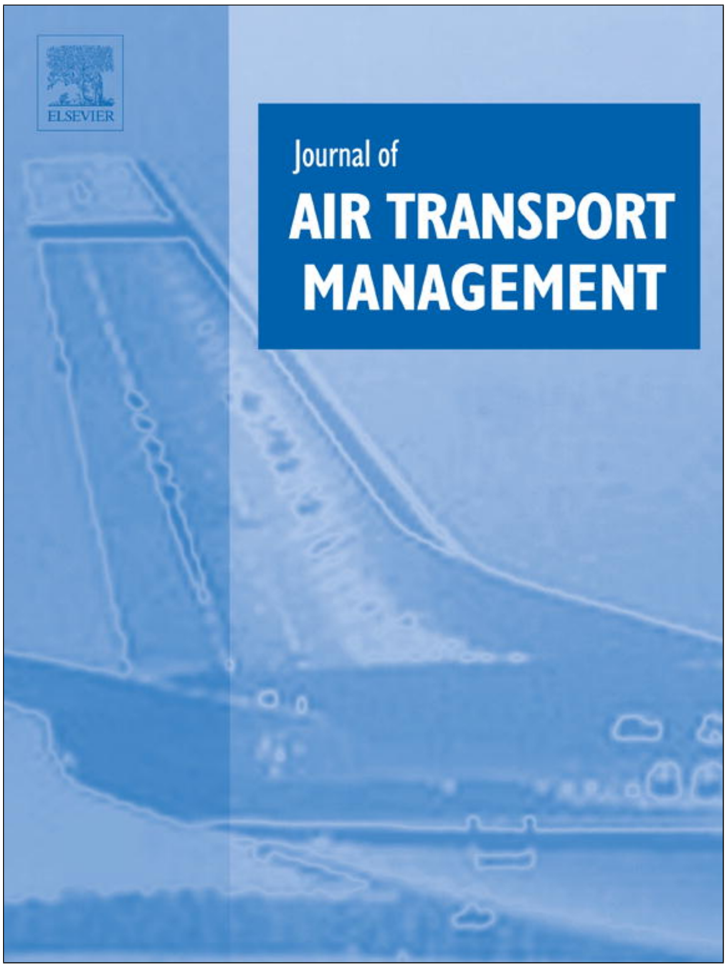
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Airport relocation and expansion and the estimation of derived tourist demand: The case of Eilat, Israel

Yaron Ergas [a], Daniel Felsenstein [b,*]

[a] Tourism Planning, Ministry of Tourism, Jerusalem, Israel
[b] Department of Geography, Hebrew University of Jerusalem, Mount Scopus, 91905 Jerusalem, Israel

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A B S T R A C T

This paper looks at capacity expansion relating to an airport and the derived tourist demand that this facilitates. The context is the airport relocation planned for the tourist destination of Eilat, Israel. The paper addresses three issues. First, using a multi-regional input output model for Israel, we estimate the magnitude of the static inter-sectoral impacts associated with airport construction and operation and their impact on the regional and national economy. Second, we focus on the lag effects in this process as increased tourism demand does not elicit an immediate response on the supply side in terms of new hotel investment. Third, on the demand side, we estimate additional tourism expenditure in non-hotel activities over the period that the market adjusts and beyond.

1. Introduction

A central characteristic of the tourist industry is its level of public sector investment. Invariably, tourism is perceived as a means for stimulating regional growth through attracting capital and labor. As a result, public support is directed to infrastructure-type projects such as support for hotel construction, preservation of historic buildings, airport construction, construction of sports and cultural centers, development of beaches, national parks and nature reserves and the like. Despite this activity, evidence on the effectiveness of public infrastructure investment on regional growth is far from unequivocal (Munnell, 1990).

While work exists on the direct impacts on tourism of public infrastructure investment in general and airport investment in particular, we focus on derived demand tourism impacts. These refer to the second-round effects relating to the initial investment stimulant. For example, in the case of airport construction or expansion, direct demand effects relate to the within-sector output, employment and income changes resulting from the project. Derived demand effects would relate to the role of the airport in stimulating private investment in the hotel sector. These impacts have received far less attention. Even less attention has been paid to the dynamics of this process. By nature, infrastructure projects have long time horizons. However, very little is known as to how long it takes the capacity increase in airports to be felt in another sector, such as hotel accommodation.

This paper investigates these issues in the context of a proposed relocation and expansion of the airport near the city of Eilat, Israel. As the economy of Eilat is highly dependent on the tourism industry and the current airport functions as an important infrastructure component for local and non-local tourism, the importance of such investment cannot be over-stated.

2. Airports as gateways

The 'gateway' function of an airport relates to the increased demand facilitated by airport expansion in ancillary economic activities outside the realm of the transportation sector, such as tourism and urban development. While airport construction is a primordial example of public infrastructure investment, differing perspectives on the role of airports in regional economic development exist (Hakfoort et al., 2001). One view sees airports as transportation nodes with limited impacts on other economic activities (Cejas, 2006). The other sees them as a stimulant for regional economic growth given their multiple interactions. They operate as employers, stimulate other on-site activities and generate regional economic multipliers. For tourist activity, airports serve as an enabling infrastructure for tourist accessibility especially for locations where other means of transportation are limited. They also reduce travel time compared with other forms of transportation thereby raising regional productivity and competitiveness. Thus they can raise a region's attractiveness expressed by the

* Corresponding author. Tel.: +972 2 5883343.
E-mail address: msdfels@mscc.huji.ac.il (D. Felsenstein).

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number of visits provided that other complementary infrastructure such as accommodation is available.

The remainder of this paper is concerned with the particular gateway conditions under which increasing airport capacity will stimulate demand in the hotel sector.

3. The case study context

Eilat is Israel's premier tourist resort with over 1.5 m visitors in 2010. Of these, 15% were foreign tourists and 85% local visitors. These shares have characterized tourism in Eilat over the last decade. The city has a population of nearly 50,000 residents and an economy that is greatly dependent on the tourism industry which accounts for over 50% of local GDP (Ministry of Interior, 2006). Situated in an isolated location at Israel's southernmost tip, an estimated 50% of arrivals to Eilat come by air (international and domestic visitors, local residents etc) with the rest arriving via land transportation, mainly buses, commercial and private vehicles (Boaz, 2003). The city's 11,000 hotel rooms is the largest stock in Israel with another 5000 planned to be completed by 2030 (Ministry of Interior, 2006).

The Eilat airport is currently located in the city center. Due to the constraints imposed by its limited runway length, terminal facilities and safety standards, international charter flights have increasingly been diverted to a civilian terminal housed at the military airfield at Ovda, 60 km north of Eilat. In 2010, while Eilat handled 18,500 domestic flights, nearly 1100 international flights landed at the Ovda airfield compared with less than 250 at Eilat (Israel Airports Authority, 2011). In response to the situation, the Israeli government recently approved a proposal submitted by the Ministry of Transportation and the Israel Airports Authority (IAA) for relocating the facility to a new site (Timna) 20 km north of the city (Fig. 1) and assigned nearly $20 m for the detailed planning of this move. The relocation will free up a large area of prime location real estate in Eilat making it available for residential and hotel development. The current location of the airport poses several problems for the city's expansion potential separating the main tourist area from the rest of the city and imposing building regulations and restrictions within its proximity.

The construction cost of the new Timna airport is estimated at $150 million comprised mainly of the construction of runways, terminal, roads, parking lots and control tower (Boaz, 2003). This does not include ancillary development such as new sewage and drainage systems around the site, infrastructure relocation, expansion of the highway and junctions leading to the new location and river diversion that are likely to more than triple the direct construction cost figure; these extra costs are not considered here. The construction period is expected to last five years. The main impact of this project is attributed to its long-run annual operating costs such as wages, taxes, and annual capital returns, estimated at $25 m. The breakdown of estimated construction and operating costs is presented in Table 1.

This injection into the region is expected to diffuse through the various sectors of the local economy. The relocation and expansion of the airport is expected to enable an increase of air passenger transportation to Eilat to 1.8 m visitors a year in the initial stage, compared to 1.3 m currently, rising up to 4 m visitors at steady state over 25 years. The relocation will also increase level of service because of more modern infrastructure, better quality facilities, better equipment and more personnel. For example, current runway length is 1.78 km while the new facility is planned for 3.10 km. Current terminal size is 2650 sq m and ancillary buildings accounting for a further 840 sq m. In contrast, the modular expansion planned for the new terminal will result in terminal and

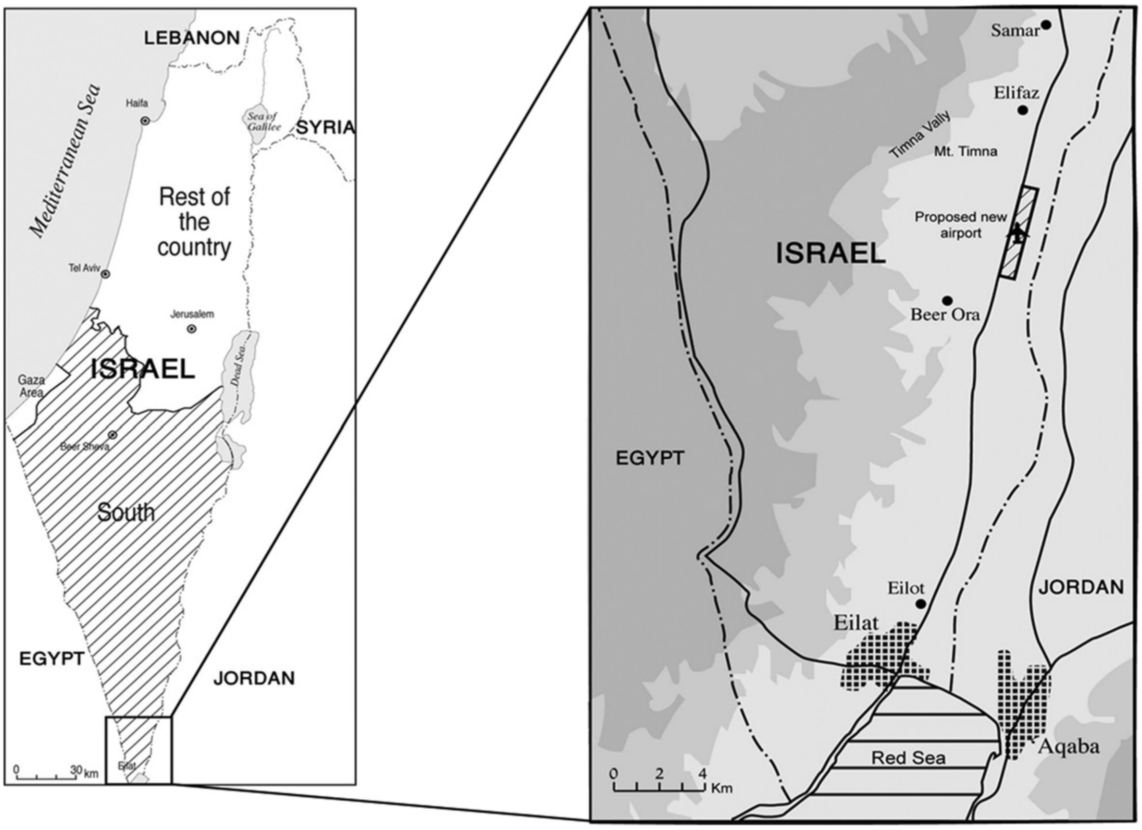

Fig. 1. The geographical setting.

Table 1
Construction and operation costs for the relocated airport in Eilat.

Construction costs	\$ m
Access roads and site infrastructure	14.1
Terminal construction	24.8
Landing strips and parking areas	59.1
Control tower, security and logistics	29.0
Electricity works	11.4
Planning and management	11.7
Total	**150.2**
Operating Costs	\$ m
Wages	4.7
Maintenance and operation	10.7
Municipal tax and other	2.0
Investment return (5%)	7.6
Total	**25.0**

Israel Airport Authority (2002).

ancillary floor space of 31,300 sq m at the final stage. Eilat airport can at present accommodate parking for five domestic flight aircraft while the Timna facility is planned for 13 to 14 local and international sized planes. Finally, in terms of aviation safety and security standards, the current Eilat airport meets only the lowest level criteria (F) while Timna is planned to meet grade B criteria.

4. Model and data

Our approach focuses on identifying the demand-side catalytic effects associated with airport relocation and expansion. Using a novel method that merges static multiplier effects with temporally-driven lag and adjustment effects, we break with the traditional mold of airport impact analyses (Airport Cooperative Research Program, 2008), offering a reproducible approach that can be used by facility managers, infrastructure and tourism planners and others interested in measuring airport effects. As illustrated below, this is attainable on the basis of admittedly crude forecasts and some summary measures of regional economic impacts.

We use the Israel multi-regional input–output (MRIO) model to investigate the inter-sectoral impacts of the airport.[1] In the current variant, we separate the Southern region (S) and the Rest of Israel (R). This choice is dictated by the small size of the country and the different geographical nature of each region: the Southern region has a limited population, low densities and a vast desert area as opposed to the heavily populated and industrialized Rest-of-Israel. In addition, dividing Israel into two equal-size areas isolates Eilat at the southernmost point of the Southern region as far as possible from the main source of tourist demand. This underscores the potential independence of Eilat and the chances of the effects of new airport investment remaining in the region.

The sectoral detail of the model emphasizes tourism and related activities such as air transportation. Major sectors of the economy such as agriculture, industry, retail trade, public and private services and so on are left highly aggregated. In contrast, sectors in which tourism is heavily represented such as hotels (four independent sectors by grade), air transport, car rentals, tour operators, and restaurants are highly disaggregated. These represent half of the sectors in the model. This structure allows for the identification of the tourism sector which has no independent industrial classification in national accounts. The multi-regional structure of the model allows us to deal with derived demand. Rather than just identifying the outward flows from an origin region, we also trace the feedback loops to the origin region from secondary demand created in other regions as they attempt to supply the demand generated by the origin region. This is particularly important in small open economies such as Israel where these kind of 'reverse' flows can account for a significant part of inter-regional trade.

The model comprises 20 sectors and uses two direct column coefficient matrices. One is the standard input–output matrix for a given region and the other is a trade flow matrix. The regional I–O technological matrices ($\mathbf{A}^n = \mathbf{A}^n_{ij}$) are arranged along the diagonal of the matrix. In an **NM*NM** multi-regional matrix (**N** regions and **M** sectors), off-diagonals are zeros. The matrix expression for the inter-sectoral relationships and end uses (of government, households, investment and exports) to gross output is:

$$\mathbf{X} = \mathbf{AX} + \mathbf{Y} \quad (1)$$

where $\mathbf{X}$ is gross output, $\mathbf{A}$ = direct coefficients and $\mathbf{Y}$ = end uses.

To integrate a trade flow matrix, the right hand side of (1) above is multiplied by trade flow matrix $\mathbf{C}$ where $\mathbf{C} = \mathbf{C}^{gh}_i$, i.e. the flow of a good from sector i from region g to region h that has the foregoing dimensions **NM*NM** and includes **N*N** 20 branch trade matrices in which the rows and columns are the 2 regions. Each element in the trade matrices is moved over 20 columns and downwards 20 rows, which causes the coefficients in each **M*M** size sub-matrix to be arranged along the diagonal. This arrangement becomes an **NM*NM** Trade matrix. Combining the two matrices by multiplication, yields:

$$\mathbf{X} = \mathbf{CAX} + \mathbf{CY} \quad (2)$$

This can be expressed as

$$(\mathbf{I} - \mathbf{CA})\mathbf{X} = \mathbf{CY} \quad (3)$$

Using the Leontief inverse to show the dependence of gross output on end uses, yields:

$$\mathbf{X} = (\mathbf{I} - \mathbf{CA})^{-1}\mathbf{CY} \quad (4)$$

The output multiplier ($\mathbf{K}$) is therefore:

$$\mathbf{K} = (\mathbf{I} - \mathbf{CA})^{-1}\mathbf{C} \quad (5)$$

The MRIO model is a hybrid based on survey and non-survey data sources. The various stages in creating the data and the adjustments needed to regionalize the model are outlined in Fig. 2. This regionalization is based on the process of bi-proportional matrix adjustment (RAS method) to generate symmetry in the I–O table. This is achieved by ensuring that the intermediate sum of columns and the intermediate sum of the rows of the sector-to-sector quarter of the table is an identity (Miller and Blair, 1985). We use the Israeli national I–O table for 1995 (Central Bureau of Statistic, 2002a) with prices updated to 2000. This year represents the last year for which output data was available and the last peak tourism year before the recession of the early 2000s. Since the base year for the study is 2000 and the latest available output data was for this year, the data in the original 1995 table is transformed to output for 2000 using:

$$\mathbf{X}^{2000}_{1995} = [\mathbf{I} - \mathbf{A}_{1995}]^{-1}\mathbf{X}\,\mathbf{Y}_{2000} \quad (6)$$

where: $\mathbf{X}^{2000}_{1995}$ is outputs for 2000 based on the 1995 I–O table, $\mathbf{A}_{1995}$ is technical coefficients based on 1995 I–O table (the basic assumption being that the technical coefficients remain the same), $\mathbf{Y}_{2000}$ is final uses for 2000.

[1] Variants of this model have been used in various contexts for tourism research (Freeman and Sultan, 1997; Freeman and Felsenstein, 2007) The MRIO model is not without limitations. Like all I–O models it assumes production functions with inputs in fixed proportions regardless of the possible variation in their relative prices or level of outputs. It is data demanding at the regional level (for example, the need for regional trade matrices) and is demand-driven. It assumes no supply constraints (i.e. the existence of excess capacity) in factor markets.

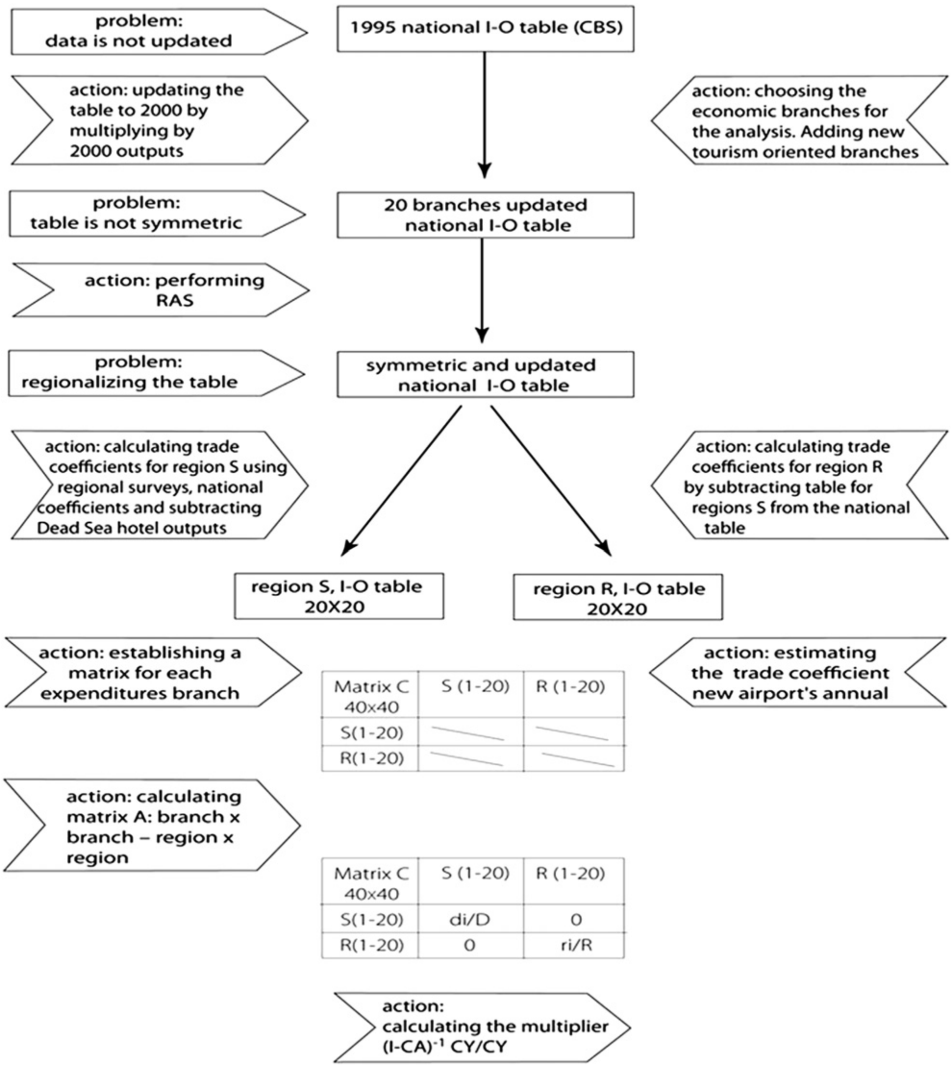

Fig. 2. Creating the regional I–O database.

The model uses detailed tourist expenditure data collected via a survey of tourist expenditures commissioned by the Ministry of Tourism in conjunction with the national Household Expenditure Survey 2004 (Central Bureau of Statistic, 2010). Hotel industry data relating to occupancy rates and investments (capital stock) comes from the quarterly survey of tourism and lodging services conducted by the Central Bureau of Statistics (Central Bureau of Statistic, 2002b) and stratified by type of tourist (foreign, local) and grade of hotel. Data on hotel product, revenues and capital returns come from Central Bureau of Statistic (2003).

Data on the stock of hotel rooms is derived from previous work (Freeman and Felsenstein, 2007) and adjusts for the stock existing at the Dead Sea resort area (roughly 25% of number of rooms in the Southern district) which is part of the Southern region but too distant to be serviced by the Eilat airport. On the basis of I–O table for the S and R regions, the trade coefficients for the regions S and R are estimated. The approach used here generates outputs and inputs for each sector and sectoral estimations of inter-regional exports and within-region consumption. For each sector, we estimate how much is exported to the other region and how much output is consumed within the region.

Finally, the MRIO framework presents the change in each sector's output as a result of a change in another sector. Since I–O tables are in annual values it is necessary to calculate the annual value of the proposed new airport. The direct output of the airport is represented by its construction and operating costs. Construction costs include a one-off capital injection and returns to capital over 25 years. Operating expenses include both fixed and variable costs that vary according to the volume of passenger traffic expected through the airport (Table 1). Estimates for airport construction and operating costs are available from an IAA report and a consultancy report prepared for the IAA (Israel Airports Authority, 2002; Boaz, 2003). As the MRIO model is essentially static, we 'shock' the model with expected operating expenses for 2020 a representative year for which the airport is expected to be in operation. This shock is inserted into the I–O table for the S region in the 'airport services' sector cell. The ripple-through extent of the shock is determined by the trade flows matrices.

5. Tourism demand forecasts

In 2010 the Eilat airport served 1.3 million passengers, the highest recorded. Given the planned sequential development of the new airport with upgraded services for 1.8 million passengers annually in the first stage and an expected capacity of 4 million passengers per years subsequently, our assumptions with respect to forecasting demand approach are formulated accordingly. Thus, the new airport is perceived as a project enabling an increased volume of passengers rather than a project that triggers direct demand. The passenger forecasts that follow are therefore based on increased demand triggered by other factors rather than the mere existence of a newly constructed airport. However an expanded airport is expected to have a part in triggering a lagged response in the demand for hotel facilities as the market adjusts. The existence of both new modern airport facilities and new hotel rooms is expected to serve rising demand and also trigger additional demand for Eilat as a tourist destination.

To derive tourism demand forecasts and to convert these eventually into extra hotel rooms we use a simple sequential approach. The mechanics of this are depicted in Fig. 4. In this linear structure, each estimate is derived from values of the preceding estimate. The sequence moves from estimating arrivals, converting these into visitor-nights and ultimately into hotel rooms (Fig. 3). We start by establishing three scenarios (low, medium and high) for demand over the 25-years time span (2016–2040) expected of the initial airport construction. These projections are based on assumptions relating to inbound and outbound tourism. The low forecast assumes an annual 2% growth rate for foreign visitors to Eilat and 3% for local visitors. The medium level scenario forecasts 4% growth for foreign visitors and 5% for locals while the high level scenario assumes business as usual with respect to locals, a 3% growth, and exponential growth of foreign tourists until all infrastructure capacity is fully utilized. Our estimates of derived demand are generated by arrivals in Eilat of tourist-visitors only and not by other potential users of the new airport such as local residents or day visitors. Additionally, although demand scenarios are based on ten year trends and averages, the aim of these scenarios is to demonstrate the combined effect of the new airport investment and the demand for new hotel rooms that is then re-inserted in the MRIO table, rather than exact forecasting.

To convert arrivals at the airport into demand for hotel rooms we use information on visitor shares supplied by local airline operators, IsraAir and Arkia and average visitor nights. Based on Ministry of Tourism survey data over the last decade (Central Bureau of Statistics, 2010), we assume that 95% of foreign visitors use the airport and of the Israelis who arrive in the city by air 55% are tourist-visitors, 23% local residents and 22% day visitors. In total, 53% of all visitors to Eilat (foreign and local) are expected to come through the airport and 63.3% of combined local and foreign visitors are expected to stay in hotels.

We use an index of visitor-nights (4.6 for foreign visitors, 2.9 for locals) based on a 10-year average and assume an occupancy rate of 75%. Assuming two visitors per room, the annual capacity of a room assuming the above occupancy rate is 548 visitor-nights. Increasing demand by 100,000 visitors will therefore lead to extra demand for 180 rooms.

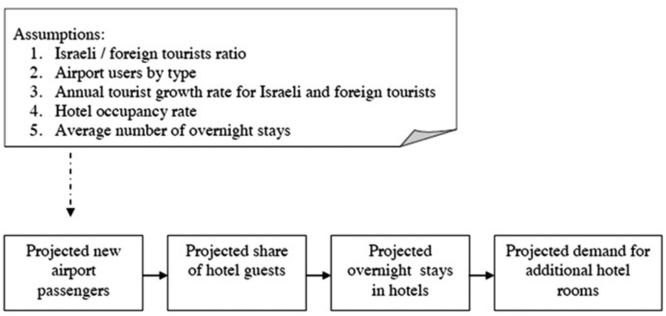

Fig. 3. Forecasting additional demand for hotel rooms.

The hotel rooms required under each demand scenario is presented in Fig. 4. The results show the time horizons of the scenarios. Under current demand conditions, roughly 7000 hotel rooms are needed which is about 30% below the level of current stock. The low growth scenario indicates no expected need for additional hotel rooms over the 25 years following the investment. This conservative scenario suggests that a new airport near Eilat has neither tourism justification nor any other justification. Under the moderate growth scenario demand for additional hotel rooms is expected in the mid 2020s. Due to the time lag in the planning process, this scenario indicates the necessity for contingency plans to deal with this situation starting from the present. Finally, the high growth scenario suggests that hotel rooms are anticipated to be in short supply virtually from the outset. This means that occupancy rates in existing Eilat hotels can be expected to rise for several years above current levels until additional hotel capacity becomes available. Under this scenario, on tourism grounds alone, new airport construction would seem justified.

Supply–demand adjustment arising through new airport construction is not, however, instantaneous. We expect to observe a lag in the triggering effects of public infrastructure investment on private investment in hotels.

6. Findings

6.1. Output effects

Table 2 presents the inter-sectoral linkages (final uses and derived output) resulting from the operation of the new airport, separating Israel into two regions, the southern region (S) and the Rest of the Country (R). The table shows detailed sectoral outputs for hotel and transport sectors and broad aggregates for others. Effects are reported excluding household demand. As can be seen, derived output for the aggregate (non-tourism sectors) sectors such as agriculture, industry, utilities and construction are felt mainly in the rest of the country. In contrast most of the readily-identifiable tourist sectors such as hotels, land and air transportation and tourist services such as travel agencies, generate output in the S region. This could be due to the large area of region S and the remoteness of Eilat from region R suppliers. This serves to cushion local services and production from competition and prevent leakage to the R region. An exception is the airport services sector where most output is registered at point of origin (R region). Overall, two thirds of tourism output in the S region emanates from within the region generating a regional output multiplier (**K**) of 1.57. The multiplier results from dividing the derived output by final use. The magnitude of **K** indicates that the final uses yielded additional demand amounting to an increase of 57% in output.

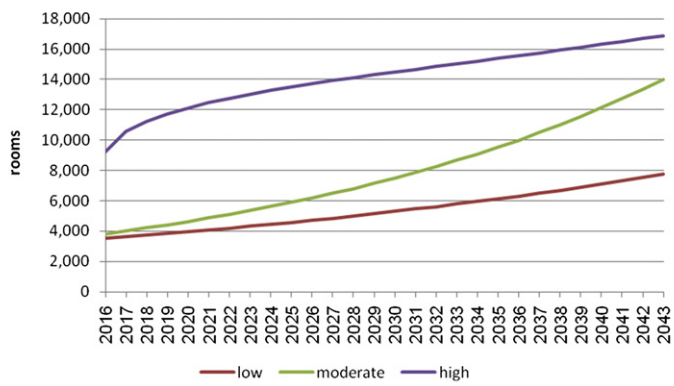

Fig. 4. Hotel room demand for each scenario projection.

Table 2
Output and final uses resulting from airport investment – excluding household demand, 2020 ($ m).

Sector	Final use	Derived output region S	Derived output region R	Derived output – total	Sector multiplier ($\mathbf{K}_S$)	Region S share (%)	Region R share (%)	Contribution of sector to overall multiplier (**K**)
Agriculture	0.00	6.46	18.76	25.22				
Food and beverages	0.00	5.46	34.44	39.91				
Light industries	55.44	11.95	69.18	81.13	1.46	14.73	85.27	0.10
Other industries	51.19	15.64	81.27	96.90	1.89	16.14	83.86	0.09
Water and electricity	0.00	6.13	16.36	22.49				
Construction	0.00	1.40	10.02	11.42				
Retail commerce	76.51	68.99	31.05	100.04	1.31	68.96	31.04	0.14
Hotels – class 4 (low)	40.77	41.08	0.02	41.10	1.01	99.95	0.05	0.07
Hotels – class 3	21.29	21.44	0.05	21.48	1.01	99.78	0.22	0.04
Hotels – class 2	52.46	53.04	0.06	53.11	1.01	99.88	0.12	0.10
Hotels – class 1 (high)	68.35	68.89	0.08	68.97	1.01	99.88	0.12	0.12
Restaurants	134.15	104.73	30.82	135.54	1.01	77.26	22.74	0.25
Land transport	51.24	56.56	12.39	68.95	1.35	82.03	17.97	0.10
Sea transport	0.00	1.04	−0.01	1.03				
Air transport	119.68	119.79	0.20	119.99	1.00	99.83	0.17	0.22
Port services	0.00	1.53	0.50	2.03				
Airport services	17.20	2.42	16.65	19.07	1.11	12.68	87.32	0.03
Travel agencies	46.48	47.18	2.31	49.49	1.06	95.34	4.66	0.09
Public and private services	122.74	251.91	139.68	391.59	3.19	64.33	35.67	0.22
Total	**857.50**	**885.65**	**463.80**	**1349.45**	**1.57**	**65.63**	**34.37**	**1.57**

To calculate the effect of the new airport it is necessary to insert its annual operating costs into the I–O table. The one-off construction costs are not included here as their effect is captured in the annual returns to capital of 5% built into the cost schedule. By omitting direct construction costs we avoid the pitfalls of double-counting. Table 3 shows the derived demand when the operating costs of the airport are inserted into the I–O table using a 'closed' model that includes household demand (and not just the direct and indirect effects as in Table 2).

The value of the airport operating costs is estimated $25 m and this is entered directly into the airport services sector. Given the size of the proposed project and the fact that the return on the capital investment is expected to last for over 20 years, the operating costs are (arbitrarily) taken to represent the year 2020. The effect of the airport $= \sum(\mathbf{I}-\mathbf{CA})^{-1}\,\mathbf{X\,CY} = 65.75$($ m) .The airport multiplier ($\mathbf{K}_{tot}$) is therefore 65.75/25 = 2.63. Since $\mathbf{K}_{tot} = \mathbf{K}_S$ (multiplier for region S) + $\mathbf{K}_R$ (multiplier for region R) then $\mathbf{K}_S = 48.66/25 = 1.95$ and $\mathbf{K}_R = 17.09/25 = 0.68$.

Table 3
Derived output from airport investment including household demand 2020 ($ m).

Sector	Region S airport	Region R airport	Total	Region S airport and hotel	Region R airport and hotel	Total
Agriculture	0.15	0.43	0.58	1.25	3.62	4.86
Food and beverages	0.20	1.25	1.45	1.29	8.16	9.45
Light industries	0.15	0.84	0.99	0.56	3.23	3.78
Other industries	0.36	1.89	2.25	0.98	5.10	6.08
Water and electricity	0.20	0.54	0.74	1.13	3.02	4.15
Construction	0.05	0.33	0.37	0.19	1.33	1.52
Retail commerce	1.30	1.10	2.40	4.60	4.35	8.95
Hotels – class 4 (low)	0.03	0.00	0.03	19.05	0.01	19.07
Hotels – class 3	0.01	0.01	0.02	13.08	0.02	13.10
Hotels – class 2	0.05	0.01	0.06	3.56	0.03	3.59
Hotels – class 1 (high)	0.05	0.01	0.06	7.20	0.04	7.24
Restaurants	0.10	0.09	0.18	0.32	0.31	0.63
Land transport	0.98	0.39	1.37	2.21	1.52	3.73
Sea transport	0.14	0.01	0.13	0.44	−0.02	0.42
Air transport	0.02	0.05	0.07	0.06	0.19	0.25
Port services	0.20	0.03	0.22	0.45	0.08	0.53
Airport services	24.94	0.17	25.11	25.11	0.46	25.57
Travel agencies	0.08	0.09	0.17	0.19	0.35	0.54
Public and privates	8.89	5.97	14.86	26.61	21.45	48.06
Households	10.77	3.90	14.67	35.85	15.33	51.18
Total	48.66	17.09	65.75	144.07	68.57	212.64

These findings in Table 3 demonstrate that 74% of the contribution of the airport multiplier is in region. The demand derived from the operating costs of the airport generates large local effects in the services sector (household expenditure and public and private services and some lesser impacts in the retail sector). The sectoral impacts in the R region are in similar sectors but of smaller magnitude. Additionally, the inter-regional ripple-through effects are felt in the rest of the country in the agriculture, industry, utilities and construction sectors. The difference in the multipliers between the open (1.57) and closed (2.63) models as presented in Tables 2 and 3, indicates that the contribution of the household sector to the multiplier is substantial, reflecting households' demand for additional labor and services as a result of new airport investment.

Once the derived demand in the hotel sectors emanating from the airport is added, the picture tends to change. The regional concentration of demand shares falls from 75% in the S region to 66% and correspondingly rises in the R region. Similarly, the sectoral effects tend to distribute more widely as hotel demand stimulates activity in food and beverages, retail and commerce, private and public sectors and much of this cannot be provided in the S region.

6.2. The lag effect

The inter-regional effects are essentially static. However, investment in a new airport is also expected to have a derived demand effect on tourism whose impact is felt over time. We expect a time lag as derived demand resulting from an overall increase in both domestic and incoming tourism to Israel enabled by the increase in airport capacity and upgraded service level, will not elicit an instant response in the supply of hotel rooms. In the mid 1990s the share of non-local tourism in overall tourism to Eilat, was around 60% non-local and 40% local. Given the three demand forecasts outlined above, we posit the following assumptions with respect to impact of the new airport: non-local tourism share will rise, although not to its peak share as in the mid 1990s and account for 25% of all tourism 10 years after the airport starts operations. This assumption is based on various infrastructure investments that are planned for Eilat over the coming years such as a convention center, concert hall, ice skating arena and other investments. The average tourist expenditure is expected to be close to the existing 10 year average as will the number of tourist nights.

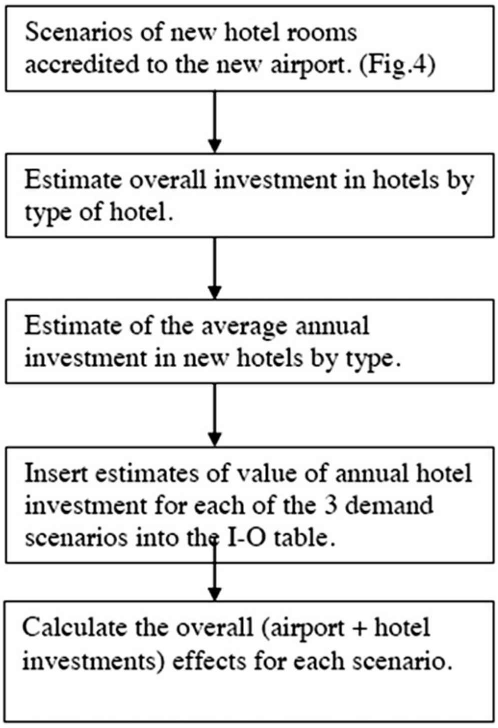

Fig. 5. Identifying the lag effect on hotel investment caused by airport construction.

Fig. 5 describes the steps by which the scenarios of hotel demand derived from the new airport are converted into investment estimates. Using hotel investment coefficients, projected additional rooms are converted into investment and annualized. These estimates are then re-inserted into the MRIO model to give an overall impact figure relating to the joint effects of the airport and the hotel investment. The static results of this exercise are presented in Table 4.

Table 4 shows the expected annual additional demand for hotel rooms up till 2028. As can be seen, given an airport opening date of 2016, the impact in terms of new hotel investment starts to be felt some 6 years later. By 2028, the number of hotel rooms needed to be constructed under the three scenarios is 800, 1600 and 2700 respectively. This is the net addition due to the capacity increase facilitated by the new airport. This derived demand translates into increased annual average hotel investment of $12 m, $23 m and $38 m using investment coefficients published in previous work (Freeman and Felsenstein, 2007). When this is added to the airport output (and the end use denominator remains fixed) multiplier effects are inflated beyond 4.0.

A six year lag effect is therefore estimated. While we expect tourist volumes to increase immediately once the relocated facility opens, demand for additional rooms is expected to be felt after a time lag. Initially additional demand will increase occupancy rates, rationalize the use of existing stock and push up the price of accommodation. This stage is expected to last until a break-even point is reached when the number of existing hotel rooms at a certain price level stimulate the private sector to invest in new hotel accommodation. This lag is also inevitable due to the lengthy time horizon of the planning and construction process. Thus, given a new airport opening in 2016, the readjustment process (lag effect) under each demand scenario is expected to be felt up until 2022.

Table 4
Demand for new hotel rooms accredited to the new expanded airport for each scenario.

Projection year	Low	Moderate	High
2022	107	197	625
2023	110	207	492
2024	114	217	405
2025	117	228	344
2026	120	239	301
2027	124	251	269
2028	128	264	246
Number of rooms	**820**	**1604**	**2682**
Average annual investment in hotels ($ m)	**12.2**	**23.4**	**38.0**

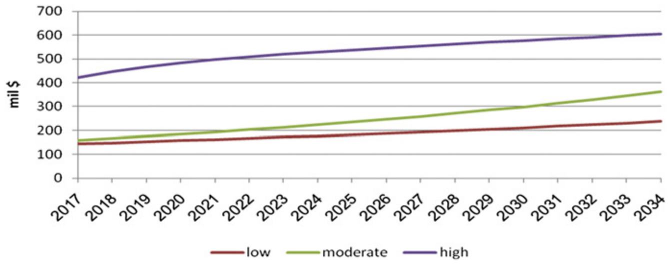

Fig. 6. Tourist expenditures accredited to the new airport, by scenario ($ m).

6.3. *Tourism demand in the adjustment period*

The operation of a new airport elicits a lag effect of six years until the hotel sector responds, but over this adjustment period a constant stream of visitors is expected to visit Eilat facilitated by the new accessibility offered by the airport. While the I–O model captures the static effects of the operation of the airport and its inter-sectoral impacts, it does not represent the spending streams of tourists that are expected to visit the city over this period before their demand is met by new hotel construction (Fig. 6).

The projected additional tourist expenditure under the three demand scenarios are of very different magnitudes and have different functional forms. This additional tourist expenditure relates to spending on items such as restaurants, guided tours and shopping that are not directly hotel related. Traditionally these items account for over 40% of all tourist spending. Across all three scenarios, expenditure patterns through the adjustment period are comprised of roughly equal annual growth increments up to 2022. For the low demand scenario, this pattern continues across the period. However in the case of the medium and high scenarios we can identify the existence of an accelerator effect associated with tourist expenditure that drives expenditure from 2022 onwards. Under both these scenarios the year-on-year growth increments in expenditure seem to increase from this date, growing exponentially till 2034 under the medium demand scenario and leveling off asymptotically under the high demand scenario. This seems to indicate that hotel investment acts as catalyst for increased non-hotel related expenditure by tourists. In the 'additionality' versus 'displacement' debate over tourist spending (Burgan and Mules, 2001), these findings indicate support for the former.

7. Conclusions

This paper examines the role of airport infrastructure in facilitating development in the tourism sector. While the necessity of large-scale public investment in transportation infrastructure such as railways has been questioned in Israel (Feitelson et al., 2006) in the case of airport infrastructure the focus of attention has been traditionally related to short-term costs and benefits. In contrast to other studies of airport impacts, we have not focused on the issues of accessibility, cost savings, employment and payroll that are generally investigated. Rather, the focus here has been on the ‘gateway’ function of the airport for the tourist industry and the way in which the increased demand attributed to the airport stimulates hotel investment and tourist expenditure.

The empirical findings have general implications for expectations of economic growth generated by a gateway airport in areas such as tourism and urban regeneration. The first relates to the time perspective. The construction of a new airport is likely to raise expectations in an industry such as tourism, where volatility is legion. Even in places where geopolitical conditions are more stable than Israel, the demand for tourism services is particularly sensitive to both price competition and non-predictable shocks whether natural hazards such as storms or hurricanes or man-made hazards such as war, terror and crime. The hotel sector is the infrastructure backbone of the tourism industry and reflects the sensitivity to demand that is characteristic of tourism. As seen here, on the supply side, the sector is ’sticky’ in response and characterized by a time lag estimated as approximately six years. Planning for change in hotel demand therefore needs to be predicated on a long-term perspective.

The second implication relates to the role of the public sector. While Eilat is admittedly an extreme case of dependence on an airport, private investment in hotel construction is symbiotically connected to public investment in infrastructure. Ostensibly, a regional output multiplier of 2.63 would seem to be enough justification for considerable public assistance. However the public discourse on this issue is critical of the magnitude of investment needed, given the narrow impacts generated. A source of this dissonance could possibly be that feasibility studies relating to the extent of public investment do not consider either the temporal (long and medium term) effects of the new airport or the spatial distribution of demand that it generates.

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