FORECASTING TOURISM DEMAND IN BARBADOS

by

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Introduction

Tourism is the most important economic activity in many Caribbean countries - including Barbados. The forecast of tourism is the key to the forecast of overall macroeconomic performance in these countries. The studies which provide some empirical basis for such forecasts - Belchere (1988) for The Bahamas, Metzgen-Quemarez (1990), Carey (1991), IMF (1992), Rosensweig and Clark (1988), Wood and Worrell (1986), Whitehall and Greenidge (1996) - all focus on the demand side of the market. The present study extends their analysis by incorporating supply factors. It also introduces a multivariate technique (seemingly unrelated regression, SUR) to estimate the model.

Studies of Tourism Demand for the Caribbean

Clarke et al (1986) present a disaggregated study of the demand for tourist services in Barbados, broken down by class of accommodation, season (winter, summer) and the tourists' country of origin. The study covers the years 1956-1983. The factors affecting demand are hotel rates, real income per capita in the source country, airfares, government grants for tourism promotion and hotel rates in Antigua (taken

to be Barbados' closest competitor). It concludes that income per capita and airfares are the most important factors. Income per capita matters most for US visitors in top quality accommodation, for Canadian visitors in apartment hotels and for UK visitors (in the summer only). Airfares are important for US visitors in top quality accommodation, Canadian visitors in apartment hotels and UK visitors in the winter.

Rosensweig (1988) estimates US and world demand for Caribbean tourism services relative to tourism services in Mexico and Europe. Demand changes in response to changes in relative prices. The Caribbean destinations include The Bahamas, Barbados, the Dominican Republic, Jamaica, the Netherlands Antilles and Puerto Rico and the period examined is 1964-83. Intra-Caribbean relative price elasticities are very high, 1.33 for visitors from the US and 2.45 for visitors from around the world. The relative price elasticity with respect to Mexico is 1.0 worldwide and 1.85 for US visitors. The elasticity of substitution between Europe and the Caribbean is 1.7.

Belchere (1988) provides details on the regional breakdown of US overseas tourists and estimates the impact of regional income variations in the US on the demand for tourism in The Bahamas. The Boston/Washington corridor and the Southeast US are the most influential regions for Bahamas' tourism. Income elasticities are always significant.

Metzgen-Quemarez (1990) estimates the effect of US real income, travel prices in selected Western Hemisphere destinations and the prices of other tourist destinations which are included in her sample for the years 1964-84. The tests are for five countries in the Western Hemisphere and six in Europe. The Caribbean countries included are The Bahamas, Jamaica and the Netherlands Antilles. The co-efficient of determination for Caribbean countries is high. Income variations are always influential with elasticities of 1.27 for Jamaica, 1.96 for The Bahamas and 4.04 for the Netherlands Antilles. Own price elasticities and competitors' price elasticities are usually significant but they do not have the expected sign.

Carey (1991) estimates the demand for Caribbean tourist services using pooled data on arrivals for Aruba, Bahamas, Dominica, St. Lucia and St. Vincent - 138 observations in all. The principal determinant is income in the tourist's country of origin. Promotional expenditure has significant impact on arrivals as well.

Countries further from source are at a disadvantage. The larger the source country the greater the number of tourists but smaller source countries supply more tourists per capita.

In the IMF study travel receipts in comparable Caribbean destinations (as a percentage of travel receipts in Barbados) are tested for the influence of relative prices in Barbados versus the competition, average GNP per capita of selected industrial countries (France, Germany, the UK, the US and Canada) and the cost of travel (proxied by the price of oil). The relative price elasticities are significant only for the Netherlands Antilles and The Bahamas but they have the wrong sign. That is, an increase in Barbados' relative prices leads to an increase in Barbados' receipts relative to the competition. Higher source country GNP per capita improves Barbados' share of the market vis-a-vis The Bahamas and the Dominican Republic. With respect to the other countries the result is not statistically significant. Travel cost increases Barbados' share relative to the Netherlands Antilles and Trinidad & Tobago, both of which are further away from the North American market and it reduces Barbados' share relative to Jamaica which is closer. However, the effects are small.

In general income in the source country seems to offer a robust explanation of the variation in Caribbean tourism arrivals, with elasticities that vary from destination to destination. There are indicators that the income elasticity of demand may be a little stronger for the Netherlands Antilles and for Barbados than for other countries tested. Evidence about the effects of relative prices are inconclusive. Rosensweig finds some evidence at a very aggregated level for the Caribbean region as a whole but the results at the national level are a mixed bag. Other factors such as the distance from major markets and airfares may have an effect but these results are not particularly robust.

A Model of Tourism Demand and Supply

It is rather strange that most studies estimate demand rather than supply. The Caribbean share of the world tourism market is so small that if tourism were an undifferentiated product the Caribbean would face an infinite demand. In fact, tourism is very highly differentiated and each country - perhaps each resort - may usefully be considered a separate product. This is tantamount to applying to tourism the scheme suggested for visible goods by Armington (1969) - as has been noted by

the IMF and others. The empirical research lends support to this approach. Most analysts find real income in the tourists' home countries an important factor in explaining arrivals. That would not be so if tourism were a homogeneous product.

However, to get a fuller picture we ought to consider the supply of tourism services. In the short run, supply is fixed; therefore, if one is estimating on annual data it is reasonable to assume there will be no quantity adjustment. However, we would expect prices to change in response to market conditions. If tourism is buoyant and capacity is fully extended prices may be drawn upward but if there is excess capacity we would expect discounting and other evidence of softer prices. Demand studies have taken the price of tourism as given. We should gain extra insight by modelling the price of tourism as responding to supply conditions.

In our model, the demand for tourism falls along the lines of previous studies. However, the price of tourism reflects the short-run supply schedule.

Demand

The macroeconomic demand function for tourism typically has three arguments: an income variable, the price of tourism relative to the prices of all other goods and the price of tourism relative to the price of competing tourist services. Foreign travel seems to be an optional consumption good with a high income elasticity of demand in most industrial countries. The first element in the potential tourist's choice is the decision to go abroad which, for many, depends on the level or growth in incomes and the price of an overseas holiday relative to the retail price level or, more typically, the change in relative prices.

The second element is the choice of destination which depends on the characteristics of the tourism destination and the traveller's preferences. Considerations which enter this choice include the relative prices of alternate tourism products, the climate, the convenience of getting there and the infrastructure for tourism. The choice may be affected by tourism promotion, travel writers' opinions and other news (see Morley (1992) for a theoretical approach). Principally because of data limitations we are unable to test for the effects of factors other than the relative prices of competing destinations.

We sidestep issues of travel distance and travel costs by comparing among Caribbean destinations where distances and costs are comparable. A complementary analysis, which we do not attempt, might compare the Caribbean with other resort areas and other world tourism. Some previous studies, including an earlier effort by Worrell (Clarke et al, 1986), include a measure of promotional activities, sometimes found to have a significant effect. The information available, which relates to expenditure by official agencies, is not a satisfactory representation of the volume, quality and intensity of promotional activity. It does not include promotion by hotels, airlines and tour companies and not all official expenditure is equally effective. The results are therefore unlikely to be helpful.

Some characteristics of tourism destinations may be reflected in the price of the product. For example, resorts with varied activities and spacious accommodation tend to command higher prices, as do exotic locations off the beaten track. These factors may show up in occupancy rates and in the percentage of high quality accommodation - factors which enter the supply relationship in our model.

The demand relationship to be tested is therefore as follows:

$$LnARR_i = f_1\,(lny_i,\ \ln[P(tour)/P_i],\ \ln[P(tour)/P(comp)]) \qquad (1)$$

ARR:	arrivals
y:	real GDP
P(tour):	price index of tourism services
P:	CPI
P(comp):	price index of competitive tourist product
i:	country index (Canada, US, UK, all others)

Arrivals from each source country is the measure of tourism activity. A measure of real tourism expenditure broken down for each source country is not available but it seems plausible that tourists from the same source will spend the same amount on average wherever they choose to have their vacation. The alternatives would be to use aggregate expenditure (receipts) but with loss of information on individual source country demand (Carey, IMF) or to confine the analysis to the US market for which a breakdown of expenditures is available (Metzgen-Quemarez).

The income variable is the constant price GDP. The price of tourism is computed

by dividing tourism receipts by the number of bed nights defined as the product of arrivals and the average length of stay. For each country the price of the competing tourism product is a weighted average of the tourism prices of the other five countries in the study. The weights are each country's share in Caribbean tourist arrivals. The consumer price indices in the source countries are chosen to represent the price of all other goods and services.

Supply

In the short run when the capital stock is fixed the supplier of tourism services maximizes profits by keying his prices to marginal costs - principally, unit labour cost and the cost of working capital. However, if he finds that the resulting levels of capacity utilization are below optimum he will lower prices in the hope of attracting a greater number of customers. The main arguments of the supply price function are therefore unit labour cost, interest rates and occupancy rates, the latter as a measure of capacity utilisation.

The supply price is also an indicator of the quality of the tourism product. Destinations which boast high quality accommodation, which have exotic appeal or some other exceptional feature, will command higher prices. The movement of prices over time may reflect the changing mix of products in the national tourism offerings. Where data is available, an index of the quality of accommodation is included in the supply relationship.

The supply equation as tested is:

$$LnP(tour) = f_2[lnULC, r, lnOCCUP, lnLUX] \qquad (2)$$

ULC:	unit labour cost
r:	prime interest rate
OCCUP:	hotel room occupancy rate
LUX:	percentage of accommodation in the "best" category

The unit labour cost is computed as the wage index divided by an index of output per employed person. We assume, not unreasonably, that changes in unit labour costs are uniform through all sectors of the economy because no data are published separately for tourism. The interest rate variable is the prime rate, the rate to which loans are usually keyed. All destinations publish data on hotel occupancy rates.

The quality index is the percentage of first quality accommodation, as defined by the Barbados tourist sector, in the total.

Results

The system of five equations (one supply and four demand equations) and four identities was estimated by the seemingly unrelated regression method (SUR, also called multivariate regression or Zellner's method). The SUR is to be prefered in a system where each equation has an endogenous variable on the left side and only exogenous variables on the right side. As in the standard regression case, the disturbances are assumed to be uncorrelated with the exogenous variable. The Barbados forecast model is recursive and each equation of this of a system could have been estimated by ordinary least squares. However, if the disturbances of the equations are correlated, the SUR estimator is more efficient, because it takes account of the entire matrix of correlation of all of the equations. The SUR estimator minimises the determinant of the covariance matrix of the disturbances, using an iterative process. Each iteration reestimates the parameters after transforming the equation to remove the correlation across the residuals. Successive iterations to convergence give the maximum likelihood estimates.

Table 1 presents the SUR model. The model converged after 14 iterations. C(1), C(2),..C(21) represent the coefficients on the individual variables which appear in the five equations below the coefficient list in the table,with their diagnostic tests. The residual covariance matrix (Table 2) indicates that there exists no significant correlation among the covariances of the residuals, while the residual correlation matrix (same table) shows no significant levels of correlation among the residuals. This verifies that our estimates are unbiased and efficient and that our t-statistics are reliable.

Chart 2, a plot of the residuals, indicates that for most of the estimation period the difference between the actual and fitted values was less than 3% for all the equations. However, round 1982 the errors rose as high as 5.5% for the UK. Chart 3 shows the actual and fitted values for each market. The regression picked up most of the turning points.

The Price Equation

Unit labour costs are the principal factor affecting prices, with an elasticity of 1.4.

The interest rate effects are trivial and insignificant. Rising occupancy levels seem to depress prices, contrary to expectations. We thought hoteliers would tend to lower prices if occupancy levels in previous years were low and vice versa. The quality variable has significant effect at the 8% level, but the sign on the coeffieient is puzzling. One would expect it to be positive indicating that as the quality of accomodations improve the price of tourism increases. The equation serves to explain supply forces well, as indicated by the high R-squared value (0.96203).

The Demand by Visitors from the US

The elasticity of demand with respect to real GDP in the US is the most significant variable (with a coefficient of 3.1). The relative price elasticity has a coefficient of 0.7 and is significant in the demand equation. The competitive price effect is also significant at the 95% confidence level, with an elasticity of -0.6. The R-squared value is quite satisfactory.

The Demand by UK Visitors

The elasticity of demand with respect to income changes in the UK is exceptionally high at 4.2. The relative price of tourism appears to have a large effect while the competitive price effect is rather small and insignificant. The equation explains demand by UK visitors well.

The Demand by Canadian Visitors

The real income elasticity of demand is positive and has a magnitude of 2.6. Relative prices of tourism are insignificant while the competitors' prices have a strong impact with an elasticity of -1.23. Once again the R-squared value is acceptable.

The Demand by Other Visitors

Most other visitors come from Europe and we assume that the growth performance of the European source countries converge on German growth. The real GDP of Germany is therefore used as our proxy. The elasticity of demand with respect to this variable is very high at 4.6. Relative prices also have significant effect. The relative price of tourism has an elasticity of -0.6 and the relative prices of competitors' tourism product are slightly less influential at -0.4. The equation has very high explanatory powers.

In Sample Forecasts, 1994-96.

The strength of any forecasting model lies in its predictive powers. A well fitted model does not necessary translate into good out-of-sample forecasts. The model was tested in terms of its forecasting performance over the period 1994 to 1996. We first generated dynamic forecasts for the dependent variables using actual values for the independent variables over the specified three year period. These were then compared to the actual in terms of the Absolute Percentage Error (APE), Table 3. The model produced forecast errors of -1.02%, -0.6% and -0.79% in the US market for 1994, 1995 and 1996, respectively. For the UK market the errors were 0.85%, -0.23 and 0.09% for the three consecutive years, and in the Canadian market the errors ranged from 0.85% to 1.1%.

1997 to 1999

For our baseline forecast (chart 4) we assume that unit labour costs were constant - that is, that increases in productivity would be sufficient to compensate for any rise in wages - and that all other variables would continue on their most recent trends. Interest rates were also kept constant since there was no recent trend evident.

Largely because of the dominant effect of the income variable and the fact that real incomes in the source countries have been growing in recent years the demand for tourism in all markets except for Canada is forecast to continue to expand. For the Canadian market the secular decline in arrivals which has been characteristic since 1979 is expected to continue. In the US market the annual average growth rate over the period is forecast at 4.5%. Arrivals from the UK have an annual average growth rate of 5.5%; after facing a 1% decline in 1997, this market is expected to grow at a rate of 8.6% in 1998 and 1999. The Canadian market is expected to decline in 1997 by 16% but for subsequent years this decline will slow to 1.3%. Arrivals from Europe and other areas have an annual average growth rate of 9.1%.

Simulations based on 1% faster growth rate in the GDP of source countries and, as an alternative, a 1% slower growth rate, confirmed the significant effect of real GDP on tourist arrivals (see chart 5 and table 4). In all cases, the pattern of expansion remains the same but the growth of arrivals accelerates or decelerates in line with the changes in real GDP. The price of tourism relative to all other prices also has a noticeable effect and the conclusions are similar (see chart 6 and table 4). Higher relative prices slow down the growth in arrivals and a more attractive price of tourism accelerates the growth of arrivals. The exception is the US market. As

before there continues to be a decline in arrivals from Canada but a lower tourism price slows down that decline. In no case is there a noticeable impact of the relative price of the competitive product: the rate of growth of arrivals is unaffected when relative prices accelerate 5% or decelerate 5%.

Because we have included the supply equation we are able to detect that unit labour cost changes can have significant impact on the pattern of arrivals. Simulations were undertaken where unit labour costs rose by 5% per year and where they declined by 5% per year (see chart 7 and table 4). In the former case, as would be expected, the decline in Canadian arrivals was more severe and the growth in other markets was severely inhibited. On the contrary, a decline in unit labour costs accelerates growth in all markets except Canada and slows the decline in Canada to a very small percentage.

Concluding Remarks

The impact of unit labour cost is the most intriguing result of this study. Strong income effects confirm earlier findings. The insignificance of interest rates and occupancy rates is surprising but their impact may evaporate too quickly to be observed in annual data. The insignificance of the quality variable may indicate the need for a better proxy. The method of estimation in the study allows us to obtain maximum likelihood estimates and therefore we are able to place a great deal of confidence in our results.

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TABLE 1

System: Tourism Demand in Barbados
Estimation Method: Iterative Seemingly Unrelated Regression
Sample: 1966 1993
Convergence achieved after 14 iterations

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	3.135433	0.593772	5.280534	0.0000
C(2)	0.700734	0.254344	2.755066	0.0069
C(3)	-0.599735	0.296208	-2.024710	0.0453
C(4)	-5.343525	5.395395	-0.990386	0.3242
C(5)	4.210437	0.566181	7.436555	0.0000
C(6)	-0.695992	0.145294	-4.790235	0.0000
C(7)	-0.090674	0.213652	-0.424399	0.6721
C(8)	-23.67747	3.232665	-7.324445	0.0000
C(9)	2.617955	0.432487	6.053257	0.0000
C(10)	-0.212465	0.320735	-0.662429	0.5091
C(11)	-1.230177	0.307491	-4.000696	0.0001
C(12)	-6.895948	4.067078	-1.695553	0.0928
C(13)	4.680482	0.281822	16.60793	0.0000
C(14)	-0.663386	0.136501	-4.859921	0.0000
C(15)	-0.358447	0.160809	-2.229015	0.0278
C(16)	-33.27924	2.795374	-11.90511	0.0000
C(17)	1.440746	0.081650	17.64538	0.0000
C(18)	-0.020705	0.014360	-1.441822	0.1522
C(19)	-0.339763	0.129329	-2.627122	0.0098
C(20)	-0.333067	0.187275	-1.778497	0.0781
C(21)	-8.041765	1.717632	-4.681889	0.0000

Determinant residual covariance 5.10E-09

Equation: LAUS = C(1)*LQUS + C(2)*LRPTRUS + C(3)*LRPJB + C(4)
Observations: 28

R-squared	0.921877	Mean dependent var	11.38302
Adjusted R-squared	0.907673	S.D. dependent var	0.461958
S.E. of regression	0.140367	Sum squared resid	0.433465
Durbin-Watson stat	1.196880		

Equation: LAUK = C(5)*LQUK + C(6)*LRPTRUK + C(7)*LRPJB + C(8)
Observations: 28

R-squared	0.967459	Mean dependent var	10.51487
Adjusted R-squared	0.961542	S.D. dependent var	0.794843
S.E. of regression	0.155874	Sum squared resid	0.534531
Durbin-Watson stat	1.669575		

System: Tourism Demand in Barbados
Estimation Method: Iterative Seemingly Unrelated Regression
Sample: 1966 1993
Convergence achieved after 14 iterations

Equation: LACN = C(9)*LQCN + C(10)*LRPTRCN + C(11)*LRPJB + C(12)
Observations: 28

R-squared	0.915253	Mean dependent var	10.97019
Adjusted R-squared	0.899845	S.D. dependent var	0.370917
S.E. of regression	0.117385	Sum squared resid	0.303143
Durbin-Watson stat	1.898558		

Equation: LAO = C(13)*LQGR + C(14)*LRPTRGR + C(15)*LRPJB + C(16)
Observations: 28

R-squared	0.937814	Mean dependent var	10.38977
Adjusted R-squared	0.930041	S.D. dependent var	0.668364
S.E. of regression	0.176780	Sum squared resid	0.750032
Durbin-Watson stat	0.780342		

Equation: LPTOUR = C(17)*LULC + C(18)*PRIME + C(19)*LOCCUP + C(20)*LQUAL + C(21)
Observations: 19

R-squared	0.962025	Mean dependent var	-8.520574
Adjusted R-squared	0.951175	S.D. dependent var	0.541206
S.E. of regression	0.119587	Sum squared resid	0.200214
Durbin-Watson stat	1.258625		

TABLE 2

Residual Correlation Matrix

	LAUS	LAUK	LACN	LAO	LPTOUR
LAUS	1.000000	-0.246420	0.742119	-0.307394	-0.247247
LAUK	-0.246420	1.000000	-0.290863	0.258910	-0.115526
LACN	0.742119	-0.290863	1.000000	-0.051621	0.056511
LAO	-0.307394	0.258910	-0.051621	1.000000	0.323284
LPTOUR	-0.247247	-0.115526	0.056511	0.323284	1.000000

Residual Covariance Matrix

	LAUS	LAUK	LACN	LAO	LPTOUR
LAUS	0.049904	-0.010190	0.043290	-0.009159	-0.005579
LAUK	-0.010190	0.034269	-0.014060	0.006392	-0.002160
LACN	0.043290	-0.014060	0.068186	-0.001798	0.001491
LAO	-0.009159	0.006392	-0.001798	0.017788	0.004355
LPTOUR	-0.005579	-0.002160	0.001491	0.004355	0.010203

Table 3.

Forecast Performance for 1994-1996 (out-of-sample)
Criterion: Absolute Percentage Error(APE)

obs	APE			
	US	**UK**	**CAN**	**OTHER**
1994	-1.025373	0.850374	1.123590	-2.284758
1995	-0.625619	-0.238369	0.848247	-2.578040
1996	-0.789588	0.093384	0.971472	-3.733405

TABLE 4

Forecast Simulations								
	USA		UK		Canada		Other	
GDP	+ 1%	- 1%	+ 1%	- 1%	+ 1%	- 1%	+ 1%	- 1%
1997	14.50	-1.81	4.31	-4.13	2.09	-2.04	-1.65	-8.89
1998	14.60	-1.81	4.30	-4.13	2.09	-2.04	1.57	-9.89
1999	14.69	-1.84	4.34	-4.11	2.84	-2.05	3.84	-9.90
Relative Prices	+ 5%	- 5%	+ 5%	- 5%	+ 5%	- 5%	+ 5%	- 5%
1997	3.64	-3.51	-3.23	3.33	-1.32	1.33	-2.97	0.66
1998	3.63	-3.52	-3.22	3.35	-1.32	1.33	-2.97	0.67
1999	3.65	-3.51	-3.21	3.35	-1.32	1.34	-2.47	0.64
Unit LabourCost	+ 5%	- 5%	+ 5%	- 5%	+ 5%	- 5%	+ 5%	- 5%
1997	3.92	4.08	-2.96	3.05	-1.00	0.80	-1.98	2.36
1998	-6.85	3.05	-6.76	5.13	-2.57	0.60	-2.27	5.13
1999	-6.76	2.02	-10.42	20.14	-3.18	1.01	-1.98	6.18

CHART 1

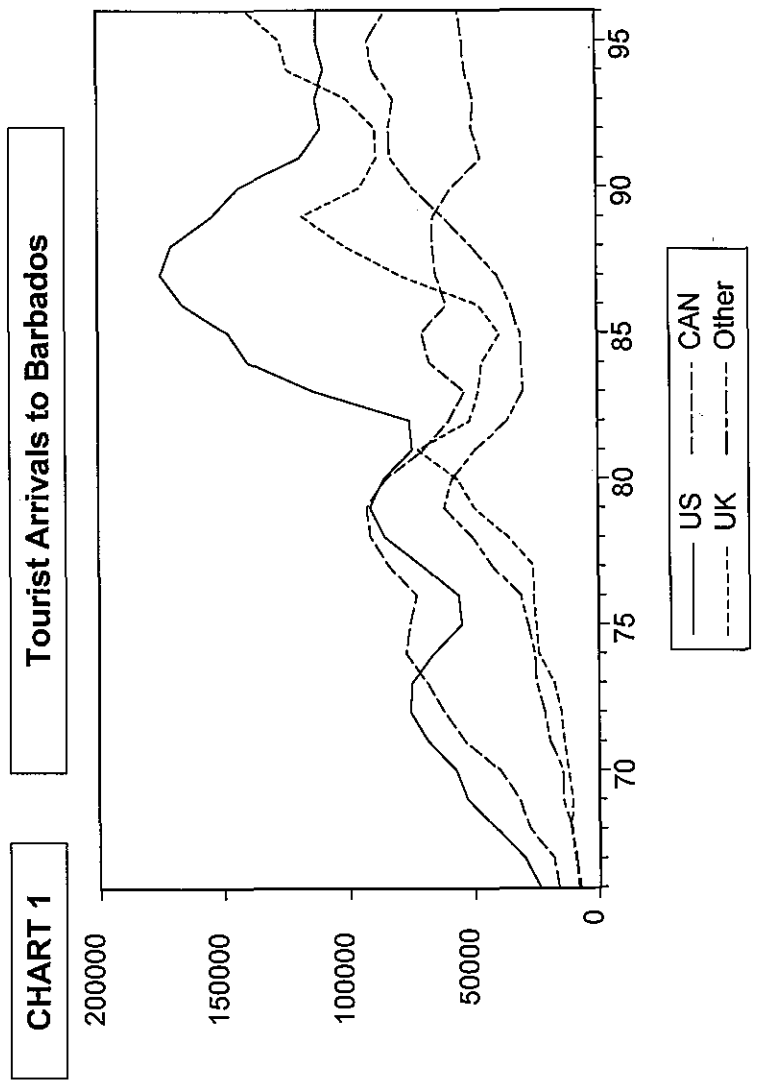


CHART 2

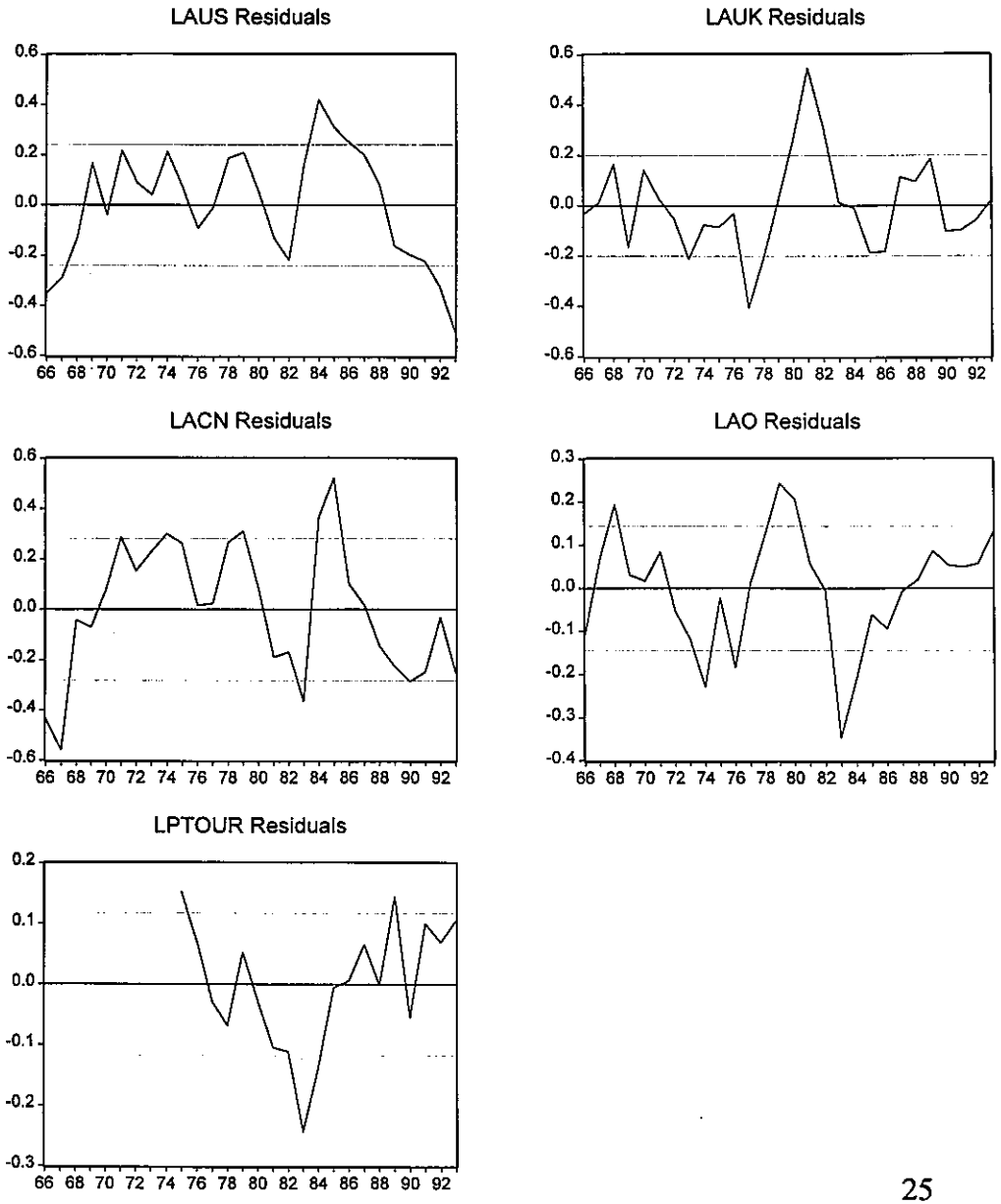


CHART 3

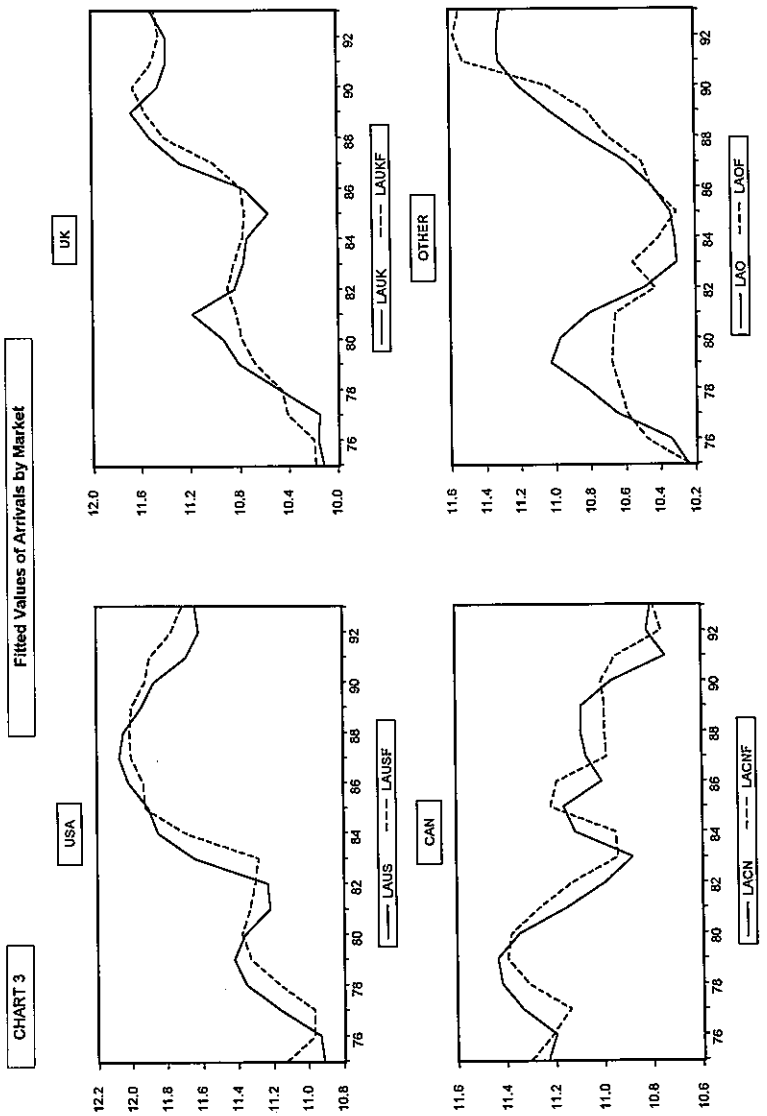


Chart 4

Forecasts of Arrivals by Market

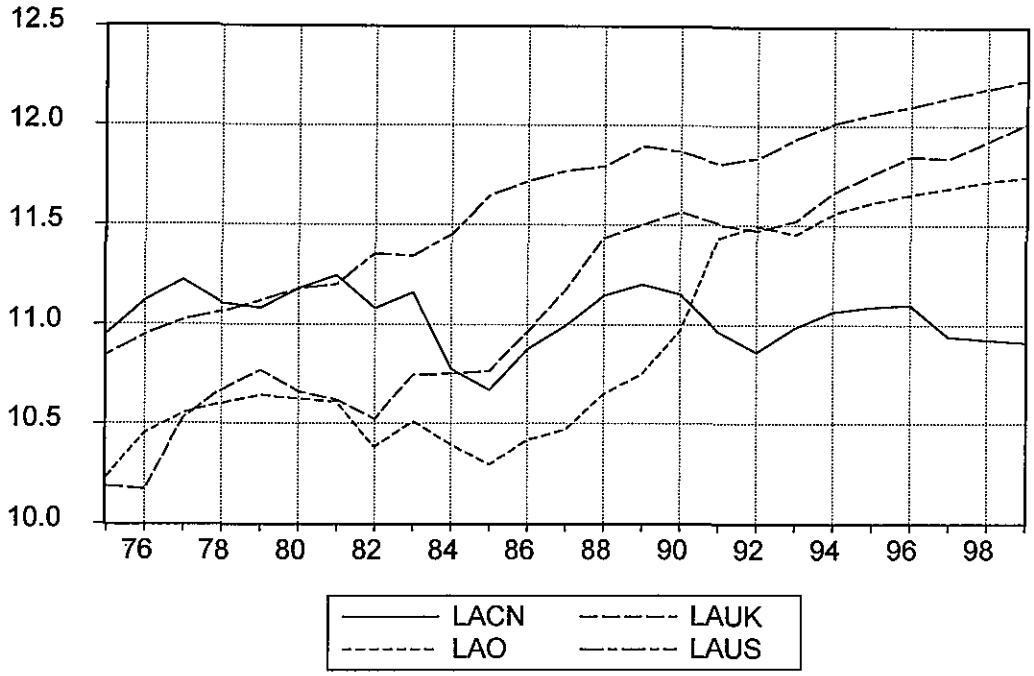
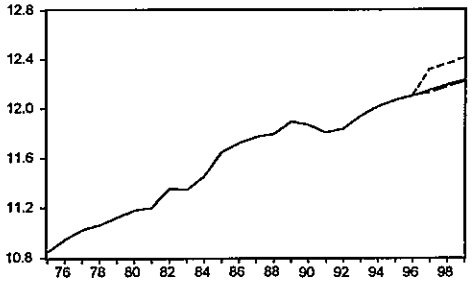


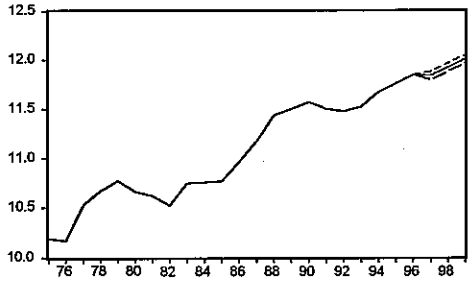
Chart 5

Forecast Simulations (varying GDP, 1997 - 1999)

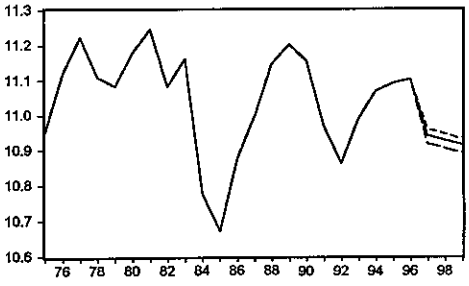
US Arrivals



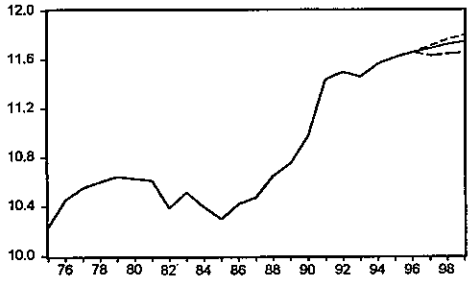
UK Arrivals



Canadian Arrivals



Other Arrivals



Baseline 1% faster GDP growth 1% slower GDP growth

Chart 6

Forecast Simulations
(varying Relative Prices, 1997 - 1999)

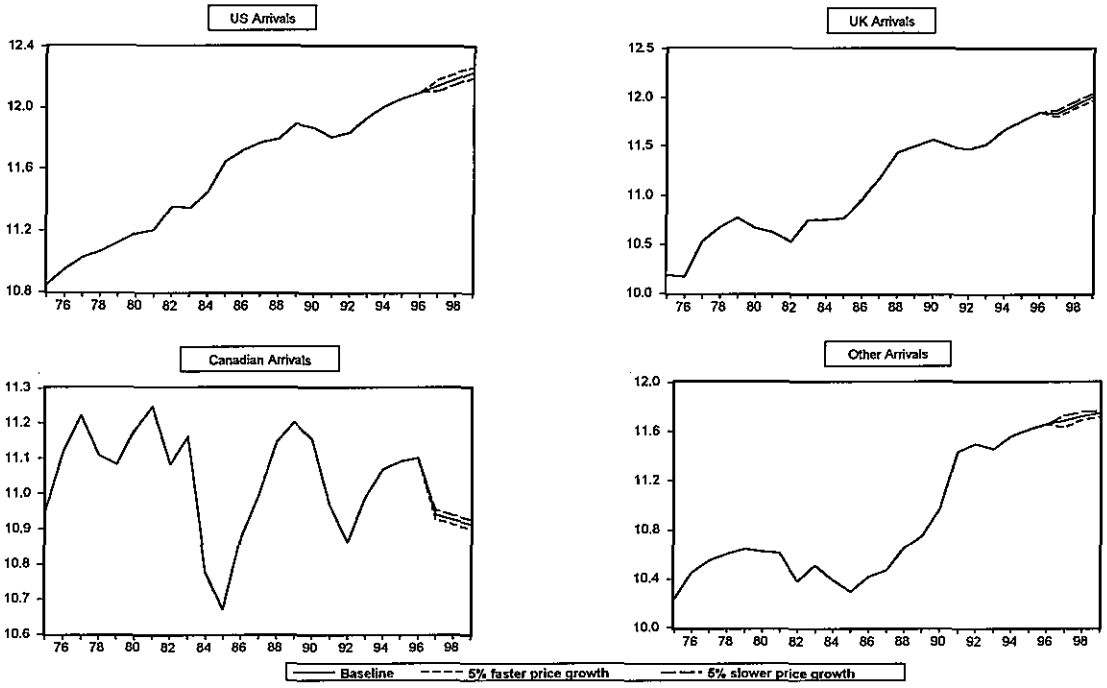


Chart 7

Forecast Simulations
(varying unit labour cost, 1997-1999)