Forecasting Traffic at Smaller Airports in a Free Market Environment

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Many small airports in the United Kingdom are competing for traffic. Ideally, forecasts for these airports should be made by applying behavioral models of airport choice to national forecasts. Although the U.K. Civil Aviation Authority has attempted this approach, it is difficult to retain sufficient accuracy to deal with the smaller airports. A two-stage method of analysis has been proposed that combines the simplicity of a "step-down" method with the accuracy of discrete choice models. The stability of regional shares of national traffic has been demonstrated for subcategories of traffic. The adequacy of discrete choice models to predict local airport shares, when applied to traffic generated within a region, has also been demonstrated by means of a case study. The two-stage approach is therefore recommended for consideration by airports wishing to determine their potential traffic in a competitive market.

It is usually straightforward to predict future traffic levels at well-established airports with clearly defined roles within a stable regulatory framework, although they can be subject to the impact of political events and fluctuations of the economy. Traffic prediction becomes progressively more difficult as air transport regulation is liberalized, thereby increasing the possibility for the airport's role to change, and as airport privatization encourages airports to seek expanded roles. The difficulties are further aggravated when the airport is small and its role is determined not only in relation to the local population but also by interactions with other airports within a region. This is the situation facing several U.K. airports. The generic diagram (Figure 1) indicates that small local airports wanting to expand their role have to compete with larger nearby regional and national airports and also with emerging (but currently small) airports situated close to the capital. The emerging capital city airports themselves have to compete with each other and with the capital's major airports.

Experience with the U.K. airport system shows that, in the absence of major initiatives, airports that are initially favored by geography or the regulators are the first to develop a range of services. Once they have a market advantage, the advantage is augmented because airlines are attracted to busier markets and passengers perceive the benefits of increased frequency. This logic leads to the well-known "S-curve" effect, whereby the airport with the major frequency share captures an even greater share of the traffic (*1*). In many cases, even when a service might have been justified at a smaller airport, the airline has adopted a cautious approach to marketing and to the supply of capacity and frequency, which results in a revealed preference by passengers for better (and probably less expensive) service at the expense of longer access trips. Deregulation, by enhancing the availability of lower fares at points of concentrated service (*2*), tends to increase the S-curve effect.

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In summary, future traffic at small airports will be influenced strongly by the local economy and the ensuing passenger demand, but also by

- Historic airport hierarchy,
- Regulatory opportunities for carriers and the airport,
- Marketing and investment decisions by competing airports, and
- Airline decisions to mount feeder or hubbing services and the quality of the resulting service.

These factors are diverse and appear to be influenced primarily by policy decisions largely outside the control of a local airport's management. It is therefore tempting to adopt one of two extreme approaches to the prediction of traffic at smaller regional airports.

On one hand, it may be considered impossible to cope with the external uncertainties except by judgment, with the emphasis then being on historic traffic trends and the econometrics of locally derived demand as practiced in traditional airport master planning. This method will call for assumptions about the level of service and the resultant market share if the projected enhanced role of the airport is to be reflected in the traffic predictions, even if substantial potential demand is shown to exist.

On the other hand, the airport may recognize that its future must be codetermined with the other airports in the national system and call for a national traffic distribution model that would be responsive to airline strategies at all competing airports. Any such model would need inputs to describe capacity and regulatory constraints and would need to model demand and supply simultaneously, so that both airline strategic decisions and the other airports' competitive marketing would be determined endogenously.

NATIONAL AIRPORT COMPETITION MODEL

The U.K. Civil Aviation Authority (CAA) has developed a model that predicts total U.K. traffic and the distribution of the traffic between London and the regions (*3,4*). The CAA model was developed primarily to study the distribution of traffic among airports in the London area and to estimate the regional airports' share of total U.K. traffic using logit models calibrated on an extensive survey of individual trips. The abil-

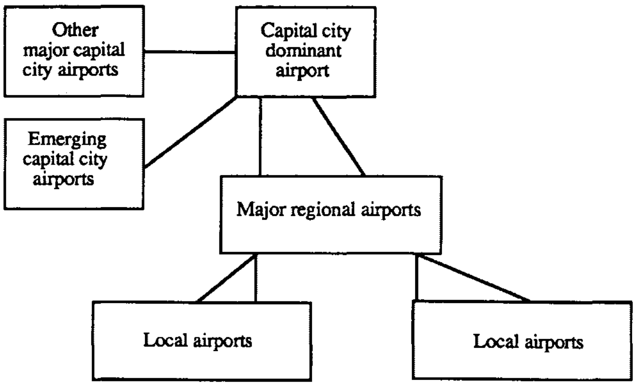

FIGURE 1 Generic relationships among U.K. airports.

ity of the model to determine individual shares for the smaller regional airports (a task for which it was not designed) is examined in detail elsewhere (*5*). Supply is addressed by calibrating a separate model of airline behavior in terms of aircraft size and operating frequency for a given traffic density. The model has potential weaknesses in the exogenous determination of the airports' attraction factors in the long-haul and domestic models. In addition, the origin zones in the regions are large compared with the distance between competing airports, and there is no allowance for increases in local demand as quality of service is increased owing to either inward job migration or increased propensity to fly.

An indication of the extent to which changes in model specifications and airport capacity assumptions can induce large changes in predictions for smaller regional airports, while having a much smaller proportional effect on the London area airports, is shown in Table 1 for two airports in the Midlands. Birmingham (BHX) and East Midlands (EMA) are both approximately 100 mi northwest of London. They are two of the regional airports closest to London and are 40 mi apart with similar runway lengths. The table gives the results of two attempts by CAA to predict regional airport traffic. The earlier attempt was published in CAP 548 (*3*), which considered four options for the possible expansion of the London area airport system; only Cases 2 and 4 are pertinent here. A later attempt was published in CAP 570 (*4*), which considered several London area options, of which only the Base and Heathrow (LHR) expansion cases are pertinent here. The four London airports considered were Heathrow, Gatwick, Stansted, and Luton.

The scenarios examined were the following:

- Case 2: assumed Heathrow, Gatwick, and Luton capacity limited at 55, 30, and 5 million passengers per year (mppa), respectively, but Stansted able to take full London area demand (33 mppa).
- Case 4: assumed capacity limits at all London area airports, including 20 mppa at Stansted.
- Base Expansion: assumed capacity limits of 50, 30, 30, and 5 mppa at Heathrow, Gatwick, Stansted, and Luton, respectively.
- Heathrow Expansion: assumed the full demand of 86 mppa at Heathrow could be met with no other airports reaching capacity.

Case 2 from CAP 548 and the Base case from CAP 570 are similar scenarios. A comparison of their traffic predictions shows how the model specification changes adversely affected East Midlands' predicted traffic and substantially increased Birmingham's long-haul traffic. These changes in the model specification were mainly to the long-haul attraction factors exogenously assigned to the airports. In effect, these attraction factors imply that the distribution of traffic is supply driven, at least while there is an overall shortfall in supply in the regions to cater for regional demand.

In comparison, the differences in predictions between Case 2 and Case 4 of the CAP 548 model and between the Base and Heathrow expansion cases of the CAP 570 model show the model predictions of spill of traffic to the regions as a result of shortages of capacity in the London system. The implications of these results are that changes in regional traffic predictions at individual airports due to changes in model specification are at least as great as those due to capacity limitations.

TABLE 1 Prediction of Airports' International Passengers by CAA (millions)

	Year 1988	Year 2005 from CAP 548		Year 2005 from CAP 570	
		Case 2 (a)	Case 4 (b)	Base (c)	Heathrow expansion (d)
East Midlands					
Short haul	1.0	4.5	6.5	3.1	3.1
Long haul	0.0	0.4	3.1	0.0	0.0
Birmingham					
Short haul	2.2	7.3	8.7	6.0	5.1
Long haul	0.0	0.5	3.9	6.3	2.2
Total Non-London					
Short haul	15.9	39.2	42.5	39.3	35.9
Long haul	1.9	1.6	9.1	17.2	10.6
Total London					
Short haul	36.9	69.7	65.0	63.8	68.5
Long haul	16.7	40.2	32.0	35.5	44.5

It appears that a full national model of traffic generation and distribution, incorporating the smaller airports, would be difficult to calibrate with sufficient accuracy. It would also be difficult to retain sufficient flexibility to cope with individual regional characteristics. However, the CAA model has been developed on a data base obtained from surveys (*6*), which sample approximately 2 percent of departing passengers at most U.K. airports on a 3- to 4-year cycle. Information is collected on socioeconomic characteristics, journey origins, access modes, trip purpose, airports used, and other data. So many data of individual travel are available from the CAA surveys that a more limited use of an airport choice model within each region, or between each region and national hub airports, could contribute considerable accuracy to regional airport traffic estimates. Although it may be possible to develop a satisfactory behavioral model to share regional traffic between the local airports and large national airports, in practice this has proved difficult (*7*). Problems are likely to arise with any particular continuous form of frequency function. The high frequencies at large airports are likely to mean that passengers will be less responsive to a given percentage or absolute change of frequency at these airports than at smaller airports with only one or two services per day. There are attractive and unattractive features of large airports, apart from the services to specific destinations, which are difficult to model convincingly, particularly because they vary over time. Added attractions include the synergy of large networks, choice of airlines, shopping opportunities, and availability of official and unofficial discounts. Conversely, congestion inside and outside the airport is unattractive.

HYBRID MODEL APPROACH

The alternative approach is to take advantage of any stability in the national and regional situation to establish regional shares, reserving the rich information derived from discrete airport choice models for local airport competition. Stable relationships between national and regional traffic can form the basis of a step-down approach to modeling regional traffic, given the existence of uncontroversial national forecasts. These are available in the United Kingdom, disaggregated by business or leisure, short or long haul, U.K. or foreign (*8*). Although subject to any forecasts' imperfections, CAA's forecasts offer a consistent base from which to develop a feasible range of national forecasts.

Step-Down Element

An attempt has been made to establish the reliability of the step-down approach to forecast U.K. regional and individual airport traffic at a less aggregate level (*9*). The analysis separately considered international short-haul scheduled and charter traffic to each of the primary destinations in each category and also the aggregate traffic at each airport and in each region. Three reasonably well-defined regions were chosen in addition to the London area: the Northwest (NW) with Manchester (MAN), Leeds-Bradford (LBA), and Liverpool (LPL) airports; the Northeast (NE) with Newcastle (NCL) and Teesside (MME) airports; and the Midlands (MID) with Birmingham (BHX) and East Midlands (EMA) airports. In the traffic categories examined there are few airport access trips between these regions, although there is substantial use of London area airports by passengers with ultimate origin or destination in these regions. The analysis is based on annual traffic from 1982 through 1989. Airport traffic and international route traffic data are taken from CAA's Annual Airport Statistics and domestic route data from the Annual Airline Statistics. The international scheduled destinations considered are Paris (CDG), Amsterdam (AMS), Dublin (DUB), and Frankfurt (FRA). Charter destinations are Malaga (AGP), Palma (PMI), Faro (FAO), and Corfu (CFU).

Shares of Total Boardings

All three regions' total traffic shows strong statistically significant linear relationships with total U.K. traffic in each traffic category. When the regional shares themselves are regressed against U.K. traffic (thus increasing the sensitivity of the analysis), the NW region is shown to be increasing its share of international scheduled traffic at the rate of 1.09 percent per 10 million U.K. passengers (5 percent in 1989) and its share of charter traffic at 3.4 percent per 10 million passengers (23 percent in 1989). The Midlands region's growth in U.K. share is 0.48 percent (2 percent in 1989) and 0.85 percent (9 percent in 1989) per 10 million U.K. passengers for international scheduled and charter traffic, respectively. The results of this analysis are given in Table 2. The relationship is

$y = a + bx$

y = regional share of passengers

x = U.K. passengers (millions)

The t statistic > 1.94 indicates 10 percent significance,

> 2.45 indicates 5 percent significance, and

> 3.71 indicates 1 percent significance.

It can be seen that the NE region traffic shares calibrate much less well in terms of R^2, and the relations with U.K. traffic are weak. However, the NE constant terms are significant, indicating that its shares of scheduled and charter traffic are remaining constant at 0.38 percent and 3.4 percent, respectively.

It is noticeable that there is a much higher penetration of charter into the regions than of scheduled services. Although this may be explained in part by the easier acquisition of charter route rights, the main reason is likely the charter airlines' ability to control load factors in the lower-density markets by offering relatively low capacity. This is not available to scheduled airlines on most routes at reasonable fares because low levels of service drive down the demand for direct service. The resultant higher fares drive down demand further.

It is also noticeable that NW and MID shares of U.K. traffic are increasing at approximately the same relative rate, whereas NE shares are constant. These trends result from longer-term trends in the economies of the regions and the airlines' responses to the potential market. Success appears to breed

TABLE 2 Relationship Between Traffic in U.K. Regions and Total U.K. Traffic

	100a		100b		R^2
	Value	't'	Value	't'	
International Scheduled					
NW	-0.167	-0.34	0.1090	8.15	0.917
MID	-0.0407	-0.15	0.0484	6.47	0.875
NE	0.377	6.07	-0.0002	-0.09	0.001
Charter					
NW	13.30	10.80	0.340	6.26	0.867
MID	6.49	6.87	0.085	2.03	0.408
NE	3.39	8.56	-0.0009	-0.49	0.038

The constants are defined by the equation in the text.

success once a viable minimum network of routes can be supported. It may well be that success comes not only from increasing economies of station density but also from stimulated demand, with stimulated demand coming from the release of latent demand among the existing population as their total disutility of travel falls and also from demand induced as new economic activity is drawn to the improved services. Anecdotal and empirical evidence indicates that improved supply stimulates demand (*10*).

The step-down method implicitly incorporates these effects. The method clearly cannot distinguish between the factors causing the changes of regional share and presumes that the regional economies and airline reactions will continue to change in the same direction at the same rate. There may, of course, be long-term changes in regional status, the effect of which would have to be treated judgmentally, but, in general, the relative economic changes in any well-defined region are quite stable.

There may be, however, the possibility for individual airports within a region to influence their competitive position or role. Individual airports' rates of change of national traffic share are given in Table 3 for all the sampled airports that showed statistically significant relationships at the 5 percent level. The major airport in NE is NCL, but correlations for NCL traffic were not statistically significant (1989 passengers: 0.17 million international scheduled, 0.80 million charter). In almost all cases, the individual airport shares are rather less predictable than the total regional share of national traffic. In every case, the minor airports' shares grow less rapidly or fall faster than the major airports' shares in each region and their statistical explanation is worse than the major airports' shares.

Because the regions do not, in general, encompass areas of more than 2 hr access travel time by car, it is possible that smaller airports could gain share if they could induce a change of attitude by the airlines. Otherwise, a direct step-down analysis shows that all the smaller airports are likely to capture a decreasing share of regional traffic. Indeed, in the case of MME, there is a statistically robust falling national share. These trends are reinforced by an analysis of the small airports' share of the regional markets. The statistical fit of the NW airports' shares is poor; the MID and NE airports' fit is much better but still gives R^2 of less than 0.7. Thus, even if the smaller airports were prepared to accept the implications

TABLE 3 Regional Airports' Growth in Share of U.K. Traffic (percent per million U.K. passengers)

		% change	1989 passengers (millions)
NW International Scheduled			
	MAN	0.0963	2.21
	LBA	0.0068	0.16
	LPL	0.0056	0.12
NW Charter			
	MAN	0.3220	5.93
	LBA	0.0248	0.25
MID International Scheduled			
	BHX	0.0457	1.03
	EMA	0.0027	0.14
MID Charter			
	BHX	0.0781	1.57
	EMA	Indeterminate	0.92
NE International Scheduled			
	MME	- 0.0014	0.02
NE Charter			
	MME	- 0.0081	0.06

of declining market share, the statistical quality of the second stage of a two-stage step-down model does not allow much confidence in its use.

Shares of Route Traffic

The step-down analysis has been concerned so far only with total traffic growth at a regional airport in a given category. The total traffic growth, in fact, consists of growth per route and also new route starts. The growth per route can be analyzed on a step-down basis. It would be expected that, as the regional penetration of the national market matures, the growth in share would tend asymptotically to zero. The market share at the point of zero growth would be the maximum likely penetration, reflecting the best likely supply of direct service from the region whether concentrated at the main airport or shared between airports. The average growth in share (i.e., growth in total traffic at a given airport) would tend to be greater than growth on mature routes because of the higher growth in share on emergent routes and the addition of new routes.

When this analysis is carried out for four of the most common destinations in each traffic category, the growth in share is inevitably seen to be variable with rather poor statistical significance. By taking the international scheduled category first, the NW route shares indeed show much lower growth than its share in the total traffic, and the intercepts' t-tests are robust, implying maturity on these dense routes. However, the MID shares to the same destinations are still growing strongly and robustly, indicating that maturity of penetration has not been reached even in the densest markets. Estimates of the average maximum U.K. market penetration for mature routes is given in Table 4. These estimates provide a cut-off point when growth in market share is used for prediction. The growth in total share is actually lower than the average growth in the four top markets because one of the top markets performed poorly. Even the top markets from most regions are rather fragile. This suggests that it would be optimistic to take the penetration of the densest markets as indicators of likely long-term penetration. In the NE, there is actually negative growth in share to two of the three destinations, because of historically established, artificially high penetration of the market to AMS due to Air U.K.'s route network.

In contrast to the scheduled routes, all the top charter destinations from all the regions appear to have reached mature shares: all the regressions show low and statistically insignificant growths in share, the R^2 is small, and the intercept t-tests are robust. Despite this maturity on the densest routes, the rate of growth in share of total charter traffic in NW and MID is considerably greater than for the total scheduled traffic (Table 2), indicating the importance of new charter route starts in the regions. This relative paucity of destinations from the regions is likely to continue into the medium-term future; if total rather than route-by-route market shares were to be used for prediction, some estimates would have to be made of the maximum likely penetrations of the total U.K. market that would be lower than those reported in Table 4.

Attempts to analyze the smaller airports' shares of their regional markets on a route-by-route basis fail to establish consistent patterns or statistically significant correlations. However, inspection of market shares over time indicates a consistent tendency to converge to values that reflect the historic balance between the attractions of the major regional airport, the spatial distribution of demand, and the airlines' supply strategy. The resulting estimates of likely maximum minor airport shares are given in Table 4.

Airport Choice Element

Although it is unlikely that the balance between regional and national interests will change other than slowly and predictably regardless of airport and airline managerial initiatives, this is less true of the balance between airports within a region. It would be possible to attract airlines and passengers by investment in improved facilities (e.g., extended runways, provision of airbridges, and competitive fuel tendering). There is also the possibility of changes of spatial economic distribution within a region, of airlines setting up competing services (possibly even a hubbing operation) without head-on competition from an incumbent airline at the major airport, of there being an easier environmental or land use situation for expansion at the minor airport, or of the major airport approaching capacity so that lower-cost airlines begin to be displaced. An analysis of the implications of any of these scenarios for the smaller airports cannot rely on the step-down approach, which, by definition, assumes that the factors that are already changing will continue to change at the same rate and no new factors will enter the situation.

Certainly, there is room within the market share method for some exercise of judgment to allow for limited change, but it would be risky to rely only on that when major changes in the role of an airport are anticipated. In these circumstances

TABLE 4 Estimates of Maximum U.K. Market Shares on Mature International Short-Haul Routes

	Total Regional Flow, 1989 (millions)	Regional Share of UK Total	Minor Airport Share of Regional Total
NW Scheduled	2.5	0.12	0.20
NW Charter	6.3	0.25	0.10
MID Scheduled	1.2	0.07	0.30
MID Charter	2.5	0.13	0.45
NE Scheduled	0.2	0.01	0.20
NE Charter	0.9	0.05	0.18

the analysis of intraregional competition requires a modeling tool sensitive to local spatial changes in demand patterns, access times, and the supply of service on a route-by-route basis. In other words, a local version of CAA's airport choice model with local demand a function of air service available would be a feasible approach. Despite some reservations about the choice of independent variables in the utility function, similar logit models have been used to good effect in many studies (*11*,*12*). Other U.K. uses of the model are referred to elsewhere (*5*).

Just such a model has been developed for trips by short-haul scheduled services from the Midlands region where BHX is the major airport and EMA is the minor airport (*13*). A CAA survey of passengers at the region's airports was used to define the set of approximately 100 zones from which passengers might travel to use the region's airports and to identify individual trips to a set of destinations jointly served by both airports (*6*). These trips were used to calibrate a standard logit model whose utility function took the following form:

$$U_{ijm} = aA_{ij} + bF_j + cP_j$$

where

- A_{ij} = access time (min) for a passenger in zone i to airport j,
- F = share of weekly flight departures for airport j (i.e., departures at j/(departures at $j + k$),
- P = full economy fare from airport j to destination m (£ sterling),
- U = utility of a passenger in zone i using airport j to reach destination m.

Separate models were calibrated for business and leisure passengers, each to the same four high-volume destinations. The calibrations were successful in each case. The fare variable added no additional explanation in the business model and was dropped when the model was used for prediction.

The utility function in the business passenger model, based on 1,525 observations, was calibrated as

$$U = -0.0757A + 8.695F$$
$$(-19.7) \qquad (11.8)$$

The values in brackets denote the t-test results. The leisure passenger utility function, based on 720 trips, was found to be

$$U = -0.0769A + 4.898F - 0.0808P$$
$$(-14.7) \qquad (3.1) \qquad (-3.0)$$

The signs and relative sizes of the coefficients are all in agreement with intuition. Frequency is more important to the business traveler, and cost is the predominant concern of the leisure passenger. This is borne out by the utility functions when average values of 30 min, 0.5, and £90 are substituted for A, F, and P, respectively. (£1.00 is approximately equal to U.S. $1.70 during the period under analysis.) The implied direct elasticities, averaged over BHX and EMA airports, are

- A −0.59 for business, −0.52 for leisure;
- F 0.62 for business, 0.30 for leisure; and
- P −0.73 for leisure.

Because leisure passengers will have paid perhaps only 50 percent of full economy fares, their real fare elasticities are probably nearer to −1.4.

In view of the small differences in fare and frequency between BHX and EMA (Table 5) on the four jointly served routes in the 1983 calibration year, the coefficients are surprisingly reasonable and intuitively correct. All EMA services were operated by British Midland with turboprop aircraft, and the BHX services were almost exclusively operated by British Airways (BA) using BAe 1-11 jets. The market shares to EMA in 1983 from the observed set of zones were 29 and 49 percent for business and leisure passengers, respectively.

Although the model fit the 1983 data well, it was not so successful when predicting 1987 market shares. By then, EMA had only approximately a 33 percent frequency share because of more airlines serving BHX, although not always with jet service. This resulted in an actual average market share to EMA of 30 percent on routes served twice a day; CDG obtained 17 percent on a once-daily service. The models overpredicted these shares by 7 percent.

The discrepancy could be because of a misspecification of the frequency function, either in its nature (e.g., ratio or difference instead of share) or in its shape (e.g., log or exponential instead of linear). It is also true that the situation changed substantially between 1983 and 1987. In favor of East Midlands subregion, there was differential growth in population and the economy relative to the West Midlands subregion. The increased service at BHX was mostly by foreign airlines and with turboprop aircraft. Furthermore, British Midland began to establish an image as an international airline as well as being able to compete with BA on the major domestic shuttle routes from Heathrow. In favor of Birmingham, an impressive new BA terminal was opened in 1984, and the introduction of new destinations began to create a hubbing synergy. Unless the model's frequency function is in error, it appears that the changes favoring EMA have had a greater effect than those favoring BHX. A short-term expedient is

TABLE 5 Air Services Offered in 1983 at Birmingham (BHX) and East Midlands (EMA) Airports

	Frequency per week		Full economy fare (£)	
	BHX	EMA	BHX	EMA
AMS	13	12	87	87
CDG	12	6	116	95
GLA	10	10	66	54
BFS	13	10	56	54

therefore to adjust the model with a positive constant (dummy) for EMA. When this is done and the model is used to investigate the effect of changes in airline policy and access routes, it suggests that if EMA services matched BHX frequencies EMA would take approximately a 50 percent share of the market from the zones selected, even without a matching jet service. This is owing to the lower density but spatially larger natural catchment area of EMA. Furthermore, improvements to the roads linking the two airports favor EMA at equal frequency because the dense Birmingham population then becomes available, whereas less of the natural catchment area of EMA is vulnerable to BHX. The model suggests that reducing the trip time between airports from 50 to 40 min, as happened in 1991, increases EMA's market share at equal frequencies by some 5 percent.

Work is ongoing to improve the frequency function and include flight timing and examine the implications of closely timed flights. Other areas under further investigation are nationality mix of the airlines, aircraft technology, and importance of fares, using new data on fares actually paid. In addition, there are indications that, although it is not possible to calibrate a nationwide model to give sufficient accuracy at local airport level, it may be possible to develop a model to distribute traffic from a defined region simultaneously between the major airports and the local airports by careful specification of the frequency function. This would call for the step-down method to be applied directly to trip generations in a region instead of to the trips revealed through the region's airports. The differential growth in regionally based trips would be established through the ongoing series of CAA surveys.

CONCLUSIONS

The step-down procedure for forecasting regional airport demand was investigated in a U.K. case study. The approach is shown to be valid when it is possible to define regions sufficiently free standing for there to be little interregional competition for air traffic. It has been shown that, where substantial competition between airports exists within a region, the step-down procedure is inappropriate to define market share within the region even when status quo assumptions can be made. When it is necessary to analyze the implications of new competitive scenarios, it has been shown that logit models can be used to distribute intraregional demand between airports in response to changing quality of service. It is, of course, not possible within that methodology to predict the extent to which airlines will provide that quality of service. The step-down procedure can still provide the total regional traffic predictions as an input to the logit models, although more work is necessary to account for the effects of improved coverage of supply within a region on the regional share of U.K. traffic.

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