tend to focus on passengers in aviation and freight in shipping. However, whilst this apparently attractive physical distinction rightly influences working procedures, it is of limited importance when considering long-term demand forecasting methodology. Ignoring unimportant exceptions, transport demand is derived rather than final. Thus for example the demand for non-business international passenger travel by air is largely derived from the demand for overseas holidays and visits to friends and relatives. Likewise, the demand for iron ore transport by sea is derived from the demand for products made from iron and steel. Ultimately the demand for both aviation and shipping services can be analysed by resort to a common conceptual framework, ie. the economic theory of consumer behavior. Economists usually regard the market demand for a final product as being the sum of the effective demands of individual consumers. In turn, individual demand is usually viewed as a function of such basic variables as product price, the prices of substitute and complementary goods, disposable income, net worth, tastes and expectations, where long-term demand forecasts in aviation and shipping do sometimes differ, is in the extent to which they attempt to analyse basic variables directly, rather than assume a stable relationship between basic variables and intermediate or proxy variables. For example, many aviation non-business passenger forecasts use relatively close proxies to individual consumers incomes such as consumption per capita, whilst a forecast of seaborne trade in steel may rely on more remote relationships say between steel output and gross domestic product, and between the stage of the economic cycle and international trade in steel. Although in principle the use of basic variables is preferable to reliance on intermediate or proxy variables, data deficiencies and/or working-time constraints usually determinie which variables are to be used.

Long-term demand forecasts in aviation and shipping are primarily used to aid decisionmaking on the acquisition of aircraft and ships and the provision of infrastructure. Whilst it is quite common for aircraft manufacturers to forecast their market 15-20 years ahead, it is rare to see shipbuilding demand projections looking more than 5-10 years into the future [2]. This situation can be explained by differing relationships between technology and capital costs in aviation and shipping. A new aircraft design is often formulated at the frontiers of technology and may involve several years of research and development before production starts. Consequently, the decision to launch a new aircraft often involves a major investment which must be recovered from high volume sales in the relatively distant future [3]. Conversely, although some specialised tonnage involves expensive research and development, the majority of ships incorporate existing technology and are built on a 'one off' or small batch basis. Major expansions of both airports and seaports often involve relatively long *minimum* timescales. In part, this reflects the technical need to evaluate the external effects of such projects on, for example, inland transport facilities, housing, the environment and land use planning in general. Increasingly, however, the timescale also reflects the time needed for related administrative and political processes to operate.

Lastly, although fluctuations in the world business cycle influence the demand for both aviation and ship-

ping services, it can be argued that bulk shipping services are particularly prone to cyclical influences. Thus freight rates, ship prices, orders for new tonnage and lay-up/scrapping of tonnage can fluctuate by several orders of magnitude on numerous occasions within the physical life of a ship. In such circumstances the timing of a ship purchase, sale or charter becomes critical to financial success or failure. Consequently, shipowners, shippers, shipbuilders and bankers all have an interest in predicting turning points in shipping markets. Despite such interest and much effort, it has to be admitted that progress to date leaves much to be desired [1].

There is an old English saying that 'the proof of the pudding is in the eating'. Applying this test there seems little doubt that very considerable improvements are still required in the quality of long-term demand forecasts in aviation and shipping. The two examples which follow illustrate this point all too clearly.

The first example is taken from the official reapprisal of the Maplin project for a Third London Airport [4]. Table 1 below shows air passenger demand at London airports in 1972 and 1973 (actual) and 1990 (forecast). The forecasts for 1990 were derived from a disaggregated economic model which was considered to be an improvement on earlier work by the Roskill Commission [5]. The high forecast incorporated a combination of assumptions which would tend towards a high level of passenger demand and the low forecast a combination which would tend towards a low level of demand. Given uncertainty, single values were taken for the price of oil and some elasticities and further tests of sensitivity applied. The point of this example is not whether the forecasts are 'right' or 'wrong', but the policy uncertainties implicit in the range between high and low forecasts. Although not large as a percentage of the mid point between the high and low forecasts, the absolute magnitude of uncertainty significantly exceeds actual 1973 terminal throughput. Put another way, it was not possible in 1974 to say whether a substantial current terminal investment programme would need supplementing in the 1980s by a further programme costing several hundred million pounds.

Table 1 - Air passenger demand London airports

million passengers

1972	1973	1990 (Forecast)			
		Without Channel Tunnel		With Channel Tunnel	
27	29	High	114	High	106
		Low	78	Low	73

Source: *Maplin: Review of Airport Project,* p.4.

The second example relates to shipping and shipbuilding. It is tempting to argue that current excess capacity in both the tanker market and shipbuilding shows clearly the need for better long-term demand forecasting, particularly as the tanker order boom contined for several months after oil prices had risen. However, it should be recalled that in the summer of 1973 some forecasters were predicting a tanker surplus even at the pre-increase oil prices then prevailing. The implication is that even where forecasts were subsequently vindicated by reality, there must have existed a credibility gap which led many decisionmakers to prefer other judgements of the future. It is not difficult to see why such a credibility gap exists. Within the past year technically respectable forecasts have appeared suggesting restoration of equilibrium in the tanker market at almost any date between 1979 and the mid 1980s [6]. For many decisionmaking purposes this is clearly an excessive margin of uncertainty.

The examples quoted above were not selected for dramatic effect, a wide range of similar instances could be listed by almost anybody involved in such forecasting exercise. What the examples do show very clearly, is that measured against the needs of decisionmakers, substantial improvements are still needed in long-term demand forecasts for aviation and shipping.

THE NEED FOR FORECASTERS TO CONSIDER A WIDER RANGE OF ISSUES THAN HITHERTO

'Demand analysis should not be conceived as confined to the estimation of the influence of income and prices, but should seek to draw upon as complete an understanding as possible of the whole complex of factors influencing consumption'.

Report of the Informal Consultation of Experts on Demand Analysis, Geneva, June 1957. FAO/ECE Agric, p. 5 [7].

How are much needed improvements in the quality of long-term aviation and demand forecasts to be obtained? At this point I want to briefly consider three possible sources of improved forecasts:

a) Better statistics

b) Greater use of sophisticated econometric techniques

c) Consideration by forecasters of a wider range of issues than hitherto.

The frequent caveats about data deficiencies to be found in almost all long-term demand forecasts could be taken to imply that all would be well if only better statistics were available. Indeed, I have no doubt that better statistics *of the right sort* would lead to much improved forecasts, particularly in shipping, where in my experience internationally available statistics fall short of those available in many other industries. However, better statistics are not only expensive to obtain but of limited value if the methodological framework within which they are to be used is unsound, or perhaps more likely, imperfectly understood. For example, a few years ago it was quite common for long-term forecasts of tanker demand to be based on correlations between the oil consumption of leading industrial countries and changes in gross domestic product. Even assuming stable real oil prices and reliable oil consumption and gross domestic product statistics, such forecasts underpredicted demand because they ignored the spatial dimension, ie. the tendency for demand for tanker ton miles to expand faster than tonnage demand because of the trend towards longer voyages.

Another potential source of improved long-term demand forecasts in aviation and shipping is the greater use of more sophisticated econometric techniques. It would be foolish to deny that in many circumstances worthwhile improvements can be obtained in this way. However, as with statistics, better econometric techniques will not *of their own account* guarantee better results if the underlying conceptual framework is suspect or misused. There is of course also the danger that more sophisticated techniques will create further communication barriers between forecasters and their customers. On this point I am more optimistic. The proposition that all decisionmakers are innumerate is just as suspect as the proposition that all forecasters are illiterate. Indeed, on balance understanding between forecasters and their customers might be improved if greater stress were given in final reports to the results of statistical significance tests. All to often there is little more than a nod in the direction of R^2.

I have already argued that long-term demand forecasts in aviation and shipping share a common conceptual framework, ie. the economic theory of consumer behavior. To the extent that the economic theory of consumer behavior is unsatisfactory so too will forecasts based thereon. It is clear from recent work [8] that the economy theory of consumer behavior is much more complex than the simplistic distillations given in most first year undergraduate textbooks. In particular, dealing with quality changes raises severe technical difficulties, whilst the behavioral assumptions used are often simplistic. It does not follow that forecasters should search for a new conceptual framework. However, it does imply that forecasters should pay more attention than hitherto to the strengths and limitations of their conceptual framework. The two examples which follow serve to illustrate my belief that this end will best be served by forecasters considering a wider range of issues than hitherto.

THE APPROACH TO SATURATION LEVELS OF LEISURE PASSENGER DEMAND FOR INTERNATIONAL FLIGHTS [9]

The figures in Table 2 have been produced purely to illustrate an argument in this paper and cannot be treated as a serious forecast of international passenger traffic at United Kingdom airports in 1990 [10]. The figures show a projection to 1990 of pre-oil crisis traffic growth rates using 1975 as a base year and making the assumption that the market environment and causal relationships which prevailed between 1962 and 1973 continued to operate during 1975-90. On the basis that a trip involves two passenger movements (out and return), the implication of the 1990 projection is that on average every inhabitant of the United Kingdom will take an overseas holiday by air in 1990. If we allow for some people not taking a holiday at all, domestic holidays and seaborne overseas holidays, such a prediction loses all credibility. In short, future growth rates of international

Table 2 - Crude projections of international passenger movements at United Kindom Airports in 1990

	1975 (Actual-Millions)	% Charge Per Annum (Average 1962-73)	Growth Factor 15 Years	1990 Projection (Millions)	
United Kingdom Inclusive Tour	6.65	20.2	15.797	105.05	Total United Kingdom Leisure 133.7m
Other United Kingdom Short Haul Leisure	2.27	6.3	2.5	5.675	
Other United Kingdom Long Haul Leisure	1.61	19.4	14.291	23.01	
Foreign Leisure Short Haul	2.83	15.5	8.684	24.58	Total Foreign Leisure 60.5m
Foreign Leisure Long Haul	4.59	14.7	7.824	35.91	
United Kingdom Business Short Haul	1.91	10.1	4.235	8.09	Total Business Travel 27.1m
United Kingdom Business Long Haul	0.58	16.0	9.266	5.37	
Foreign Business Short Haul	1.66	12.4	5.774	9.58	
Foreign Business Long Haul	0.99	9.9	4.12	4.08	
TOTAL	23.09			221.35	

NOTE: These projections are derived from the International Passenger Survey (IPS); the results of which are published in *Business Monitor M6: Overseas Travel and Tourism,* Department of Industry Business Statistics Office, H.M.S.O. The IPS excluded about 7 million international passenger movements in 1975.

leisure passengers originating in the United Kingdom are likely to be below those experienced during the past decade and simple extrapolations such as those given in Table 2 can be highly misleading. The forecasting problem is to get some feel for the path demand will take between a known present and a saturation point whose magnitude and timing is unknown, and to identify ways in which this path will differ from growth in the recent past.

Given the limited length of the main data series (13-15 years) and the need to retain a reasonable number of degrees of freedom in the estimation, one is effectively limited in any econometric analysis to a small number of explanatory variables - say 3 or 4 - if one is to derive useful results. In practice, experience shows that in economic models of the demand for international air travel by leisure passengers only price and income usually emerge as significant explanatory variables. Total population, relative fares for other modes, flight time reductions etc. all tending to add little to the explanatory power of forecasting equations. Even when constant price and income elasticities have been derived for the past in this way, there remains the problem that elasticities can be expected to change in the future. Income elasticity in particular can be expected to decline as income rises - a pattern for which there is both theoretical and empirical backing. In addition, the luxury nature of air travel and its position as a relatively new commodity is likely to be related to high price elasticities in the leisure market. Over time, as air travel takes an increasingly well established place in consumption patterns and comes to be regarded as less of a luxury and more of an essential then price sensitivity will also decline.

At this point the forecaster is left in a rather unsatisfactory position. Factors other than price and income, which a priori ought to be significant fail to merit individual inclusion in the forecasting equations, whilst considerable scope for judgement exists in selecting future price and income elasticities. One potential route which is now being explored in the United Kingdom has evolved from taking a wider viewpoint than hitherto. Leisure passengers on international flights do not demand air travel as a final product. The final product is a holiday, which in turn may compete with other outlets for leisure time and expenditure. At present in Britain about 60% of the population take a holiday and about 13% take a holiday abroad. Table 3 shows the propensity of Great Britain residents to travel in 1975, by age and socio-economic groups. Clearly, Table 3 casts considerable doubt on the 1990 trend projections in Table 2; it also suggests potentially useful lines of further work. For example, do people over the age of 65 travel less because of custom (which may not occur when the next generation reaches this age), or because of medical constraints?

Table 3 - Propensity to travel - 1975 - GB residents

% in group

		Domestic holiday	Overseas holiday	Any holiday
Age group	16–24	43	16	55
	25–34	54	12	62
	35–54	54	15	66
	55–64	53	18	66
	65+	46	6	51
Socio-economic group	AB	61	30	81
	C1	54	19	67
	C2	53	10	60
	DE	40	6	46

Source: British National Travel Survey

To conclude this example, it is worth considering the 1990 projections of foreign tourists visiting the United Kingdom by air (Table 2 refers). Even using the economic modelling techniques described above rather than the simple extrapolations of Table 2, forecasts of a substantial inflow of tourists emerge for 1990. At this point it is essential not to lose sight of the basic economic concept of market clearance via an inter-action between supply and demand. Only if supply were perfectly elastic could such a surge in demand occur without, for example, a rise in hotel prices. To the extent that higher hotel prices are needed to stimulate investment or to ration capacity, there will be a reaction on demand, ie. some incoming tourists will be deterred by higher hotel prices. Narrowly based forecasts which ignore such potential constraints run obvious risks.

PORT CHOICE FOR GENERAL CARGO WHEN PORT HINTERLANDS OVERLAP

For many purposes seaborne cargo can conveniently be divided into bulk and non-bulk or general cargo. In this example we are not concerned with bulk cargo, ie. single shipload consignments. Instead our interest is in general cargo, ie. consignments of diverse goods which require aggregation to obtain a shipload. The forecasting problem with which we are concerned is one faced by decisionmakers considering proposals for investment in major extensions of port facilities for general cargo - if port hinterlands overlap, which ports will cargo be shipped through and what types of ship will be used.

The problems of forecasting the volume, commodity composition and geographical spread of seaborne trade have been studied extensively in the United Kingdom by the National Ports Council [11]. Although such forecasts involve substantial problems they are not our concern in this paper. Instead, the results of such exercises will be regarded as an input to further analysis. Until the late 1960s the problem of predicting which ports would be used by general cargo in the United Kingdom was less difficult than is now the case. Inland transport costs were such that most goods would not move more than about 30 miles from the quayside and hence for all but expensive/low bulk items hinterland overlaps were limited. However, with the growth of containerisation, other forms of unitisation, freightliner and improved roads, the shippers' choice of port has widened considerably. Further, whilst in the mid 1960s it was usually safe to assume that general cargo would be shipped by general cargo vessels of conventional design, a much wider range of possibilities now exists, eg. cellular containership, ro-ro modernised conventional cargo ship. To the extent that such ships require different purpose built port facilities an extra dimension has been added to the forecasting problem.

Again, I would argue that useful insights into this type of forecasting problem can be obtained by forecasters taking into account a wider range of considerations than hitherto. For example, recent studies from the Marine Transport Centre of Liverpool University [12] cast serious doubt, at least in respect of the North Atlantic, on the widely held belief that containerisation reduces the range of ports served in a given trade. Likewise, another recent study from the same source [13] gives important insights into the choice of vessel type. In the absence of such studies, there is a danger that past trends will be extrapolated without asking searching questions, eg. facilities may be built for giant vessels which may not materialize.

MANAGEMENT IMPLICATIONS

Before concluding the paper by commenting on the implications of my arguments for research management, there remains one general point which can most usefully be made at this stage. I referred earlier to three possible ways of getting better long-term demand forecasts in aviation and shipping, without defining what was meant by 'better' in this context. In an ideal decision-makers world 'better' might be thought to mean more accurate forecasts of the future subject to narrower bands of uncertainty than are now normal. However, in practice the future is usually very uncertain, consequently 'better' forecasts may sometimes encompass a wider rather than a narrower range of uncertainty. Forecasters do not serve the best interests of decision makers by predicting certainty where it does not exist.

Throughout this paper I have stressed the need for forecasters to counter the limitations of the economic theory of consumer behaviour, by taking a wider view than has hitherto been normal. I wish to stress the following important implications of such an approach for the management of forecasters:

a) Forecasters are unlikely to be able to take a wider view unless they work in an open intellectual climate in which purposeful contact with other researchers, both business and academic, is encouraged.

b) To gain insights into the weak points of forecasting methodology there is a case for re-running forecasting equations *after* the forecasting period is over and using correct data at each point so as to identify problem areas. Although I know of no published examples of such work, I have seen very useful unpublished consultants post-mortems of shipbuilding demand forecasts.

c) Given the pressure of other work and staff mobility there is a danger that successive forecasting teams will merely re-discover the problems which earlier forecasters failed to solve. If progress is to be made a conscious management decision to commit scarce resources to research, which will not produce results until beyond the next forecasting round, is required.

d) At appropriate stages during the evolution of a forecast, the methodology and results should be exposed to constructive criticism from people with a different but related interest, eg. long-term forecasts of leisure passenger traffic by air can usefully be discussed with tourism as well as aviation interests.

REFERENCES

1] D. C. Garvett and N. K. Taneja, **New Directions for Forecasting Air Travel Passenger Demand,** Department of Aeronautics and Astronautics, Massachusetts Institute of Technology, July 1974. P. Lorange and V. Norman (editors) **Shipping Management,** Institute for Shipping Management, Bergen and Maritime Research Centre, the Hague, 1973 (see 'forecasts and Their Use').

2] Contrast for example the Boeing forecast cited in 'Making

Fuel Go Further', **Flight International,** 29 January 1977, with almost any shipbuilding forecast.

3] See page 7 of the **Report of the Committee of Inquiry into The Aircraft Industry** (Plowden Report), Cmnd 2853, HMSO, London 1965, for an illustration of this point.

4] **Maplin: Review of Airport Project,** Department of Trade, HMSO, London 1974.

5] **Report of the Commission on the Third London Airport,** HMSO, London 1971.

6] Examples include **An Outlook for World Tankers 1976 to 1979,** Terminal Operators Limited, London January 1976 and Chapter 5, **Maritime Transport 1975,** OECD, Paris 1976.

7] I owe this quotation to Chapter 6 of D. S. Ironmonger **New Commodities and Consumer Behaviour,** Cambridge University Press, Cambridge 1972.

8] See Ironmonger op at.

9] This section has benefit considerably from discussion with my colleague Mr. J. H. T. Green. The author is alone responsible for any views expressed or errors remaining.

10] More sophisticated forecasts than those used for illustrative purposes in Table 2 can be found in [4], and **Airport Strategy for Great Britain Part 1: The London Area - A Consultation Document,** Department of Trade, HMSO, London 1975.

11] **UK International Trade 1980-85,** National Ports Council, London 1976.

12] E. D. Edmunds and R. P. Maggs, 'Container Ship Turnaround Times at UK Ports', **Maritime Policy and Management,** July 1976. S. Gilman, R. P. Maggs, and S. C. Ryder **Containerisation on the North Atlantic: An Economic Analysis of Ships and Routes,** Marine Transport Centre, Liverpool University, February 1977.

13] S. Gilman, 'Shipping Technologies for Developing Countries', **Journal of Transport Economics and Policy,** January 1977.